Coopetition in Business Ecosystems:

The Key Role of Absorptive Capacity and Supply Chain Agility

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This article has been officially published in the Journal of Business Research by Elsevier and is available at the following URL: https://doi.org/10.1016/j.jbusres.2022.03.071

Acknowledgments:

This work was supported by the Spanish Ministry of Economy and Business (ECO2017-84138-P) and FEDER/Junta de Andalucía-Ministry of Economy and Knowledge (A-SEJ-154-UGR18). The first author's work was supported by Spanish Ministry of Science, Innovation and Universities (FPU Predoctoral Program, FPU16/04712; and a complementary mobility grant for short stays; Application number EST18/00138).

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Abstract

This study aims to shed light on the mechanisms that enable firms to manage the contradictory logics of coopetition (i.e. simultaneous cooperation and competition) in business ecosystems to achieve superior performance. In particular, we examine the relationship between coopetition and performance through the indirect effects of absorptive capacity and supply chain agility. Primary survey data collected from 214 firms hosted in tech-cities is used to test four hypotheses through regression analysis with bootstrapping. Results do not support a direct, positive relationship between coopetition and firm performance. Rather, firms in business ecosystems gain crucial knowledge through coopetition that then positively influences absorptive capacity, which relates to improved supply chain agility and firm performance. To the best of our knowledge, this is the first paper to provide empirical evidence on the impact of coopetition on firm performance through indirect effects. A new validated scale for measuring coopetition is also provided.

Keywords: Coopetition; supply chain agility; absorptive capacity; business ecosystem; survey.

Article classification: Research paper.

1. Introduction

Coopetition theory has claimed firms can enhance their performance by simultaneously pursuing and successfully combining the advantages of cooperation and competition (Le Roy & Czakon, 2016). Yet, implementing coopetition does not always achieve the desired outcomes as balancing the dual forces of cooperation and competition, which must co-exist and yet contradict, is not straightforward. Indeed, the paradoxical nature of coopetition generates tensions (Bengtsson *et al*., 2016), including the duality of simultaneously trusting and distrusting, creating and appropriating value (Chou & Zolkiewski, 2018), and generating common and individual benefits (Brandenburger & Nalebuff, 1996). While there are benefits to coopetition, the nature of the inter-firm relationship involves many risks (e.g. conflict, knowledge spill-overs or opportunistic behaviours) since this practice involves essentially "sleeping with the enemy" (Bengtsson & Raza-Ullah, 2016; Crick & Crick, 2021). This has led to calls for further research into the dynamics underpinning coopetitive relationships to better understand how a firm can use this strategy to achieve superior performance (Hoffmann et al., 2018).

The study of coopetition becomes particularly relevant and challenging in the context of business ecosystems since they involve inter-related systems that result in "coopetition" structures (Moore, 1993, p. 76). In successful ecosystems, firms balance cooperation to create value alongside competition to capture it (Hannah & Eisenhardt, 2018). For instance, many companies in business ecosystems, such as Amazon, Apple and IBM, collaborate with rivals to share resources, develop new technologies or grow new markets whilst competing in their existing markets (Ritala et al., 2014). COVID-19 has recently highlighted the relevance of business ecosystems, where coopetition has been a central component of the response to the pandemic (e.g. pharmaceutical organisations developing vaccines together and companies sharing information and resources; Crick

and Crick, 2020). Yet, it remains unclear how ecosystem members effectively balance cooperation and competition.

Literature has called for further research into coopetition and its performance implications on ecosystems (Le Roy and Czakon, 2016; Bacon et al., 2020). Even if coopetition is natural to ecosystems, and scholars have recognised its importance, it has not yet been fully integrated into the ecosystems literature (Cobben et al., 2022). Moreover, empirical evidence on coopetition in general is scarce (Crick & Crick, 2021), with contributions to date largely focused on either innovation, profitability, or market performance, revealing both positive and negative results (Le Roy and Czakon, 2016; Estrada and Dong, 2020). Contradictory performance effects may imply that an important variable that explains/mediates the relationship is being overlooked meaning more detailed research is needed, as suggested by Le Roy and Czakon (2016). Equally, further investigation is required into the capabilities needed to effectively balance coopetitive tensions (Bengtsson *et al*. 2016; Raza-Ullah, 2020). Accordingly, there is a need to conduct quantitative studies that consider the capabilities valuable to firms in business ecosystems, as these firms regularly face the conflicting forces of cooperation and competition (Gueler & Schneider, 2021). Such work would shed light on the co-evolution and mutual adaptation of ecosystem members, as requested by prior literature (Jacobides et al., 2018), whilst embedding the role of coopetition in the ecosystem and considering its performance implications (beyond the innovation outcomes traditionally studied in ecosystems literature; Riquelme-Medina et al., 2021). Thus, we ask:

RQ: *Does coopetition in the context of business ecosystems influence firm performance, and how can its contradictory forces be managed?*

Against this backdrop, we adopt a capability-based approach under the resource-based view (RBV) to examine the coopetition-performance relationship. Barney (2018) recently

expanded this view to incorporate the role of stakeholders, which can be extended further to incorporate competitors within the context of business ecosystems. As we will justify, we propose that absorptive capacity and supply chain agility mediate this relationship. First, amongst other capabilities, scholars have suggested that absorptive capacity is likely to be beneficial in the context of coopetition (Wu, 2014; Bengtsson and Raza-Ullah, 2016; Dorn *et al*., 2016) since it enables knowledge to be acquired and exploited effectively to improve competitive positioning in inter-firm networks (Zahra and George, 2002). Second, agility has similarly been identified through exploratory cases as a key capability for dealing with the challenges of coopetition since it allows relationships to be rapidly built and reconfigured over time (Bengtsson and Johansson, 2014). Yet, further research on how to effectively manage coopetition in supply chain settings is needed.

Four hypotheses are presented and tested using regression analysis with bootstrapping based on a survey of 214 firms embedded in business ecosystems. Our research enriches the literature in four ways. First, this is one of the first papers to consider coopetition from an operations management perspective, thereby providing a basis for understanding the implications of coopetition for firm operations in the context of business ecosystems. Second, it examines the mechanisms by which firms can simultaneously compete and collaborate to obtain superior performance. It responds to the need to analyse and explain how different capabilities lead to performance outcomes in coopetitive relationships (Czakon, Srivastava, et al., 2020), focusing on absorptive capacity in those relationships, as demanded by Dorn *et al*. (2016). Moreover, the mediation analysis leads to important theoretical implications since it shows empirically that coopetition is linked to higher levels of absorptive capacity, which in turn influences supply chain agility to achieve superior performance. Third, it enriches the business ecosystems literature where coopetition naturally occurs but implies high-risks. It equally enlarges the ecosystems

literature by integrating the RBV within the context of business ecosystems. Finally, it provides a new validated scale for measuring coopetition.

Meanwhile, the article presents implications for practice. For example, managers and practitioners in firms that want to belong to, or currently belong to, business ecosystems should be aware that they will most likely have to work cooperatively and competitively (Moore, 1993). Indeed, many of the world's leading companies that are integrated in ecosystems often collaborate with competitors (e.g. Amazon-Netflix, or Microsoft-Apple-Google). Managers should realise that coopetition can be a valuable practice since competitors speak the same language and share similar problems, goals and interests, although it is true that there are many risks and tensions involved, which cause many coopetitive relationships to fail. In facing up to the challenges of coopetition, the present article aims to explain, on a large scale, what capabilities ecosystem members need in order to benefit from coopetition. If harnessed correctly, coopetition could entail a performance-enhancing strategy for firms in business ecosystems.

