

The role of product innovation and customer centrality in transforming tacit and explicit knowledge into profitability

M. Ángeles López-Cabarcos, Suresh Srinivasan and Paula Vázquez-Rodríguez

Abstract

Purpose – By fusing knowledge-based theory, organizational learning theory and dynamics capability theory, this study aims to explore, on the one hand, the linkage between exploration, sensing and tacit knowledge, and on the other hand, exploitation, seizing and explicit knowledge. Thereby, it argues that not only tacit knowledge but also explicit knowledge contributes to competitive advantage for firms. This study also investigates how knowledge transforms into profitability.

Design/methodology/approach – The conceptual model is tested with a study sample of 153 industrial organizations using structural equation modelling.

Findings – Results confirm the importance of both tacit and explicit knowledge for achieving sustainable competitive advantages. Furthermore, both tacit and explicit knowledge transform into profitability, both directly and through product innovation and customer centrality which play partial mediating roles.

Practical implications – Explicit knowledge strategies can be easier to manage, implement and institutionalize than tacit knowledge strategies, which require human component and intervention to succeed. Managers should hence first implement explicit knowledge strategies to gain expeditious results. Further, with the advent of digital technologies and algorithms that can extract deep customer insights and organizational experiences which are highly tacit in nature and codifying the same into explicit knowledge, the importance of explicit knowledge is further enlarged.

Originality/value – By fusing three adjacent theories to establish a robust model specification, this study is able to demonstrate the contribution of explicit knowledge in the firm's competitive advantages.

Keywords Customer centrality, Profitability, Explicit knowledge, Tacit knowledge, Product innovation

Paper type Research paper

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Introduction

Knowledge management is an essential element of managing any type of business (Gloet and Terziovski, 2004) and is a key enabler of competitive advantage (Yang, 2010). Discussions on knowledge are becoming increasingly important and a firm's future is largely dependent on its ability to manage this asset (Coakes, 2003). The source of competitive advantage is moving away from cost and productivity (Teece, 1998) to innovation backed by knowledge capabilities possessed by the firm (Egbu, 2004; Gold *et al.*, 2001). A firm has competitive advantage when the rents associated with such advantage, i.e. its performance and profitability (Rumelt, 1991) are superior in comparison to industry peers (Grant, 1996a, 1996b; Teece, 2007).

Knowledge is mainly present in the form of tacit and explicit (Polanyi, 1966); while some studies show that these two cannot co-exist within a firm (Hansen *et al.*, 1999), others highlight such coexistence, interaction and a continuous dialogue between the two (Nonaka, 1994). While explicit knowledge can be codified and communicated, tacit knowledge can only be observed through its application and acquired through "people to

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people” personal interaction; its transfer between people is slow, costly and uncertain thereby making it inimitable (Grant, 1996b; Kogut and Zander, 1992).

The resource-based theory contends that competitive advantage lies in the ability of firms to build unique capabilities that are valuable, rare, inimitable and organized (Barney and Griffin, 1992; Barney, 1991; Wernerfelt, 1984). Extending the resource-based view, the knowledge-based theory of organizational capabilities argues that knowledge is the most strategically important capability (Grant, 1996a). A knowledge-intensive organization acquires and exploits knowledge continuously and repeatedly in a circular process, termed as “knowledge spiral” (Nonaka, 1994). The knowledge-based theory fundamentally argues that the main role of a firm is to integrate specialist individual tacit knowledge into its products and services (Grant, 1996b); hence, tacit knowledge is competitive advantage because of its inimitability, while explicit knowledge is not (Grant, 1996a). While few studies point out that codification strategies (Inuzuka and Nakamori, 2004; López-Nicolás and Meroño-Cerdán, 2011) and information and communication technologies (Vaccaro *et al.*, 2010), which are explicit in nature (Choi and Lee, 2003), are also important for firm profitability, the importance of tacit knowledge contributing to firm profitability is overwhelming in knowledge management and strategy literature. In fact, several studies in the field of knowledge management agree that explicit knowledge is not as important as tacit knowledge for generating competitive advantage (Grant, 1996a, Grimaldi *et al.*, 2012; Sveiby, 1997). Contrarily, this study advocates that while tacit knowledge is important, explicit knowledge is also very important for competitive advantage of firms; this is the first research gap of this study. To fill this research gap, two adjacent theories were used: the organizational learning theory (March, 1991) and the dynamic capabilities theory (O’Reilly and Tushman, 2008; Teece *et al.*, 1997; Teece, 2007).

So, the theoretical motivation for this paper stems from fusing resource-based theory (Barney, 1991), knowledge-based theory of organizational capabilities (Grant, 1996a, 1996b), organizational learning theory (March, 1991) and dynamic capabilities theory (O’Reilly and Tushman, 2008; Teece *et al.*, 1997; Teece, 2007). Knowledge can be considered a result of learning (Kogut and Zander, 1992). The organizational learning theory prescribes two types of learning: exploration and exploitation, both competing for common organizational resources (March, 1991). This theory advocates that both exploration and exploitation are important, and a cautious balance is required for organizations to have a sustainable competitive advantage (Govindarajan, 2016; O’Reilly and Tushman, 2008). In essence, Nonaka (1994) argues that with mere “socialization” and without “combination”, the knowledge spiral will not work; in line with the principal that exploration alone will not be effective without exploitation in the organization learning theory. The study then imports and links the dynamic capabilities literature to argue that firms must cautiously balance between “sensing” and “seizing” capabilities, which again compete for common organizational resources, to achieve sustainable competitive advantage (Teece, 2007). Sensing activities in dynamic capability literature are exploratory learning in nature and akin to tacit knowledge and seizing activities is exploitative learning and is explicit knowledge intensive. So, this study stretches exploration as a learning typology (March, 1991) and sensing as a knowledge capability (Teece, 1998, 2007) to Nonaka’s (1994) “socialization” ontology, which is highly tacit and knowledge intensive (Popadiuk and Choo, 2006). Further, the study extends exploitation as a learning classification (March, 1991) and seizing as a capability (Teece, 2007) to Nonaka’s “combination” ontology that encompass explicit knowledge-intensive activities (March, 1991; Nonaka, 1994; Popadiuk and Choo, 2006). Given such close linkage that has been established between organizational learning theory and dynamic capability view, the study hypothesizes that not only tacit knowledge, but also explicit knowledge is important and both need to co-exist for competitive advantage and profitability (Nonaka, 1994; O’Reilly and Tushman, 2008; Teece, 2007). This is the first incremental contribution of this study.

