

This is a pre-print of an article published in the **European Journal of International Management**.
The final authenticated version is available online at: <http://dx.doi.org/10.1504/EJIM.2020.10026140>

Berbegal-Mirabent, J.; Gil-Doménech, D.; Senent-Bailach, C. (2021). Coopetition in start-ups: Impact on innovation and business performance. *European Journal of International Management*, 16(4), 694-711.
DOI: 10.1504/EJIM.2020.10026140.

Coopetition strategies of start-ups: Evidence from a Spanish regional innovation system

Jasmina Berbegal-Mirabent¹, Dolors Gil-Doménech², Carolina Senent-Bailach³

¹Universitat Internacional de Catalunya, Department of Economics and Business Organization.
C. Immaculada, 22. 08017 Barcelona, Spain. Email: jberbegal@uic.es

²Universitat Internacional de Catalunya. Department of Economics and Business Organization.
C. Immaculada, 22. 08017 Barcelona, Spain. Email: mdgil@uic.es

³IUDESCOOP. University of Valencia. C. Serpis, 29. Valencia 46022, Spain. Email:
carolinasenent@coev.com

Abstract: Start-ups operate in a highly competitive environment, surrounded by companies that offer similar products and services. In this context, collaboration between competitors has been found to help companies reduce risk and share costs, resources and expertise. Despite its relevance, coopetition (i.e. the simultaneous pursuit of cooperation and competition) in entrepreneurship has attracted little scholarly attention. This study aims at filling this theoretical and empirical gap by exploring the impact of coopetition on the performance of start-ups. Drawing on the existing literature, this study also considers innovation and knowledge sharing as key factors that can shape business performance. The analysis is based on qualitative comparative analysis (QCA) because the focus is on the combined effect of the determinants of firm performance rather than their net effects. This approach enables identification of different start-up strategies. The results indicate that coopetition and innovation are important to positively influence market performance. However, knowledge sharing is only relevant when competing start-ups either have solid market experience or are highly innovative.

Keywords: Coopetition, innovation, knowledge sharing, performance, start-ups

1. Introduction

In today's globalised world, start-ups operate in a highly competitive environment that comprises numerous firms with similar offerings. These firms may be either large corporations or small and medium-sized enterprises (SMEs). Start-ups are characterised as companies that 'often develop innovative ideas, are flexible and agile, willing to take risks, and aspire to achieve high growth' (Hora et al., 2018, p. 411). Yet they do so whilst competing for funds and talent because their newness and smallness means that they tend to lack the necessary resources, capabilities and knowledge. They must therefore collaborate to share resources, costs and risks by entering into cooperative partnerships.

Competition, collaboration and innovation are at the heart of the knowledge-based economy. The European Commission supports the sustainable development of innovative start-ups in Europe through numerous initiatives. This support highlights the importance of start-ups for economic growth in Europe and reflects not only the job opportunities created by start-ups but also their contribution in providing innovative solutions that respond to the needs of today's society (EU Startup Monitor, 2018).

This study aims at providing new insights into the impact of cooperation on firm performance in the specific context of start-ups. According to Galkina and Lundgren-Henriksson (2017) and Hora et al. (2018), cooperation in entrepreneurship has attracted little attention in the literature despite its relevance. Bouncken et al. (2015) and Gast et al. (2015) have conducted exhaustive literature reviews that analyse the evolution of the concept of cooperation and suggest future lines of research. The authors of both of these studies highlight the importance of linking cooperation to entrepreneurship, specifically in relation to start-ups. According to Gast et al. (2015, p. 511), 'research is needed to determine whether cooperation can really be a solution to the liabilities of smallness and

newness in the context of start-ups'. Other scholars have also highlighted the importance of linking entrepreneurship to collaborative alliances. For Sarkar et al. (2001), the partners of an entrepreneurial alliance are more likely to boost their performance in the market. Rezazadeh and Mahjoub (2016) reported that gaining knowledge of the competition through an alliance is likely to increase entrepreneurial effectiveness in terms of innovativeness, risk-taking and proactiveness. Later, Rezazadeh and Nobari (2018) focused on cooperative entrepreneurship, identifying entrepreneurial attitudes, complementarity and compatibility as antecedents and detecting firms' agility, customer relationship management, learning, and innovative and sensing capabilities as consequences of cooperative entrepreneurship. Similarly, Ribeiro-Soriano and Urbano (2009) discussed the concept of collaborative entrepreneurship and highlighted its importance in the current environment characterised by complexity and continual innovation, stressing the value of knowledge to ensure greater success.

Indeed, most studies of coopetition have primarily focused on large corporations (e.g. Dahl, 2014; Gnyawali and Park, 2011) and SMEs (e.g. Gnyawali and Park, 2009). Although a few recent studies have examined coopetition in start-ups (Bouncken et al., 2018; Hora et al., 2018; Soppe et al., 2014), no study has tested the effect of coopetition on these firms. This approach represents the novelty of this research. According to Bouncken and Fredrich (2012), further research is needed to better understand the antecedents of performance in cooperative environments.

Following Kumar and Dutta (2017), we argue that coopetition can have a positive effect on market performance, and we study this effect in an entrepreneurial setting. More specifically, we address the following research questions: How do companies in their early stages compete and cooperate at the same time? When do they use coopetition and when is it appropriate? And how does coopetition affect performance?

The original contribution of this paper stems from its analysis of coopetition in an entrepreneurial setting. In this study, we build upon the work of Bouncken and Fredrich (2012), who consider competitive success and innovation as effects of coopetition, and Bouncken and Kraus (2013), who argue that innovation and knowledge sharing help shape business performance in the context of coopetition. The goal of this study is to identify the patterns that start-ups follow to achieve business success when coopeting. Qualitative comparative analysis (QCA) of a sample of 46 start-ups from the Region of Valencia (Spain) is used for this purpose.

Building upon the research by Devece et al. (2019), who advanced the systematisation of studies on coopetition, our study describes the dynamics of coopetition based on evidence from different cases. Studies of this nature are collectively labelled as having a 'broad approach to coopetition'. This study complements the existing literature (e.g. Bengtsson and Johansson, 2014; Bouncken and Fredrich, 2012; Bouncken and Kraus, 2013, Fernandez et al., 2014, Park et al., 2014a; Ritala and Tidström, 2014), offering a new approach to the study of coopetition strategies.