The remainder of this paper is organised as follows. Section 2 presents the theoretical background and hypotheses before Section 3 outlines the research method. The results are presented in Section 4, followed by a discussion in Section 5. Finally, Section 6 addresses theoretical and managerial implications, limitations, and future research directions.

2. Theoretical Background and Hypotheses

2.1 *The Business Ecosystem Context*

Business success no longer relies on the individual firm and its immediate supply chain. Uncertainty, complex environments, and rapid technological changes have pushed firms into joining "business ecosystems" (Adner et al., 2013; Moore, 1993). This term was first introduced by Moore (1993), making an analogy with biological ecosystems since they

too involve *"a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival"* (Iansiti and Levien, 2004a, p. 8). If they work effectively, business ecosystems can create solutions that no single firm can produce by itself (Adner, 2006; Fuller et al., 2019). Despite a surge of interest, ecosystems are still poorly understood and gaps in knowledge remain, especially when ecosystem members have to handle simultaneous cooperation and competition (Hannah & Eisenhardt, 2018).

In business ecosystems, members "*work cooperatively and competitively to support new products, satisfy customer needs, and incorporate the next round of innovation"* (Moore, 1993, p.76). That is, collaboration and competition co-exist; hence, while ecosystem members depend on each other and share the same fate, they also compete for the best configuration of resources and capabilities (Barile *et al*., 2016). This idea is illustrated in the study by Gueguen and Isckia (2011), which suggested that coopetitive relationships are particularly relevant in the mobile handset ecosystems war. However, the idiosyncrasies of ecosystems, which differ from traditional structures (Rong *et al*., 2018), create new challenges. First, they are bigger structural entities (i.e. networks of networks) than supply networks, where members maintain (in)formal relationships and depend on each other even if they do not transact (Wulf and Butel, 2017); i.e. changes in a firm's offerings may affect other members' contributions towards value creation. Second, they involve interdependent members that coordinate without hierarchies (i.e. no member has full control or ownership of the ecosystem; Jacobides *et al*., 2018). Third, ecosystems extend beyond the traditional chain of suppliers, distributors, customers, etc. (Iansiti and Levien, 2004a) or any industry boundary (Iansiti and Levien, 2004b). Finally, ecosystem activities exceed the individual company and are based on complementary offerings and co-evolution with other members (Fuller *et al*., 2019), including competition.

2.2 The Nature of Coopetition

The term "coopetition" was introduced in the 1980s by Ray Noorda, founder of Novell, to describe a paradoxical relationship that entails two contradictory forces (Bengtsson *et al*., 2016), i.e. the simultaneous pursuit and coexistence of cooperation and competition between rivals during the same period of time (Luo, 2007). Traditionally, cooperation and competition are considered perfect opposites. Interactions between the two dimensions of coopetition occur on one continuum in which cooperation advances at the expense of competition and *vice versa*, with coopetition lying at some sweet-spot in-between. A more recent perspective however considers a dual-continuum, where competition and cooperation independently oscillate from low to high levels (Bengtsson *et al*., 2010). It is this perspective, which emphasises the co-existence of two contradictory logics (Bengtsson *et al*., 2016), that is adopted in our study. Similarly, we focus on the inter-firm level, where coopetition is believed to achieve reciprocal advantages for firms involved in the relationship (Luo, 2007), which in turn may be relevant to interdependencies within an ecosystem.

Firms must still however manage coopetitive tensions. Some scholars posit that it is only when firms achieve a balanced interaction, combining strong competition with strong cooperation that the advantages of coopetition are fully realised (Lado *et al*., 1997; Bengtsson *et al*., 2010). Balanced coopetition promotes meaningful exchanges and valuable relationships among competitors through cooperation and keeps firms alert in order to seek and maintain competitive advantages through competition (Das and Teng, 2000). Within a business ecosystem, new opportunities for value creation are more likely to arise when the two dimensions of coopetition coexist (Ritala *et al*., 2013; Radziwon *et al*., 2017). Yet the extant literature provides little demonstration of how firms effectively balance cooperation and competition (Dorn *et al*., 2016) to improve firm performance in

business ecosystems. Hannah and Eisenhardt's (2018) multi-case study highlights some required capabilities (i.e. dynamic capabilities) needed to balance simultaneous cooperation and competition in ecosystems. We extend their work by providing further empirical evidence on the relationship between coopetition and performance whilst adopting a capability-based approach to the RBV. Specifically, the paper builds on a recent take on the RBV that incorporates stakeholders (Barney, 2018), and is hereby extended to account for the role of competitors in business ecosystems. This approach focuses on how access to external resources and capabilities and their co-specialization enables a firm to achieve different levels of performance (Barney, 2018). Such a source of economic advantage will only be achieved when the firm is able to create and manage rare, costly to imitate, and non-substitutable resources in the ecosystem (Barney, 1991; 2018). Equally, although we do not directly consider it, the paper presents implications for dynamic capabilities, which enable the creation, extension and adaptation of a firm's resource base (Helfat, 2007) in order to adapt to the ecosystem's changing environment. Specifically, we propose that the improvement in absorptive capacity (i.e. a key component of dynamic capabilities) that results from balancing coopetition's conflicting forces can positively impact upon supply chain agility, leading in turn to higher performance. This responds to recent calls to incorporate existing theories within the ecosystems literature (Cobben et al., 2022).

2.3 Coopetition and Performance

Based on theory, coopetition would allow firms to increase performance since it facilitates access to markets, strengthens market positioning, and improves the exploration, acquisition and utilization of resources across firms in business networks (Bengtsson and Kock, 2000; Luo, 2007; Bouncken and Fredrich, 2012). Accordingly, many practical examples have indicated that coopetition can improve firm performance. Bengtsson and

Johansson (2014) illustrated how Xelerated and Broadcom, two rival firms, introduced a product package together, enabling them to broaden their markets and product lines, increasing cost-efficiency and flexibility in their customer systems whilst competing for customers by marketing their products through their respective networks. Similarly, Citroën, Peugeot, and Toyota shared resources and leveraged technologies while simultaneously competing for customers through differentiation and branding (Ritala *et al*., 2014). Finally, Sony and Samsung created joint technology and manufacturing facilities in South Korea, enabling them to become LCD TV market segment leaders (Gnyawali and Park, 2011). These, however, are isolated examples and larger-scale empirical evidence is needed, especially in a business ecosystems context (Bacon et al., 2020; Cobben et al., 2022) where relationships are mainly coopetition-based (e.g. the collaboration between Amazon and Netflix ecosystems).

In business ecosystems, members work cooperatively and competitively, co-evolving together (Rong *et al*., 2018) and being interdependent (Jacobides *et al*., 2018). Cooperative relationships enable firms to share costs and information, accessing complementary resources and knowledge (Bengtsson *et al*., 2010; Dussauge *et al*., 2000; Wu, 2014). Meanwhile, competition improves efficiency, increases innovativeness, and forces firms to remain active in order to enhance their positioning (Bengtsson and Kock, 2000; Porter, 1990). Thus, firms collaborate in some areas to jointly improve performance and compete in others to increase their own performance. Thus, we propose:

H1: *Coopetition positively influences firm performance in a business ecosystem-context.*

2.4 The Role of Absorptive Capacity

Knowledge acquisition in coopetitive relationships may be a key source of competitive advantage. However, there remains the risk that the same knowledge used to cooperate could also be used to compete (Gnyawali and Park, 2009). Thus, firms must be aware of

this trade-off and ensure the benefits of coopetition exceed the costs since negative outcomes are likely to occur if they cannot effectively manage competitive aggressiveness (Crick & Crick, 2021). According to literature, the negative appropriation incentive associated with spill-overs and opportunistic behaviour might be counterbalanced by a positive absorption incentive (Cohen & Levinthal, 1990; Nemeh & Yami, 2019). This relies on having absorptive capacity, which determines how well the firm can acquire and utilise knowledge from external sources (Cohen and Levinthal, 1990). Therefore, firms maintaining coopetitive relationships participate in a race in which those achieving higher absorptive capacity succeed (Hamel, 1991; Wu, 2014).