Having established that explicit knowledge is also very important for competitive advantage, this study further explores as to how tacit and explicit knowledge transform into firm profitability. Despite this direct relationship between knowledge and profitability, previous research has shown that there are other variables that can also lead to firm profitability. Earlier studies show that knowledge positively impacts product innovation (Gloet and Terziovski, 2004; Nonaka, 1994; Verona and Ravasi, 2003) which in turn impacts profitability (D'Attoma and Pacei, 2018; Deschamps and Nayak, 1993; Jajja *et al.*, 2017). Innovation is important for knowledge management practices to transform into superior firm performance (Byukusenge *et al.*, 2016). Furthermore, researchers have shown that deep customer insights and customer knowledge results in customer centricity, which is defined as the ability of the firm to identify attractive customers to prospect, initiate and maintain relationships, and translating such relationships to superior firm performance (Morgan *et al.*, 2009; Wang and Feng, 2012). Product innovation and customer centricity are both result of organizational learning and knowledge creation. Firstly, a highly-tacit knowledge-intensive "one on one" interaction with customers is required to assess megatrends and understand changing consumer behaviour so that the firm is able to design futuristic innovative products and services that appeal to the customers (Deschamps and Nayak, 1993; O'Reilly and Tushman, 2008). Secondly, once such deep customer insights are captured, the firm needs to internalize the external knowledge through "externalization", "internalization" and "combination" to deliver innovative products to customers, which are explicit knowledge-intensive (Nonaka, 1994; O'Reilly and Tushman, 2008). Hence, it seems logical to hypothesize that not only tacit knowledge, but also explicit knowledge transforms into profitability and such transformation take place through product innovation and also through customer centricity. Bringing together the two most relevant mediating variables, product innovation and customer centricity, this study attempts to specify a robust model that elucidates how tacit and explicit knowledge transforms into firm profitability, which is the second incremental contribution of this study.

The conceptual model developed in this study is tested using a sample of 153 organizations in the industrial sector using structural equation modelling (SEM) and hierarchical regression analysis. The layout of the paper is as follows: Section 2 offers a conceptual framework in which the mediation hypotheses are explored. Section 3 sets out the methodology. Section 4 presents the results and findings obtained. Section 5 provides discussions and conclusions. Section 6 highlights the managerial implications of the study and explores the scope for future research.

Conceptual framework and hypotheses development

Tacit and explicit knowledge

The organization's role is to primarily integrate specialist knowledge residing within individuals into its products and services by establishing the necessary coordination mechanisms (Grant, 1996b). Although, the concept of knowledge is extensively studied in management literature, it still lacks integration of ideas and terminologies (Braganza *et al.*, 1999). One of the reasons can be that knowledge has many dimensions and manifestations (Alvesson and Kärreman, 2001; Blackler, 1995). It can be mainly present in the form of both explicit and tacit knowledge (Polanyi, 1966).

Tacit knowledge is an intangible asset consisting of mental models and schemas, which is about timely extraction of relevant parts from mass data to find solutions (Lubit, 2001). Although scholars have variedly described tacit knowledge, it can be defined as a combination of personal, context specific experiences, ideas, values and emotions (Nonaka, 1991), which is difficult to describe and transmit to others (Guo, 2013). Tacit knowledge is unique in the sense that it is more than mere deployment of technology and tools; it is about connecting people and facilitating the flow of knowledge within the firm, allowing people to think together (Alvesson and Kärreman, 2001) and is acquired through

personal experience and shared by person-to-person interaction (Hansen *et al.*, 1999). Researchers also view tacit knowledge as dynamic (Sveiby, 1997), nurtured through social interaction and personalization (Hansen *et al.*, 1999; Leonard and Sensiper, 1998), centred on human resources (Gloet and Terziovski, 2004) and describe it as “know-how” (Coakes, 2003; Sveiby, 1997).

In contrast to tacit knowledge, explicit knowledge is described as systems oriented (Choi and Lee, 2003) and it is generally captured, structured, codified and institutionalized in the form of procedures, manuals, policies, production schedules, forecasts, blueprints and market intelligence data (Schoenherr *et al.*, 2014). Hence, it can be easily put down on paper (Coakes, 2003; Sveiby, 1997) and is deepened through codification (Hansen *et al.*, 1999; Leonard and Sensiper, 1998). For this reason, it is easily transferred, shared and reused among members (Nonaka, 1994; Samuel *et al.*, 2011). Explicit knowledge management, as a codification strategy is centred on “hard” information technology resources (Gloet and Terziovski, 2004). Information and communication technologies including electronic database, data transfer systems, workflows, mailing lists and video conferencing are enablers for explicit knowledge capture (Vaccaro *et al.*, 2010).

Profitability

One of the main outcomes of knowledge management is increased organizational profits (Edvardsson, 2006). Superior firm-level profitability is a result of unique organizational capabilities (Palacios Marqués and Garrigós Simón, 2006), and such unique capabilities emanates from access to, and integration of, specialist knowledge (Grant, 1996a). In this sense, a hallmark of new economy is the ability of firms to extract value from its knowledge assets (Gold *et al.*, 2001). In other words, performance differences between firms are an outcome of their differing abilities in developing and deploying knowledge (Bierly and Chakrabarti, 1996). However, what is true is that to achieve such competitive advantage and superior profitability, knowledge needs to be managed effectively and efficiently (López-Nicolás and Meroño-Cerdán, 2011; Zack, 2002).

The eventual objective of all strategic management theories is for firms to achieve profitability higher than industry peers. Be it Porter’s five forces model (Porter, 1980), strategic conflict model (Shapiro, 1989), resource-based theory (Barney, 1991; Wernerfelt, 1984) or be it the dynamic capabilities view (Teece *et al.*, 1997), the deep rooted question is how firms can gain competitive advantage and achieve superior profitability in comparison to the competitors. A firm’s competitive advantage manifests itself as superior firm-level profitability in comparison to industry peers (Teece, 2007). In this study, the firm-profitability dimension of competitive advantage as the eventual outcome of knowledge management was explored.

Knowledge and profitability

A large body of studies shows that tacit knowledge is considered to be a source of competitive advantage because of its inimitability and given its difficulty to be transferred (Grant 1996b; Sveiby, 1997). Firms intensive on tacit knowledge management strategies are more long-term focused, explorative, aggressive, innovation centred, better integrators of external and internal learning and are more profitable than other firms (Bierly and Chakrabarti, 1996). So, tacit knowledge acquisition, accumulation and learning yield the greatest potential for contributions to a firm’s strategy and profitability (Teece *et al.*, 1997).

