Degree of Standardization and Innovation Capability Dimensions as Driving Forces for Innovation Performance

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ABSTRACT

Purpose: In 2019, the International Organization for Standardization (ISO) published the first international Management Standard (MS) for innovation management, the ISO 56002:2019, following previous successful MS as ISO 9001 and ISO 14001. Within this framework, this paper discusses the relationship between the implementation of MS and the Innovation capabilities (IC) and Innovation Performance (IP) the company. In other words, the article analyses whether the greater degree of standardization (DS) in firms, combined with some IC dimensions, positively influence the IP of firms.

Methodology/Approach: As the number of ISO 56002 implementations is still not very high and it is not certifiable yet, a survey has been carried out considering the spanish certifiable homologue standard UNE 166002 combined with other ISO standards such as ISO 9001, ISO 14001, ISO-TS 16949, OHSAS 18001 and/or others. The suvey has been responded by 73 certified companies; and a further fuzzy set Qualitative Analysis (fsQCA) has been performed.

Findings: The paper confirms that at least three main dimensions of IC influence positively the IP, namely: strategy, market, and structure and network. It is also confirmed that the DS is clearly a positive contributor to a higher IP.

Research Limitation/Implication: The data are gathered in only one specific country, although it is one of the few that had national certifiable standards specifically developed for innovation management.

Originality/Value of paper: The main value of the article is to be one of the first ones to analyse, in any way, the impact of the degree of standardization (including or not the innovation MS as for instance the ISO 56002 or the UNE 166002) on the IC and IP of the company.

Category: Research paper

Keywords: innovation performance; innovation capability; fsQCA; management standards

1 INTRODUCTION

Innovation is a key factor of successful companies. Nowadays, there is no discussion about it, one must bear in mind the widely recognized contributions from the last century by the economist Schumpeter (1934) who pointed out the influence of innovation on economic cycles, or the competitive advantage of innovation (Porter, 1980), or the large set of models of innovation processes classified in five generations (Rothwell, 1994) and the Open Innovation concept (Chesbrough, 2003) among others. Empirical studies such as those by Prajogo (2006) demonstrate the importance of innovation performance (IP), understood as the results of the innovation process, for business performance. Thus, innovations create value by definition (Grandstrand and Holgersson, 2020).

Innovation capability (IC) can be understood as the potential to innovate (Saunila and Ukko, 2012), or the ability to continuously transform knowledge and ideas into new products, processes, and systems for the benefit of the company and its stakeholders. Furthermore, it is conceptualized as the ability to manage and integrate multiple key capabilities (Lawson and Samson, 2001) and resources of the firm to successfully stimulate innovation. Narcizo, Canen. and Tammela (2017) identified 19 different definitions for IP in the literature, concluding that the variability in descriptions of the term makes it difficult to build a unified definition. However, studies suggest that IC, as a construct of strategy, market, structure and network, innovation culture and project management, is found to be a key enabler for IP, which is, in turn, a key factor for business performance (Mir, Casadesus and Petnji. 2016).

Globalization needs effective collaboration within different actors around the world on innovation projects. Collaboration with external partners, suppliers and institutions are important for the IC of firms (Dziallas and Blind, 2019). Technology allows companies to build up innovation networking teams. However, collaborations must be managed properly to get efficient IP. In this context, the use of management standards (MS) is a relevant topic of study because having common frameworks of understanding between companies are supposedly beneficial for these collaborations and thus, for the innovation performance success.

Many studies have been carried out regarding the impact on business performance using MS, like ISO 9001 for quality management (QM) (Casadesus, Gimenez and Heras, 2001) or ISO 14001 for environmental management (Corbett and Kirsch, 2001), at national and cross-national level. However, when the analysis is focused on the impact of innovation MS on performance, the studies are limited to national scopes (Pellicer et al., 2008, 2014; Yepes et al., 2016; Mir, Casadesus and Petnji, 2016; Martínez-Costa, Jimenez-Jimenez and Castro-del-Rosario, 2019). There was no international consensus about how to manage innovation until when the ISO published the first international standard for innovation management, the ISO 56002:2019 “Innovation Management. Innovation Management System. Guidance”.

