

The impact of knowledge creation and acquisition on innovation, coopetition and international opportunity development

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Abstract: This study sought to analyse the impact of the creation and acquisition of knowledge in company coopetition and innovation, as well as the effect of coopetition and innovation on internationalisation. The analysis used variables included in the database of the Community Innovation Survey – CIS 2012, to which multivariate statistical tests were applied. The results reveal that the creation process, including knowledge creation, has an impact on company innovation and coopetition. In addition, innovation has a positive impact on the internationalisation of enterprises. Thus, companies that promote knowledge creation and acquisition and that implement coopetition strategies innovate significantly more, thereby promoting internationalisation. This study's results

contribute to validating the importance of investment in knowledge – supported by coepetition strategies – as a way to understand trends and to plan and define innovation strategies that contribute to companies' entry into the global market.

Keywords: acquisition of knowledge; coepetition; creation of knowledge; innovation; internationalisation.

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Biographical notes: Gina Marques Carvalho Santos characterised and related the profile, the duplication of women's roles, motivations and environment (rural vs. urban) of the Portuguese entrepreneurial woman in her Master's in Management. She has published some articles in international journals and international conferences. Currently, her research interests include entrepreneurship, strategy, gender and the implications of innovation for organisational and institutional change.

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1 Introduction

The paradigm shift in industrialised economies and gradual evolution of societies towards a knowledge society (Drucker, 1968) have increased interest in knowledge management. Industrialised economies were based on natural resources rather than intellectual assets, so firms have been forced to focus increasingly on their underlying knowledge about their business and ways that they use knowledge (Ferraris et al., 2017; Swan and Newell, 2000). Recent research by Ramadani et al. (2018) has suggested that internationalisation is a way firms utilise their knowledge through collaborating with other companies on new products, services and processes. Drucker (1994) argues that while, in knowledge economies, knowledge is the main factor leading to economic development, conventional factors of production such as land, labour and capital have not been abolished but instead have become secondary. This approach breaks with established theories on companies in terms of neoclassical economics and focuses instead on knowledge as a factor that, more and more often, explains the idiosyncrasies of companies (Nonaka and von Krogh, 2009).

Since the seminal work by Teece (1981, 1982) and Nelson and Winter (1982), knowledge has assumed an increasingly legitimate and prominent role in organisational research (Nonaka and von Krogh, 2009). According to some authors (e.g. Kogut and Zander, 1992; Nonaka and Takeuchi, 1995), knowledge is a critical success factor in companies' competitiveness over time. The creation of new knowledge becomes a core activity during the development of new products, services and processes (Bengoa et al., 2015; Madhavan and Grover, 1998; Mahr and Lievens, 2012). As a result, the innovation process depends heavily on knowledge (Gloet and Terziovski, 2004), especially tacit knowledge (Leonard and Sensiper, 1998). New, important knowledge is created and converted into goods, services and practises (Choy et al., 2006), transforming general knowledge into specific knowledge. According to Nonaka (1994), knowledge is one of the main requirements for innovation and competitiveness.

Coopetition is a combination of collaboration and competition that occurs in the context of business relationships, strategies or models in which companies compete and cooperate at the same time (Bengtsson and Kock, 2000; Bergendahl and Magnusson, 2014; Gnyawali and Park, 2009; Ritala et al., 2014). Coopetition evolves through complex networks between multiple actors, based on shared interests and the creation of congruent value – in other words, as a result of mutual convenience (Padula and Dagnino, 2007; Ritala et al., 2014). Formal networks can facilitate transactions, as well as cooperation, in areas such as knowledge, production, logistics, product development, business innovation and internationalisation (Welch and Welch, 1996; Wilkinson et al., 2000).

Numerous studies in this area have been based on the Community Innovation Survey (CIS), which has collected data since 1992 on the European Union (EU) (e.g. Cassiman and Veugelers, 2006; Catozzella and Vivarelli, 2014; Antonelli and Fassio, 2015; Cesário Fernandes and Roach, 2016; Estrada et al., 2016; Pereira and Piglet, 2016; Marques et al., 2011; Vega-Jurado et al., 2009). These data are related to innovation activities carried out by companies, demonstrating the importance of national statistics in this field of research.

Previous research has recognised the importance of understanding the relationships between or impacts of the practices under study, namely, connections between knowledge management (e.g. Grimpe and Kaiser, 2010; Nonaka and von Krogh, 2009),

cooperation (e.g. Chevallier et al., 2016; Neyens et al., 2010; Yami and Nemeh, 2014), innovation (e.g. Bengtsson and Kock, 2014; Leiponen and Helfat, 2010) and internationalisation (e.g. Estrada et al., 2016). Using the CIS 2012 database, we sought to fill one of the gaps in research on this management issue. The CIS 2012 survey was conducted during a time of financial crisis in Portugal, so the data reflect a period dominated by the need for change and the rehabilitation of companies to develop the new characteristics required by the global market. In some sectors, this was achieved through cooperation.

In this context, the present study sought to analyse the impact of knowledge creation and acquisition on cooperation and innovation, as well as the impact of cooperation and innovation as antecedents of internationalisation. To this end, the resulting article is structured as follows. After this introduction, the literature on knowledge management, co-participation, innovation and internationalisation is reviewed, and the research model is presented. In the third section, the methodology and tools applied in the empirical analysis are described. The last three sections present and discuss the results and final considerations, ending with the main conclusions, limitations and suggestions for future lines of research.