While tacit knowledge strategies are viewed to be profitable and leading up to competitive advantage, several authors think explicit knowledge has a much lesser impact on firm profitability in comparison to tacit knowledge (Grant, 1996b; Sveiby, 1997; Teece *et al.*, 1997). Their predominant contention is that codified explicit knowledge is static and cannot be considered as knowledge at all (Grimaldi *et al.*, 2012; Sveiby, 1997). Several authors

have stated that knowledge cannot reside outside an individual. Once codified and documented, such knowledge becomes static and hence it needs to be interpreted and blended with personal knowledge to make it knowledge again (Coakes, 2003). In this sense, Hansen *et al.* (1999) argue that converting information to explicit knowledge through documentation and coding will not be effective and will not replicate the nuance and detail that are generally captured in face-to-face conversations. Firms intensive on explicit knowledge management strategies focus only on incremental learning and exploiting their current capabilities, are less aggressive, less innovative and are also less profitable than firms that are tacit knowledge focused (Bierly and Chakrabarti, 1996). Further, explicit knowledge and operational management tools cannot be a source of competitive advantage for the organization as they do not have significant tacit component that makes them inimitable (Teece, 2007), facilitating at the most codification strategies and existing knowledge reuse (Alvesson and Kärreman, 2001).

Although many earlier studies viewed both tacit and explicit knowledge as inseparable (Hildreth and Kimble, 2002; Lai, 2013; Nonaka and Von Krogh, 2009; Polanyi, 1969), part of the same continuum (Craighead *et al.*, 2009) and constantly interacting with one another (Nonaka and Takeuchi, 1995; Schoenherr *et al.*, 2014; Scully *et al.*, 2013), it is only recently that few studies show that explicit knowledge can also contribute to a firm's competitive advantage and profitability (López-Nicolás and Meroño-Cerdán, 2011; Vaccaro *et al.*, 2010). In this sense, this study advocates that while tacit knowledge is important, explicit knowledge is also very important for competitive advantage of firms; this is the first research gap this study has identified. To fill this research gap, the organizational learning theory (March, 1991) and dynamic capabilities theory (O'Reilly and Tushman, 2008; Teece *et al.*, 1997; Teece, 2007) were used.

As already commented, the organizational learning theory prescribes two types of learning: exploration and exploitation. Exploration is experimentation with new ideas, alternatives and possibilities. It is futuristic where returns are distant, uncertain and often negative. Exploitation is refinement and extension of existing paradigms, technologies and competencies, more to do with productivity and efficiency; its returns are predictable, proximate and positive (March, 1991). While the focus in exploitation is achieving returns for the present, exploration is about preserving competitive advantage for the future (March, 1991; O'Reilly and Tushman, 2008). Further, most firms focus too much on achieving profits for the present, resulting in their learning typology being excessively exploitation oriented; although such organizations could be successful for the present but self-destructive and unsustainable in the long run (Govindarajan, 2016; O'Reilly and Tushman, 2008). However, excessive focus on exploration is also a problem as exploitation is not only important for organizational well-being for the present, but also funds the high-risk exploration activity that makes organization sustainably successful over the longer term (Govindarajan, 2016). Hence, although exploration and exploitation compete for common organizational resources, the organizational learning theory advocates that both exploration and exploitation are important and a cautious balance is required for organizations to have a sustainable competitive advantage (Govindarajan, 2016; March, 1991; O'Reilly and Tushman, 2008). This study stretches exploration as a learning typology to Nonaka's (1994) "socialization" ontology, which is highly-tacit knowledge intensive, and exploitation as a learning typology to Nonaka's (1994) "combination" ontology, which is highly-explicit knowledge intensive (March, 1991; Nonaka, 1994; Popadiuk and Choo, 2006). Nonaka (1994) conceived "socialization" as a "person to person" tacit knowledge exchange and "combination" that necessitates conversion of new tacit elements of knowledge with existing explicit knowledge; his study also includes "internalization" and "externalization" as learning ontology completing the knowledge spiral. In essence, Nonaka (1994) argues that with mere "socialization" and without "combination", the knowledge spiral will not work; in line with the principal that exploration alone will not be effective without exploitation, as in the organization learning theory paradigm.

The study then imports and links the dynamic capabilities literature to argue that sensing activities in capability building are exploratory learning in nature and akin to tacit knowledge and seizing activities is exploitative learning and is explicit knowledge intensive. Dynamic capabilities theory argues that firms must cautiously balance between sensing and seizing capabilities to achieve sustainable competitive advantage; sensing is a creative activity that requires external learning and ability to integrate such learning and knowledge, which is highly tacit intensive (Teece, 1998). Further, exploration concerns search and discovery; it requires organizational flexibility and informality and hence is akin to tacit knowledge. Exploitation is about efficiency, productivity, certainty and variance control, and requires discipline and results in incremental improvement which is analogous to explicit knowledge. Additionally, seizing is about deploying organizational structures and procedures for seizing the opportunities that are sensed and shaped which is more akin to explicit knowledge that is documented and codified in nature (O'Reilly and Tushman, 2008; Teece, 1998). Moreover, as sensing and seizing activities also compete for common organizational resources, the dynamic capability theory argues that both sensing and seizing are important and needs a cautious balance and co-existence for firms to have a sustainable competitive advantage (Govindarajan, 2016; O'Reilly and Tushman, 2008; Teece, 2007). Given such close linkage that has been established between organizational learning theory and dynamic capability theory, the study deduces that it is not only tacit knowledge that is important, explicit knowledge is also important in explaining firm profitability and both need to co-exist for competitive advantage (Nonaka, 1994; O'Reilly and Tushman, 2008; Teece *et al.*, 1997). The theoretical motivation fusing the four relevant theories highlighting the importance of explicit knowledge in explaining firm profitability is the first incremental contribution of this study.

At this point, it can be interesting to analyse if the linkage between exploration and exploitation, sensing and seizing and tacit and explicit knowledge gets reinforced from a customer and product innovation perspectives. In this sense, sensing, which is explorative in nature, can involve interpretations based on hunches and informed guesses related to new market opportunities and potential customer requirements which are highly tacit in nature. Once such opportunities are sensed, seizing activities, which are exploitative in nature, become very important as they involve establishing structured organizational routines, rules and procedures to seize such sensed opportunities, which are explicit knowledge intensive (Teece, 1998). Precisely, what is important to analyse is whether such tacit and explicit knowledge capabilities are equally important for achieving firm performance through both customer and product innovation capabilities.