The rest of this paper is structured as follows. Section 2 provides the theoretical framework that supports our research. More specifically, we review the most recent developments in coopetition and discuss how innovation and knowledge sharing practices can foster or hinder entrepreneurial endeavours. Section 3 describes the sample, metrics and method used in this study. The results are presented in Section 4. Section 5 concludes by presenting implications for theory and practice as well as some concluding remarks.

2. Theoretical underpinnings

2.1. Coopetition

The term *coopetition* was introduced by Ray Noorda, the founder and CEO of Novell, in the 1980s (Bouncken and Fredrich, 2012). Since then, it has become increasingly popular amongst strategy and management scholars to refer to simultaneous cooperation and competition between companies (Bengtsson and Raza-Ullah, 2016). Coopetition is said to be paradoxical by nature (Bengtsson and Kock, 2014; Raza-Ullah et al., 2014) because it entails two contradictory yet interrelated positions (namely, cooperation and competition) that can cause tension between value creation and value appropriation (Bouncken et al., 2015). Coopetition can thus be defined as ‘a strategic and dynamic process in which economic actors jointly create value through cooperative interaction, whilst they simultaneously compete to capture part of that value’ (Bouncken et al., 2015, p. 591). Bengtsson and Kock’s (2000) research is of particular interest because it describes the difference between cooperation and competition as a function of proximity to the customer. Accordingly, there is less cooperation and greater competition in activities that are closer to the market, whereas there is greater cooperation and less competition in activities that are further from the market. Competitive relationships focus on value appropriation strategies, whereas cooperative relationships centre on collective value generation strategies (Osarenkhoe, 2010).

Cooperating with competitors can help firms gain advantages that they could not otherwise obtain (Luo, 2007). These benefits include sharing costs, resources, competencies, innovation and knowledge (Bouncken and Fredrich, 2012; Ritala et al., 2014). In the context of coopetition, Santos et al. (*in press*) argued that companies that promote knowledge creation and acquisition innovate significantly more and that this greater innovation also positively affects their internationalisation. According to

Gnyawali and Park (2009) there are several significant differences between collaborating with competitors and collaborating with other firms. First, resources are more useful because competitors have higher degrees of market and resource similarity. Second, these resources are more likely to be used directly, with little alteration or further development. Third, because competitors are subject to similar external pressures, they can more efficiently deal with them by working together and sharing resources. Lastly, by joining forces, firms can overcome resource constraints and constant threats from larger competitors. Crucially, however, coopetitors also face risks in the form of opportunism and lack of trust, which can reduce performance and innovation (Bouncken and Fredrich, 2012). Hence, risks as well as benefits can be jointly considered when studying coopetition.

Galkina and Lundgren-Henriksson (2017) suggested that coopetition resembles an entrepreneurial process because it involves dealing with uncertainty, exploring and exploiting new opportunities, and taking risks, which are the classic elements of entrepreneurial behaviour. There is an emerging stream of literature on the effects of coopetition on entrepreneurship. For instance, Bengtsson and Johansson (2014) investigated how coopetition can help SMEs generate entrepreneurial opportunities, finding that the capacity to build legitimacy, boost agility and create flexibility plays an important role in generating and sustaining these opportunities. Likewise, Soppe et al. (2014) explored why start-ups engage in vertical coopetition and how they manage this type of relationship. Their results suggest that coopetition is common amongst entrepreneurial firms and that it frequently arises as an unplanned and organic strategy. They also found that start-ups usually centralise the management of cooperative ties, unlike large companies, which tend to decentralise the management of cooperative ties through divisionalisation or departmentalisation. Recently, Bouncken et al. (2018)

studied how coopetition affects the entrepreneurial involvement of co-working spaces, concluding that, depending on the type of co-working space, the inherent tensions between value creation and value capture in coopetition vary. Hora et al. (2018) explored why start-ups and corporates are able to cooperate. Their research suggests that whereas start-ups perceive cooperating with corporates as a way of facing resource restrictions, corporates can benefit from start-ups' innovative ideas.

According to Le Roy and Czakon (2016), the normative theory of coopetition suggests that cooperative strategies enhance firm performance. Gast et al. (2015) identified cooperation in innovation as a separate cluster in cooperation research and linked it to knowledge creation and exchange. Cooperative strategies improve innovation performance in firms because cooperation creates the tension that forces innovation, whilst cooperation leads to the exchange of the necessary knowledge for this innovation (Park et al., 2014b). Bengtsson and Raza-Ullah (2016) examined the construct of cooperation from a multi-level, dynamic perspective, identifying the following fundamental variables in relation to cooperation: innovation, knowledge, performance and trusting relationships between firms. The first three variables are objectively measurable and are therefore relevant to this study.

2.2. Innovation in the context of cooperation

Ritala and Hurmelinna-Laukkanen (2009) used game theory to analyse the differences between innovation in a collaborative relationship and innovation in a cooperative relationship. They observed that innovation activities entail multiple phases with two dimensions: value creation and value appropriation. Whereas joint innovation between non-competitors means that both value creation and value appropriation can be collaborative, in joint innovations between competitors, value creation can be collaborative, but value appropriation will always be competitive.

Coopetition is a growing force in the innovation setting. Innovation is commonly classified into two categories: incremental innovation and radical innovation. Whereas incremental innovation refers to changes in products and technologies, radical innovation refers to variations in existing capabilities in the company and builds the basis to offer completely new products and services (Tushman and Anderson, 1986). According to McCarthy et al. (2018), for some companies, innovation is still a deep secret that must be kept, whereas, for others such as coopetitors, sharing challenges, objectives and development has become a new and more efficient way of working that in turn accelerates innovation.