2 Literature review

2.1 Knowledge management

Based on Polanyi's (1962, 1967) work, Nonaka (1994) distinguishes between two types of knowledge in organisations: tacit knowledge and explicit knowledge. These together are designated by the latter cited author as the epistemological dimension – although a distinction still needs to be made between them. Tacit knowledge is composed of cognitive elements (i.e. mental models such as schemas, paradigms, beliefs and points of view) and technical components (i.e. concrete knowledge, manual work and abilities that apply to specific contexts). Tacit knowledge is disjointed and connected to the senses, movement skills, physical experiences, intuition or implicit rules (Nonaka, 1994). This knowledge differs from explicit or codified knowledge that is objective and rational and transmitted in formal, systematic ways (i.e. discrete or digital content captured in historical records such as libraries, archives and databases and accessed sequentially) (Nonaka, 1994; Ramadani et al., 2017). According to Takeuchi (2013), explicit knowledge prevents managers from making irrational, hasty and unsubstantiated decisions in given contexts.

Knowledge, as an integral part of individuals, is amplified in organisational knowledge through interactive processes, which Nonaka (1994) designates the ontological dimension or social interaction level. Organisational knowledge is created through a synthesis of individuals' different views within organisations (Takeuchi, 2013). Thus, to Nonaka (1994), knowledge is a multifaceted concept with many interpretations that can be defined as a 'belief based on truth'. From the perspective of creation as conceptualised by the theory of knowledge, this is a dynamic human process of justifying personal beliefs as part of a search for the truth, as opposed to how knowledge is defined by traditional epistemology.

In this way, knowledge is the asset that drives strategy, which is the main characteristic that separates the knowledge-based view (KBV) or theory from other schools of thought in strategy research (Kogut and Zander, 1992; Takeuchi, 2013;

Winter, 1987). Many authors have identified knowledge as the main resource that companies can control, and the KBV was developed to explain persistently superior business performance (Barney and Arakin, 2005). Hoskisson et al. (1999) argue that the KBV is based on the resource-based view (RBV) or theory (e.g. Barney, 1991; Wernerfelt, 1984) and extend this concept to include seeing firms as heterogeneous entities of knowledge. Based on the RBV of companies, external research and development (R&D) serves as a tool to access knowledge resources that can later be reallocated along with existing resources in ways that result in better performance than competitors (Barthélemy and Quélin, 2006; Kogut and Zander, 1992).

In parallel with this theoretical perspective, Teece et al. (1997) developed a theory of dynamic capabilities with reference to enterprises. In contrast to resource-based theory, this framework emphasises the importance of dynamic processes. According to Nonaka and von Krogh (2009), the theory of organisational knowledge creation seeks not only to explain the nature of knowledge assets and management strategies but also to complement the KBV of companies and the theory of dynamic capabilities. Together, these approaches explain the dynamic processes of organisational knowledge creation (Nonaka, 1991, 1994; Nonaka et al., 2006).

Nonaka and von Krogh (2009) define the creation of organisational knowledge as the process of making available and expanding the knowledge created by individuals, as well as crystallising and connecting it to the knowledge system of organisations. The theory of organisational knowledge creation (Nonaka, 1994) arose as a comprehensive view of knowledge that could boost organisational creativity, learning, innovation and change (Nonaka 1988, 1991). Researchers consider two premises important when explaining the dynamic processes of knowledge creation. These are that tacit and explicit knowledge can be conceptually distinguished along a continuum and that the conversion of knowledge explains the interaction between tacit and explicit knowledge. This interaction and alternation between tacit and explicit knowledge occurs in four processes. These are socialisation (i.e. from tacit knowledge to tacit knowledge), externalisation (i.e. from tacit knowledge to explicit knowledge), combination (i.e. from explicit knowledge to explicit knowledge) and internalisation (i.e. from explicit knowledge to tacit knowledge). These modes of knowledge conversion are referred to as the SECI model based on the acronym of the four processes (Nonaka, 1994; Nonaka and Takeuchi, 1995).

Wu and Voss (2015) point out that companies can have a greater capacity for absorption (Cohen and Levinthal, 1989, 1990) – a concept that gives special emphasis to companies' pre-existing knowledge in the processes of identifying, assimilating and exploiting external knowledge. Companies with this capacity are more capable of assimilating and exploiting new ideas and entrepreneurial skills that will have a greater impact on the overall performance of their business. Other authors (e.g. Szulanski, 1996; Zahra and George, 2002), however, have defined absorptive capacity more broadly as a dynamic capacity that restructures firms' knowledge base through iterative learning processes.

Based on Cohen and Levinthal's (1989) work, researchers have argued not only that companies' internal efforts to create new knowledge encourage the use of external sources of knowledge but also that these efforts increase companies' ability to exploit these sources of knowledge. This is an efficient way to develop new products and processes (Vega-Jurado et al., 2009). Therefore, the greater the internal capacity of a company to create knowledge, the greater the effects are of different external strategies of knowledge acquisition on the company's innovation performance (Vega-Jurado et al., 2009).

Mowery (1983) was perhaps the first to find evidence of complementarities between external knowledge and organisations' internal development of knowledge. Mowery (1983) and Mowery and Rosenberg (1989) extended the transaction cost perspective by suggesting that the demand for extramural R&D was greater when firms had the expertise to identify their needs and use external research. Conducting R&D internally can thus be important in various ways.

Internal R&D creates company-specific knowledge resources upon which reimplementation processes of external knowledge can be based (e.g. Barney and Mackey, 2005; Sirmon et al., 2007). This follows the logic that companies' resource specificity can be characterised as an isolation mechanism (Wang et al., 2009) insofar as they may not be easily negotiated, reimplemented outside the company or imitated by competitors (Dierickx and Cool, 1989). The greater the internal stock of companies' specific knowledge resources, the greater the likelihood that combinations with external knowledge are unique, less generic and, therefore, more valuable (Grimpe and Kaiser, 2010).