Mediating role of product innovation

Having established that not only tacit knowledge but also explicit knowledge is important for competitive advantage and profitability, the study then explores how tacit and explicit knowledge transform into firm profitability. Prior studies show that knowledge positively impacts product innovation (Gloet and Terziovski, 2004; Nonaka, 1994; Verona and Ravasi, 2003) which in turn impacts profitability (D'Attoma and Pacei, 2018; Deschamps and Nayak, 1993; Jajja *et al.*, 2017). Knowledge management differences across firms explain a large part of differential in innovativeness and the differences in valuation of the firms (Stefani *et al.*, 2019). Product innovation is vital for superior knowledge management practices to transform into superior firm performance (Byukusenge *et al.*, 2016). Innovation can be described as implementation of discoveries and inventions and the resultant new products, services and processes (Gloet and Terziovski, 2004). Borghini (2005) contends that innovation encompasses organizational activities that include discovery and experimentation leading to new products and services.

Knowledge management and innovation

Innovation and competitiveness are highly knowledge dependent (Gloet and Terziovski, 2004; Nonaka, 1994; Rhee and Park, 2018). By combining existing knowledge with new knowledge, firms create new specific valuable knowledge that is required for launching new products, services and processes (López-Nicolás and Meroño-Cerdán, 2011). Creativity and discontinuous innovation require integration of explicit and tacit knowledge spatially distributed across multinational organizations (Neukam and Guittard, 2018). In other words, knowledge management strategies positively impact innovation and creativity (Teece, 1998; Soon and Zainol, 2011).

Innovation is tacit knowledge intensive (Leonard and Sensiper, 1998). Tacit knowledge is synonymous with sharing of information and is poised towards exploratory initiatives that contribute to organizational innovation (March, 1991; Swan *et al.*, 2000). Previous research also provides evidence that explicit knowledge being static and backward looking is not as important for innovation (Bierly and Chakrabarti, 1996; Rhee and Park, 2018). However, the postulation that it is only tacit knowledge that translates into innovation is also contestable. In fact, recent studies show that it is explicit knowledge which contributes towards radical innovation (López-Nicolás and Meroño-Cerdán, 2011; Majchrzak *et al.*, 2004). In this sense, explicit knowledge in the form of information and communication technologies is important for innovation as it enhances quality, knowledge exchange and facilitates knowledge transfer, improving firm innovation capabilities, increasing design speed and allowing more precise and detailed design activities (Vaccaro *et al.*, 2010). Not only tacit, but also explicit knowledge created through codification, documentation and knowledge sharing have a positive impact on innovation (Andreeva and Kianto, 2011).

Product innovation as a mediator

The extant literature related to knowledge management, innovation and firm performance is still developing (Darroch, 2005; López-Nicolás and Meroño-Cerdán, 2011). An organization's ability to innovate leads to competitiveness (Braganza *et al.*, 1999). In a context of intense global competition, where the market environment is increasingly dynamic and technological changes are developing at high speed, innovation is considered mandatory and a very important factor for organizations' survival (Seidler-de Alwis and Hartmann, 2008). Perennially great companies are differentiated by their ability to produce never ending and profitable products through consistent innovation while others deliver sporadic new products that fail or are unprofitable (Deschamps and Nayak, 1993). So, there is a positive relationship between product innovation and firm performance (D'Attoma and Pacei, 2018; Jajja *et al.*, 2017).

Wang and Wang (2012) show that both explicit and tacit knowledge impact innovation and performance, while explicit knowledge impacts innovation, speed and financial performance, tacit knowledge impacts innovation, quality and operational performance. Highlighting the importance of explicit knowledge, Vaccaro *et al.* (2010) show that explicit knowledge management tools, such as information and communications systems, can effectively substitute tacit knowledge in the form of "face to face" knowledge exchange. Even when deep customer insights and their unmet needs are captured in the form of tacit knowledge, firms have to deploy explicit knowledge intensive tools in the form of "externalization", "internalization" and "combination" to deliver product innovation (Nonaka, 1994; O'Reilly and Tushman, 2008).

It is well documented that learning orientation positively impacts innovativeness and ultimately firm performance (Rhee *et al.*, 2010). Studies have also shown that innovation mediates the relationship between knowledge management and business performance (Byukusenge *et al.*, 2016). Other recent studies have documented a partial mediating effect of product innovation on tacit knowledge firm performance relationship (López-Cabarcos *et al.*, 2019). The study by

López-Nicolás and Meroño-Cerdán (2011) shows that codification and personalization strategies impact organizational performance and profitability directly as well as through innovation. The study by Vaccaro *et al.* (2010) also shows that naturalness in using information and communication technology tools substituting face-to-face contacts has a positive impact on the firm's financial performance and profitability. Hence the following hypotheses are proposed:

- H1. Product innovation mediates the relationship between tacit knowledge and profitability.
- H2. Product innovation mediates the relationship between explicit knowledge and profitability.

Mediating role of customer centricity

Having established that tacit and explicit knowledge could transform into firm profitability through the mediating role of product innovation, the study then explores the mediating role of customer centricity in the tacit and explicit knowledge firm profitability relationship. Close customer interaction and customer knowledge accumulation is vital to understand changing consumer behaviour which is critical for designing futuristic products and services that delivers customer's unmet needs, ahead of competition (Deschamps and Nayak, 1993; O'Reilly and Tushman, 2008). Such deep customer insight and knowledge result in customer centricity. When a firm is able to identify attractive customers to prospect, initiate and maintain relationships, and translate such relationships into superior firm performance and profitability, the firm is considered to be customer centric (Morgan *et al.*, 2009; Wang and Feng, 2012).

Customer centricity has been studied in literature from various dimensions (Shah *et al.*, 2006), and it is considered as the opposite of product centricity (Galbraith, 2005). A customer-centric approach moves the focus away from the product and services offered to the whole customer experience. Thereby, it can create value in a way that is intimately related to the individual self of the customer (Lamberti, 2013). Customer centricity is related to the generation of customer intelligence through the collection and processing of data to create complete data repositories with information about the interactions between the company and the customer that allow to carry out personalized marketing activities (Lamberti, 2013; Sharma and Sheth, 2004). Such customer knowledge gained from deep customer insights facilitates the firm to deliver core value propositions that meet customer expectations (Galbraith, 2002). It can also be described as a holistic, sound and productive relationship with customers supported by technology (Chang *et al.*, 2010), prescribing the unit of analysis of every marketing action and reaction to be the individual customer (Ramani and Kumar, 2008).