Numerous studies have examined the connection between coopetition and innovation. Ritala and Hurmelinna-Laukkanen (2013) studied how absorptive capacity (i.e. a company's ability to realise the value of new external information, assimilate this information and then apply it for commercial purposes) and appropriability (i.e. the protection of a company's intellectual assets) affect innovation in companies that coopete. According to these authors, high absorptive capacity is associated with high innovation in coopetition. This effect is stronger in the case of incremental innovation. These authors pointed out that appropriability increases when high levels of innovation occur and that, in such cases, the effect is stronger for radical innovation. Bouncken and Kraus's (2013) research was also along these lines. Focusing on knowledge-intensive SMEs, they found that coopetition can trigger radical innovation. This result is consistent with the findings reported by Bouncken and Fredrich (2012), who, after performing a study of IT firms, concluded that coopetition improves radical innovation but that incremental innovations occur only in environments of high trust and high dependency. Gnyawali and Park (2011) focused on large technological firms, analysing the positive impact of coopetition on technological innovation. They found that when

big corporations follow cooptation strategies, there are two desirable outcomes. Not only do partnering firms benefit from cooptation by better responding to technological challenges and advancing innovation, but cooptation also produces subsequent cooptative arrangements with other companies, resulting in more advanced technological development. Park et al. (2014a) investigated the impact of cooptation on innovation performance and deduced that balanced cooptation consisting of moderately high competition and high cooperation positively affects innovation performance.

2.3. Knowledge sharing practices

In the current era of highly networked relationships, knowledge sharing is a crucial force to channel the flow of information and other resources across organisational boundaries (Chen et al., 2014). In this setting, knowledge sharing is a key factor of firms' performance because it helps companies improve their innovation capabilities, which Zawislak et al. (2012) list as technology development, operations, management and transaction capabilities (Shih et al., 2006). According to Chen et al. (2014), knowledge sharing can take place when partners develop trust and establish long-term relationships.

In the context of cooptation, knowledge sharing is deemed crucial because it can strengthen and help maintain the relationship between cooptitors whilst further enhancing the effect of cooptation on innovation. Accordingly, various cooptation studies have examined knowledge sharing. Notably, Shih et al. (2006) adopted a cooptation perspective to explore the factors affecting knowledge sharing practices in high-tech firms. Their results show that firms should generate a cooptative environment to boost knowledge sharing behaviours. Bouncken and Kraus (2013) went a step further and included this construct as a moderator together with learning from partners and technological uncertainty when analysing the effect of cooptation on innovation.

Knowledge sharing in this context is also central to the study by Ritala and Hurmelinna-Laukkanen (2013), who found that, in the case of incremental innovation, a firm-level emphasis on knowledge sharing and learning positively affects the results of cooptation. Bergendahl and Magnusson (2014) also highlighted the importance of knowledge sharing and intrinsic motivation in bridging and aligning collaboration and competition mechanisms.

However, knowledge sharing through collaboration with competitors also creates tensions resulting from the risk of unintentional knowledge leaks and the appropriation of this knowledge by competitors. Estrada et al. (2016) proposed the establishment of contingency factors in cooptation strategies to enable the integration of knowledge acquired by the firm whilst protecting knowledge that is not supposed to be shared. Gast et al. (2019) distinguished between formal and informal knowledge protection practices, defining formal practices as those related to legal instruments and IT tools and informal practices as those carried out through relational norms included in the organisational culture and human resource management practices.

3. Data and methods

3.1. Sample

The sample for this study comprised start-ups located in the Region of Valencia (Spain). This region was chosen because Valencia was recently classified as one of the most important emerging capitals in the Spanish entrepreneurial landscape after Barcelona and Madrid. Valencia was home to 5.5% of Spanish start-ups in 2017 (Mobile World Capital, 2018). The selected start-ups were applicants to specific competitions because they were competing for the same award. More specifically, the potential sample was formed by 245 start-ups that, between 2012 and 2015, applied for the CEEI (European Centre of

Innovative Firms) awards in Castellón and Elche, the IVACE (Valencian Institute of Business Competitiveness) grant programme of creation of technology-based companies in the Region of Valencia and the 5U-CV STARTUP competition run by the University of Valencia. The final sample comprised 46 of these start-ups (19%) that were interested in participating in the study.

3.2. Measures

A questionnaire was designed with three main sections. The first section gathered general information about the firm such as company name, year of creation, sector, location and number of employees (as a proxy for firm size). Respondents were also asked to indicate their role in the company. The questionnaire was completed by someone with a leading position within the start-up (e.g. founder or CEO) to ensure the validity of the results.

The second section comprised 19 items referring to the three main constructs of interest: *coopetition*, *innovation* and *knowledge sharing*. To measure *coopetition*, we used Morris et al.'s (2007) scale. The scale distinguishes between 'mutual benefit', 'trust' and 'commitment'. For the purposes of this study, we considered only the eight items from the 'mutual benefit' scale because we were interested in measuring how prone a start-up is to collaborate with a competitor. Items in this scale were formulated as statements that respondents indicated their level of agreement or disagreement with using a 5-point Likert scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). We excluded the sub-dimensions of 'trust' and 'commitment' from the original scale because these concepts depend on one another, whereas levels of mutual benefit are subject to many other factors, even when trust and commitment are high (Morris et al., 2007). *Innovation* was operationalised using Ritala's (2012) scale. In this scale, respondents were asked to compare their organisation's innovation performance over the

last three years with that of other start-ups in the same sector. Statements (seven items) were thus formulated as tasks, and respondents had to rate how well the organisation had performed on a scale ranging from 1 (*very poorly*) to 5 (*very well*). *Knowledge sharing* was measured using a four-item scale. Although several scales have been developed to assess how organisations share and disseminate information amongst employees, to the best of our knowledge, no scale captures how this behaviour takes place within start-ups. Accordingly, our four-item scale was inspired by Fullwood et al. (2013), who developed a comprehensive scale to measure academics' knowledge sharing attitudes. From this scale, we took the items that refer to organisational structure and normative beliefs. Following the same procedure as for the 'coopetition' construct, items were presented as statements that respondents indicated their level of agreement or disagreement with using a 5-point Likert scale ranging from 1 (*completely disagree*) to 5 (*completely agree*).

Lastly, the third section consisted of performance measures. Because the respondent companies were unwilling to share information on return on investment (ROI) and return on equity (ROE), a set of four questions was added. Thus, performance was captured through four perceptual questions related to sales growth, profitability, market share and market growth (Ritala, 2012). For each item, respondents rated their company with respect to their closest competitors. Answers were given on a 5-point Likert scale ranging from 1 (*performed very poorly*) to 5 (*performed very well*). This approach is similar to that used by Dess and Robinson (1984) and Eddleston and Kellermanns (2007), who empirically showed that subjective and objective performance measures are strongly correlated and have strong convergent validity. It is also worth noting that, by asking respondents to rate company performance in comparison to that of the closest competitors, we automatically controlled for firm size and industry effects (Love et al., 2002).

