Dominant Logic and External Collaboration: Determinants of Innovation in An Emerging Economy and A Developed Country

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Abstract: From the cognitive perspective and focusing on external collaboration, this study aims to show their contribution to innovative performance, which usually differs between emerging and advanced economies. Databases on Science, Technology and Innovation activities of the countries studied are used, together with CFA and SEM, to validate the hypotheses. It is found that dominant logic and external collaboration enjoy a positive relationship with innovative performance. In Spain, the returns of research and development are greater. This may be due to the fact that cognitive aspects are determinant of leveraging collaborative networks, while in Colombia this needs to be strengthened. In addition to contributing theoretically to the operationalisation of dominant logic and external collaboration in innovative performance, this research contributes to the literature by proposing relationships among the factors studied, providing insights into their influence in the innovation process in a developed and an emerging country, which has not been addressed before.

Keywords: dominant logic; external collaboration; innovation

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1. Introduction

The innovation paradox states that developing countries innovate much less than advanced countries (Cirera & Maloney, 2020). It is somewhat illogical that although innovation provides potential gains in company performance and in economic development, the conditions are not in place for investment to be equal across all economies; hence, there is a difference in competitiveness between emerging and developed countries. Regarding these differences, Cirera & Maloney mention that there are obstacles to the free flow of knowledge, such as the low entrepreneurial capacity to innovate by adding value. According to Sutton and Kpentey (2012), capabilities are the basic resources that the company must identify and adopt. Resources such as knowledge, processes, reputation, technology, and relationships have gained importance as globalisation, competition, and technology have intensified in the marketplace (Liu *et al.*, 2019). These resources, known as intangibles due to their value, rareness, and their difficulty in being imitated or transferred, have been studied by academics who have determined the existence of a positive relationship between these resources and business success (Ferreira et al., 2020; Khan *et al.*, 2019). Therefore, according to Nadkarni and Perez (2007), the mindset, also called dominant logic (DL), along with cognitive mapping, mental models, strategic frameworks, and belief structures, constitutes the knowledge structures that management teams use in their decision-making; therein lies the importance of studying DL within the field of strategic cognition. Dominant logic is defined as the way in which managers conceptualise their businesses and make critical resource allocation decisions from a cognitive perspective; this is applicable for technologies, product development, distribution, advertising, and even human resources (Prahalad & Bettis, 1986).

Previous studies on DL have been summarised in the literature review by Engelmann et al. (2020). From a final core of 94 papers that addressed the topic explicitly from a business perspective, 58 correspond to empirical studies that were conducted between 1990–2018, with the highest concentration of production in 2015 with eight studies, and a total average of 2.5 articles per year. The particularly noteworthy article by Obloj *et al.* (2010) describes the theoretical basis for the operationalisation of DL to enable the measurement of business performance, whereby the study of the concept is recognised as being theoretically attractive, but with few empirical studies due to the lack of a clear theoretical framework and operationalisation. Several studies that have operationalised DL are worthy of note within the sample: Coté *et al.* (1999) provided the procurement management model from the DL perspective; Von Krogh, Erat and Macus (Von Krogh *et al.,* 2000) measured DL from six dimensions from the external and internal environment; and Obloj et al. (2010) described a system of four elements, namely, opportunity identification, proactivity, learning, and routines.

The study by Engelmann (2020) enables six empirical pieces of research to be identified where the concept relates to innovation: Bouwen & Fry (1991), Strategic Actions to Generate Business Innovations; Ellonen et al. (2015), DL Relationship and Dynamic Capabilities in Innovation Processes in the Publishing Industry; Garg, V.K., Walters, B.A. and Priem (2003), Company Performance from Internal and External Environments with Emphasis on Innovation Functions; Hadida & Paris (2014), Managerial Cognition in the Digital Music Industry; Von Krogh et al. (2000), Relationship between DL and Business Performance; and Walters et al. (2005), Strategic Functions from Internal (Innovation vs. Efficiency) and External Environments.

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Furthermore, several recent empirical studies confirm an interest in the study of cognition (DL) in business performance and innovation: Su and Wang (2018), The Relationship between Control Systems and Entrepreneurial Orientation from Cognition; Khan *et al.* (2019, 2020), The Impact of DL on the Performance of China-SMEs; Palma-Ruiz *et al.* (2020), The Key Elements to Evaluating DL in Organisations; Brandtner and Freiling (2021), DL as a Value or a Constraint in Organisational Change; and Dwipayana *et al.* (2021), The Integrative Model of DL in the Pursuit of Business Performance.

Intangible resources and external collaboration (EC) enable organisations to generate new knowledge; this has been widely studied in the field of innovation management through empirical studies that provide evidence of how this factor increases the innovative performance (IP) of companies (Fındık & Beyhan, 2015). Business innovation as a competitive advantage strategy, seeks in collaboration, additional sources of resources, obtaining benefits such as: complementing their business capabilities, better knowledge transfer, better risk management and sharing R&D expenses (Fossas-Olalla *et al.,* 2015). Companies want to share the risks of innovation, working together, obtaining resources and capabilities that complement their internal structure (Chesbrough *et al.*, 2006).