Knowledge management and customer centricity

Customer centricity is in effect the result of the knowledge management process within a firm which involves acquisition, storage and retrieval of customer-centric information and knowledge (Lamberti, 2013). Knowledge management initiatives focused towards customer centricity involve deep tacit components (Wind and Rangaswamy, 2001) such as generating customer intelligence (Lamberti, 2013; Sharma and Sheth, 2004), co-creating value along with them and gathering such tacit information and building the organizational tacit knowledge base (Payne and Frow, 2005; Payne *et al.*, 2008). With increased market fragmentation and demanding customers, there is an expectation from firms to view their customers as a core asset of the company and to try to and increasingly customize their products and services to meet their demands (Galbraith, 2005; Lamberti, 2013; Salunke *et al.*, 2019). Customer knowledge could be both tacit and explicit. Information gathered needs to be processed, codified wherever possible and transformed into comprehensive data repositories profiling the interactions between the customer and the firm, which could be highly explicit in nature (Chang *et al.*, 2010).

Customer centricity as a mediator

Superior customer knowledge has a positive impact on customer loyalty (Komejani and Mohaghegh, 2017) which in turn translates into competitive advantage (Pereira *et al.*, 2016). A customer-based relational approach positively impacts customer profitability (Ramani and Kumar, 2008). Inter-firm performance differential is explained by heterogeneity in proximity and relationships with attractive customers (Wang and Feng, 2012). Previous research has concluded a positive impact of knowledge management strategies on customer intimacy and firm performance (Mckeen *et al.*, 2006).

Few authors show that tacit knowledge enhances customer centricity by better understanding the needs and expectations of the customers, which in turn promotes customer loyalty and thereby enhances competitive advantage (Pereira *et al.*, 2016). Besides highly-tacit knowledge-intensive “one on one” interaction with customers that is required to understand customer needs (O’Reilly and Tushman, 2008), explicit knowledge management tools such as customer relationship management software positively impact firm profitability (Chang *et al.*, 2010). The literature has not established customer centricity as a mediating variable in the relationship between tacit and explicit knowledge and its impact on firm profitability. However relying on the studies that establish a relationship between customer knowledge management and customer centricity (Deschamps and Nayak, 1993), customer centricity and firm profitability (Morgan *et al.*, 2009; Wang and Feng, 2012) and customer knowledge management and firm profitability (Ramani and Kumar, 2008), the following hypotheses are proposed:

- H3. Customer centricity mediates the relationship between tacit knowledge and profitability.
- H4. Customer centricity mediates the relationship between explicit knowledge and profitability.

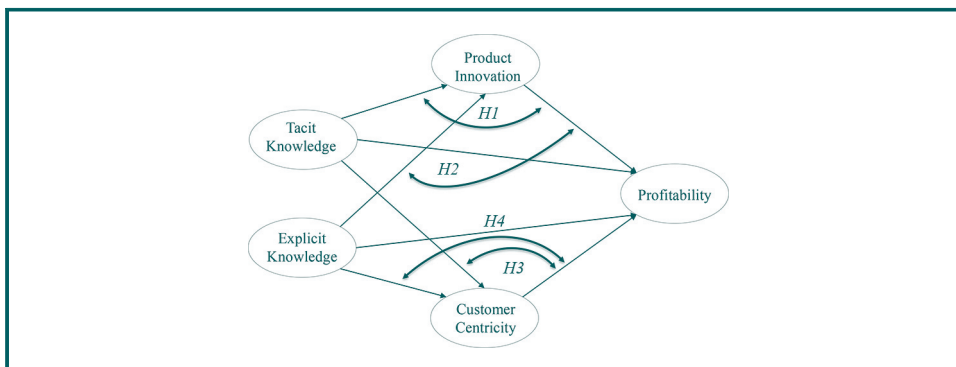
The robust model specification that has been attempted in this study bringing together the two most relevant mediating variables, product innovation and customer centricity, is the second incremental contribution. Figure 1 summarizes the proposed model.

Method

Participants and procedure

The study universe was formed by 521 industrial organizations with more than 50 employees. The source of information used was the Portuguese National Institute of Statistics. A total of 153 organizations participated in the study (response rate: 29%). The sample characterization is as follows: average age of the company is near 20 years (SD =

Figure 1 Proposed model



13.74); private limited corporations (64.5%); public limited corporations (33.6%); companies with less than 100 employees (57%); companies with between 100 and 249 employees (39%); and companies with more than 249 employees (4%).

A questionnaire was sent to all organizations' managers with an instruction letter for the correct completion of the survey, also guaranteeing data protection in accordance with legal regulations. The hypotheses were tested using SEM with the statistical package AMOS SPSS 22.0.

Instruments

Tacit and explicit knowledge: The management of tacit (four items) and explicit knowledge (four items) within the organization was measured with the scale proposed by [Choi and Lee \(2003\)](#) on a five-point Likert scale (1 = *totally disagree*; and 5 = *totally agree*). Examples of items of these scales were "It is easy for employees to acquire knowledge through direct contact with experts or pairs of work" (tacit knowledge) and "Knowledge can be easily acquired through formal documents that are available in the organization" (explicit knowledge).

Product innovation: Four items of the [Spanos and Lioukas's \(2001\)](#) scale were used to measure the company's differentiation strategy through product innovation on a five-point Likert scale (1 = *a lot less than the competitors*; and 5 = *a lot more than the competitors*). An example of the items included is "R&D expenditures for process innovations".

Customer centricity: Four items of the [Spanos and Lioukas's \(2001\)](#) scale were used to measure the degree of customer orientation of the company in relation to its competitors on a five-point Likert scale (1 = *weaker than competitors*; and 5 = *stronger than competitors*). It included items such as "Advantageous relationships with customers".

Profitability: Three items were used to measure profitability as a performance's perception measure ([Dess and Robinson, 1984](#); [Powell and Dent-Micallef, 1997](#)) in relative terms of competitors ([Rivard et al., 2005](#); [Venkatraman and Ramanujam, 1987](#); [Woo and Willard, 1983](#)) and over a period of three years to better reflect the notion of sustainable performance ([Arend, 2006](#)). An example of the items included on a five-point Likert scale is "Net profit" (1 = *far below average*; and 5 = *far above average*).