Table 1 shows the items used to measure the constructs described above (coopetition, innovation, knowledge sharing and market performance). Because the original scales were in English, a back-translation process was used to ensure the quality of the measurements (Brislin et al., 1973). Two additional metrics were included in the model. First, we considered the size of the start-up, measured by number of employees. Second, we controlled for years of experience in the marketplace.

Table 1. Items included in the questionnaire

Coopetition	
C1	Even if the partner is my competitor, I would not hesitate to enter a relationship if my competitive position were enhanced.
C2	Even though the partner is my competitor, we are open to sharing resources and information.
C3	When I have a relationship with a competitor, the relationship is more important than competing.
C4	*Even if I establish a relationship with a competitor, competition with the partner is more important to me.
C5	I am willing to enter a relationship only when my partner has resources such as equipment, knowledge and connections, which I do not have.
C6	I enter a relationship with a competitor only if the competitor is of a similar size to my company.
C7	*I enter a relationship with a competitor only if the competitor is smaller than my company.
C8	To establish a relationship with my competitor, both companies must have mutual goals and objectives.
Innovation	
I1	Replacement of products being phased out
I2	Replacement of services being phased out
I3	Extension of product/service range within the main market
I4	Extension of product/service range outside the main market
I5	Development of environment-friendly products/services
I6	Opening of new market abroad
I7	Opening of new domestic target groups
Knowledge sharing	
KS1	The structure of my organisation promotes collective rather than individualistic behaviour.
KS2	My organisation designs processes to facilitate knowledge exchange.
KS3	My organisation promotes employees' autonomy; for acquiring information/knowledge, employees need to perform their tasks.
KS4	My organisation believes that employees should share information/knowledge with other members of the organisation.
Performance	
P1	Growth in sales
P2	Profitability
P3	Market share
P4	Market growth

* Reversed questions

3.3. Method

The analysis consisted of a two-step process. In the first step, we assessed the validity and reliability of the constructs using confirmatory factor analysis. In the second step, we used qualitative comparative analysis (QCA) to determine which combinations of factors lead to high performance in the market. QCA is increasingly gaining attention from researchers because it overcomes the limitations of linearity and complementary associations between variables by allowing for asymmetrical relationships (Woodside, 2016). QCA can identify which antecedent conditions or combinations of conditions lead to a given outcome. Causal complexity is thus assumed, allowing combined effects of antecedent conditions to lead to an outcome. Thus, QCA embraces equifinality, meaning that multiple paths may lead to the same outcome. Although QCA performs well in both large and small samples, it is particularly attractive for studies with few observations. Prior studies have shown the validity of this approach for data sets with fewer than 50 cases (Fiss, 2007, 2011).

QCA requires the transformation of the antecedent conditions (which can be thought of as explanatory variables) and the outcome into fuzzy or crisp sets. This transformation is necessary because QCA uses Boolean algebra in its calculations. This transformation, known as calibration, allows sets to be expressed according to degree of membership in a given condition (Ragin, 2017). Cut-off points to establish membership are grounded in both theory and the researchers' knowledge (Fiss, 2007). Therefore, QCA combines both qualitative and quantitative techniques. Membership scores range from 1 to 0, where 1 indicates full membership and 0 indicates full non-membership. Usually, the threshold of 0.95 is used to indicate full membership, and 0.05 is used to denote full non-membership. The crossover point (0.5) denotes cases with maximum ambiguity regarding their membership in the set.

The next step is to construct a truth table. This table has 2^k rows, where k is the number of antecedent conditions in the analysis. Each row reflects a specific combination of attributes, and each column represents a condition. Each empirical case (i.e. each start-up) corresponds to a configuration (i.e. a row of the truth table) depending on which antecedent conditions correspond to that case (Fiss, 2011). The Quine–McCluskey algorithm (Quine, 1952) is then used to logically reduce the number of configurations. The criteria used for this reduction rely on two parameters: coverage and consistency. Coverage indicates the empirical relevance of a solution, and consistency quantifies the extent to which cases sharing similar conditions lead to the same outcome. A minimum consistency of 0.8 is sufficient to indicate goodness of fit, and the recommended minimum coverage value is 0.4 (Ragin, 2017).

4. Results

4.1. Confirmatory factor analysis

We performed four confirmatory factor analyses, one for each construct, to confirm that the scales in Table 1 fit our data. Convergent validity was confirmed for all scales for which all items had a significant weighting (see Table 2).

Table 2. Reliability of scales

Factor	Item	Loading	t-statistic	Mean	SD	Reliability analysis
Coopetition	C1	0.730	-	4.326	0.967	Cronbach's alpha: 0.717 CR: 0.670 AVE: 0.380
	C2	0.940	4.123***	3.717	1.241	
	C3	0.643	4.276***	3.935	1.218	
	C4	0.343	2.173**	2.348	1.233	
	C6	0.261	1.838*	2.891	1.197	
	C8	0.514	3.262**	4.500	0.837	
Innovation	I1	0.503	-	3.674	0.944	Cronbach's alpha: 0.781 CR: 0.762 AVE: 0.339
	I2	0.537	2.663***	4.174	0.677	
	I3	0.895	3.424***	3.913	0.812	
	I4	0.768	3.137***	3.761	0.899	
	I5	0.354	1.964**	4.087	0.962	
	I6	0.380	2.334**	3.674	1.136	
	I7	0.413	2.598***	3.804	1.088	

Knowledge sharing	KS1	0.627	-	4.696	0.591	Cronbach's alpha: 0.720 CR: 0.731 AVE: 0.407
	KS2	0.575	3.422 ^{***}	4.522	0.586	
	KS3	0.731	4.029 ^{***}	4.674	0.474	
	KS4	0.607	3.103 ^{***}	4.761	0.480	
Performance	P1	0.845	-	3.413	1.046	Cronbach's alpha: 0.891 CR: 0.893 AVE: 0.677
	P2	0.923	11.392 ^{***}	3.478	1.169	
	P3	0.732	5.779 ^{***}	3.043	1.173	
	P4	0.779	6.424 ^{***}	3.457	1.005	

Notes: CR = composite reliability; AVE = average variance extracted; significant p-values at 1% (^{***}), 5% (^{**}), and 10% (^{*}).