Nowadays, there are more and more MS implemented in companies. Benefits and principles of management systems integration are also widely studied (Bernardo et al., 2015; Nunhes, Bernardo and Oliveira, 2019). The study of Hernandez-Vivanco et al. (2019) found that the ISO 9001 is the common factor of these combinations, and it is also the first standard adopted by most companies. These results would suggest that ISO 9001 might be a relevant driver towards improving business performance.

Therefore, ICs and the use of MS can be considered complementary antecedents of IP. For this reason, it is of paramount importance to not only understand the influence of each of the concepts on IP but also their combination to boost a firm's success. In other words, the main Research Question (RQ) of this article is which combination of ICs and degree of standardization (DS) are more likely to lead to a better IP of the firm? With this main objective, three specific RQ can be stated:

RQ 1: Innovation capabilities (IC) influence positively the innovation performance (IP)?

RQ 2: A higher degree of standardization (DS) impact positively on the innovation performance (IP)?

RQ 3: A combination of innovation capabilities (IC) with a higher degree of standardization (DS) boost innovation performance (IP)?

This study contributes to the literature in its orientation towards certified companies in its theoretical grounding and in its analysis procedures. First, the analysis of the combination of MS and innovation capabilities that explain better firms' performance is the study focus, rather than the solely impact of MS and innovation capabilities on IP that has been widely studied in the literature. Second, the study applies a Fuzzy-set Qualitative Comparative Analysis (fsQCA). fsQCA provides a platform from which to investigate combinations of all antecedents that would better explain the innovation outcomes. Third, this study also has a sustainability orientation in its choice of business outcomes. The results of the study may be a decisive argument for those business managers who question whether it is worth the effort of implementing MS as a complementary factor to their IC for the enhancement of the IP.

This paper is structured in the following manner. The first section is a literature review. The second section explains the methodology used including the sampling and data collection. In the third section, the results of the study are exposed. In the fourth section, the conclusions are described and, finally, the last section contains the discussion and further research proposals.

2 LITERATURE REVIEW

The most relevant literature related to this study is twofold. On the one hand, literature has been reviewed regarding IC dimensions and its influence on IP.

This is a necessary prior step to support the capability dimensions analysed in this study and its contribution to the relationship between IC and IP.

On the other hand, there is a state of the art in previous studies regarding MS and its influence on IP that must be considered because the results of this study will contribute also to this field of study.

2.1 Innovation Capability (IC) Dimensions and Innovation Performance (IP)

Studies on the relationship between IC and IP were performed previously in different perspectives. A literature review published on the relationships between IC, innovation measurement and IP at the firm level suggests that IC and measurement are multi-faceted constructs (Bayrle, Stein and Brecht, 2019), and states that this research area has become more diversified and innovation drivers have been emerging over time.

Dziallas and Blind (2019) analyzed scientific publications on innovation indicators published between 1980 and 2015 in which they identified 82 unique indicators to evaluate innovations. They found six company-specific dimensions (strategy, innovation culture, competence and knowledge, organizational structure, R&D activities and input, and financial performance) and three contextual dimensions (market, network, and environment) as enablers for innovative products, innovation process and innovation project management. However, their conclusions included that: “Despite the high number of well-known indicators and factors, concrete indicators to evaluate innovations are difficult to identify in the selected literature. Nevertheless, these factors are important because they have a positive or negative impact on the innovation outcome, depending on the identified publications” (Dziallas and Blind, 2019, p.16).