Results

Common method bias

Data were collected from a single session and in self-reporting measure. So, to avoid the common method bias, the recommendations of [Podsakoff et al. \(2003\)](#) were followed. In addition, the Harman's single factor test ([Harman, 1967](#)) was performed, detecting the existence of three factors (eigenvalues > 1) that explained 75.9% of the total variance. No single factor responsible for most of the variance emerged ([Christmann, 2000](#)). Furthermore, a confirmatory factor analysis with all items loaded onto one single factor was performed ([Korsgaard and Roberson, 1995](#)). The results concluded that the measurement model fit data significantly better than the single-factor model. Therefore, common method variance was not a problem in this study ([Podsakoff et al., 2003](#)).

Measurement model

Simple correlations, Cronbach's alpha, descriptive statistics, average variance extracted (AVE > 0.5) and composite reliability (>0.7) ([Fornell and Larcker, 1981](#)) are presented in [Table 1](#). As expected, all variables correlated positively with each other.

Table 1 Descriptive statistics, Cronbach's alpha, correlations, AVE and composite reliability

	<i>M</i>	<i>SD</i>	<i>TK</i>	<i>EK</i>	<i>PI</i>	<i>CC</i>	<i>PR</i>	<i>AVE</i>	<i>Composite reliability</i>
TK	3.26	0.94	0.903					0.705	0.905
EK	3.21	0.90	0.478**	0.900				0.698	0.902
PI	2.94	0.95	0.651**	0.446**	0.907			0.709	0.907
CC	3.11	0.89	0.673**	0.443**	0.603**	0.899		0.697	0.902
PR	3.09	0.94	0.623**	0.482**	0.686**	0.701**	0.907	0.773	0.911

Notes: *N* = 153. Variables: tacit knowledge (TK); explicit knowledge (EK); product innovation (PI); customer centricity (CC); and profitability (PR). Cronbach's α on the diagonal. * $p < 0.05$ ** $p < 0.01$

The scale's reliability was supported by confirming its convergent and discriminant validity (Hair et al., 2010). The goodness-of-fit indices showed good values: $\chi^2 (df) = 315,756(142)$, $p < 0.001$, GFI = 0.824, RMSEA = 0.09, TLI = 0.912, CFI = 0.927 and $\chi^2/df = 2.224$.

From tacit and explicit knowledge to profitability throughout product innovation

To fully confirm the partial mediating role of product innovation in the relationship between tacit and explicit knowledge and profitability, two additional models were tested in each of the two cases. Both in the case of tacit knowledge (Table 2) and in the case of explicit knowledge (Table 3), the direct relationship between tacit and explicit knowledge and profitability was significant (Model 2), and it remained once product innovation was introduced in Model 3 (partial). The paths from tacit and explicit knowledge to product innovation and from product innovation to profitability remained significant in Models 3 and 1 (full). In both cases, the mediating effect of product innovation in the relationship between

Table 2 Fit results and path coefficients for structural equation models

	$\chi^2 (df)$	<i>p</i>	<i>GFI</i>	<i>RMSEA</i>	<i>TLI</i>	<i>CFI</i>	χ^2/df
Model 1 (full mediation)	99.873 (42)	0.000	0.896	0.095	0.943	0.957	2.378
Model 2 (direct effects)	218.293 (43)	0.000	0.832	0.164	0.832	0.868	5.077
Model 3 (partial mediation)	93.193 (41)	0.000	0.902	0.092	0.947	0.961	2.273
	Standardized coefficients and (<i>t</i> -values)						
	Tacit knowledge → Product innovation		Product innovation → Profitability		Tacit knowledge → Profitability		
Model 1	0.728 (14.27)***		0.782 (19.07)***				
Model 2					0.677 (11.28)***		
Model 3	0.707 (13.34)***		0.582 (5.71)***		0.259 (2.25)*		

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

Table 3 Fit results and path coefficients for structural equation models

	$\chi^2 (df)$	<i>p</i>	<i>GFI</i>	<i>RMSEA</i>	<i>TLI</i>	<i>CFI</i>	χ^2/df
Model 1 (full mediation)	75.218 (42)	0.000	0.923	0.072	0.965	0.973	1.791
Model 2 (direct effects)	177.116 (43)	0.000	0.861	0.143	0.862	0.892	4.119
Model 3 (partial mediation)	69.545 (41)	0.000	0.929	0.068	0.969	0.977	1.696
	Standardized coefficients and (<i>t</i> -values)						
	Explicit knowledge → Product innovation		Product innovation → Profitability		Explicit knowledge → Profitability		
Model 1	0.510 (7.50)***		0.774 (18.43)***				
Model 2					0.523 (7.07)***		
Model 3	0.489 (6.99)***		0.675 (11.07)***		0.186 (2.24)*		

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

tacit knowledge and profitability ($z = 10.838$; $p < 0.001$) and explicit knowledge and profitability ($z = 6.946$; $p < 0.001$) was also supported by the Sobel's (1982) test. As shown in Table 2 (tacit knowledge model) and Table 3 (explicit knowledge model), the χ^2 of partial mediation Model 3 was lower and significantly different than the χ^2 of full mediation Model 1 ($\chi^2 = 6.680$, $\Delta df = 1$; $\Delta \chi^2 = 5.673$ $\Delta df = 1$, respectively) and lower and significantly different than the χ^2 of direct relation Model 2 ($\Delta \chi^2 = 125.100$, $\Delta df = 2$; $\Delta \chi^2 = 107.571$, $\Delta df = 2$, respectively). Furthermore, variance accounted for (VAF) fell within the range of 0.20-0.80 proposed by Hair et al. (2014) (tacit knowledge model: 0.6137; and explicit knowledge model: 0.6395), so the mediating role of product innovation was supported.

From tacit and explicit knowledge to profitability throughout customer centrality

The same analysis as the previous one was carried out to test the mediating role of consumer centrality in the relationship between tacit and explicit knowledge and profitability.

Tables 4 and 5 show that the relationship between tacit and explicit knowledge and profitability was significant in Model 2 (direct effects), and it did not disappear once product innovation was introduced (Model 3). The paths from tacit and explicit knowledge to customer centrality and from customer centrality to profitability remained significant in partial and full mediation models. In both models, Sobel's (1982) test also supported the mediating effect of product innovation (tacit knowledge model: $z = 10.599$, $p < 0.001$; and explicit knowledge model: $z = 7.056$, $p < 0.001$). As shown in Table 4 (tacit knowledge model) and Table 5 (explicit knowledge model), the χ^2 of partial mediation Model 3 was lower and significantly different than the χ^2 of full mediation Model 1 ($\Delta \chi^2 = 5.326$ $\Delta df = 1$; $\Delta \chi^2 = 6.441$ $\Delta df = 1$, respectively) and lower and significantly different than the χ^2 of direct relation Model 2 ($\chi^2 = 130.172$, $\Delta df = 2$; $\Delta \chi^2 = 107.662$, $\Delta df = 2$, respectively).