From the perspective of open innovation (Chesbrough, 2003), collaboration plays a very important role in the identification and adoption of technologies because the use of external ideas promotes creativity. In the field of innovation management, the topic is quite recognized, reflected in the good number of publications that address the subject (Bogers *et al.*, 2017; Cheng & Huizingh, 2014; Lopes & de Carvalho, 2018). In other words, business innovation, has in collaboration a determining factor, as it allows the exchange of knowledge and tangible and intangible resources with external actors, thus fostering innovation (Fisher & Qualls, 2018; Randhawa *et al.*, 2016). Collaboration allows the creation and capture of value for the benefit of the organisation through the attraction of partners and the strengthening of the links between them (Aranha & Carvalho, 2022).

According to the study by Meireles *et al*, (2022), approximately 42% of the high impact scientific articles, which have studied the relationship between open innovation and collaboration, highlight approaches on learning and knowledge management, theories related to psychology (individual) and collaborative networks. Mainly these theories focus on the organisational level, i.e., characteristics, capabilities and skills of firms that contribute to the strengthening of inter-organisational relationships required to innovate. The most recent articles associated with this level focus on the types of partners, capabilities, and needs of partners (Secundo *et al.,* 2019), how strong collaborative linkages of firms with other partners contribute to innovation, as well as the nature of those linkages (Radziwon & Bogers, 2019) and how business success may be determined by the strength of networks and how knowledge flows through those connections (Corral de Zubielqui *et al.*, 2019; Di Pietro *et al.*, 2018). Networks within the context of collaboration, as a mechanism to exchange knowledge and strengthen the links between the different actors of an ecosystem, are the main factor in the development of the innovative process (Gutiérrez *et al.*, 2021).

In summary, more empirical studies are needed to explain business performance through the operationalisation of DL, especially those that allow the management of innovation to be measured in companies. On the other hand, the collaboration factor is confirmed as a determinant of innovation through the frequency of relationships with external actors in an innovation ecosystem.

Based on the gap described, this study pursues the following objective: to contribute to the scientific literature by providing empirical evidence that supports the importance of DL in IP by answering the following questions: Does DL have a positive and significant relationship with entrepreneurial IP? Can similarities/differences in the relationship between DL and EC with respect to IP be viewed as evidence between an emerging country and a developed country? In order to answer these questions, the reference framework of Obloj *et al.* (2010) has been utilised from two perspectives The DL is as follows: Routines and information filters (cognitive framework) and to operationalise the EC, whereby dichotomous variables are identified in order to determine the degree of the relationship of companies with different stakeholders from the science, technology, and innovation system of the countries under study. The main contribution of this empirical study, in addition to contributing theoretically and methodologically to the operationalisation of DL and EC, involves measuring innovative business performance, which implies that these relationships can be expounded in an emerging country, such as Colombia, and in a developed country, such as Spain.

This article is structured as follows: Section 2 presents the theoretical framework of the study and states the hypotheses. Section 3 then describes the data selection and the quantitative model used. Subsequently, the results of the empirical analysis are discussed in Section 4. The final section, Section 5, concludes with the contributions of the article to the field of innovation management and proposes future research.

2. Theoretical basis

The resource-based view of organisational theory describes companies as entities or sets of tangible and intangible resources that determine heterogeneity among companies (Peteraf & Barney, 2003). However, the most recent literature on this theory argues that intangible resources are a major source of competitive advantage (Obloj *et al.*, 2010). That is to say, knowledge, tasks, reputation, technology, and relationships have become more important since globalisation, competition, and technology have all intensified in the marketplace (Liu *et al.*, 2019). Furthermore, innovation has become a major part of competitiveness and organisation sustainability and generates competitive advantages by way of developing new or improved products/processes (Danneels, 2002). Innovation activities allow companies to improve their performance through the use of intangible resources, since they are unique and difficult to imitate or substitute (Barney, 1991), although such activities should enable organisations to be proactive without limiting their possibilities.

However, for companies in emerging countries, tangible resources such as financing, technology, and logistics systems remain limited

(Bruton & Rubanik, 2002). Therefore, it is necessary for organisations to acquire and exploit their intangible resources and incorporate them in a better way than entrepreneurs do in developed countries (Knott *et al.,* 2003).

Among the intangible resources of an organisation are the knowledge structures that management teams employ for strategic actions (Nadkarni & Perez, 2007). This is the DL, which is the way managers conceptualise their business and make critical resource-allocation decisions, whether with respect to technologies, product development, distribution, advertising, or human resources (Prahalad & Bettis, 1986). These authors argue that the difficulties of managing diverse businesses are not only due to the structure of the industry and diversity of businesses, but also due to the cognitive structures of organisations, which are decided by the knowledge and experience of the business management team. Although these cognitive structures are invisible, they become visible in the company's infrastructure and administrative tools, that is, the concept of DL covers both invisible (cognitive) and visible aspects (Engelmann *et al.*, 2020).