For the cooperation construct, we dropped two items from the initial scale (C5 and C7) because the loadings were very low and non-significant. Accordingly, our scale to measure cooperation had 6 items. After this adjustment, the four constructs were found to be reliable based on the classic threshold of Cronbach's alpha (> 0.6 ; Bagozzi & Yi, 1988).

Discriminant validity was tested using linear correlations between latent variables. As Table 3 shows, the inter-factor correlations are lower than the square root of the average variance extracted (AVE). Discriminant validity is thus confirmed.

Table 3. Correlation matrix of latent factors

	1	2	3	4
1 Cooperation	<i>0.616</i>			
2 Innovation	0.128	<i>0.582</i>		
3 Knowledge sharing	0.385	0.195	<i>0.638</i>	
4 Performance	0.326	0.544	0.241	<i>0.823</i>

Notes: All correlations are significant at the 0.01 level (bilateral); diagonal elements are the square roots of the average extracted.

4.2. Qualitative comparative analysis

Five antecedent conditions were considered to explain the outcome of high market performance of start-ups. These conditions were cooperation, innovation, knowledge sharing, market experience and size. Table 4 shows how the different constructs were transformed into fuzzy-set conditions.

Table 4. Variable definition and calibration values

Condition*	Membership threshold values		
	Full non-membership (0.05)	Crossover point (0.5)	Full membership (0.95)
Coopetition	-0.960	0.100	0.810
Innovation	-0.640	0.040	0.710
Knowledge sharing	-0.740	0.170	0.360
Size	2.100	7.500	34.500
Experience	3.100	4.900	13.900

Notes: * Observations falling above the 90th percentile were considered to represent full set membership; the 10th percentile was the threshold for full non-membership; the crossover point was approximated using the median; values have been rounded.

For each antecedent condition, observations falling above the 90th percentile were considered to have full set membership. The 10th percentile was established as the cut-off point for full non-membership. The median defined the crossover point. Some adjustments were made to obtain a meaningful transformation. Observations deemed to lie outside the set (full non-membership) or observations with low values in any antecedent condition (e.g. innovation) do not mean that these start-ups are not innovative. These values simply mean that, compared to other start-ups in the sample, these start-ups have low levels of the condition under consideration. In the discussion that follows, we use the terms *present* and *absent*, but these terms should be interpreted within the context of the sample.

QCA embraces complex causality and focuses on asymmetric relationships. Therefore, before proceeding with the analysis, we examined the individual effect of each antecedent condition on the outcome to determine whether it is a necessary condition (Meyer et al., 1993). Following Schneider and Wagemann (2010), a condition may be deemed necessary when its consistency score is greater than or equal to 0.9. Table 5 displays the results. We tested two opposite outcomes: high market performance and poor market performance.

Table 5. Analysis of necessary conditions

Conditions*	Performance		~Performance	
	Consistency	Coverage	Consistency	Coverage
Coopetition	0.663	0.669	0.534	0.501
~Coopetition	0.505	0.538	0.648	0.642
Innovation	0.710	0.764	0.467	0.467
~Innovation	0.504	0.504	0.764	0.710
Knowledge sharing	0.712	0.652	0.562	0.479
~Knowledge sharing	0.431	0.514	0.591	0.656
Size	0.673	0.728	0.437	0.439
~Size	0.481	0.479	0.729	0.675
Experience	0.663	0.759	0.409	0.435
~Experience	0.507	0.480	0.774	0.681

Note: * The symbol (~) represents the negation of the characteristic.

As Table 5 shows, no antecedent condition alone is sufficient to predict either of the outcomes of interest. This initial observation seems to support our intuition that start-ups' performance results from a combination of conditions. Thus, we examined the consistency of different configurations of causal conditions.

Table 6 displays the results for the intermediate solution when the desired outcome is high performance in the market. The notation used for the table of solutions is as follows: the presence of a condition is indicated with a black circle (●), whereas a white circle (⊗) denotes its absence. Ambiguous conditions are left blank. Feasible configurations are combinations of not only the presence of conditions (either positive or negative) but also their absence (Wu et al., 2014).

Five separate configurations arise. Because there is more than one relevant solution, the results confirm that no unifying causal path is able to explain the outcome. This result is consistent with the existing literature, which suggests that start-ups follow different strategies. The solution consistency and coverage are 0.84 and 0.70, respectively, denoting good fit. At the individual level of each configuration, the consistency scores also surpass the recommended threshold value (0.8), and raw coverage values are fairly high, indicating that the data fit the configurations well.

Table 6 shows that cooperation and innovation appear in almost all configurations. On the contrary, knowledge sharing has a moderate effect because it is only relevant when the start-up collaborates with competitors and either has solid market experience (configuration #1) or is highly innovative (configuration #2). For small start-ups, cooperation is also important, particularly when the company has experience and high innovation performance compared to competitors (configuration #4). If the start-up is in its initial stages but is large, it is recommended to have collaborative agreements with competitors and to stay abreast of trends by developing new offerings (configuration #5). Lastly, configuration #3 indicates that, in cases where collaboration with competitors is not desired, innovation is paramount to achieve high performance, particularly for large and experienced start-ups.

Table 6. Sufficient configurations of antecedent conditions for performance

Configuration no.	Antecedent conditions					Coverage		Consistency
	Cooperation	Innovation	Knowledge sharing	Size	Experience	Raw	Unique	
1	●		●		●	0.383	0.084	0.931
2	●	●	●			0.420	0.068	0.835
3	⊗	●		●	●	0.297	0.139	0.902
4	●	●		⊗	●	0.207	0.025	0.978
5	●	●		●	⊗	0.213	0.019	0.937
Solution coverage = 0.700; solution consistency = 0.840 Frequency threshold = 1; consistency threshold = 0.845								

QCA can also shed light on how antecedent conditions affect poor market performance. This analysis is relevant because it reveals the paths that start-ups should try to avoid. Table 7 shows the results. Three configurations arise. Fit indices are sound (solution coverage = 0.579; solution consistency = 0.870). Likewise, all configurations have consistency scores that are greater than 0.8.