Table 4 Fit results and path coefficients for structural equation models

	χ^2 (df)	p	GFI	RMSEA	TLI	CFI	χ^2/df
Model 1 (full mediation)	123.448 (42)	0.000	0.879	0.113	0.920	0.939	2.939
Model 2 (direct effects)	248.294 (43)	0.000	0.812	0.177	0.804	0.847	5.774
Model 3 (partial mediation)	118.122 (41)	0.000	0.883	0.111	0.923	0.942	2.881
	Standardized coefficients and (<i>t</i> -values)						
	Tacit knowledge → Customer centrality		Customer centrality → Profitability		Tacit knowledge → Profitability		
Model 1	0.755 (13.73)***		0.784 (16.68)***				
Model 2					0.677 (11.28)***		
Model 3	0.735 (13.13)***		0.585 (5.22)***		0.248 (2.23)*		

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

Table 5 Fit results and path coefficients for structural equation models

	χ^2 (df)	p	GFI	RMSEA	TLI	CFI	χ^2/df
Model 1 (full mediation)	91.919 (42)	0.000	0.909	0.088	0.947	0.960	2.189
Model 2 (direct effects)	193.140 (43)	0.000	0.848	0.152	0.844	0.878	4.492
Model 3 (partial mediation)	85.478 (41)	0.000	0.915	0.084	0.952	0.964	2.085
	Standardized coefficients and (<i>t</i> -values)						
	Explicit knowledge → Customer centrality		Customer centrality → Profitability		Explicit knowledge → Profitability		
Model 1	0.512 (7.88)***		0.778 (15.88)***				
Model 2					0.523 (7.07)***		
Model 3	0.488 (7.51)***		0.673 (9.90)***		0.194 (2.46)*		

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

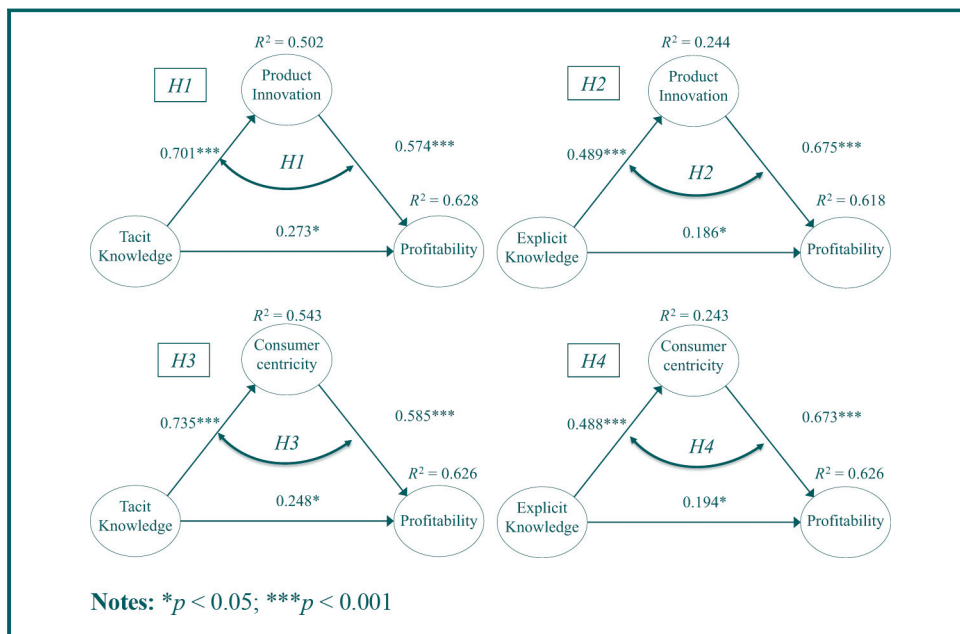
Finally, results show a VAF value of 0.6342 (tacit knowledge model) and 0.6286 (explicit knowledge model); so, the mediating role of customer centrality was also supported.

Figure 2 summarizes the results of the hypotheses tested.

Discussion and conclusions

The results show that product innovation partially mediates the relationship between tacit and explicit knowledge and profitability (supporting *H1* and *H2*). Hence, organizations achieve superior profitability from tacit and explicit knowledge either directly or through product innovation. The indirect effect of tacit and explicit knowledge on profitability through product innovation is greater than the direct effect of tacit and explicit knowledge on firm profitability. This clearly demonstrates the importance of product innovation as a mediator variable and emphasizes that tacit and explicit knowledge indeed transforms into profitability through product innovation. The establishment of product innovation as a mediator variable is in line with the results of previous research (López-Cabarcos *et al.*, 2019; López-Nicolás and Meroño-Cerdán, 2011; Vaccaro *et al.*, 2010). The study results also highlight that the effect of tacit knowledge on profitability through product innovation is greater than explicit knowledge transforming into profitability through product innovation; nevertheless, explicit knowledge also being a vital component in transforming knowledge to profitability through product innovation. The vitality of explicit knowledge in explaining profitability and competitive advantage which this study has uncovered is contrary to previous studies (Birly and Chakrabarti, 1996; Grant, 1996b; Grimaldi *et al.*, 2012; Sveiby, 1997; Teece *et al.*, 1997). Another fact that this study establishes is the coexistence of tacit and explicit knowledge for achieving competitive advantage, which is contrary to Hansen *et al.* (1999) but it is in line with the study of López-Nicolás and Meroño-Cerdán (2011), which shows the coexistence of codification and personalization strategies. Our results are also in line with the study of Bollinger (2019), who shows the importance of a “balanced” managerial control having the right proportions of human interactions (which are tacit in

Figure 2 From tacit and explicit knowledge to profitability throughout product innovation and customer centrality



nature) and information system tools (which are explicit knowledge intensive) to ensure the transformation of the firm's innovation initiatives into firm performance.