According to Von Krogh et al. (2000), empirical evidence shows that differences in DL lead to different strategic reactions to industry developments and, thus, result in differences in performance. A constantly changing environment will induce diverse potential strategies within companies. The greater the DL in a company, the more successful its reaction is to substantial increases in environment diversity.

Although Prahalad and Bettis (1986) define DL as a mental model for the operationalisation of business and management tools in order to achieve business goals and make decisions, Obloj (2010) proposes two basic perspectives that arise from this definition, that is, DL as routines and DL as information filters (cognitive framework).

2.1 Dominant logic as routines

From the perspective of organisational routines, DL focuses on the procedures and methods of the standard operations of companies; this includes the identification of opportunities and threats. This view determines the influence that DL exerts on how companies exploit their existing resources (Obloj *et al*., 2013).

Learning can also be considered within this perspective (Cope, 2005), given the extent to which companies identify and select repeatable strategies and learn them, which leads to the creation or change of routines (Walsh, 1995).

2.2 Dominant logic as information filters

Bettis and Prahald (1995) and Bettis (2000) consider DL to be a knowledge structure that is dynamic over time and depends on business characteristics, critical tasks that determine success, performance measures, and on the evolution of norms and values. These factors work as a set of perceptual and conceptual filters that purify the information coming from the environment. In other words, it is a set of dominant beliefs (Nadkarni & Perez, 2007) that enable organisations to expand or limit their options.

According to Obloj *et al.* (2010), the above perspectives should be related and DL should be proposed as a system of four elements. The first is Proactive/reactive nature, which is how the organisation acts strategically and the speed of reaction. The second is External orientation, which consists of how companies perceive their environment, whether as an opportunity or a threat. Third is Learning, which refers to how companies act in the face of difficulties. Lastly, the fourth element is Routine, which corresponds to the degree to which learning becomes routine. In their study, the authors associate 22 factors or items to measure the four elements, which have been used as a reference for certain studies using official descriptive bases to explain DL.

Of the four above elements, proactivity is the approach that has been the most important in recent years because of its relationship to the concepts of entrepreneurial mindset and managerial cognition. Proactivity is defined as the individual's voluntary behavior to make things happen (Khan et al., 2020), that is, to take actions in favor of something. Thus, and in accordance with the limitation of this study, by using data from descriptive databases of two organisations of the STI (Science, Technology, and Innovation) system in the study countries to measure the innovative performance of companies, the authors determined to evaluate only the proactivity dimension using the factors proposed by Obloj *et al*, (2010), in this dimension, those that allowed operationalising the DL according to the available variables. In summary, for this study, the emphasis lies on the proactive nature of companies to explain the DL.

According to Su & Wang (2018), proactivity in a company focuses on seeking new opportunities that may or may not be related to the current business model by introducing new products and eliminating operations that no longer add value to the company. Furthermore, Covin and Slevin (1989) stated that entrepreneurial proactivity in itself entails an effort to shape the environment for one's own benefit. Along these lines, for this study, it is assumed that a company is proactive when it invests in science, technology, and innovation activities, hires personnel with advanced degrees in fields linked to research and development (R&D), and takes advantage of government incentives that promote investment in STI activities. This assumption is made since, through the information provided by the external environment, the company filters and identifies opportunities to remain ahead of its competitors from a market point of view and takes actions that add to an enhanced IP.

3. Variables that measure innovative performance

Studies on business strategy have focused on explaining IP through variables and their factors. According to Becheikh *et al.* (2006), there are internal variables (company characteristics, global strategies, company structure, monitoring activities, organisational culture, work teams, and functional assets and strategies) and environmental variables (industry, region, networking, knowledge/technology acquisition, public policies, government, and culture) that explain the dependent variable "innovation." Furthermore, an innovative process can be measured through specific indicators that, according to the existing literature,

are divided into indirect indicators, such as patents and R&D budgets, and direct indicators, namely the number of new product ideas and the percentage of potentially marketable ideas (Dziallas & Blind, 2019; Moreira *et al.,* 2016). Klomp and Van Leeuwen (2001) highlight the relevance of R&D expenses as the most important innovation input, and newly created or improved products or process innovation as the outputs of the innovation process. However, the Oslo Manual prepared by the OECD and Eurostat describes the possible indicators for measuring innovation, while taking innovative activities into consideration that enable evaluation and international comparability. Thus, for this study, two bases are used which have taken the Oslo manual as a reference in order to allow the surveys targeted at the companies to be designed; these are the survey of technological development and innovation (EDIT) devised by the National Department of Statistics of Colombia (DANE), and the survey of business strategies of Spanish companies (ESEE) devised by the State Society of Industrial Participations (SEPI). Both surveys are for the manufacturing industry, most of which are small and medium-sized companies.