Thus, maintaining strong internal R&D activities also means that client firms retain the tacit knowledge needed to discern and develop the full potential of encoded external knowledge (Weigelt, 2009). Assuming there is competition for management attention among different corporate functions, management will presumably also remain focused on the effectiveness of innovation processes. As a result, increased management attention will be paid to the resource reassignment process, and the threat of the dilution of companies' resource base is reduced (Grimpe and Kaiser, 2010).

Internal knowledge resources can become more valuable when co-evolving with other resources (DeSarbo et al., 2005). To gain competitive advantages, knowledge resources can, on the one hand, be deployed in more productive ways than competitors' deployment of knowledge (DeSarbo et al., 2005). On the other hand, resources can be purchased externally and later redistributed with existing internal resources so that the combination results in the enhancement of companies' specific organisational capabilities. In short, the internal stock of knowledge and resources of companies – both human and material – make companies more likely to co-opt relationships and exploit their own absorption capacity (Pereira and Leitão, 2016).

2.2 Coopetition

The term coopetition comes from a combination of the words 'cooperation' and 'competition' (Brandenburger and Nalebuff, 1996). Some researchers (e.g. Brandenburger and Nalebuff, 1996; Ritala and Hurmelinna-Laukkanen, 2009; Yami et al., 2010) have pointed to coopetition or collaboration between two directly competing firms as a viable strategy to stimulate the development of new products and launch them on the market. This type of alliance mixes competitive and cooperative positions among competitors, which can be combined directly (Bengtsson and Kock, 2000) or in complex networks (Padula and Dagnino, 2007).

The phenomenon of coopetition has been explained from different theoretical perspectives. On the one hand, this can be approached from an organisational standpoint through organisational and/or strategic learning (e.g. Luo et al., 2006; Mariani, 2007) and social network theory (e.g. Gnyawali et al., 2006; Tsai, 2002). On the other hand, coopetition can be examined from an economic perspective through resource-based theory (e.g. Mention, 2011; Ritala and Sainio, 2014), game theory (e.g. Ritala and

Hurmelinna-Laukkanen, 2009; Ritala, 2012), transaction cost theory (e.g. Ritala and Hurmelinna-Laukkanen, 2009) or dynamic capabilities theory (e.g. M'Chirgui, 2005).

Competing firms share interests and positions in strategic, market, technology and business domains (Kim and Parkhe, 2009; Luo et al., 2007). Therefore, collaboration between competitors facilitates the pooling of additional resources that are needed to turn product innovation projects into market successes (e.g. Wassmer and Dussauge, 2011). Competitors are also likely to have additional resources and relatively similar knowledge bases (Park et al., 2014). This similarity of knowledge reduces ambiguity and increases companies' potential absorptive capacity (Lane and Lubatkin, 1998), facilitating access to and acquisition of valuable knowledge by those companies that promote a cooptation strategy (Ritala and Hurmelinna-Laukkanen, 2013). Competitors can thus exchange explicit and tacit knowledge – a fundamental factor in the recombination process (Galunic and Rodan, 1998) – and generate substantial competitive advantages in terms of new innovations contributed to the market (Faems et al., 2007).

Cooperation evolves into relationships or complex networks with several actors based on shared interests and the creation of congruent value (Dana, 1995; Padula and Dagnino, 2007). The exchange, sharing and creation of knowledge with competitors in joint projects reveals that competitive and cooperative behaviours require that a balance be maintained between opportunism and pooling of resources (Miles and Snow, 1986). In addition, arbitration must reconcile private and collective interests (Gulati et al., 2000), leading to harmony between the parties involved (Jorde and Teece, 1989). Thus, companies can coordinate, share knowledge, learn from each other and join forces to thrive, thereby reducing the risk of opportunism from rival partners (Chevallier Laarraf et al., 2016).

According to the RBV, strategic resources and skills are strategically located between firms in cooperative systems. These become hybrid organisational forms in which cooperation takes place in an intermediate place somewhere between the market and company hierarchy (Chevallier Laarraf et al., 2016). Organisational management studies have thus shown that knowledge management and cooptation strategies are two interrelated concepts (e.g. Kogut, 2000; Ritala and Hurmelinna-Laukkanen, 2013) and that the most specific trait of cooptation is the simultaneity of rivalry and cooperation.

The choice to cooperate, compete or engage in cooptation – or all three together – is influenced by companies' knowledge structure, according to Padula and Dagnino (2007). Thus, companies wishing to engage in cooperation and/or competition or cooptation need to increase or acquire their stock of internal knowledge and resources (Bengtsson and Kock, 2000). This external acquisition of knowledge is extremely important for companies seeking to strengthen their competitiveness and innovation when competing with competitors. We, therefore, developed the following research hypotheses:

H₁: The creation of organisational knowledge influences cooptation.

H₂: The acquisition of organisational knowledge influences cooptation.

2.3 Innovation

The study of innovation stems from Schumpeterian economic research on industrial organisations focusing on the impact of waves of technological change on industry and market structures (Dosi, 1982). According to Trott (2005), innovation can be defined as a process by which a new viable idea is produced and implemented to generate value. The

notion of innovation as a 'process' (i.e. set of successive activities) introduces the conceptualisation of innovation as a 'capacity' (i.e. ability to perform a particular task, function or activity) (Helfat, 2007). This involves standardised organisational behaviour that companies can invoke repeatedly rather than idiosyncratically. More precisely, innovation entails a 'dynamic capacity'. According to Helfat (2007), this refers to the ability of organisations to create, expand or deliberately modify their resource base.