Absorptive capacity may help to explain how coopetition translates into superior performance. First, partnerships with competitors improve learning and capability acquisition, especially when rivals have complementary resources (Dussauge *et al*., 2000). Through coopetition, firms enhance their knowledge base and skills, and they learn how to increase absorptive capacity (Gnyawali and Park, 2009). Second, higher levels of absorptive capacity mean that firms are better able to utilize renewed knowledge to identify business opportunities (Liu *et al*., 2013). Finally, by leveraging both new and existing knowledge, and then exploiting it, firms may exhibit higher performance results. In fact, joint learning among rivals softens competition and achieves higher profits compared to separate learning/no learning effects (Deng *et al*., 2019).

Given the above, we postulate that, through absorptive capacity, firms ensure access to a relevant base of knowledge when they collaborate with competitors in order to obtain superior performance. Therefore, we suggest:

H2: *Coopetition indirectly influences firm performance through absorptive capacity in a business ecosystem-context.*

2.5 The Role of Supply Chain Agility

Bengtsson and Johansson (2014) identified agility as one of the key capabilities for dealing with the challenges of coopetition. In the current global context, agility must be understood beyond the reach of the individual company as supply chain partners must work together to achieve the desired level of agility (van Hoek *et al*., 2001). Supply chain agility describes a firm's ability to effectively collaborate with partners to quickly respond to market changes (Swafford *et al*., 2006; Braunscheidel and Suresh, 2009; Liu *et al*., 2013), which we extend here to include working with competitors. This study analyses the mediating role of supply chain agility to achieve superior performance in coopetitive relationships.

First, firms involved in coopetition might exhibit more agile behaviour derived from the capabilities required to simultaneously manage cooperative and competitive relationships. According to Devece *et al*. (2017), coopetition allows firms to remain flexible and agile, while it has been identified as a relevant capability for managing supply chains (Wilhelm and Sydow, 2018). Through agility, firms are able to respond faster to changes and to develop and configure coopetitive relationships (Bengtsson & Raza-Ullah, 2016). For instance, coopetitors can gain access to knowledge and resources that might be valuable for adapting to unforeseen circumstances or market changes. Besides, agility becomes essential when collaborating with competitors for building and reconfiguring relationships over time (Bengtsson and Johansson, 2014), which can be especially relevant in the specific context of business ecosystems. Second, supply chain agility can be seen as a critical mechanism for dealing with coopetitive costs, including technological risks, management challenges, and a loss of control (Gnyawali and Park, 2009). It enables the firm to mitigate disruption risks, quickly react to marketplace changes and other uncertainties, and to achieve a superior competitive position (Braunscheidel and Suresh, 2009; Swafford *et al*., 2006). Finally, supply chain agility is a crucial factor in responding

effectively and efficiently to operational changes, and to improving performance (Blome *et al*., 2013; Liu *et al*., 2013). If firms can manage cooperation and competition simultaneously then this will promote supply chain agility, enabling superior performance to follow. As a result, we posit that:

H3: *Coopetition indirectly influences firm performance through supply chain agility in a business ecosystem-context.*

2.6 The Serial Influence of Absorptive Capacity and Supply Chain Agility

The above has considered the effect of two mediators separately, but absorptive capacity may also increase supply chain agility. It has been argued that absorptive capacity is a key element of dynamic capabilities (Wang and Ahmed, 2007), which transform a firm's operational capabilities (Winter, 2003; Cepeda and Vera, 2007) such as supply chain agility. The exploratory case study of Do *et al*. (2021) illustrated how supply chain agility was developed during the COVID-19 crisis based on dynamic capabilities. Overall, absorptive capacity ensures a rich base of market knowledge and a shared understanding amongst partners (Liu *et al*., 2013*)* of the ecosystem to respond to changes and provide joint solutions faster.

Business ecosystems allow knowledge to be exchanged within different network structures (Wulf and Butel, 2017), but firms must ensure they have the right capabilities to manage knowledge and that they develop the required competencies. In this sense, high levels of absorptive capacity ensure firms can acquire external knowledge for reengineering their processes and exploiting new opportunities in the environment (Cohen and Levinthal, 1990). Besides, absorptive capacity allows interdependencies to be leveraged to favour the positioning of the firm in the trade-off between value creation and appropriation in coopetitive relationships (Chou & Zolkiewski, 2018). As a result, firms can adapt and rapidly respond to marketplace changes to ensure supply chain

agility. When they collaborate with competitors, agility allows firms to build and reconfigure relationships over time to sustain opportunities (Bengtsson and Johansson, 2014). Eventually, through supply chain agility, firms achieve superior competitive positioning (Swafford *et al*., 2006). As an example, see the case of Mercadona, whose superior agility allowed it to provide face masks more efficiently than the Spanish Government during the coronavirus crisis (Lin et al., 2020). Overall, we propose that coopetition influences absorptive capacity and, in doing so, has an indirect effect on supply chain agility and, eventually, on firm performance. In this sense:

H4: *Coopetition serially influences firm performance through the indirect effects of both absorptive capacity and supply chain competence in a business ecosystem-context.*

3. Method

3.1 Data Collection and Sample

A survey of firms belonging to two Spanish tech-cities was conducted. These two tech-cities were chosen due to their relevance and large size within the country (i.e. they contained a total of 1,100 companies). They act as access points for the study to reach firms operating in global ecosystems since they host firms that participate in physical/digital ecosystems worldwide. Hence, the sample is not geographically constrained as most firms operate internationally (see Table 1). Further, prior to starting the questionnaire, and to ensure that firms were embedded in a business ecosystem, we specified that the study was analysing communities bigger than networks. We provided an explanation based on the exploratory study of Wulf and Butel (2017), which described ecosystems from a managerial perspective (i.e. “a set of organisations with which your firm relates, including those beyond suppliers, distributors and customers conforming a larger structural entity than networks. These can be communities,

associations, clusters, physical/IT platforms, where your firm and other organisations are embedded.”). Moreover, to objectively evaluate the degree to which each firm is embedded in business ecosystems, we used the three-dimensional construct developed by Riquelme-Medina et al. (2021). Due to low factor loadings, two items were dropped after exploratory factor analysis (EFA; see Appendix A). We calculated the firm’s overall business ecosystem embeddedness as a weighted average of the three dimensions (i.e. interdependencies, 5 items; value potential, 2 items; and shared components, 2 items), considering the number of items per dimension. We concluded that almost 98% of the sample has a medium/high degree of embeddedness (see Table 1). As a result, beyond being members, practically all the sample firms are actively involved and influenced by a business ecosystem.