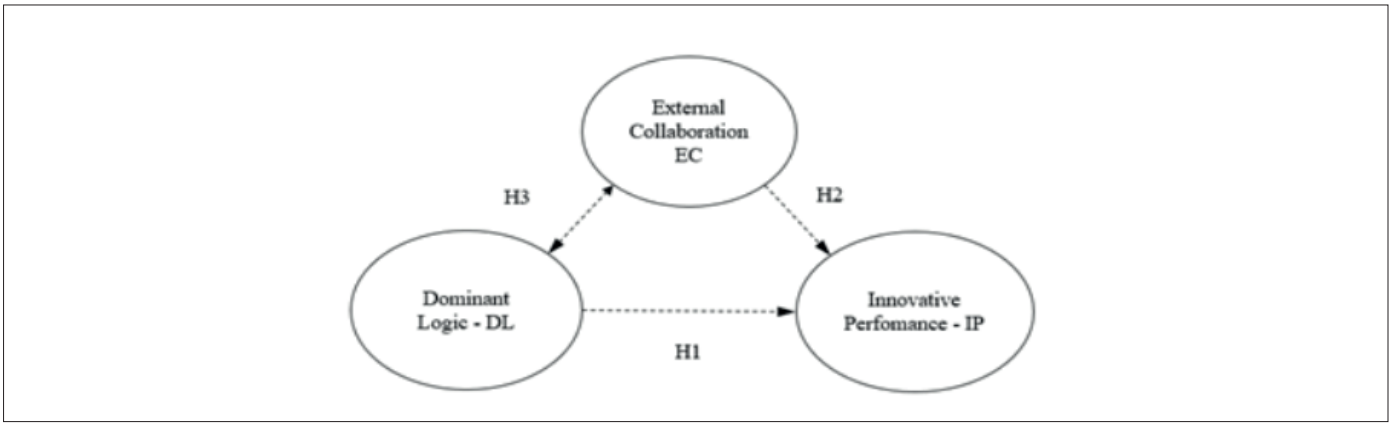
However, it is important to note that the literature on the measurement of innovative performance is extensive. According to Dewangan & Godse, (2014), two approaches are presented to classify the authors' discussions on this topic. The first refers to the weaknesses and strengths of performance indicators (number of patents, R&D entries, new product launches, among others). The second approach refers to the best way to group innovation performance indicators and discusses related indicators. In this category, the authors present 19 studies, including, as an example, the study by Cooper & Kleinschmidt, (1995), who describe at least 10 elements that allow measuring success in the development of new products, related to the impact on sales, profitability, and the achievement of objectives in these two dimensions.

Regarding exports, according to Aghion *et al.* (2018), opportunities in larger markets increase incentives to innovate for all companies. As international competition increases, incentives to innovate for less productive companies are reduced. On the other hand, according to Harris & Moffat (2011), the existing literature has documented that a one-way relationship exists between exports and innovation, that is, innovation determines the exploitation of opportunities in international markets. However, academics have shown that there may be a causal relationship between exports and innovation, since stronger competition in foreign markets includes a learning process, with access to better foreign knowledge and exposure to technology, creating the need for companies to invest in R&D and to innovate.

Knowledge may encompass different types of external innovation partners, depending on their field of action and expected value. The diversity and combination of these sources of innovation are important in business strategy. Sources include customers, suppliers, universities and research centres, intellectual property experts, and partner networks (Brunswicker & Vanhaverbeke, 2015).

Based on the above, the following conceptual framework is proposed (Figure 1), which illustrates the theoretical relationships between DL, EC, and IP.

Figure 1. Conceptual Framework



Source: Prepared by the author.

The following table lists the factors that operationalise the unobservable variables:

Table 1. Variables of the conceptual model

Unobservable variable	Observable variable	Description
Dominant Logic –DL	G.ID	R&D Total expenses
	FE3*	Tax deductions
	EA	No. R&D jobs
External collaboration - EC	CP1*	Collaboration with universities
	CP2*	Customer collaboration
	CP3*	Competitor collaboration
	CP4*	Supplier collaboration
	CP5*	Technological cooperation agreements
	CP6*	Technology park collaboration
Innovative Performance - IP	PI0	No. Product innovations
	NV	Export value
	DI2*	Process innovation
	DI3*	Innovation in methods
	DI4*	Innovation in marketing techniques

Source: Prepared by the author.

Note: (*) Dichotomous variables (yes/no).

4. Hypotheses

Proactivity and Innovation

As mentioned above, it is assumed for this study, in accordance with the concept of proactivity, that companies take action when they identify opportunities in the environment that can improve their IP. These actions include allocating resources to develop in STI activities (R&D total expenses), identifying and appropriating sources of incentives to innovate (Tax deductions), and hiring and retaining formal education (number of R&D jobs) to promote new or improved processes so that the organisation's economic goals can become drivers of innovation. Proactivity in a company's R&D function allows it to explore new innovations when current knowledge loses its value, thus renewing its existing competencies (Mudambi & Swift, 2011). It is valid to say that a company that invests in R&D, is because it takes actions to create advantages over the competition as the environment changes. On the other hand, it has been studied that a tax deduction system encourages entrepreneurs and managers to take actions to invest in innovative solutions (Walicka & Prystrom, 2015). Furthermore, companies require employees to take action based on their cognitive abilities and personal characteristics, and also with a willingness to be innovative and contribute to the innovative performance of companies (Durana *et al.*, 2020). In short, proactivity is associated with actions in support of innovation.