Since the seminal work by Nonaka (1991) and Nonaka and Takeuchi (1995), a close relationship between innovation and knowledge creation has been accepted as established. The process through which knowledge is created is considered the cornerstone of innovation activities. According to Nonaka and Takeuchi (1995) and Nonaka et al. (2006), knowledge creation involves a continuous process through which individual boundaries and constraints imposed by information from and learning in the past are overcome. In this way, individuals or organisations acquire new contexts, worldviews and knowledge.

By interacting and sharing tacit and explicit knowledge with others, individuals increase their ability to define a situation or problem and apply their knowledge to act and resolve specific problems. New or improved products, services, processes, organisational methods or business models that may arise as solutions to problems or challenges (i.e. the innovations obtained) can be seen as the result of the knowledge creation process (Lundvall and Nielsen, 2007; Nonaka and Takeuchi, 1995).

To combat the risk of imitation, companies invest in the development of tacit knowledge or in the search for external knowledge – a strategy that results in attempts to innovate. Organisations thus must understand how to reorganise the knowledge they possess and, through the resulting innovations, be able to take advantage of newly constructed competitive advantages. A close relationship can be said to exist between organisations' knowledge and their capacity to innovate and create (Borghini, 2005).

The innovation process depends heavily on the acquisition of knowledge (Gloet and Terziovski, 2004), especially tacit knowledge (Leonard and Sensiper, 1998). Companies thus create valuable new knowledge that is converted into products, services and processes (Choy et al., 2006), transforming general knowledge into specific knowledge. Nonaka (1994) argues that knowledge is a primary requirement for innovation and competitiveness (Nonaka, 1994). Therefore, the creation of new knowledge is the most central activity during the development of new products and services (Madhavan and Grover, 1998). We thus formulated two more hypotheses:

H₃: The creation of organisational knowledge enhances innovation.

H₄: The acquisition of organisational knowledge enhances innovation.

Some authors point to cooperation or collaboration between two companies in direct competition as a viable strategy to stimulate the development of new products and launch them on the market (e.g. Brandenburger and Nalebuff, 1996; Gnyawali and Park, 2009; Ritala and Hurmelinna-Laukkanen, 2009; Yami et al., 2010). In contrast to simple alliances between companies, cooperation brings crucial benefits to innovation activities, although the risk of (re)competitive actions and opportunism is high in this complex, uncertain innovation process, as emphasised by some studies (e.g. Bouncken and Kraus, 2013; Bouncken and Fredrich, 2015; Ritala, 2012; Ritala et al., 2016). However, competition only positively influences the performance of company product innovation if internal knowledge-sharing mechanisms and formal mechanisms of knowledge protection are present (Estrada et al., 2016). Thus, given the numerous benefits of

knowledge recombination, coopetition can contribute positively to companies' innovation performance (Estrada et al., 2016), leading us to propose the following hypothesis:

H₅: Coopetition has an impact on innovation.

2.4 Internationalisation

Internationalisation is commonly understood as the process of adapting business operations to international environments (Calof and Beamish, 1995). This is important to companies because it often results in vital growth (Luostarinen, 1980), useful learning outcomes (Zahra et al., 2000) and better financial performance (Lu and Beamish, 2001).

Any companies' decision to enter international markets is itself a sequential process. Vernon (1966) developed a model of how the product life cycle and companies' initial innovation results drive the process of internationalisation of products and companies. In the first phase, firms innovate through the generation of products based on opportunities detected in the companies' domestic market (Ratten et al., 2017). As the demand for their products begins to appear elsewhere, firms decide to internationalise by exporting these products to markets looking for products with similar characteristics.

Vernon (1979) goes on to argue that a sequential internationalisation process based on product innovation particularly characterises the internationalisation of innovative small and medium-sized enterprises (SMEs). These SMEs may not have sufficient resources and capabilities to innovate for global markets, so they start with nationally-based innovation, gradually moving towards the possibility of exporting and, finally, to internationalisation. Previous studies have pointed out that innovation or, more specifically, product innovation is an important factor when explaining entry into an export market (e.g. Cassiman and Martinez-Ros, 2007).

According to Prashantham (2005), two different channels exist through which product innovation can affect companies' decisions to initiate export operations. On the one hand, successful innovation can serve as an investment that increases productivity, leading indirectly to the self-selection of firms in export markets. On the other hand, innovation activities may also have a direct effect on export decisions. Companies can start overseas operations because of increased demand for their new products or seek to recover R&D costs through a higher sales volume (Prashantham, 2005). Given the above findings, we formulated the following hypothesis:

H₆: Company innovation fosters internationalisation.

In the 1970s, researchers in the field of international business (e.g. Johanson and Vahlne, 1977) argued that companies' market knowledge determines their internationalisation, in which three dimensions are conspicuous. These are the selection of international markets, the choice of entry mode and the pace of internationalisation (Jones and Coviello, 2005). The companies' knowledge regulates the resources committed to foreign markets – a notion that is supported by the literature (Eriksson et al., 1997).

Knowledge is a key driver for a successful internationalisation process, which implies that internationalisation is a form of innovation (Casillas Moreno et al., 2008). In addition, knowledge is fundamental to dealing with the environmental uncertainties that characterise internationalisation, informing decisions about market selection, choice of mode and pace of internationalisation (Casillas et al., 2008).