[Take in Table 1]

The questionnaire was designed to be completed by each firm’s CEO or a top manager since they have a broad perspective on the firm’s ecosystem relationships. From 245 initial responses, 31 were removed due to incomplete or missing data, attributed to the questionnaire length. Thus, our final sample consisted of 214 firms (response rate: 19.5%), covering a wide range of firms in terms of their industry, scope, size, and age.

The questionnaire included a seven-point scale for each construct and some specific questions to measure control variables. Validation of the new measures is discussed in sections 3.2 and 4 below. Digital and paper versions of the questionnaire in English and Spanish were developed. Brislin's (1980) procedures were performed by two Spanish bilingual academics to ensure equivalent meaning in both languages. The questionnaire was piloted with five top managers, with refinements made to avoid ambiguity. Data were treated anonymously to avoid positively biased responses. Finally, following Armstrong

and Overton (1977), we evaluated non-response bias by comparing the first and last 25% of responses. No significant differences were found regarding firm age, firm size, scope, industry, or ecosystem embeddedness (see Appendix B), meaning that non-response bias is not a major concern for the study.

3.2 Measures

Appendix A displays the measurement scales for the constructs. Only the scale for coopetition was developed specifically for this study. We calculated the overall scores for each construct as an average of the items pertaining to each construct (Hair *et al*., 2014; Liu *et al*., 2013). Thus, higher values indicate higher variable levels. EFA with varimax rotation was performed on a second sample of 130 firms. This exceeds the minimum rule of thumb of 5:1, meaning 5 cases per variable, and all items loaded on their respective factors above the 0.5 criterion suggested by Hair *et al*. (2014).

3.2.1 Independent variable

The *coopetition* variable measures the extent to which a firm maintains coopetitive relationships, i.e. simultaneously cooperates and competes (Brandenburger and Nalebuff, 1996; Lado *et al*., 1997; Bengtsson and Kock, 2000; Luo, 2007) at the inter-firm level (Dorn *et al*., 2016). In other words, we considered collaborative relationships amongst competitors in business ecosystems.

We developed a new scale for coopetition based on the literature where: (i) the first four items measured whether a firm maintained coopetitive relationships, considering the perceived benefits of coopetition (Czakon, Klimas, et al., 2020) and the drivers identified in the literature (i.e. the enhancement of competitive positions, or the achievement of common goals and the best configuration of resources; Bengtsson and Kock, 2000; Barile *et al*., 2016; Dorn *et al*., 2016); and, (ii) the last two items described

cooperation and competition intensities, respectively (i.e. the extent to which a firm collaborates actively with competitors and takes competitive actions in coopetitive relationships; Bengtsson *et al*., 2016). Overall, we obtained a six-item construct that allows the existence and intensity of coopetition for a firm at the inter-firm level to be measured (see Appendix A). According to the scale, when a firm presents higher levels of coopetition, it also presents high intensity levels of both cooperation and competition (i.e. strong balanced coopetition), and *vice-versa* for low levels of coopetition (i.e. low balanced coopetition). Further, although this is not the goal of the study, we created a categorical variable for measuring unbalanced coopetition by calculating the differences among cooperation and competition intensities. We established that unbalanced coopetition occurs when the difference is greater than 3 on a seven-point scale (a positive difference will denote cooperation-dominance, e.g. a cooperation intensity of 6 and a competition intensity of 2; while a negative difference denotes competition-dominance). According to this descriptive measure, only 8.9% of the firms presented unbalanced coopetition, and no significant differences were found with regards to the variables in the model (i.e. coopetition, performance, absorptive capacity, and supply chain agility). The categorical variable may be used in future research to measure the effects of balanced/unbalanced coopetition.

The EFA results in Appendix C for the 130-firm sample also show that all factor loadings were >0.7 (Hair *et al*., 2014). Cronbach's alpha coefficient was 0.91 after confirmatory factor analysis (CFA) was performed.

3.2.2 Mediator variables

Absorptive capacity refers to a "set of organisational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organisational capability" (Zahra and George, 2002; p. 186). Absorptive capacity was measured using a 4-item construct validated by Ettlie and Pavlou (2006) with a Cronbach's alpha of 0.79.

Supply chain agility describes a firm's ability to effectively collaborate with partners to quickly respond to market changes (Swafford *et al*., 2006; Braunscheidel and Suresh, 2009; Liu *et al*., 2013). We employed the twelve-item scale developed by Swafford *et al*. (2006) to measure it. Similar to Swafford *et al*. (2006), after conducting EFA and CFA, two items were dropped. These items presented low inter-item correlations (<0.3) and the standardised factor loadings were below 0.7 (Hair *et al*., 2014). Cronbach's alpha was 0.91.

3.2.3 Dependent variable

Firm performance was measured in terms of *market share*, *overall profitability*, *return on investment*, and *overall commercial success* using the scale developed and validated by Mishra and Shah (2009, p. 330). Consistent with these authors, we asked respondents to indicate the firm's performance relative to the competition; but we adapted the measure by limiting responses to the last three years to obtain more objective and comparable data. According to Narasimhan *et al*. (2010), the approach of comparing performance outcomes with others tends to standardize industry differences. Although we used a perceptual measure for performance, this is common practice in the operations management literature and particularly suitable when large samples and accurate reliability tests are used (Ketokivi and Schroeder, 2004). Moreover, objective measures

do not necessarily yield more reliable results (Ward *et al*., 1998). Cronbach's alpha was 0.88.

3.2.4 Control Variables

We considered four control variables (i.e. firm age, firm size, scope, and industry) to remove any alternative explanation of the dependent variable. This also reduced endogeneity problems caused by omitted variables (Lu *et al*., 2018). *Firm age*, i.e. the number of years elapsed since foundation, accounts for any differences in performance between young/old firms. *Firm size* referred to the number of employees per firm. Although larger firms usually appropriate most of the value of collaborative relationships, some studies have shown that SMEs also benefit from coopetition (see, e.g. Bengtsson and Johansson, 2014) and that this plays an important role in their performance (Gnyawali and Park, 2009) by allowing them to acquire resources they would otherwise lack. Following recent studies on coopetition (see, e.g. Crick and Crick, 2021), *scope* was used to control for any differences in performance between firms operating at a local/national/international level. Finally, we considered and controlled for a wide range of *industry* sectors, providing breadth to the coopetition research, as demanded by Crick and Crick (2021).

3.3 Data Analysis

To control for common method bias, we followed Podsakoff *et al*. (2003). First, we separated independent/dependent variables so they did not replicate the structure and order of the hypotheses. Therefore, a respondent could not have intuitively predicted the model. Second, we guaranteed a respondent's anonymity and assured them that there were no right/wrong answers. Third, we improved the survey items by providing examples, defining ambiguous or unfamiliar terms, and avoiding complicated syntax.

Fourth, we conducted Harman's single-factor test and concluded that no single factor accounted for the majority of the variance (all <30%). Fifth, as an alternative test, we followed the recommendations of Chang *et al*. (2010) by constraining all items to one single factor in the CFA analysis. The results presented poor fit (RMSEA=0.155, CFI=0.486, IFI=0.490, $\chi 2$=1538.001 with 252 d.f.; p>0.000), meaning that one single factor did not account for all of the variance in the data. Finally, we used the marker variable technique (Lindell & Whitney, 2001), which it is argued performs better than earlier remedies (Craighead *et al*., 2011). This compares the correlations of a theoretically unrelated variable (i.e. marker variable) with the relevant variables in the model. Results showed non-significant correlations (see Appendix D). Overall, the results showed that common method bias was not a major concern.