According to Khan *et al,* (2020) a high level of proactivity has a positive relationship with business performance, not only because of a rapid response capacity to the dynamics of the environment but also because the actions taken are part of the research and the search for opportunities. It is valid to say that from the perspective of open innovation, where an exchange of knowledge and resources is sought, it forces stakeholders to have a proactive behavior in the search for the sources of such resources. Knowledge becomes actions to obtain significant results in the innovation process as a competitive advantage strategy.

First, total R&D expenses and innovation are the main drivers of business development; however, the literature that has studied this relationship is split between those that consider the contribution of R&D to company performance as positive, and those that consider it to be negative. This may be due to the fact that the return on R&D investment is not immediate. It is true that it creates value for the company, but it is more difficult to estimate its impact on company performance in the short term. R&D expenses could produce very high-performance costs as a result of zero return on investment. However, it brings benefits to the company, as it allows them to perform better and maintain a better position in the market (Bouaziz, 2016). It could be said that R&D activities improve or increase the company's market value, resulting in higher values of the innovation indicators. This is proved by the large number of empirical studies that confirm this positive and significant relationship, such as Cheng *et al.* (2006), Connolly & Hirschey (1984), and Liang & Zhang (2005).

Second, tax deductions are an effective tool to encourage investment in R&D activities, since they allow competitiveness to be promoted and high-impact research to be carried out both for companies and for the country, with the promotion of actions in accordance with the opportunities provided by the environment (Guceri & Liu, 2017). Thus, government subsidies can solve the problem of low IP, and can enhance the resources allocated to innovation, reduce uncertainty, and mitigate the risk of the company's R&D investment (Lee & Cin, 2010). Conversely, government subsidies have the ability to improve companies' external financing capacity, as well as endogenous debt and equity financing. Therefore, it reduces the total cost of financing (Xu *et al.*, 2021). Identifying government incentives enables actions to be taken in favour of business development and innovation.

However, according to Grant & Ashford (2008), proactive employees think ahead and contribute to better results and to the learning process. In other words, these individuals often experiment with the goal of finding something new and new innovative means of action. They also seek to make a difference in their environments, whether within their organisations, to other people, or to themselves (Bateman & Crant, 1993). Since employees are a tangible resource and their value largely depends on their knowledge and skills, education constitutes a major factor in improving competitiveness and gaining knowledge (Barro & Lee, 2001). Therefore, innovation in the organisation is a knowledge-intensive organisational process and the professional training of employees helps achieve business goals and IP.

Based on the above, the following hypothesis is proposed:

H1: A company's level of proactivity positively and significantly affects the company's innovative performance (DL → IP).

Relationship between external collaboration and innovation

External collaboration is an effective strategy employed to increase companies' innovative capabilities (Clausen, 2013). Companies collaborate with other organisations to share the risk of innovations and/or to increase their efficiency. These network-like collaborative relationships contribute towards increasing the innovative capabilities of companies, since companies can gain new knowledge, rapid access to resources, and enable greater capacity in the transfer of knowledge (Powell & Grodal, 2005). Hence, according to Findik & Beyman (2015), EC in IP is crucial because companies gain access to knowledge, which allows them to improve organisational learning and thus innovation capabilities. That is to say, knowledge for innovation is distributed among different sources, whether these are stakeholders or organisations, such as users, suppliers, universities, consultants and research institutes (Edquist, 2005; Von Hippel, 2006). Empirical studies have confirmed the existence of a positive relationship between IP and inter-organisational collaboration (Faems *et al.*, 2005; Huang & Yu, 2011; Un & Asakawa, 2015).

Based on the aforementioned evidence, the following hypothesis is proposed:

H2: External collaboration positively and significantly influences companies' innovative performance (EC → IP).

External collaboration and dominant logic

The proactive personality, defined by Bateman and Crant (1993) as the personality of those who can change their environment by taking action through identifying opportunities, presents an important vehicle for innovation according to Escrig-Tena *et al.* (2018). This is consistent with the DL theory put forward by Bettis & Prahalad (1995), which is their information-filtering perspective.

Accordingly, companies and employees with proactive personalities tend to take more risks and learn from failure. External collaboration is an activity that adds greater risk to innovation, such as the risk of sharing sensitive information (Grindley & Teece, 1997; Veugelers, 1998) and creating dependency on external knowledge (Doz, 1996), but if these risks are not taken, then companies cannot manage success and failure to become more competitive (Brettel & Cleven, 2011). From the perspective of new product innovation, the literature refers to positive interactions of companies when collaborating with customers (Brockhoff, 2003; Salomo et al., 2003; Von Hippel, 1986), universities and research centres (Hise *et al.*, 1980; Santoro & Betts, 2002), and with consultants and independent research institutes (Bessant & Rush, 1995; Tether & Tajar, 2008), but not with competitors, with whom relationships can be very risky,(McGill, 2007).

Hence, the following hypothesis is proposed:

H3: There is a direct relationship between external collaboration and a company's proactivity (EC~~ DL).