The results regarding the importance of explicit knowledge to achieve firm performance are in line with the strategies of management consulting companies operating in knowledge intensive industries, which make elaborate investments in explicit knowledge initiatives to improve organizational performance. They follow a "people to document" approach, where knowledge is codified after being extracted from the person who develop it, stored regardless of who developed it and reused for similar client engagements (Hansen *et al.*, 1999). In this sense, codification strategies can help maximize high quality, reliable and fast reuse of codified knowledge across the organization with the aim to maximize organizational performance.

Having specified a robust model closely linking with two adjacent theories, the organizational learning theory and dynamic capabilities theory, and confirming such model specification through the study results, it might be cautiously extended the interpretation that explicit knowledge, in line of exploitation as a learning typology and seizing as capability is very important for sustained competitive advantage. Further as documented in literature, exploitation and seizing activities are critical not only for the current success of the organization, but also for funding the exploration and sensing activities (Govindarajan, 2016). The need for coexistence of exploration and exploitation, sensing and seizing is also highlighted in the ambidexterity literature (O'Reilly and Tushman, 2008; Teece, 1998). The study thus draws a parallel to interpret that explicit knowledge is critical for current organizational profitability which potentially could fund the more complex tacit knowledge management activities of the firm. The study provides a clear linkage between knowledge-based theory, organizational learning theory and the dynamic capabilities view. This is the first incremental contribution of this study.

Emerging digital technologies such as artificial intelligence and machine learning are becoming major enablers of codifying and converting tacit knowledge into explicit knowledge within organizations (Schneider and Handali, 2019). For example, the global consulting major, Accenture, views that more than 80% of data floating around are unstructured in nature and most often ignored and overlooked, thereby missing out on crucial insights. Through its search and content analytics practice using machine learning and natural language processing, Accenture helps organizations to extract crucial insights which are highly tacit in nature and codify the same into explicit knowledge thereby unlocking value for organizations. Such algorithms as facilitators of explicit knowledge management are fast emerging (Accenture, 2019). Woodside, the Australian oil and gas major, has codified close to million pages of documentation from historical reports, correspondence and experiences, creating explicit knowledge that deepens insights to the employees through user-friendly search options. While employees used to spend 80% of their time researching problems and 20% of their time fixing it, such explicit knowledge management has reversed that (IBM Woodside, 2019), demonstrating how explicit codified knowledge can improve employee productivity leading to profitability. It is clear that such digital technologies are shifting the knowledge dynamics and positioning explicit knowledge management as crucial for competitive advantage.

This study also shows that customer centrality partially mediates the relationship between tacit and explicit knowledge and profitability (supporting *H3* and *H4*). So, besides product innovation, organizations achieve superior profitability from tacit and explicit knowledge either directly or through customer centrality, as well. The indirect effect of tacit and explicit knowledge on profitability through customer centrality is greater than its direct effect on firm profitability. Hence, customer centrality also comes out as a mediator variable thereby demonstrating that tacit and explicit knowledge transforms into profitability through customer centrality, as well. The results also highlight that although the effect of tacit knowledge on profitability through customer centrality is greater than explicit knowledge

transforming into profitability through customer centricity, explicit knowledge is still a vital component in transforming knowledge to profitability through customer centricity. Bringing together two most relevant mediating variables, product innovation and customer centricity, and to specify a robust model that elucidates how tacit and explicit knowledge transform into firm profitability, is the second incremental contribution.

Explicit knowledge is already being viewed as crucial in the health-care industry. IBM's Watson Explorer helps hospitals to extract key insights from unstructured patient medical history, physician notes and dictations to predict the risk of post-discharge complications and need for readmissions. This demonstrates the capture of tacit knowledge through digital technologies and codified in the form of predictive algorithms and explicit knowledge, thereby providing superior customer care in hospitals that use Watson Explorer (Watson Explorer, 2019). This increases the patient's willingness to pay resulting in increased competitive advantage of such hospitals.

Managerial implications and future research

This study attempts to answer the question on how managers can use knowledge strategies to achieve superior competitive position. The results demonstrate that tacit and explicit knowledge are both important for gaining competitive advantages. For organizations that are in the early stages of embracing a knowledge management model, explicit knowledge strategies can be easier to manage, implement and institutionalize in comparison to tacit knowledge strategies that require human component and intervention to succeed (Kruger and Johnson, 2010). Considering this and given that both tacit and explicit knowledge are important to achieve superior product innovation, customer centricity and profitability, it would be recommended that managers create at first a robust explicit knowledge management system which can possibly provide positive results ahead of moving towards implementing tacit knowledge strategies. With the advent of digital technologies in the form of artificial intelligence and machine-learning algorithms, the importance of explicit knowledge is ballooning. In a sense, such digital technologies and algorithms are extracting deep customer insights and organizational experience that are highly tacit in nature and are codifying the same into explicit knowledge (Holford, 2019; Schneider and Handali, 2019).

For organizations to tap the full potential of codified explicit knowledge, it must manage the obsolescence of the hardware in which such knowledge is stored (Barcelo-Valenzuela et al., 2016; Coakes, 2003; Sveiby, 1997). While digital recordings of disks, file systems and internet are prone to failure, emerging technologies such as blockchain not only helps maintaining credible data storage solutions for inputs into artificial intelligence but can also host artificial intelligence advanced enough to work with its own data for advancing knowledge (Sgantzios and Grigg, 2019). Blockchain along with artificial intelligence and machine-learning algorithms is hence expanding the horizon of explicit knowledge scope as a facilitator of knowledge creation and transfer. Given that the business impact in terms of performance to cost ratio is also lower for explicit knowledge strategies (Inuzuka and Nakamori, 2004; López-Nicolás and Meroño-Cerdán, 2011), organizations eventually need to become stronger in terms of tacit knowledge management capabilities, for which sound explicit knowledge management is inevitable and a precursor.

This study does have certain limitations. While the variables used in the study are extremely important, but are not exhaustive; external variables such as competitive rivalry and industry forces along with internal variables within the firm such as managerial capabilities, organizational structure and operational excellence are some of the key variables that may have to be studied and their moderating behaviours understood. Further with the advent of digital technologies such as artificial intelligence, machine learning and algorithmic analytics, there is an emerging view that human tacit knowledge can be extracted through special elicitation machine-learning techniques thereby codifying tacit knowledge into explicit knowledge (Schneider and Handali, 2019). However, other authors argue that

codifying and converting tacit knowledge in terms of human creativity, heuristics and symbolic transformations into explicit knowledge is complex and is still far from reality (Holford, 2019). Linking knowledge management theory with emerging digital technologies to understand its implications on tacit and explicit knowledge provides scope for an interesting research agenda.

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