Table 7. Sufficient configurations of antecedent conditions for poor performance

Configuration no.	Antecedent conditions					Coverage		Consistency
	Coopetition	Innovation	Knowledge sharing	Size	Experience	Raw	Unique	
1	⊗	⊗		⊗		0.402	0.084	0.879
2		⊗	⊗	⊗	⊗	0.389	0.065	0.887
3	●	⊗	●	●	⊗	0.198	0.099	0.871
Solution coverage = 0.579; solution consistency = 0.870 Frequency threshold = 1; consistency threshold = 0.819								

The results show that poor market performance is closely linked to low innovation. In the absence of innovation, the first configuration indicates that performance will be worse if the company is small and does not collaborate with competitors (configuration #1). Also, for small start-ups that do not innovate, a lack of structures that facilitate knowledge exchange also hinders good market performance (configuration #2). Lastly, the absence of innovation and experience might also lead to poor performance, even though the start-up is large, engages in coopetition and has a knowledge sharing atmosphere (configuration #3).

5. Discussion

This study examines the impact of coopetition on the performance of start-ups. This paper contributes to the literature in three main ways. First, it addresses the research gap highlighted by Bouncken and Fredrich (2012) in relation to the lack of studies that examine how coopetition shapes firm performance. Second, because research analysing entrepreneurial coopetition (Galkina and Lundgren-Henriksson, 2017; Hora et al., 2018) is still scarce, our study also contributes to this field by exploring this phenomenon using a sample of start-ups located in the Spanish region of Valencia. Third, the empirical analysis is based on QCA. This method has been shown to overcome some of

the limitations of traditional approaches by using a more complex and realistic approach (i.e. configurational analysis), where antecedent conditions are combined and different patterns emerge. In QCA, different configurations can lead to similar results, meaning that start-ups can follow the strategy that best suits their resources and strategic vision.

Our results indicate that cooperation and innovation are important for all cases to positively influence market performance. Knowledge sharing is only relevant when cooperating start-ups either have solid market experience or are highly innovative. In the case of small start-ups, cooperation is also imperative, particularly when they have experience and high innovation performance with respect to competitors. If start-ups do not wish to collaborate with competitors, innovation is paramount to achieve high performance, particularly for large, experienced start-ups.

Our results also show that, in the absence of innovation, performance will be worse if start-ups are small and do not cooperate. In addition, for small start-ups that do not innovate, a lack of structures that facilitate knowledge sharing also hinders good market performance. Lastly, for start-ups that cooperate and share knowledge, the absence of innovation and experience can lead to poor performance, even if they are large.

Our findings have some managerial and practical implications. Given the importance of cooperation for innovative as well as non-innovative start-ups, managers of these firms should promote cooperation with competitors to ensure good market performance. This statement holds true regardless of the firm's size. However, if start-ups do not wish to cooperate, innovation is paramount to achieve high performance. Managers of cooperating start-ups should also be aware of the importance of knowledge sharing for good market performance only if they have solid market experience or are highly innovative.

Finally, given the positive influence of competition on the performance of start-ups, we consider the influence of public policies as an external driver of competition in an entrepreneurial context. Governments and public administrations should promote innovation as a key success factor of firms, regardless of whether they follow competition-based strategies. Governments and public administrations should also encourage the development of cooperation networks that help new firms access these competition strategies or simply access knowledge exchange practices to strengthen their innovation strategies. Ribeiro-Soriano et al. (2016) studied competition between innovative firms in the Region of Valencia, reporting that, through collaboration, firms can increase their innovativeness. Therefore, networks of cooperation between micro-enterprises and small firms should be encouraged.

6. Concluding remarks

The results of this study show the importance of innovation in start-ups' competition strategies. The study shows that innovation is crucial in all cases, leading to enhanced firm performance. This performance will be better if accompanied by a competition strategy. However, knowledge exchange is the least relevant variable, although it should be supported by greater innovation to improve the performance of start-ups.

Despite following a rigorous procedure, this study has several limitations that should be highlighted. These limitations provide opportunities for future research. Future studies should consider measuring business performance using other metrics (e.g. ROI or ROE). We used a different approach, which, whilst valid, relied on managers' subjective perceptions. Another limitation relates to the sample size. Although QCA performs well with small samples, working with larger samples might help corroborate our results. Also, larger samples enable the use of different methods

such as structural equation modelling. These methods can complement and enrich the results obtained in this study. Likewise, we encourage researchers to test this model in other geographical settings. Future studies might also consider comparing different sectors (rather than just high-tech sectors).

Based on our results and given the scarcity of literature on coopetition, we formulate four key research questions that warrant researchers' endeavours. First, how should coopetition strategies be designed and implemented? Second, how can formal and informal networks boost the development of coopetition strategies? Third, what are the contingency factors of coopetition strategies, particularly in relation to the collaborative facet of knowledge sharing? Finally, what synergies and advantages can be derived from coopetition strategies? To address these questions, we must keep in mind that coopetition entails risk (e.g. misunderstandings, lack of trust and opportunism), which, can simultaneously affect the performance of competing firms (Bonel et al., 2008; Ritala, 2009). Therefore, we encourage future studies that include both perspectives (risk and performance) in the analysis of coopetition strategies.

References

- Bagozzi, R. and Yi, Y. (1988) 'On the evaluation of structural equation model', *Journal of the Academy of Marketing Science*, Vol. 16, No. 1, pp.74–94.
- Bengtsson, M. and Johansson, M. (2014) 'Managing coopetition to create opportunities for small firms', *International Small Business Journal*, Vol. 32, No. 4, pp.401–427.
- Bengtsson, M. and Kock, S. (2000) 'Coopetition in business networks—to cooperate and compete simultaneously', *Industrial Marketing Management*, Vol. 29, No. 5, pp.411–426.
- Bengtsson, M. and Kock, S. (2014) 'Coopetition-quo vadis? Past accomplishments and future challenges', *Industrial Marketing Management*, Vol. 43. No. 2, pp.180–188.