5. Methodology

As mentioned above, this comparative study uses descriptive data to measure, through different indicators, the STI activities of companies in the industrial sector in Colombia and Spain. The Colombian dataset is public, while the Spanish dataset comprises data from surveys conducted by a private entity, since the information produced by the Spanish National Institute of Statistics (INE) is unavailable to the public. The Colombian dataset contains 7,529 records for the period 2017-2018, while the Spanish dataset has information from 1,808 records in 2016. From each of the datasets, the companies that had total R&D expenses greater than zero were selected, which led to a total of 732 items of data for Colombia and 602 for Spain being obtained. The years of study correspond to the latest data available for each of the datasets.

In accordance with the conceptual framework in Figure 1, IP, DL, and EC were the determinants selected.

5.1 Dependent variable

IP was considered as the dependent variable, determined by five variables, namely, the number of product innovations, export value, and the dichotomous variables of new processes, methods and marketing techniques, and information contained in the study databases. These variables were selected according to the theoretical evidence mentioned in the corresponding section.

5.2 Independent variables

In order to operationalise the DL as a non-observable variable, the starting point is given by Obloj *et al.* (2010), who describe the theory as an "information filter" containing two different dimensions (filter and external orientation) and "learning routines". Subsequently, the factors described in the author's study associated with the proactivity dimension are employed to determine the measurable variables for this construct: these factors mean that is possible to associate the available variables with the theory, as evidenced in the study by Khan *et al.* (2020). In addition, six dichotomous variables were identified to determine the degree of relationship of the companies studied with different stakeholders of the STI system of both countries, which was labelled EC.

In order to validate the proposed hypotheses, the structural equation modelling (SEM) methodology was proposed, which was implemented using statistical software R (Team, 2020). The SEM is a family of statistical models used to explain relationships among multiple variables (Hair *et al.,* 2010). This type of model examines the structure of interrelationships expressed in a series of equations similar to multiple regression equations. These equations represent all the relationships among constructs (latent or unobservable variables) involved in the analysis that are constructed as factors in factor analysis.

For the implementation of this technique in the data sets described above, it is important to bear in mind that most of the variables involved, both in Colombia and in Spain, are dichotomous in nature. This is not a limitation for the model, but it is important to take it into account when computing correlations (which would not be Pearson correlations but polychoric) or choosing the estimation method for the model (in this case, Weighted least square mean and variance adjusted or WLSMV). It is also possible to compromise the calculation of some indicators.

6. Results

The following sections show the results for each country, starting with the correlation matrix (Pearson between numerics, polyserial between numerics-ordinals, and polycorich between ordinals) along with basic descriptive statistics (mode for factors and mean and standard deviation for numerics). Subsequently, the preliminary results of the exploratory factor analysis are shown without suggesting a model, since the proposed factor model was based on theory. Finally, the results of the confirmatory factor analysis and the regression model with the factors are shown to complete the SEM.

Colombia

Table 2 shows the correlations between the variables studied. The results suggest that all the relationships are positive, and that the strongest relationship is between CP2 and CP3.

Table 2: Correlation Matrix and descriptive statistics

	G.ID	PI0	DI2	DI3	DI4	FE3	CP1	CP2	CP3	CP4	CP5	CP6	NV	EA
G.ID	1.00													
PI0	0.11	***1.00***												
DI2	0.04	0.09	***1.00***											
DI3	0.05	0.11	0.36	***1.00***										
DI4	0.06	0.17	0.26	0.29	***1.00***									
FE3	0.13	0.23	0.31	0.22	0.12	1.00								
CP1	0.14	0.35	0.19	0.26	0.21	0.40	***1.00***							
CP2	0.07	0.22	0.11	0.12	0.09	0.27	***0.57***	***1.00***						
CP3	0.08	0.27	0.26	0.16	0.17	0.24	***0.61***	***0.74***	***1.00***					
CP4	0.12	0.21	0.20	0.32	0.12	0.28	***0.61***	0.68	0.63	1.00				
CP5	0.12	0.25	0.22	0.31	0.17	0.35	***0.61***	0.44	***0.58***	***0.51***	***1.00***			
CP6	0.07	0.19	0.29	0.26	0.42	0.13	***0.70***	0.45	***0.52***	0.39	***0.53***	***1.00***		
NV	0.19	0.14	0.02	0.11	0.04	0.14	0.14	0.08	0.14	0.11	0.23	0.04	***1.00***	
EA	0.36	0.24	0.12	0.12	0.10	0.24	0.29	0.05	0.18	0.21	0.28	0.19	0.44	1.00
Mean*	191	2											7,561	8
SD*	810	3											21,254	11
Mode			56%	68%	71%	88%	79%	73%	68%	96%	84%	98%		
			Y	N	N	N	N	N	N	N	N	N		

Source: Prepared by author. Note: (*) G.ID and NV are expressed US Dollar thousand. Y (Yes). N (No).