We conducted descriptive data analysis using SPSS (Version 24) and CFA using EQS 6.1 (Byrne, 2013). A three-path mediation model was used to test the indirect effects of coopetition on performance. Specifically, the hypothesised relationships were tested using the PROCESS macro for SPSS, which is widely used for estimating direct and indirect effects in mediator models (Hayes, 2013) as it enables the indirect effects passing through two or more mediators in a series to be isolated, providing estimates of confidence intervals through the bootstrapping procedure.

4. Results

CFA was conducted prior to hypothesis testing (see Table 2). First, we examined composite reliability (CR). The CR statistics and Cronbach's alpha values for all scales were >0.70, while all constructs had an average variance extracted (AVE) value >0.5 (Fornell and Larcker, 1981; Nunnally and Bernstein, 1994; Hair *et al*., 2014). Moreover, all inter-item and item-total correlations exceeded the thresholds of 0.3 and 0.5, respectively. As a result, all measures indicated internal consistency of the scales.

[Take in Table 2]

Second, we examined convergent validity. All factor loadings were >0.59 (Hair *et al*., 2014) and statistically significant ($t \geq 1.96$; α=0.05; Anderson and Gerbing, 1982). Third, we used the square roots of the AVEs to test discriminant validity. Since these values exceeded the correlations between the constructs, the benchmark for discriminant validity was reached. Moreover, the correlation matrix showed correlations <0.5, indicating that latent variables in the theoretical model correspond to different constructs. Given the above, all measures exceeded the recommended threshold for discriminant validity of the measurement model. Table 2 demonstrates goodness-of-fit between the model and data (Byrne, 2013) based on CFA results. Robust indices were used due to the non-normality of our data. Meanwhile, Table 3 summarises the means, standard deviations, and correlations of all variables.

[Take in Table 3]

4.1 Hypothesis Testing

We tested the hypotheses and conducted regression analysis using the PROCESS macro for SPSS. Figure 1 illustrates the model with all estimates of the path coefficients, while Table 4 presents the results of the multiple mediation model (all relationships are established with a 95% confidence interval).

[Take in Table 4 and Figure 1]

H1 evaluated whether coopetition is positively and directly related to performance, but the results showed no significant total (β=0.088) or direct effects (β=-0.002). We also examined the indirect effects through the three-path mediation model (H2, H3, and H4). H2 stated that coopetition indirectly influences firm performance through absorptive capacity in the context of business ecosystems. The indirect effect is significant (β=0.050; CI: 0.012, 0.096), thereby supporting H2. Moreover, the results in

Table 4 revealed that coopetition predicted absorptive capacity (β=0.201) and that absorptive capacity predicted performance (β=0.250).

H3 theorised that coopetition indirectly influences firm performance through supply chain agility in the context of business ecosystems, yet the results were non-significant (β=0.019; CI: -0.031, 0.083). Finally, H4 stated that coopetition serially influences firm performance through the indirect effects of both absorptive capacity and supply chain agility in the context of business ecosystems. This indirect effect was shown to be statistically significant (β=0.019, CI: 0.004, 0.040). Moreover, according to Table 4, coopetition positively affects absorptive capacity (β=0.201) and absorptive capacity predicts supply chain agility (β=0.258), which in turn affects performance (β=0.369). Therefore, H4 is supported; coopetition is associated with higher absorptive capacity, which relates to increased supply chain agility and performance levels.

Overall, H2 and H4 were supported and all of the effects occurred irrespective of the inclusion/exclusion of control variables. As a result, although coopetition does not directly affect performance, its indirect effect through both serial mediators is positive and statistically significant. Moreover, only the paths that include absorptive capacity provide positive statistical significance, i.e. absorptive capacity has both a direct effect on firm performance and an indirect effect through supply chain agility.

5. Discussion

This paper sought to further our understanding of how coopetition in the context of business ecosystems influences firm performance. The extant literature has reported conflicting results when measuring the effects of coopetition on other aspects of organisational performance, attributed to the paradoxical nature of coopetition and its opposing forces (Bengtsson *et al*., 2016; Gnyawali *et al*., 2012). Thus, there has been a need for further research that explains how the interplay between cooperation and

competition drives performance (Hoffmann et al., 2018). To the best of our knowledge, we provide one of the first operations management-oriented paper on this topic, showing that coopetition can increase performance for firms in business ecosystems indirectly through two mediators.

Our findings reveal that coopetition itself does not have a direct, positive effect on firm performance. This is consistent with earlier studies on horizontal collaboration for which non-significant performance effects were reported (Robson & Bennett, 2000), or that only showed positive results under certain conditions (Estrada and Dong, 2020). One explanation is that although coopetition seeks to obtain the positive-sum effects of simultaneous cooperation and competition, its specific costs (Gnyawali and Park, 2009) impact the ability to achieve these outcomes. Indeed, Bouncken and Fredrich (2012) explained that coopetition can enhance performance but that this can be undermined by opportunism risk and misunderstanding. Similarly, Crick and Crick (2020) claimed that coopetition can be a performance-enhancing strategy in a crisis (such as the COVID-19 pandemic), but only when managed correctly to avoid associated risks. Equally, the same authors later proved that high 'competitive aggressiveness' can harm the positive performance outcomes of coopetition (Crick & Crick, 2021).

The above means that firms may need additional capabilities in order to mitigate the risks of coopetition and ensure they capitalise on the benefits. Specifically, we focus on the capacity to absorb external knowledge since knowledge exchange is a key motivation for maintaining coopetitive relationships (Ritala *et al*., 2013). Our findings suggest that only through higher levels of absorptive capacity can firms achieve the dual benefits of cooperation and competition in ecosystems. Collaboration with competitors eases external knowledge acquisition since it is likely that the firm will have a common language and similar processes to rivals. A rival's knowledge is particularly relevant to

a firm since it is the basis of differentiation (Wu, 2014), while it can be easier to identify and absorb non-redundant knowledge from competitors (Yan *et al*., 2020). Even if opportunistic behaviour is a concern, competitive pressure means firms remain alert to knowledge spill-over risks, while our research demonstrates that negative appropriation can be counterbalanced by a positive absorption incentive. Supporting this view, recent literature has demonstrated that competition intensity is positively associated with knowledge integration, which contributes to speed when developing new products (Lyu et al., 2022). Therefore, absorptive capacity helps to strike a balance between the strategic resources and capabilities that firms acquire from rivals and those that they provide, especially in business ecosystem settings with interdependent members.

Based on our results, we argue that the competitive dimension of coopetition pushes the firm to develop absorptive capacity to ensure relevant knowledge is acquired and utilised effectively, and in such a way that is better than the competition. Furthermore, beyond the idea of "outperforming the competition", Deng *et al*. (2019) demonstrated that joint learning among rivals yields higher profits compared to separate or no learning pools. In conclusion, having the right knowledge at the right moment leads to better decisions; and, by utilising knowledge, firms can improve previous processes or develop new capabilities to enhance performance in the ecosystem. Supporting our results, Fredrich et al. (2019) showed that absorptive capacity is a necessary requisite for inter-organisational learning in coopetitive relationships, while Xie and Wang (2021) highlighted the favourable role of knowledge absorption in (innovation-oriented) ecosystem contexts.