Similarly, Mir, Casadesus and Petnji (2016) not only identified, but also assessed and empirically confirmed five innovation capability dimensions (Project Management Process, Innovation Culture, Structure and Network, Market and Strategy). In fact, the variables used for the present study are adopted from Mir, Casadesus and Petnji (2016), which in turn were inspired by Lawson and Samson (2001) and Saunila and Ukko (2012) models and based on the standard CWA 15899 (CEN, 2008).

Studies on the relationship between IC and IP are paramount for the theoretical framework in this study. Therefore, a literature review on this topic is presented in Table 1.

Table 1 – Literature Review Summary on IC and IP

Author	Main objective	Method	Sample	Main findings
Saunila (2014), Saunila, Pekkolo and Ukko (2014)	Study the relationship between organizational IC and firm performance.	Survey in Finland.	311 SMEs employing 11-249 persons and having a revenue of two to 50 Meuro.	Three aspects found: ideation and organizing structures, participatory leadership culture, and know-how development. The three aspects influenced the financial performance more than the operational.
Rajapathirana and Hui (2018)	Investigated the relationship between IC, innovation type and firm performance, including IP.	Survey in Sri Lanka.	379 senior management of insurance companies.	IC has direct and positive impact on the product, process, marketing, and organizational innovations, and stimulates the IP through innovation efforts. Furthermore, IP implies higher market and financial performance.
Oanh (2019)	Assess the impact of IC on types of innovation and innovation performance in foreign direct investment enterprises.	Survey in Vietnam	254 foreign direct investment enterprises in Vietnam.	Positive relationship between IC and IP mediated by four types of innovation (organization, product, process and marketing) in the scope of foreign direct investment firms, suggesting that improving IC affects corporate culture towards IP.
Wang and Hu (2020)	Reveal the mechanisms of collaborative innovation processes by investigating the relationships among critical factors influencing firm's IP in supply chain networks.	Survey in China	236 firms	Significant positive relationships were found between collaborative innovation activities, knowledge sharing, collaborative IC, and firm's innovation performance. Collaborative IC shows a moderating effect on the innovation process.

Notes: IC – Innovation Capability, IP – Innovation Performance.

The literature confirms the positive relationship between IC and IP in many studies. Some consider types of innovation as mediating factors (Rajapathirana and Hui, 2018; Oanh, 2019). Others focused on moderator factors, such as measurement (Saunila, Pekkolo and Ukko, 2014). Saunila (2014) centered studies on the relevant aspects of IC namely ideation and organizing structures, participatory leadership culture, and know-how development. Mir, Casadesus and Petnji (2016) analyzed the IC dimensions in five construct variables, project manager process, innovation culture, structure and network, market and strategy. Wang and Hu (2020) suggest collaborative innovation activities, knowledge sharing and IC as the three key factors that jointly shape IP.

2.2 Management Standards (MS) and Innovation Performance (IP)

Literature on Management Standards (MS) are especially extensive regarding Quality Management (QM) disciplines, in which the ISO 9001 is the most studied globally. They are studied in terms of benefits and drawbacks in many perspectives, such as internal and external benefits (Casadesus, Gimenez and Heras, 2001; Casadesus and Karapetrovic, 2005). Integration benefits within other standards are studied (Bernardo et al., 2009), ISO 9001 quality system certification and its impact on product and process IP was also studied in Australia (Terziovski and Guerrero, 2014) among others, ISO 14000 is also studied widely (Corbett and Kirsch, 2001). Several MS implementations such as ISO 14001, ISO 9001, OHSAS 18001, ISO 27001 and SA 8000 are also studied focusing on integration scope, sequence and time of implementation (Karapetrovic and Casadesus, 2009).