- Bengtsson, M. and Raza-Ullah, T. (2016) 'A systematic review of research on coopetition: Toward a multilevel understanding', *Industrial Marketing Management*, Vol. 57, pp.23–39.
- Bergendahl, M. and Magnusson, M. (2014) 'Combining collaboration and competition: A key to improved idea management?', *European Journal of International Management*, Vol. 8, No. 5, pp.528–547.
- Bonel, E., Pellizzari, P. and Rocco, E. (2008) 'Coopetition and complementarities: Modeling coopetition strategy and its risks at an individual partner level', *Management Research: Journal of the Iberoamerican Academy of Management*, Vol. 6, No. 3, pp.189–205.
- Bouncken, R. and Fredrich, V. (2012) 'Coopetition: Performance implications and management antecedents', *International Journal of Innovation Management*, Vol. 16, No. 5, pp.12500281–125002828.
- Bouncken, R., Gast, J., Kraus, S. and Bogers, M. (2015) 'Coopetition: A systematic review, synthesis, and future research directions', *Review of Managerial Science*, Vol. 9, No. 3, pp.577–601.
- Bouncken, R. and Kraus, S. (2013) 'Innovation in knowledge-intensive industries: The double-edged sword of coopetition', *Journal of Business Research*, Vol. 66, pp.2060–2070.
- Bouncken, R., Laudien, S., Fredrich, V. and Görmar, L. (2018) 'Coopetition in coworking-spaces: Value creation and appropriation tensions in an entrepreneurial space', *Review of Managerial Science*, Vol. 12, No. 2, pp.385–410.
- Brislin, R.W., Lonner, W.J. and Thorndike, R.M. (1973) *Cross-cultural: Research methods*, John Wiley, New York.
- Chen, Y., Lin, T. and Yen, D. (2014) 'How to facilitate inter-organizational knowledge sharing: The impact of trust', *Information & Management*, Vol. 51, pp.568–578.
- Dahl, J. (2014) 'Conceptualizing coopetition as a process: An outline of change in cooperative and competitive interactions', *Industrial Marketing Management*, Vol. 43, No. 2, pp.272–279.
- Dess, G.G. and Robinson, R.B. (1984) 'Measuring organizational performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit', *Strategic Management Journal*, Vol. 5, No. 3, pp.265–273.

- Devece, C., Ribeiro-Soriano, D.E. and Palacios-Marqués, D. (2019) 'Coopetition as the new trend in inter-firm alliances: literature review and research patterns', *Review of Managerial Science*, Vol. 13, No. 2, pp.207–226.
- Eddleston, K.A. and Kellermanns, F.W. (2007) 'Destructive and productive family relationships: A stewardship theory perspective', *Journal of Business Venturing*, Vol. 22, No. 4, 545–565.
- Estrada, I., Faems, D. and De Faria, P. (2016) 'Coopetition and product innovation performance: The role of internal knowledge sharing mechanisms and formal knowledge protection mechanisms', *Industrial Marketing Management*, Vol. 53, pp.56–65.
- EU Startup Monitor (2018) *2018 Report* [online]. <http://startupmonitor.eu/EU-Startup-Monitor-2018-Report-WEB.pdf>. (Accessed 16 August 2019)
- Fernandez, A.S., Le Roy, F. and Gnyawali, D.R. (2014) 'Sources and management of tension in co-opetition case evidence from telecommunications satellites manufacturing in Europe', *Industrial Marketing Management*, Vol. 43, No. 2, pp.222–235.
- Fiss, P.C. (2007) 'A set-theoretic approach to organizational configurations', *Academy of Management Review*, Vol. 32, No. 4, pp.1180–1198.
- Fiss, P.C. (2011) 'Building better causal theories: A fuzzy set approach to typologies in organization research', *Academy of Management Journal*, Vol. 54, No. 2, pp.393–420.
- Fullwood, R., Rowley, J. and Delbridge, R. (2013) 'Knowledge sharing amongst academics in UK universities', *Journal of Knowledge Management*, Vol. 17, No. 1, pp.123–136.
- Galkina, T. and Lundgren-Henriksson, E.L. (2017) 'Coopetition as an entrepreneurial process: Interplay of causation and effectuation', *Industrial Marketing Management*, Vol. 67, pp.158–173.
- Gast, J., Filser, M., Gundolf, K. and Kraus, S. (2015) 'Coopetition research: towards a better understanding of past trends and future directions', *International Journal of Entrepreneurship and Small Business*, Vol. 24, No. 4, pp.492–521.
- Gast, J., Gundolf, K., Harms, R. and Matos Collado, E. (2019) 'Knowledge management and coopetition: How do cooperating competitors balance the needs to share and protect their knowledge?', *Industrial Marketing Management*, Vol. 77, pp.65–74.

- Gnyawali, D.R. and Park, B.J. (2009) 'Co-opetition and technological innovation in small and medium-sized enterprises: A multilevel conceptual model', *Journal of Small Business Management*, Vol. 47, No. 3, pp.308–330.
- Gnyawali, D.R. and Park, B.J. (2011) 'Co-opetition between giants: Collaboration with competitors for technological innovation', *Research Policy*, Vol. 40, No. 5, pp.650–663.
- Hora, W., Gast, J., Kailer, N., Rey-Marti, A. and Mas-Tur, A. (2018) 'David and Goliath: causes and effects of coopetition between start-ups and corporates', *Review of Management Science*, Vol. 12, pp.411–439.
- Kumar, A. and Dutta, S.K. (2017) 'Tacit knowledge transfer in coopetition: An empirical investigation of the role of business group (BG) affiliation', *Journal of Strategy and Management*, Vol. 10, No. 4, pp.453–468.
- Le Roy, F. and Czakon, W. (2016) 'Managing coopetition: the missing link between strategy and performance', *Industrial Marketing Management*, Vol. 53, pp.3–6.
- Love, L.G., Priem, R.L. and Lumpkin, G.T. (2002) 'Explicitly articulated strategy and firm performance under alternative levels of centralization', *Journal of Management*, Vol. 28, No. 5, pp.611–627.
- Luo, Y. (2007) 'A coopetition perspective of global competition', *Journal of World Business*, Vol. 42, No. 2, pp.129–144.
- McCarthy, C., Carleton, P.F., Krumpholz, E. and Chow, M.P. (2018) 'Accelerating innovation through coopetition. The innovation learning network experience', *Nursing Administration Quarterly*, Vol. 42, No. 1, pp.26–34.
- Meyer, A.D., Tsui, A.S. and Hinings, C.R. (1993) 'Configurational approaches to organizational analysis', *Academy of Management Journal*, Vol. 36, No. 6, pp.1175–1195.
- Mobile World Capital (2018) *Digital startup ecosystem overview* [online]. Mobile World Capital, Barcelona. <http://mobileworldcapital.com/ca/report/startup-ecosystem-overview-2018/>. (Accessed 10 January 2019)
- Morris, M.H., Koçak, A. and Özer, A. (2007) 'Coopetition as a small business strategy: Implications for perform', *Journal of Small Business Strategy*, Vol. 18, No. 1, pp.35–55.
- Osarenkhoe, A. (2010) 'A coopetition strategy – a study of inter-firm dynamics between competition and cooperation', *Business Strategy Series*, Vol. 11, No. 6, pp.343–362.