Likewise, supply chain agility was expected to be an important capability in coopetitive settings. Yet the results showed no significant indirect effect on the relationship between coopetition and performance. Although many benefits of

coopetition relate to the three key supply chain processes – procurement/sourcing, manufacturing, and distribution/logistics (Swafford *et al*., 2006) – coopetition offers similar opportunities to competitors. Moreover, since competitors operate at the same horizontal level, they may share suppliers. Thus, although suppliers may provide valuable information on new technologies, products/services, or advise on cost reductions (Robson and Bennett, 2000), competitors can easily access the same expertise. Besides, the successful acquisition and exploitation of the rival's expertise to enhance a firm's operational processes is not always guaranteed. Firms must first learn how to better integrate and utilise competitors' resources to increase agility. Finally, even if "coopetitors" get to improve certain activities together (e.g. market responsiveness, delivery lead time or new products), firms still need to manage the costs associated with coopetition, potentially eclipsing any of the benefits. Overall, supply chain agility does not yield superior performance when firms maintain coopetitive relationships.

The influence of coopetition on supply chain agility may however be indirect since firms build agility onto a previous knowledge base. Specifically, absorptive capacity ensures the acquisition of external knowledge and its integration with existing knowledge so firms can successfully exploit it (Ettlie and Pavlou, 2006). We thus analysed the influence of coopetition on performance through absorptive capacity and supply chain agility, demonstrating a serial indirect effect.

When a firm collaborates with competitors, it can acquire valuable knowledge since competitors pursue similar goals and interests, while their similar knowledge bases facilitate knowledge acquisition and exploitation (Ritala and Hurmelinna-Laukkanen, 2013; Wu, 2014). Moreover, due to competitive pressure, firms seek to improve their existing level of absorptive capacity in order to create a better basis on which to build

further technologies, solutions, or competences. Specifically, absorptive capacity represents a fundamental component of dynamic capabilities (Wang and Ahmed, 2007), which means that it helps to build other operational capabilities (Winter, 2003; Cepeda and Vera, 2007). A firm can employ external knowledge to seize opportunities, better understand the market and coordinate with other partners' activities, thereby rapidly responding to market changes through supply chain agility. For instance, Lin et al. (2020) demonstrated that firms using the internet to share, obtain and integrate information from external sources can better develop agility, especially in complex environments like business ecosystems. Equally, since agility allows it to build and reconfigure relationships over time to sustain their opportunities (Bengtsson and Johansson, 2014), a firm's competitive position within the business ecosystem can be improved. As a result, coopetition has positive effects on performance through supply chain agility, but only when it is indirectly affected by absorptive capacity. This resonates with previous studies that identified the positive influence of absorptive capacity on supply chain agility (see Liu *et al*., 2013) or showed how supply chain agility has been operationalised based on dynamic capabilities to cope with the COVID-19 crisis (Do *et al*., 2021). More recently, Fernandez-Giordano *et al*. (2021) demonstrated the relevance of knowledge management as a potential antecedent of a firm's supply chain agility. Accordingly, our results show that only through absorptive capacity can collaboration with competitors successfully increase supply chain agility and performance. Meanwhile, firms without sufficient absorptive capacity cannot balance the dual forces of coopetition, overshadowing any possible benefits that it offers.

6. Conclusions

6.1 Theoretical Implications

This paper has four key theoretical implications. First, considering the concept of coopetition from an operations management perspective provides a basis for understanding how coopetitive relationships affect a firm's operations, particularly those in business ecosystems. To the best of our knowledge, this is the first paper to empirically demonstrate the impact of coopetition on performance through the indirect effects of two serial mediators. Thus, it also enriches the broader coopetition literature by extending its reach into a firm's operations through supply chain agility.

Second, our study has identified mechanisms that enable a firm to simultaneously compete and collaborate in business ecosystems. Specifically, it has shown that coopetition relates to higher levels of absorptive capacity, which positively influences supply chain agility, leading to superior results. In doing so, we have responded to three calls: (i) to build on a contingency view (Estrada & Dong, 2020) and the critical success factors affecting the coopetition-performance relationship (Hoffmann et al., 2018); (ii) to examine mediators and other relationships that may explain the impact of coopetition on performance (Czakon, Srivastava, et al., 2020); and, (iii) to empirically investigate the role of absorptive capacity in coopetitive relationships (Dorn *et al*., 2016), which contributes to addressing the gap on how to strike a balance between knowledge sharing and appropriation in coopetition (Hoffmann et al., 2018).

Third, this study extends the business ecosystems literature by providing empirical evidence on the performance of ecosystem members collaborating with competitors. in this way, it integrates the role of coopetition within the ecosystems literature, as called for by prior studies (Cobben et al., 2022). Moreover, it enlarges the contributions of recent literature that have combined the RBV with emerging ecosystems theory (Gueler

& Schneider, 2021). In business ecosystem settings, absorptive capacity can be a key component of dynamic capabilities that balances the dual forces of coopetition to obtain superior agility and performance. Finally, we have provided and validated a much-needed new scale for measuring coopetition (Bengtsson and Raza-Ullah, 2016).

6.2 Managerial Implications

The notion of coopetition may be counterintuitive to some managers; but they should be aware that, when harnessed correctly, it entails a performance-enhancing strategy. In particular, competitors pursue similar goals and face similar problems, thus by collaborating with them firms can leverage information and conduct joint problem solving (Wu, 2014).

Coopetition is natural in business ecosystems. Thus, managers in ecosystems should be especially aware of how best to effectively utilise this practice, since ecosystems require a different mind-set that accounts for the capabilities that reside across organisational boundaries (Cobben et al., 2022). In particular, they should foster external knowledge absorption. This can be achieved by creating routines for searching external information (Ritala and Hurmelinna-Laukkanen, 2013), increasing the range of information sources, continually assessing changing market demands, and promoting information sharing with ecosystem partners and within organisational units (e.g. maintaining systematic (in)formal meetings, visits or workshops). Equally, firms could: establish roles for exploiting acquired knowledge, build mutual trust and commitment with competitors, and use a common language to embed knowledge effectively both at the intra and inter-firm level. Overall, this should enhance the utilisation of a rival's knowledge to sustain competitive advantage.

By leveraging external knowledge, managers can make better decisions and gain a better market understanding. As a result, firms can collaborate with partners more

effectively and respond to market changes faster (Braunscheidel and Suresh, 2009; Liu *et al*., 2013; Swafford *et al*., 2006), thereby increasing supply chain agility. Finally, coopetition can help a firm to obtain benefits such as stronger market positioning, cost sharing, shorter lead times, production efficiencies, or access to valuable resources. But without the development of knowledge absorption capabilities, the benefits of coopetition for supply chain agility and performance cannot be realised.

6.3 Limitations and Future Research

Four limitations should be considered when interpreting our results. First, we have used cross-sectional data, which limits the cause-effect relationships that can be inferred. As recommended by recent literature (Cobben et al., 2022), since business ecosystems are constantly evolving, future research could examine longitudinal data to understand further aspects of coopetition in business ecosystems (e.g. the effects of coopetitive experience, or the development of certain competencies over time through coopetition). Moreover, as recently highlighted by Crick and Crick (2021), coopetition should be analysed through the lens of dynamic capabilities. Although the present study provides some insights, a temporal dimension could enable an investigation into the role of absorptive capacity as a component of dynamic capabilities that transform operational capabilities, and how this enables firms to cope with the dual forces of coopetition over time. Second, our data is from two Spanish tech-cities only, which limits the generality of results. Although ecosystems normally surpass the boundaries of countries/industries, future research could evaluate if there are differences for tech-cities located in other countries. Third, our data is from a single informant per company only. Although we sought to control for common bias, data from multiple sources within each firm would be advantageous. In addition, qualitative research could be undertaken to provide

knowledge on how to better implement the mediator capabilities in coopetition, combined with secondary data to improve the quality of future results.