Studies on standardized innovation management systems (SIMS) have been studied, focusing on national innovation standards such as the Spanish UNE 166002 (AENOR, 2006). Studies in the SIMS construction sector are focused on implementation case studies (Pellicer et al., 2008, 2014; Yepes et al., 2016) and further empirical studies in many sectors studied the impact of SIMS on business and IP (Mir, Casadesus and Petnji, 2016). Martinez-Costa, Jimenez-Jimenez and Castro-del-Rosario (2019) found that implementing the SIMS promotes all types of innovations and their results found a positive relationship between administrative and technological innovation. Hernandez-Vivanco et al. (2019) studied the combinations of different MS and found that the ISO 9001 is the common factor of these combinations. It was found to be the first standard adopted by most companies while suggesting that it might be a relevant driver towards improving business performance. A case study examined the standardization effort as a complex codified knowledge (Xie et al., 2016) concluding that more codified knowledge implies more incremental and architectural innovation outcomes but less modular and radical innovations. Sahoo (2019) examined the relationship between QM, IC and firm performance under mediation and moderation models using data from 134 Indian SME manufacturing firms, they found that QM through the firm's IC is indirectly associated with a firm's business performance as QM practices encourage the definition of innovation strategies of products and processes.

Although some studies investigate the impact of MS on the IP, such as quality MS (Hernandez-Vivanco et al., 2019) and innovation MS (Mir, Casadesus and Petnji, 2016; Martinez-Costa, Jimenez-Jimenez and Castro-del-Rosario, 2019), none of the studies detected answers to the question of whether the DS is a relevant factor in combination with IC to positively influence IP. Furthermore, neither of these studies answer the question regarding which of the IC dimensions of the construct in combination with others are more relevant in this influence. Thus, this study aims to fill this gap in the knowledge as an unprecedented contribution to the literature in this field. No contribution has been detected that answers the questions of whether the DS in combination with

IC influence IP, or which of the IC dimensions of the construct combination are more relevant in this influence.

3 METHODOLOGY

3.1 Sampling and Data Collection

A specific questionnaire was designed for the research line of this paper. The questionnaire had four sections. Apart from the first and second sections (demographic characteristics of the respondent and firm's descriptive data), the rest of the questionnaire was based on standards and guidelines, namely UNE 166002 (AENOR, 2006), CWA 15899 (CEN, 2008), EFQM Framework for innovation (EFQM, 2005), Oslo Manual (OECD, 2005) and the Community Innovation Survey (CIS, 2010).

The firms that received the questionnaire were selected through a random sampling method. In total, one thousand questionnaires were sent by post to Spanish firms. The final number of responses collected was seventy-three after rejecting incomplete questionnaires. Most of the questionnaires were answered by the R&D Director (44%), the Technical Manager (29%) or the General Manager (15%) of the firm. Once the answers were collected, a Harman's single factor test was performed to assess common method bias in the responses. No bias was detected.

3.2 Method

Because the interest of this research is to understand, on the one hand, the impact of innovation and DS on business performance and, on the other hand, the impact of their combination, this study uses qualitative comparative analysis (QCA) because this method explores which combinations (or configurations) of determinants (or antecedents' conditions) are sufficient to explain the outcome. QCA assumes causal complexity because uses Boolean logic rather than traditional correlation methods to set causal conditions related to a particular outcome (Ragin, 2008). Due to this capability, QCA has become an attractive technique in the field of management. The perspective of QCA produces better managerial conclusions because permits to conduct more fine-grained analysis of the antecedents that explain better the outcome (Rasoolimanesh et al., 2021).

According to Berbegal-Mirabent and Llopis-Albert (2016), QCA is appropriate when the analysis is based on a small data sample and the conclusions and implication may be generalized to larger populations.

Since QCA can only compute binary variables, the authors applied fsQCA (fuzzy set Qualitative Analysis) that permits the incorporation of continuous variables as antecedents or outcomes. In the study, the software used was fsQCA 3.0 (Ragin and Davey, 2016).