Bengtsson and Kock (2014) point out that the motifs or results of coopetition, as well as the different dimensions of this process, are more multifaceted at the inter-organisational

level. According to Bengtsson et al. (2013), four different results can be identified in the flow of cooptation: (1) increased competitiveness and competitive advantages, (2) development of technological innovations, (3) exploration of international opportunities and (4) access to necessary resources. Rodrigues et al. (2009) also suggest that cooptation may result in competitive advantages for the parties involved in terms of increased sales, market shares, international brand recognition and market penetration.

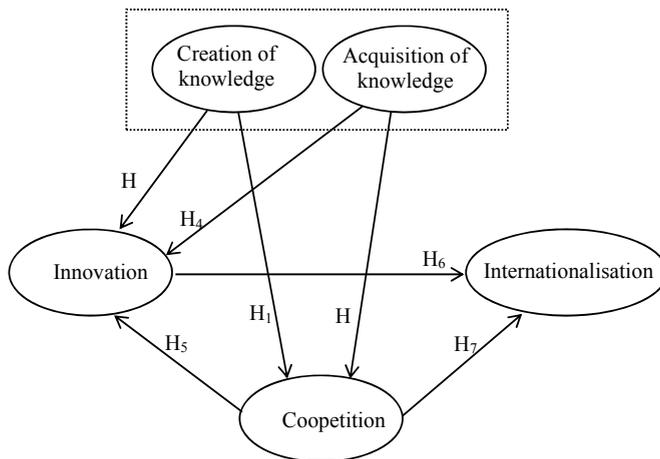
Thus, the link between cooptation and the internationalisation of companies is due to the ability of companies to manage cooperation and competition simultaneously. They must find a balance or deal with the imbalance of cooptation relationships, reducing the risks and costs related to the expansion of their activities in the market (Kock et al., 2010). These findings led us to postulate the final hypothesis:

H₇: Companies involved in cooptation strategies increase their internationalisation.

2.5 Research model

A conceptual research model was proposed based on the present study’s objective and research hypotheses developed through the above literature review (see Figure 1). This model reflected the articulation and embedding of dimensions in the CIS 2012 survey and the gaps in previous studies that examined relationships between the areas under study, resulting in the five dimensions proposed here (e.g. Antonelli and Fassio, 2015; Catozzella and Vivarelli, 2014; Estrada et al., 2016; Pereira and Leitão, 2016; Vega-Jurado et al., 2009).

Figure 1 Conceptual research model



3 Methodology

3.1 Data and sources

The data used in this study came from the CIS 2012 in Portugal (CIS, 2012). This is the main survey of innovation in companies in Europe, and participation is mandatory for all

EU member states according to the Eurostat (2005) methodological guidelines, based on the principles set out in the Oslo Manual. The CIS 2012 collected information on innovation in companies for 2010, 2011 and 2012 in Portugal. The survey was conducted by the Direção-Geral de Estatísticas da Educação e Ciência do Ministério da Educação e Ciência (Directorate-General of Education and Science Statistics of the Ministry of Education and Science). The data collection period ran from 3 June 2013 to 14 March 2014.

The universe considered for the CIS 2012 corresponds to the companies headquartered in Portugal and included in 11 sections of the Categoria de Atividade Empresarial (Category of Business Activity) – Rev. 3 code. These are Sections B (Divisions 05–09), C (Divisions 10–33), D (Division 35), E (Divisions 36–39), F (Divisions 42 and 43), G (Division 46 and Group 471), H (Divisions 49–53), J (Divisions 58–63), K (Divisions 64–66), M (Divisions 69 and 71–75) and Q (Division 86). Following the guidelines and recommendations of Eurostat, the Instituto Nacional de Estatística (National Institute of Statistics) collected a sample composed of 9423 companies with 10 or more employees. This was based on a combined census of companies with 250 or more employees and a random sampling of the remaining companies. At the end of the data collection period, 6,840 responses were considered valid, out of 7995 companies in the corrected sample, corresponding to a response rate of 86%. The CIS 2012 gathers information about companies of a generic nature (e.g. industry, size, turnover and geographic markets), information about innovation (e.g. products, processes, marketing and organisational innovation), sources of information and cooperation.

3.2 Variables

The present study used five dichotomous constructs: knowledge creation (*KC*), knowledge acquisition (*KA*), coooperation (*COOP*), innovation (*INOV*) and internationalisation (*INT*). The variable knowledge creation (*KC*: No/Yes) refers to the existence or not of R&D activities carried out by companies to create new knowledge or to solve scientific or technical problems. This variable corresponds to the CIS 2012's internal research and development (*RRDIN*) variable.

The variable knowledge acquisition (*KA*: No/Yes) is applicable if a company has met one of three conditions. The first two are external R&D acquisition (CIS 2012's *RRDEX*) and acquisition of existing knowledge from other companies or institutions (CIS 2012's *ROEK*). The third is acquisition of existing know-how, copyrighted works, and patented and non-patented inventions, among other resources, from other companies or institutions for the development of new or significantly improved products or processes (CIS 2012's *RMAC*).

The innovation variable (*INNOV*: No/Yes) represents whether companies have product innovation (CIS 2012's *PROD_INNOV*) or process innovation (CIS 2012's *PROC_INNOV*). Product innovation is measured by the existence of goods innovation (CIS 2012's *INPDGD*) or service innovation (CIS 2012's *INPDSV*). Process innovation, in turn, is measured by the presence of innovation in manufacturing or production methods (CIS 2012's *INPSPD*); methods of logistics, delivery or distribution of inputs or final products (i.e. goods and/or services) (CIS 2012's *INPSLG*); or activities to support company processes (CIS 2012's *INPSSU*).