Finally, future research could investigate other contingency factors and capabilities (e.g. reputation, mutual trust, perceived vulnerability, cultural and technological compatibility, alliance portfolio management capabilities, coopetition capability, relational and combinative capabilities, the firm's role in the ecosystem, etc.; Bengtsson and Raza-Ullah, 2016; Czakon et al., 2020b; Cozzolino et al., 2021), or consider effects beyond mediation (e.g. moderation or curvilinear effects; Le Roy and Czakon, 2016) to improve understanding of the coopetition-performance relationship in the specific context of business ecosystems.

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Tables and Figure

Table 1. Sample Characteristics

Variables	Frequency (N)	Percentage (%)
Age		
< 5	38	17.8
5 - 10	51	23.8
11 - 25	66	30.8
26 - 50	35	16.4
51 - 100	14	6.5
> 100	10	4.7
Size		
< 10	55	25.7
10 - 50	62	29.0
51 - 250	45	21.0
251 - 1000	17	7.9
> 1000	35	16.4
Scope		
Local	9	4.2
National	38	17.8
International	167	78.0
Industry		
1. Agriculture, Forestry and Fishing	1	0.5
2. Manufacturing	50	23.4
3. Electricity, Gas, Steam and Air Conditioning Supply	12	5.6
4. Water Supply; Sewerage, Waste Management and Remediation Activities	3	1.4
5. Construction	2	0.9
6. Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	14	6.5
7. Transportation and Storage	9	4.2
8. Information and Communication	62	29.0
9. Financial and Insurance Activities	11	5.1
10. Professional, Scientific and Technical Activities	35	16.4
11. Administrative and Support Service Activities	1	0.5
12. Education	1	0.5
13. Human Health and Social Work Activities	3	1.4
14. Arts, Entertainment and Recreation	1	0.5
15. Other Service Activities	8	3.7
16. Activities of Extraterritorial Organizations and Bodies	1	0.5
Business Ecosystem Embeddedness		
Low	5	2.3
Medium	91	42.5
High	118	55.1
Balanced/unbalanced Coopetition		
Balanced Coopetition	195	91.1
Unbalanced coopetition		
Cooperation-dominant	13	6.1
Competition-dominant	6	2.8

Notes: N = 214. Statistical Classification of Economic Activities in the European community (NACE Rev. 2) was adopted for sector classification. Out of 21 sectors, 16 were represented in our sample.

Table 2. CFA Results and Goodness of Fit Statistics of the Measurement Model.

Variable	λ	CR (>0.7)	AVE (>0.5)	Cronbach's α (>0.7)	Measurement Model's Goodness-of-Fit Statistics
1. Coopetition		0.909	0.628	0.908	
COOPET01	0.728				
COOPET02	0.830				
COOPET03	0.849				
COOPET04	0.916				
COOPET05	0.800				
COOPET06	0.590				
2. Absorptive Capacity		0.805	0.510	0.792	
AC01	0.745				$\chi2$ = 435.012 with 246 d.f.
AC02	0.591				
AC03	0.783				
AC04	0.724				NFI = 0.915
3. Supply Chain Agility		0.948	0.517	0.911	CFI = 0.924
SCA01	0.748				
SCA02	0.673				IFI = 0.925
SCA05	0.623				
SCA06	0.699				RMSEA = 0.060
SCA07	0.723				
SCA08	0.758				Cronbach's α = 0.878
SCA09	0.765				
SCA10	0.643				
SCA11	0.739				
SCA12	0.797				
4. Performance		0.936	0.538	0.883	
P01	0.701				
P02	0.903				
P03	0.846				
P04	0.816				

Notes: All t-values > 1.96. $\chi2$ is significant at p<0.000.

Table 3. Means, Standard Deviations and Correlations for All Variables.

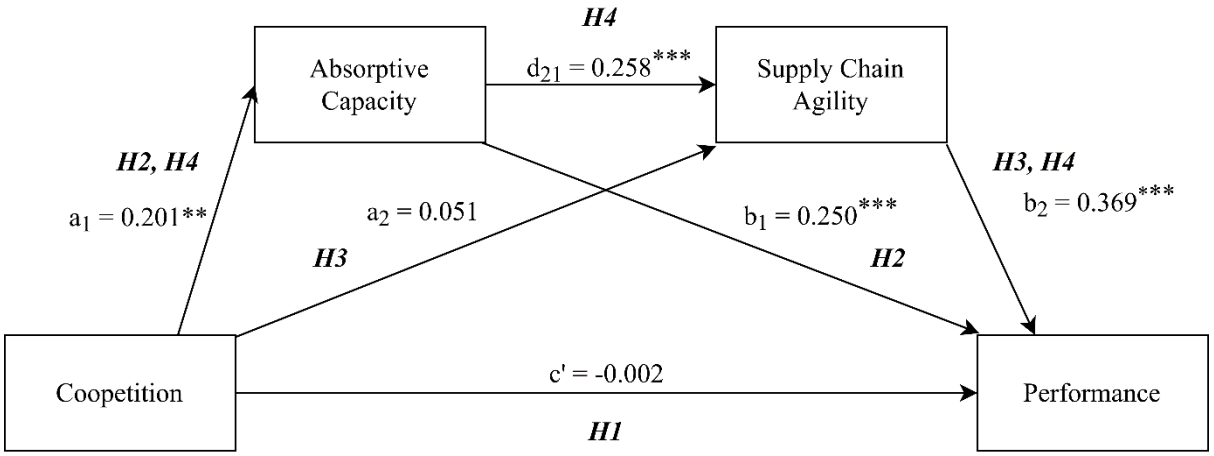
Variables	Mean	SD	1	2	3	4	5	6	7	8
1. Coopetition	3.86	1.71	-							
2. Absorptive capacity	5.26	1.18	0.16*	-						
3. Supply chain agility	5.31	1.07	0.09	0.28**	-					
4. Performance	5.27	1.16	0.05	0.38**	0.45**	-				
5. Age	27.01	43.02	-0.16*	-0.04	-0.02	-0.05	-			
6. Size	5535.23	27305.70	-0.04	0.02	0.05	0.05	0.46**	-		
7. Scope	2.74	0.53	-0.17*	0.11	0.01	0.15*	0.02	0.08	-	
8. Sector	8.71	4.46	0.15*	-0.15*	-0.08	-0.16*	-0.06	0.08	-0.18**	-

*Notes: N= 214. SD. = standard deviation; ** $p < 0.01$; * $p < 0.05$; two-tailed test.*

Table 4. Regression Coefficients, Standard Errors and Model Summary of the Serial Multiple Mediation Model.