3.3 Measured Factors

Based on the above review of the literature regarding IC factors (Saunila, 2014; Mir, Casadesus and Petnji, 2016; Wang and Hu, 2020) and standardizing effort (Xie et al., 2016), and considering the stated hypotheses, six determinants were explored in the present study. On the one hand, the five innovation capability dimensions adopted from Mir, Casadesus and Petnji (2016): Project Manager Process (PMP), Innovation culture (ICULT), Structure and Network (STRU), Market (MARK) and Strategy (STRA) and, on the other hand, the antecedent DS that computes the number of MS implemented in the firm.

Table 2 presents the main descriptive statistics and the factor loadings of the variables that compose the underlying innovation capability dimensions, resulting from the five principal component analysis conducted, using varimax rotation. All the variables are based on a 4-point scale (ranging from 1: totally disagree to 4: totally agree). Most of the loading values are over the recommended cut-off level of 0.6 indicating a good convergent validity. In addition, Table 2 includes the indices of internal consistency (Cronbach's alpha and Average Variance Extracted) of each dimension. Both values are also over the recommended cut-off levels of 0.7 (Nunnally and Bernstein, 1994) and 0.5 (Fornell and Larcker, 1981) and, therefore, the internal consistency of the five innovation capability dimensions are validated.

Table 2 – Descriptive Statistics and Validity of the Innovation Capability Dimensions

	Descriptive statistics		**Principal component analysis**	
	Mean	**St. Dev.**	**Load.**	**Internal consist.**
Project Management Process (PMP)				
C4: Innovation project risks are controlled systematically using methods and tools such as DAFO analysis, etc.	2.63	0.98	0.804	α: 0.765 AVE: 0.685
C27: Innovation projects are nearly always carried out on planned time and budget schedules	2.67	0.80	0.845	
C28: Clearly defined and precise criteria are used to evaluate and select potential projects for implantation	2.89	0.85	0.835	
Innovation Culture (ICULT)				
C3: Management bodies demonstrate high willingness to engage in new ventures (openness to new markets and technologies, etc.)	3.23	0.87	0.828	α: 0.789 AVE: 0.618
C7: Employees are free to present ideas or suggestions at any time	3.56	0.72	0.793	
C15: Capability exists for employees with different backgrounds to work together in innovation project teams	3.28	0.72	0.787	
C29: Project team members treat one another with trust and respect	3.43	0.55	0.736	

	Descriptive statistics		Principal component analysis	
	Mean	**St. Dev.**	**Load.**	**Internal consist.**
Structure and Network (STRU)				
C11: A budget is allocated for innovation projects that is not directly funded by customer orders	2.97	0.94	0.826	α: 0.816 AVE: 0.736
C16: External business partners who meet the particular project requirements are sought	3.46	0.78	0.854	
C17: Correspondence with external research sources is maintained to remain aware of relevant technological and research developments	3.26	0.85	0.894	
Market (MARK)				
C18: Relationships with customers, suppliers, etc. are maintained in anticipation of future market needs	3.10	0.75	0.823	α: 0.859 AVE: 0.592
C19: To meet future demands, customers are included in the entire process of product/service development	2.93	0.80	0.799	
C20: Feedback such as complaints and suggestions are systematically reviewed and acted upon	3.02	0.72	0.840	
C33: Through innovation, the company has acquired greater market shares than its competitors	2.83	0.83	0.759	
C35: As part of the innovation process, market-oriented distribution channels are identified at an early stage	2.54	0.78	0.637	
C36: By taking into account various factors throughout the product development process, a diverse range of products is produced	2.63	0.82	0.743	
Strategy (STRA)				
C12: Innovation projects are based on the general company strategy	3.15	0.81	0.791	α: 0.904 AVE: 0.635
C21: Excellent knowledge on the competitive market environment	2.91	0.75	0.782	
C22: Precise definition creation in advance of developing tasks and goals	2.78	0.80	0.844	
C23: Communication of information needed for innovation projects is exceptionally frank, transparent and honest	2.97	0.76	0.820	
C24: Mistakes made during innovation projects are viewed as opportunities to systematically learn and improve	3.24	0.77	0.802	
C30: The innovation vision is considered during strategic decision-making	3.23	0.84	0.774	
C31: Innovation projects follow a documented innovation process that considers all areas of activity	3.10	0.79	0.765	