The coooperation variable (*COOP*: No/Yes) reflects if a company is involved in a product and/or process cooperation strategy with competitors or other companies in the

same industry, that is, whether CIS 2012’s *CO41*, *CO42*, *CO43*, *CO44* or *CO45* are present. Finally, the internationalisation variable (*INT*: No/Yes) is measured by the geographic market of the goods or services sold by companies, with the geographic market defined as either the countries of the EU and associated countries (CIS 2012’s *MAREUR*) or other countries (CIS 2012’s *MAROTH*).

To characterise the sample, statistical measures such as the mean and standard deviation and Spearman’s correlation coefficient (ρ) were applied, and the constructs under study were subjected to frequency analysis. In order to test the formulated hypotheses, three logistic regression models were developed, each with a distinct dichotomous dependent variable (i.e. *COOP*, *INNOV* and *INT*; 0 = No, 1 = Yes). The corresponding formulas for logistic regressions were as follows:

$$COOP = \frac{1}{1 + e^{-(\beta_0 + \beta_1 KA + \beta_2 KC)}} \tag{1}$$

$$INNOV = \frac{1}{1 + e^{-(\beta_0 + \beta_1 KA + \beta_2 KC + \beta_3 COOP)}} \tag{2}$$

$$INT = \frac{1}{1 + e^{-(\beta_0 + \beta_1 COOP + \beta_2 INNOV)}} \tag{3}$$

The values of the parameters were estimated using the maximum likelihood method. Like multivariate linear regression, which presents the coefficient of determination (R^2) as an indicator of the adjustment of the regression, logistic regression presents some measures that can be used as analogies of the coefficient of determination. Among these measures, we focused on the Cox and Snell and Nagelkerke R^2 – of which the latter was considered the most important to our analysis. Data analysis was performed using IBM’s SPSS Statistics 24 software.

4 Results

4.1 Brief characterisation of companies

Table 1 presents the frequency analysis of variables in the proposed models for the 6,840 companies in the study sample. The results verify that 21.7% of companies are involved in knowledge creation activities (*KC*) and 35.7% in knowledge acquisition activities (*KA*). A further 3.8% are involved in cooperation strategies (*COOP*), 46.8% in product or process innovation activities (*INNOV*) and 60.3% in internationalisation processes (*INT*).

Table 1 Distribution of the sample by the variables of the proposed models

	<i>n</i>	%
Knowledge creation (<i>KC</i>)	1482	21.7
Knowledge acquisition (<i>KA</i>)	2445	35.7
Cooperation (<i>COOP</i>)	258	3.8
Product/process innovation (<i>INNOV</i>)	3198	46.8
Internationalisation (<i>INT</i>)	4123	60.3

Table 2 presents some statistical descriptive measures and the correlations matrix with ρ -values, where we could verify the existence of statistically significant positive correlations between all the variables present in the proposed models. In the results, significant correlations stand out, among others, between innovation and knowledge acquisition ($\rho = 0.748$; $p < 0.001$) and between innovation and knowledge creation ($\rho = 0.526$; $p < 0.001$).

Table 2 Spearman’s correlations for the variables of the proposed models

<i>Variables</i>	<i>M</i>	<i>DP</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Knowledge creation (KC)	0.22	0.412	1				
Knowledge acquisition (KA)	0.36	0.479	0.429***	1			
Coopetition (COOP)	0.04	0.191	0.276***	0.227***	1		
Innovation (INNOV)	0.47	0.499	0.526***	0.748***	0.204***	1	
Internationalisation (INT)	0.60	0.489	0.168***	0.143***	0.046***	0.176***	1

Note: *** $p < 0.001$.

4.2 Relationships between knowledge, coopetition, innovation and internationalisation

In order to test the hypotheses, three logistic regression models were created, each with its distinctive dummy dependent variable showing the estimated odds ratios (OR) and respective confidence interval of 95% (CI 95%). The results obtained for each of the proposed models are discussed below.

4.2.1 Model 1: coopetition as an endogenous variable

This first logistic regression model sought to capture the effects of knowledge creation and acquisition on the probability of companies being involved in a strategy of coopetition, to provide confirmation of the first two research hypotheses. As seen in Table 3, we were able to verify that there is a significant propensity towards a coopetition strategy in companies with knowledge creation (KC: $B = 2.12$; $OR = 8.292$; $p < 0.001$) and knowledge acquisition (KA: $B = 1.95$; $OR = 7.018$; $p < 0.001$). Companies involved in strategies encouraging knowledge creation activities are about eight times more likely to be involved in a coopetition strategy, and companies with knowledge acquisition activities are about seven times more likely. Thus, the results support hypotheses H_1 (i.e. The creation of organisational knowledge influences coopetition.) and H_2 (i.e. The acquisition of organisational knowledge influences coopetition.).

Table 3 Model 1: effects of knowledge creation and acquisition on coopetition

<i>Variables</i>	<i>Coopetition</i>		
	<i>B</i>	<i>OR</i>	<i>CI 95%</i>
Knowledge creation	2.12***	8.292	[5.300; 12.971]
Knowledge acquisition	1.95***	7.018	[5.072; 9.709]
Constant	-5.61***	0.004	
R^2 (Cox&Snell)		0.075	
R^2 (Nagelkerke)		0.272	
		$\chi^2(2) = 530.944$; $p < 0.001$	

Note: *** $p < 0.001$.

4.2.2 Model 2: innovation as an endogenous variable

The second logistic regression model was developed to capture the effects of knowledge creation and acquisition and companies’ involvement in a strategy of cooptation on the probability of those companies being involved in product or process innovation. The model thus corresponds to research hypotheses H₃, H₄ and H₅. Table 4 shows that companies with knowledge creation (KC: B = 4.72; OR = 112.383; p <0.001), knowledge acquisition (KA: B = 3, 84; OR = 46.613; p <0.001) and cooptation (COOP: B = 2.54; OR = 12.687; p <0.001) have an extremely significant propensity towards becoming involved in product innovation activities.