		Consequent									
		M_1 (AC)				**M_2 (SCA)**				**Y (P)**	
Antecedent		**Coeff.**	**SE**	**p**		**Coeff.**	**SE**	**p**		**Coeff.**	**SE**	**p**
X (COOPET)	a_1	0.201	0.052	0.008	a_2	0.051	0.046	n.s.	c'	-0.002	0.037	n.s.
M_1 (AC)		—	—	—	d_{21}	0.258	0.066	0.000	b_1	0.250	0.062	0.000
M_2 (SCA)		—	—	—		—	—	—	b_2	0.369	0.082	0.000
Constant	i_{M1}	4.850	0.538	0.000	i_{M2}	4.294	0.654	0.000	i_Y	1.517	0.664	0.025
Age		-0.039	0.002	n.s.		-0.038	0.002	n.s.		-0.064	0.001	n.s.
Size		0.049	0.000	n.s.		0.071	0.000	n.s.		0.060	0.000	n.s.
Scope		0.114	0.147	n.s.		-0.033	0.172	n.s.		0.096	0.132	n.s.
Sector		-0.160	0.018	0.016		-0.068	0.017	n.s.		-0.086	0.016	n.s.
		$R^2 = 0.071$ $F(5, 208) = 2.329, p = 0.016$				$R^2 = 0.085$ $F(6, 207) = 3.136, p = 0.006$				$R^2 = 0.294$ $F(7, 206) = 17.067, p = 0.000$		

Notes: COOPET: Coopetition, AC: Absorptive capacity; SCA: Supply chain agility; P: Performance. Controls: age, size, scope, sector. M_1: First mediator; M_2: Second mediator; n.s.: non-significant. All coefficients are standardised.



N= 214, *** p<0.001; ** p < 0.01; *p < 0.05

Figure 1. Three-path Mediation Model

Appendix A. Measurement Scales

Business Ecosystem Embeddedness (Riquelme-Medina *et al.*, 2021).

Items from ECO01 to ECO05 refer to *interdependencies*; items from ECO06 to ECO08 refer to *value potential*; and items from ECO09 to ECO11refer to *shared components*.

Please indicate the degree to which each of the following situations is present in the environment where your firm conducts its business (1: Very low degree; 7: Very high degree):

- ECO01: We find a large number of loosely interconnected entities.
- ECO02: We find a large number of entities that depend on each other for their mutual effectiveness and survival.
- ECO03: We find a large number of entities that depend on each other even if they do not directly interact.
- ECO04: We are part of a complex larger community that is structured as several networks of entities (e.g. networks of partners and other organizations).
- ECO05: We find different networks, each of them valuable for different purposes (such as access to knowledge, resources exchanges, or for obtaining relevant information).
- ECO06: We find critical and potential partners that are valuable for our business success (e.g. suppliers, distributors, outsourcing firms, technology providers, competitors, and a host of other organizations).
- *ECO07: We maintain formal or informal relationships with other organizations that fall outside the traditional chain of suppliers, distributors, and customers (e.g. relationships with financing institutions, business associations, universities, research institutes, stakeholders, government organizations, incubators, or even competitors and customers when their actions and feedback affect the development of our products/services).
- ECO08: We find room for potential opportunities to create new markets, technologies, or products/services that may not exist today.
- ECO09: Our firm and other organizations conduct their business on a larger infrastructure or platform (i.e. clusters, services, tools, or core technologies).
- ECO10: We share a similar vision with many of the organizations in our networks about the future of our business environment.
- *ECO11: Our goals must sometimes be sacrificed for the greater good of our business environment.

Coopetition (newly developed scale based on previous literature, see section *3.2.1 Independent variable*)

Items from COOPET01 to COOPET04 refer to the existence of coopetition (based on the perceived benefits and drivers of coopetition identified by the literature; Bengtsson and Kock, 2000; Barile et al., 2016; Dorn et al., 2016; Czakon, Klimas, et al., 2020); and COOPET05 to COOPET06 refer to the intensity of both cooperation and competition in coopetitive relationships (according to Bengtsson et al., 2016).

Please indicate the extent to which you agree or disagree with the following statements with regards to your firm (1: Disagree completely; 7: Agree completely):

- COOPET01: We often find valuable partners amongst our most direct competitors.
- COOPET02: We collaborate with competitors to achieve common goals.

- COOPET03: We collaborate with competitors to access resources that our firm lacks.
- COOPET04: Collaboration with competitors is effective in enhancing our competitive position.

Please indicate the degree of intensity of your relationship with your main competitors in the following situations (1: Very low intensity; 7: Very high intensity):

- COOPET05: When we establish a relationship with our competitors, active collaboration is very important to us.
- COOPET06: When we establish a relationship with our competitors, active competition is very important to us.

Absorptive Capacity (adapted from Ettlie and Pavlou, 2006).

Please indicate the degree to which your firm demonstrates each of the following abilities (1: Very low degree; 7: Very high degree). Ability to:

- AC01: Identify, value, and import external knowledge from other entities in the networks.
- AC02: Adequate internal routines to analyse the external knowledge from other entities in the networks.
- AC03: Integrate new knowledge acquired from other entities in the networks successfully with existing knowledge.
- AC04: Exploit newly integrated knowledge successfully in concrete applications (e.g. developing a product using external knowledge).

Supply Chain Agility (adapted from Swafford *et al*., 2006).

Please indicate the degree to which your firm is able to perform the following actions in response to unforeseen circumstances and/or unpredicted and changing market conditions in a timely manner (1: Disagree completely; 7: Agree completely):

- SCA01: Reduce manufacturing/service provision lead time.
- SCA02: Reduce product/service development cycle time.
- *SCA03: Increase the frequency of new product/service introductions.
- *SCA04: Increase the level of customisation.
- SCA05: Adjust worldwide delivery capacity/capability.
- SCA06: Improve the level of customer service.
- SCA07: Improve delivery reliability.
- SCA08: Improve responsiveness to changing market needs.
- SCA09: Reduce set-up/changeover time.
- SCA10: Increase production capacity.
- SCA11: Decrease ramp-up time for new products/services.
- SCA12: Reduce delivery lead time.

Performance (adapted from Mishra and Shah, 2009).

Relative to your competitors, indicate how your firm performed over the last three years in the following areas (if the age of your company is less than 3 years, consider the number of years elapsed since foundation; 1=Performed very poorly,7=Performed very well):

- P01: Market share.
- P02: Overall profitability.
- P03: Return on investment (ROI).
- P04: Overall commercial success.

**Removed items*

Appendix B. Non-response Bias

The following table summarises the results of t-tests to explore differences between early and late respondents according to firm age, firm size, scope (i.e. local, national, international), industry sector, and ecosystem embeddedness. The results indicate no significant differences between the responses of early and late respondents suggesting non-response bias is not a major concern in this study.

Table B. Non-response bias

Variables	First/Early Respondents	Last/Late Respondents	Significance Values
Average Age	14.80	22.76	0.058
Average Size	120.94	2878.61	0.233
Average Scope	2.61	2.54	0.553
Average Sector	9.15	9.31	0.851
Average Ecosystem	4.58	4.33	0.244

Notes: We compared the first 25% of responses with the last 25% of responses.

Appendix C. EFA Results: Component Matrix for Coopetition

Table C. EFA Results: Component Matrix for Coopetition

Item	Component 1
COOPET01	0.810
COOPET02	0.905
COOPET03	0.891
COOPET04	0.913
COOPET05	0.908
COOPET06	0.791
Cronbach's Alpha	0.936
Kaiser-Meyer-Olkin	0.909

Notes: N= 130. Extraction method: principal component. Bartlett's Test of Sphericity: $\chi 2$ is significant at $p<0.000$, 15 df.

Appendix D. Common Method Bias (Marker Variable Technique)

Table D. Common Method Bias (Marker Variable Technique)

Variables	1	2	3	4	5	6
1. Coopetition	-					
2. Absorptive capacity	0.16*	-				
3. Supply chain agility	0.09	0.28**	-			
4. Performance	0.05	0.38**	0.45**	-		
5. Marker variable (country)	-0.07	0.06	0.02	0.12	-	

*Notes: N= 271. SD. = standard deviation; ** p < 0.01; * p < 0.05; two-tailed test.*