To compute the number of MS implemented, the respondents had to select from a list of the five most implemented MS in Spain: ISO 9001, ISO 14001, ISO-TS 16949, OHSAS 18001, UNE 166002 (Mir, Casadesus and Petnji, 2016). Moreover, there were the options of 'none' and 'others'. Table 3 presents the main and the standard deviation of the number of standards implemented. The authors also considered it necessary to include, as antecedent, the categorical variable 'size' to control the configurations by the size of the firm. The respondent had to choose between three options in the questionnaire: large, medium, or small size. However, in this study, firm size is transformed into a clear set with 0 denoting SMEs and 1 denoting large firm (+ 250 employees).

Finally, the output of the analysis (innovation performance) was measured with the percentage of firm's turnover due to innovations with less than three years in the market. The respondent had to select one of the next three options: the percentage had reduced, maintained, or increased in the period 2007 to 2011. Table 3 presents the main descriptive statistics of 'degree of standardization', 'size' and '% turnover innovation'.

Table 3 – Descriptive Statistics of Degree of Standardization, Firm Size and Turnover Innovation

	Mean	**St. Dev.**
Degree of standardization (DS)		
Number of management standards implemented in the firm (1 – 7)	2.47	1.38
Size (SIZE)		
Size of the firm	SMEs: 68,5%	
	Large: 31.5%	
% Turnover innovation (TURNINN)		
% of turnover due to innovations with less than three years in the market	Increased: 37%	
	Maintain: 52%	
	Reduced: 11%	

4 RESULTS

Three steps are necessary to apply fsQCA method. First, the calibration of outcome and antecedent conditions into fuzzy sets. Second, the construction of the truth table and, finally the reduction of the number of rows in the truth table for obtaining the combinations that explain the outcome. Following Ragin (2008), the calibration procedure was applied in all the antecedents, except for the binary variable 'firm size', and the outcome. Two anchors are defined denoting full membership (fuzzy score = 0.95) and full non-membership (fuzzy score = 0.05).

Next, the truth table is constructed based on a matrix space with 2k rows, where k is the number of antecedent conditions. Table 4 presents the truth table. None of the antecedents is higher than the cut-off level of 0.90 and, consequently, none of the antecedents is a necessary condition to produce the outcome (Schneider, Schulze-Bentrop and Paunescu, 2010). Therefore, all the antecedents are included in the fsQCA.

Table 4 – Truth Table

	Consistency	**Coverage**
PMP	0.623744	0.725786
~PMP	0.581120	0.755001
ICULT	0.601205	0.711757
~ICULT	0.569516	0.726031
STRU	0.646507	0.745305
~ STRU	0.538049	0.706417
MARK	0.627092	0.798976
~ MARK	0.602321	0.713455
STRA	0.626199	0.741543
~ STRA	0.565275	0.720421
DS	0.624191	0.680370
~ DS	0.517072	0.726560
SIZE	0.316224	0.616087
~ SIZE	0.683776	0.612800

Notes: PMP – Project Management Process, ICULT – Innovation Culture, STRU – Structure and Network, MARK – Marketing, STRA – Strategy, DS – Degree of Standardization, SIZE – Size of the company.

Table 5 presents the results of the fsQCA. Following Ragin's (2008) recommendation, an intermediate solution was selected to interpret the results. We followed the notation proposed by Fiss (2011). The presence of a condition is represented by a full circle (●) while an empty circle (o) represents its absence, whereas ambiguous (unclear) conditions are represented by blank cells. Moreover, large circles indicate that a condition is core to a given configuration, while small circles point to a peripheral role. A condition is considered core when it has a strong causal relationship with the outcome of interest while a condition is peripheral when it has a contributing role.