Table 4 Model 2: effects of cooptation and knowledge creation and acquisition on innovation

Variables	Innovation		
	B	OR	CI 95%
Knowledge creation	4.72***	112.383	[87.829; 143.801]
Knowledge acquisition	3.84***	46.613	[34.074; 63.766]
Cooptation	2.54***	12.687	[4.323; 37.231]
Constant	-1.95***	0.142	
R ² (Cox&Snell)		0.555	
R ² (Nagelkerke)		0.742	
			$\chi^2(3) = 5543.605; p < 0.001$

Note: *** p < 0.001.

Companies with strategies encouraging knowledge creation activities are about 112 times more likely to be involved in product or process innovation. Firms with knowledge acquisition activities are about 46 times more liable to engage in product or process innovation, and those involved in cooptation strategies are about 12 times more likely. Thus, the results provide support for hypotheses H₃ (i.e. the creation of organisational knowledge enhances innovation.), H₄ (i.e. the acquisition of organisational knowledge enhances innovation.) and H₅ (i.e. cooptation has an impact on innovation.).

4.2.3 Model 3: internationalisation as an endogenous variable

Finally, in the third logistic regression model, we sought to capture the effects of companies’ involvement in cooptation and innovation strategies on the probability of these companies being involved in internationalisation. This model thus addressed hypotheses H₆ and H₇. Table 5 verifies that companies engaged in cooptation (COOP: B = 0.135; OR = 1.144; p = 0.348) are not more reliable to be involved in implementing an internationalisation strategy. Product or process innovation (INNOV: B = 0.722; OR = 2.059; p <0.001), however, has a significant relationship with internationalisation since companies involved in innovation activities are twice as likely to be involved in an internationalisation strategy. Thus, the results provide support for hypothesis H₆ (i.e. company innovation fosters internationalisation), but hypothesis H₇ (i.e. companies involved in cooptation strategies increase their internationalisation) is not supported.

Table 5 Model 3: effects of coopetition and innovation on internationalisation

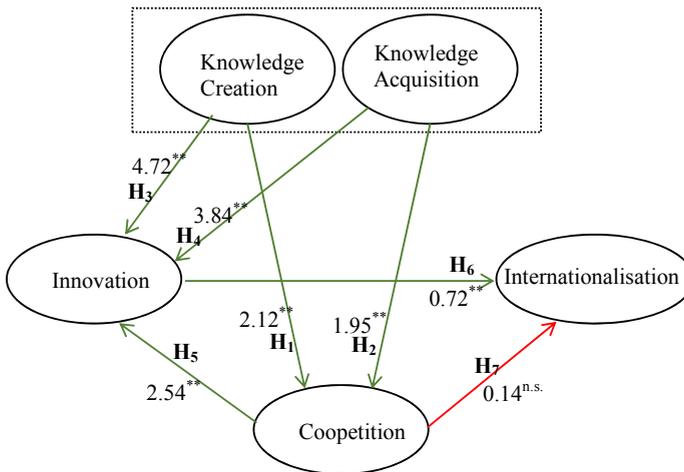
Variables	Internationalisation		
	B	OR	CI 95%
Innovation	0.72***	2.059	[1.860; 2.279]
Coopetition	0.14 ^{n.s.}	0.890	[0.863; 1.517]
Constant	0.09**	1.093	
R ² (Cox&Snell)		0.031	
R ² (Nagelkerke)		0.042	
			$\chi^2(2) = 213.937; p < 0.001$

Note: *** $p < 0.001$; ** $0.001 \leq p < 0.010$; $p \geq 0.050$; n.s. = $p \geq 0.050$.

5 Discussion of results

After the above presentation of the results, we discuss what was deduced from the evaluation of the structural model. This is represented graphically in Figure 2, with the respective regression coefficients and statistical significance.

Figure 2 Evaluation of structural model



Notes: *** $p < 0.001$; ** $0.001 \leq p < 0.010$; n.s. = $p \geq 0.050$.

Table 6 summarises the results for the research hypotheses with indications of the paths associated with each of these, as well as whether they are supported.

The validation of hypotheses H₁ and H₂ is in line with existing studies (e.g. Kogut, 2000; Ritala and Hurmelinna-Laukkanen, 2013), in which the relationship between knowledge and coopetition was confirmed. Thus, firms involved in cooperation and/or competition or coopetition relationships need to increase or acquire their stock of internal knowledge and resources (Bengtsson and Kock, 2000). This external acquisition of knowledge is extremely important for companies in order to strengthen their competitiveness and innovation when competing with rivals. The exchange of explicit

and tacit knowledge by co-operators, which is a fundamental factor in recombination processes (Galunic and Rodan, 1998), generates substantial competitive advantages in terms of creating new innovations for the market, as confirmed by Faems et al. (2007).

Table 6 Analysis of research hypotheses

<i>Hypotheses</i>	<i>B</i>	<i>OR</i>	<i>Hypothesis supported?</i>
H ₁ : Knowledge Creation → Coopetition	2.12***	8.292	Yes
H ₂ : Knowledge Acquisition → Coopetition	1.95***	7.018	Yes
H ₃ : Knowledge Creation → Innovation	4.72***	112.383	Yes
H ₄ : Knowledge Acquisition → Innovation	3.84***	46.613	Yes
H ₅ : Coopetition → Innovation	2.54***	12.687	Yes
H ₆ : Innovation → Internationalisation	0.72***	2.059	Yes
H ₇ : Coopetition → Internationalisation	0.14 ^{n.s.}	0.890	No

Note: *** $p < 0.001$; ** $0.001 \leq p < 0.010$; n.s. = $p \geq 0.050$.