- Park, B.J., Srivastava, M. and Gnyawali, D. (2014a) 'Walking the tight rope of coopetition: Impact of competition and cooperation intensities and balance on firm innovation performance', *Industrial Marketing Management*, Vol. 43, pp.210–221.
- Park, B.J., Srivastava, M. and Gnyawali, D. (2014b) 'Impact of coopetition in the alliance portfolio and coopetition experience on firm innovation', *Technology Analysis & Strategic Management*, Vol. 26, No. 8, pp.893–907.
- Quine, W.V. (1952) 'The problem of simplifying truth functions', *The American Mathematical Monthly*, Vol. 59, No. 8, pp.521–531.
- Ragin, C.C. (2017) *User's guide to fuzzy-set/qualitative comparative analysis* [online]. Department of Sociology, University of California, Irvine, California. <http://www.socsci.uci.edu/~cragin/fsQCA/download/fsQCAManual.pdf> (Accessed 10 January 2019).
- Raza-Ullah, T., Bengtsson, M. and Kock, S. (2014) 'The coopetition paradox and tension in coopetition at multiple levels', *Industrial Marketing Management*, Vol. 43, pp.189–198.
- Rezazadeh, A. and Mahjoub, M. (2016) 'Alliance entrepreneurship and entrepreneurial orientation: The mediating effect of knowledge transfer', *Gadjah Mada International Journal of Business*, Vol. 18, No. 3, pp.263–284.
- Rezazadeh, A., and Nobari, N. (2018) 'Antecedents and consequences of cooperative entrepreneurship: A conceptual model and empirical investigation', *International Entrepreneurship and Management Journal*, Vol. 14, No. 2, pp.479–507.
- Ribeiro-Soriano, D.E., Roig-Tierno, N. and Mas-Tur, A. (2016) 'Governance models of coopetition and innovation: the case of Spanish firms', *International Journal of Technology Management*, Vol. 71, No. 1–2, pp.38–57.
- Ribeiro-Soriano, D.E. and Urbano, D. (2009) 'Overview of collaborative entrepreneurship: An integrated approach between business decisions and negotiations', *Group Decision and Negotiation*, Vol. 18, No. 5, pp.419–430.
- Ritala, P. (2009) 'Is coopetition different from cooperation? The impact of market rivalry on value creation in alliances', *International Journal of Intellectual Property Management*, Vol. 3, No. 1, pp.39–55.
- Ritala, P. (2012) 'Coopetition strategy – When is it successful? Empirical evidence on innovation and market performance', *British Journal of Management*, Vol. 23, pp.307–324.

- Ritala, P., Golnam, A. and Wegmann, A. (2014) 'Coopetition-based business models: The case of Amazon.com', *Industrial Marketing Management*, Vol. 43, No. 2, pp.236–249.
- Ritala, P. and Hurmelinna-Laukkanen, P. (2009) 'What's in it for me? Creating and appropriating value in innovation-related coopetition', *Technovation*, Vol. 29, No. 12, pp.819–828.
- Ritala, P. and Hurmelinna-Laukkanen, P. (2013) 'Incremental and radical innovation in coopetition—The role of absorptive capacity and appropriability', *Journal of Product Innovation Management*, Vol. 30, No. 1, pp.154–169.
- Ritala, P. and Tidström, A. (2014) 'Untangling the value-creation and value-appropriation elements of coopetition strategy: a longitudinal analysis on the firm and relational levels', *Scandinavian Journal of Management*, Vol. 30, No. 4, pp.498–515.
- Santos, G., Marques, C.S., Ratten, V. and Ferreira, J. (*in press*) 'The impact of knowledge creation and acquisition on innovation, coopetition and international opportunity development', *European Journal of International Management*.
- Sarkar, M.B., Echambadi, R. and Harrison, J.S. (2001) 'Alliance entrepreneurship and firm market performance', *Strategic Management Journal*, Vol. 22, pp.701–711.
- Schneider, C.Q. and Wagemann, C. (2010) 'Standards of good practice in qualitative comparative analysis (QCA) and fuzzy-sets', *Comparative Sociology*, Vol. 9, No. 3, pp.397–418.
- Shih, M.H., Tsai, H.T. and Wu, C.C. (2006) 'A holistic knowledge sharing framework in high-tech firms: Game and co-opetition perspectives', *International Journal of Technology Management*, Vol. 36, No. 4, pp.354–367.
- Soppe, B., Lechner, C. and Dowling, M. (2014) 'Vertical coopetition in entrepreneurial firms: Theory and practice', *Journal of Small Business and Enterprise Development*, Vol. 21, No. 4, pp.548–564.
- Tushman, M.L. and Anderson, P. (1986) 'Technological discontinuities and organizational environments', *Administrative Science Quarterly*, Vol. 31, No. 3, pp.439–465.
- Woodside, A.G. (2016) 'The good practices manifesto: Overcoming bad practices pervasive in current research in business', *Journal of Business Research*, Vol. 69, No. 2, pp.365–381.

- Wu, P.L., Yeh, S.S. and Woodside, A.G. (2014) 'Applying complexity theory to deepen service dominant logic: Configural analysis of customer experience-and-outcome assessments of professional services for personal transformations', *Journal of Business Research*, Vol. 67, No. 8, pp.1647–1670.
- Zawislak, P.A., Cherubini Alves, A., Tello-Gamarra, J., Barbieux, D. and Reichert, F.M. (2012) 'Innovation capability: From technology development to transaction capability', *Journal of Technology Management & Innovation*, Vol. 7, No. 2, pp.14–27.