Table 5 – Sufficient Configurations of Antecedent Conditions for % Turnover Due to Innovation

Configuration	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PMP			O	●	o	o	o	o	●	●	●	●	o	●		O
ICULT	●	●	O	o	●	●	●	o	o	●		●	⬤	●	O	
STRU	●	●	O		o	o			o		●	⬤	●	o	O	O
MARK		⬤	●	o	o	●	●	o		o	O	●	o	o	O	O
STRA	⬤	●		o	o	o	o	o	o	●	●	●	o	●	O	O
DS	●	●	O	●			o	o	●	●	●		●	o	●	●
SIZE	●		O	o	●	o	o	●	⬤	●	●	o	o	o	●	●
Raw coverage	0.148	0.292	0.136	0.127	0.069	0.111	0.108	0.064	0.064	.0120	0.135	0.224	0.094	0.072	0.068	0.066
Consistency	0.752	0.865	0.893	0.896	0.945	0.860	0.875	0.954	0.912	0.937	0.951	0.794	0.976	0.805	0.947	0.942
Solution coverage	0.667															
Solution consistency	0.814															

Notes: PMP – Project Management Process, ICULT – Innovation Culture, STRU – Structure and Network, MARK – Marketing, STRA – Strategy, DS – Degree of Standardization, SIZE – Size of the company.

Table 5 also includes the measures of consistency and coverage for the multiple solutions as a whole and each of the configurations. Consistency and coverage are the measures for validating the solutions (Ragin, 2008). "Consistency refers to the degree to which cases that share a combination of conditions consistently produces the key outcome" (Campbell, Sirmon and Schijven, 2015, p.22) while "overall coverage describes the extent to which the outcome of interest may be explained by the configurations" (Pappas, Giannakos and Sampson, 2016, p.49).

The higher the raw coverage value of a configuration is, the more relevant the configuration is since that configuration covers a higher proportion of cases (Olaya-Escobar, Berbegal-Mirabent and Alegre, 2020). Results of fsQCA indicate an intermediate solution with a solution coverage of 0.667 and a solution consistency of 0.814. The existence of multiple configurations suggests that no unifying causal path can explain the outcome. In fact, sixteen possible configurations appear with a raw coverage between 0.064 and 0.292 which means that the causal models are sufficient, but not necessary according to Ragin (2008).

Next, the obtained results are analysed following the recommendation of Ragin (2008). Firstly, it is assessed the solution table, focusing the attention on configurations #2 and #12 that deserve further attention since they have the highest values of raw coverage, both over the cut-off level of 0.2. However, it has been also decided to include in the analysis the next configuration with higher raw coverage (#1) since gave us the opportunity to assess the role of the size of the firm to explain the outcome. Secondly, it is analysed each of the antecedent conditions for all the configurations.

The results reveal that, in the two most important configurations #2 and #12, at least one of the IC dimensions is present as a core condition. Specifically, MARK, and STRU respectively. In fact, whether it is included in the analysis configuration #1, almost all the IC dimensions are present in the three configurations. Only PMP is not present in configurations #1 and #2, nor MARK in configuration #2 either. Therefore, it appears that, in general, all the IC dimensions are important to boost IP.

The DS is present in configurations #1 and #2. However, it is always present as peripheral condition in the rest of configurations. These results would confirm its importance for boosting IP in any configuration but in a lower manner compared with IC dimensions. In addition, considering the three main configurations, it seems that this global perception is suitable for any size of firm since there is no consensus.

When the analysis is focused on each antecedent, different findings are obtained. The IC dimension that explains more IP is ICULT, in line with Oanh (2019). This evidence suggests improving IC impacts corporate culture towards IP, since it is present in nine out of sixteen configurations. This finding would suggest that culture is a highly transversal factor. In contrast, STRA is the dimension with less presence. The number of MS implemented is also present in most of the configurations, confirming the global analyses obtained previously. Again, there is not a clear consensus about the relationship between the size of the firm and IP.