The convenience of a factor analysis was investigated through the Kaiser-Mayer-Olkin measure (KMO) and Bartlett's test of sphericity test (Aldas & Jimenez, 2017), both of which suggest that the technique is adequate. For the KMO a value of 0.76 was obtained and therefore exceeds the threshold of 0.5 (Kaiser, 1970), while the Bartlett's test (χ^2=3900.2, p<0.0001, df=91) suggests that the correlation matrix presents significant correlations among at least some of the observable variables. To evaluate the internal consistency of the variables considered, Cronbach's Alpha (0.82) was calculated. Alphas were also computed considering the elimination of each variable, finding values between 0.79 and 0.83, all above the acceptable minimum of 0.7 (Nunnally, 1978). With this, it is concluded that the set of available variables is sufficiently related for a factor analysis and therefore also a SEM.

In order to verify the suitability of the proposed measurement model from Figure 1, a confirmatory factor analysis (CFA) was run in R which included several covariance relationships, for which the association between the value of exports and R&D Employment (NV~~EA) was considered since, according to Aghion *et al.* (2018) and Harris & Moffat (2011), there is a confirmed relationship between innovation and exports, where the focus of collaborators on R&D activities is necessary to boost export processes. Moreover, the relationship between cooperation with customers and competitors (CP2~~CP3) was also taken into account since their relationship may occur given that they constitute sources of external knowledge highly demanded by companies, although competitors may be a very risky source, according to McGill (2007).

The results indicate that the model successfully achieved the fit criteria as defined by Hair *et al.* (2010) and Hu and Bentler (1999). It is therefore concluded that the proposed model fits well and is acceptable: (CFI = 0.980, TLI = 0.975, SRMR = 0.081, and RMSEA = 0.081). Furthermore, all loadings and covariance relationships were found to be significant.

Having verified that the measurement model is suitable, the structural model was then adjusted in order to test the proposed hypotheses, and the following results were obtained for the fit indices: CFI = 0.989, TLI = 0.986, SRMR = 0.085, and RMSEA = 0.069. It is once again concluded that the model is acceptable.

Table 3: SEM Results for Colombia

Relationship	Estimation	Standard Error	Standard Estimation	p-value
DL -> IP	0.105	0.059	0.163	0.023
EC -> IP	0.318	0.060	0.694	<0.001
EC ~~ DL	0.385	0.008	0.727	<0.001

Source: Prepared by the author.

Table 3 shows the SEM results using the WLSMV method, which confirms the positive effect of both DL ($\beta = 0.163$, $p = 0.023$) and EC ($\beta = 0.694$, $p < 0.001$) on IP. This conclusion is compatible with Hypotheses H1 and H2, respectively. Similarly, it can be concluded that there is a direct relationship between EC and dominant logic (= 0.727, $p < 0.001$), which supports Hypothesis H3.

In summary, the coefficient and the p-value confirm the positive relationship of the DL from the actions taken by the companies to invest in R&D activities, also for the use of incentives such as tax deductions to improve their capacity to invest in such activities, as well as the actions to invest in professionals with capabilities and personal characteristics to innovate. In this order of ideas, the more actions companies take on these innovation drivers, the better their innovative performance will be.

Comparatively, the relationship is more positive and significant between EC and IP. Strong relationship is observed between customers and competitors. Customer-oriented companies tend to seek sources of information and knowledge that stimulate the development of new products to meet customer demands, working collaboratively (Didonet *et al.*, 2016). Complementarily, companies that are oriented to customers are also oriented to competitors, seeking to meet customer demands in a better way than the competition (Tsiotsou, 2010). This relationship is determinant for the innovative performance of firms.

The decision-making process and the selection of qualified personnel (actions) are determinants in the innovative process. When companies focus on hiring new knowledge and skills, they stimulate inter-organisational and intra-organisational collaboration (Radziwon & Bogers, 2019). In other words, these skilled personnel may have a greater propensity to participate in business ecosystems, transferring knowledge in both directions. This makes proactive (take action) employees a very important driver of open innovation.

Regarding the reliability and validity of the model, the composite reliability (CR) index was used since according to Fornell & Larcker, (1981), the convergent validity and composite reliability of a construct can be concluded from this measure, since the AVE is usually much more conservative. In this case the values found were 0.87 (EC), 0.60 (DL) and 0.53 (IP), where the first two are greater than the minimum recommended according to Hair et al, (1998) and therefore it is concluded that the constructs comply with reliability and validity. However, although the value for IP does not exceed the minimum defined, it is close enough, since evaluating its internal consistency based on Cronbach's Alpha (0.56) it is greater than 0.5 and according to (Sideridis, 2018) can be considered acceptable.

Spain

Table 4 shows the correlations between the variables studied. The results suggest that most of the relationships are positive, the strongest being between CP1 and CP3.