As for hypotheses H₃ and H₄, a close relationship was found between organisations' knowledge and their capacity to innovate and create (Borghini, 2005). The innovation process depends heavily on the knowledge acquired (Gloet and Terziovski, 2004), especially tacit knowledge (Leonard and Sensiper, 1998). This thus creates new and valuable knowledge that is converted into products, services and processes (Choy et al., 2006), transforming general knowledge into specific knowledge. Nonaka's (1994) work on knowledge creation showed that knowledge is a primary requirement for innovation and competitiveness. Therefore, the creation of new knowledge is the most essential activity during new product and service development (Madhavan and Grover, 1998).

As for hypothesis H₅, the present results corroborate that coopetition can contribute positively to companies' innovation performance (Estrada et al., 2016). Previous studies have also emphasised the positive relationship between coopetition and innovation (e.g. Bouncken and Kraus, 2013; Bouncken and Fredrich, 2015; Ritala, 2012; Ritala et al., 2016).

Regarding hypothesis H₆, we further confirmed the findings of previous studies reporting that innovation and, more specifically, product innovation are important factors in explaining entry into export markets (e.g. Cassiman and Martinez-Ros, 2007). Finally, hypothesis H₇'s lack of support in the present results partially contradicts Rodrigues et al.'s (2009) findings that coopetition can result in competitive advantages for the parties involved in terms of an increase in sales, market share, brand recognition and international market penetration. The reason for the non-significance of this result may indicate that coopetition is not needed for internationalisation. This may be due to the companies already having a stakeholder position in a foreign country and not needing the help of other companies in terms of the internationalisation process. The results are in contrast to previous research by Ramadani et al. (2018) who suggest that coopetition is required in international markets. The results of this hypothesis are interesting as they tend to support the assertion that there are different coopetition strategies for domestic as compared to foreign market entry strategies.

6 Limitations and suggestions for future research

There are some limitations of this study due to the time and resource restrictions in data collection that give rise to a number of suggestions for future research. First, the data from this study focused on firms in Portugal, so it might have limited generalisability to other geographical regions. This is due to the data being collected in 2012 when Portugal was in the midst of a financial crisis. Thus, future research needs to extend the results of this study to other geographical contexts particularly in Asia or North America to compare and contrast the findings. This would help to understand whether Portuguese firms due to a large number being in certain industries such as footwear have distinct characteristics that make them more inclined to enter into coepetition arrangements. Second, the data was based on a specified time period, thus more research should look at the longitudinal effects of coepetition. This includes focusing on case studies of Portuguese companies who have internationalised and how they have utilised coepetition. Future research should use a mixed methods approach to include both qualitative in-depth interviews of managers of international firms to see the steps and processes they took in their coepetition arrangements. It would be helpful to also supplement this with quantitative survey based data asking respondents questions about coepetition and its effects on the internationalisation process. Third, this study used a measure of coepetition in terms of knowledge and innovation but there are also different ways to define coepetition. Thus, future studies should utilise different conceptualisations of coepetition to see if they obtain similar results to this study in terms of internationalisation. It would be interesting to see if there are cultural changes in the meaning of coepetition and if this influences internationalisation rates.

7 Managerial implications

The main implications that emerged from the present study are that companies that promote knowledge creation and acquisition and implement strategies of coepetition are more innovative and that these firms can more easily reach foreign markets through internationalisation. Thus, knowledge – both internal and external – combined with coepetition strategies promotes innovation, which seeks to disseminate knowledge, create value and ensure companies' strong performance. The results also emphasise that companies are concerned about reaching other markets through internationalisation – a common objective in all sectors of the market. Notably, the data analysed refer to 2012, which was a year in which Portugal experienced an extensive economic crisis, so the shaped our decision to include the internationalisation dimension, since this can be a starting point for the recovery of companies.

Given that companies in Portugal still have major structural challenges to overcome if they are to innovate effectively, these firms should generate competitive advantages by focusing on knowledge through both internal and external R&D. In addition, Portuguese companies can implement coepetition strategies since working within organisational networks can facilitate integration into new markets, as companies jointly foster product and process innovation.

These results have practical implications including that, given the validation of the proposed model by the CIS 2012 data, these should encourage entrepreneurs to promote the creation (i.e. internal R&D) and acquisition (i.e. external R&D) of knowledge.

Companies need to establish strategies of cooptation in order to promote innovation in the market and sector in which they operate. This, in turn, provides impetus to internationalisation and, at the same time, follows internationally-recognised best practices of data dissemination in innovation processes.

This study sought to contribute to validating the importance of investment in knowledge supported by strategies of cooptation. Companies who cooperate and work within networks learn about new trends, and these firms can plan and define innovation strategies that contribute to a successful entry into the global market. With regard to future research, we plan to replicate the proposed model using the CIS 2014 data and verify if the results differ. This will confirm if the relationships found in the present study are consistent over time, as well as the intensity or probability that they will occur, in the context of Portugal's ongoing recovery from the financial crisis.

8 Conclusion

This study focused on the role of cooptation in affecting innovation and internationalisation rates amongst Portuguese firms. Increasingly more firms are focusing on knowledge through cooptation strategies and this is important in the globally connected world. The findings of this study support the view that investing in knowledge through cooptation is an important way firms can sustain their competitive advantage in the marketplace. Thus, this study contributes to the emerging literature about cooptation on internationalisation rates and the strategic importance of time.

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