5 DISCUSSION AND CONCLUSIONS

IC is of paramount importance of study because it is present as a core antecedent for IP enhancement (Mir, Casadesus and Petnji, 2016; Oanh, 2019; Wang and Hu, 2020). Six dimensions of the IC construct are analysed in this study, in combination with the DS, to draw on this field of knowledge in a deeper detail and to provide an unprecedented contribution to the literature in the field.

The results obtained are in line with previous studies, thus confirming that IC influence positively the IP of firms as, at least, one of the core conditions in the three configurations with the higher row coverage values are IC dimensions, namely: strategy, market, and structure and network. Moreover, almost all the IC

dimensions are present in the three configurations. Therefore, the first specific research question is positively contrasted.

Another relevant result is that, although the DS is not a core condition in any configuration, it is present in most of the configurations as a positive contributor antecedent. This result would confirm previous studies about the importance of the MS for seeking a better performance. In line with Casadesus, Gimenez and Heras (2001), these results suggest that MS cover most of the processes of firms, including firm innovation processes. Therefore, the second specific research question is also positively confirmed.

Finally, the results confirm the complementary coexistence of DS and IC to boost IP in most of the configurations. In addition, it seems that this coexistence is suitable for any size of firm since there is not a clear pattern of size among the configurations. For instance, the most relevant configuration (#2) represents any size of firm skilled with a close relationship with stakeholders to anticipate future market needs through including their demands in the process development of products with costumers or taking account their concerns, among other market actions. On the other hand, configuration #12 exemplify small firms that their most important IC is their structure and network. Unlike configuration #2, the DS in configuration #12 does not explain a better IP.

Therefore, the main theoretical conclusion of the present study is that further studies should consider the DS of firms as it is found to be an important antecedent factor complementary to IC for IP, at is has been demonstrated to be a transversal contributor.

Our study also offers important insights to managers. It can be concluded that it is worthy to invest on implementing MS because the effort of the implementation will have a payback. A higher DS in a transversal manner will be an excellent complementary factor to the IC of the firm, in order to improve the IP, and, in turn achieve a better business performance.

This is coherent with the innovation culture factor results, that is found to be the highest contributor IC dimension to improve IP in all the configurations, suggesting that both culture and standardization are transversal and positive for IP.

Finally, for the policy makers, the conclusion is apparent as this study highlights the benefits of the standardization. Consequently, policy makers should give further support to develop standardization policies, as is the case of the ISO that is currently developing the next innovation management system standard requirements ISO 56001 by the ISO/TC 279 technical committee. Overall, it can be concluded that the more DS contributes positively as a complement of IC in boosting IP.

6 LIMITATIONS

Regarding the limitations of the paper, the first one is that the data is gathered in only one country, Spain, but in that moment, it was one of the few countries that had national certifiable standards specifically developed for innovation management that allowed gathering data. Thus, beyond the most common standards such as QM (ISO 9001) and environment management (ISO 14001) among others, today it is difficult to perform cross-national analysis including standards for innovation management, as it is not possible to include ISO standards on innovation management because the ISO standards for innovation management that are published today, such as ISO 56000, ISO 56002, ISO 56003, ISO 56008, among others, are not certifiable standards, and data cannot be gathered.

Future research should explore other perspectives focused on MS to discover which of the different standards contribute more on IP and business performance outputs, not only the number of MS implemented are important as studied in this paper but also which of them are more important inputs for IP enhancement output. In addition, it would be interesting to perform the same analysis but with the absence of IP to understand the asymmetric role of these antecedents.

Also, it would be interesting to include in the future analysis the impact of the implementation of the ISO 56001 standard because it will be the first certifiable international standard for innovation management. Finally, future research should perform the present analysis in other regions to conduct cross-national analysis and control the influence of other contextual variables.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.