Table 4: Correlations Matrix and descriptive statistics

	G.ID	PI0	DI2	DI3	DI4	FE3	CP1	CP2	CP3	CP4	CP5	CP6	NV	EA
G.ID	***1.00***													
PI0	0.03	***1.00***												
DI2	0.32	0.44	***1.00***											
DI3	0.30	0.14	***0.54***	***1.00***										
DI4	0.03	0.35	0.41	***0.55***	***1.00***									
FE3	0.23	0.10	0.11	0.24	0.22	***1.00***								
CP1	0.13	0.04	0.13	0.18	0.01	0.26	***1.00***							
CP2	0.40	-0.02	0.13	0.26	0.05	0.47	0.48	***1.00***						
CP3	0.17	0.12	0.25	0.26	0.20	0.31	***0.69***	***0.54***	***1.00***					
CP4	0.10	0.19	0.23	0.43	0.24	0.36	0.19	0.48	0.19	***1.00***				
CP5	0.11	0.17	0.17	0.23	0.14	0.46	0.25	***0.50***	0.33	***0.66***	***1.00***			
CP6	0.08	-0.02	0.02	0.07	0.06	0.17	0.01	0.25	0.15	0.33	0.18	***1.00***		
NV	0.33	0.00	0.14	0.11	0.05	0.16	0.04	0.12	0.12	0.12	0.10	-0.04	***1.00***	
EA	***0.53***	0.05	0.42	0.33	0.12	0.11	0.21	0.41	0.24	0.26	0.30	0.19	0.18	***1.00***
Mean*	2,146	2											77,232	8
SD*	13,600	5											352,031	43
Mode			60%	64%	70%	60%	54%	90%	57%	94%	89%	96%		
			Y	N	N	N	N	N	Y	N	N	N		

Source: Prepared by author. Note: (*) G.ID and NV are expressed US Dollar thousand. Y (Yes). N (No).

In this case, the result for Bartlett's test of sphericity (χ^2=3128, p<0.0001, df=91) suggest significant correlations among the variables while the result of the KMO test was 0.68, which exceeds the acceptable minimum of 0.5. With respect to Cronbach's Alpha, in this case the value was 0.8, while for the alphas considering the elimination of each variable the values were between 0.78 and 0.81, also exceeding the minimum acceptable of 0.7. Thus, as in Colombia, the data suggest that the implementation of a factor analysis is suitable.

Regarding the verification of the suitability of the measurement model, a CFA was implemented by taking into consideration the covariance relationships between innovation in marketing techniques with the number of product innovations (DI4~~PI0), value of exports (DI4~~NV), and innovation in methods (DI3~~DI4) since it is known that there is a direct relationship,. According to covariance relationships, the actions associated with innovations in marketing techniques are related to the opportunities provided by export markets. When firms access international markets, they improve their capabilities, accessing information about more sophisticated markets and increasing the propensity to introduce technological innovations (Almeida & Fernandes, 2008; Cirera & Maloney, 2020; Clerides et al., 1998; Martins & Yang, 2009; Silva et al., 2012).

Finally, the relationship between collaboration with universities and that of competitors (CP1~~CP3) was also included, since it could be said that this direct relationship is created by the popularity of universities and research centres in the exchange of knowledge with different players of the innovation system.

Based on the fit criteria considered (CFI = 0.976, TLI = 0.969, SRMR = 0.120, and RMSEA = 0.069), it is concluded that the model fit is acceptable. Additionally, all costs and covariance relationships were found to be significant.

Having verified that the measurement model is suitable, the SEM was adjusted, thereby obtaining the following results for the fit indices: CFI = 0.982, TLI = 0.977, SRMR = 0.120, and RMSEA = 0.076. It is concluded once again that the model is acceptable.

Table 5: SEM Results for Spain

Relationship	Estimation	Standard Error	Standard Estimation	p-value
DL -> IP	0.278	0.046	0.353	<0.001
EC -> IP	0.623	0.137	0.458	<0.001
EC ~~ DL	0.225	0.023	0.518	<0.001

Source: Prepared by the author.

Table 5 shows the SEM results, from which it can be concluded that there is a positive effect of DL on IP (β = 0.353, p < 0.001), thus confirming Hypothesis H1. Similarly, it is possible to state that there is a positive effect of EC on IP (β = 0.458, p < 0.001), thereby confirming Hypothesis H2. Finally, it can be concluded that there is a direct relationship between EC and DL (= 0.518, p < 0.001), which supports Hypothesis H3.

In summary, the coefficients and p-values confirm strong and positive relationships among the constructs. As in the case of Colombia, the actions taken by firms to optimise innovation drivers determine better results in the creation of new products, methods, innovative processes, marketing techniques, and maximise opportunities in export markets. In terms of collaboration, there is a strong relationship between universities and competitors. As mentioned in the Colombia results, companies oriented to competitors, and therefore to their customers, seek sources of information and knowledge that allow them to encourage their innovation processes. It should be noted that, unlike Colombia, in Spain, collaboration with universities as a source of knowledge is quite significant, which coincides with previous studies as will be described in the following section.

Regarding the reliability and validity of the model, the CR values of the constructs were 0.77 (EC), 0.73 (DL) and 0.61 (IP), in all cases exceeding the minimum acceptable of 0.6 defined by Hair et al, (1998), therefore according to Fornell & Larcker, (1981) all constructs have reliability and validity within the model.

7. Discussion and conclusions

How companies identify their external environment and assimilate it, including transforming it into innovative management actions, requires a major cognitive effort that is worthy of further study so that economies may adjust their business support policies to create value. From the study point of view, DL represents an important construct not only for the evaluation of business proactivity for the pursuit of those opportunities that create innovations but also in order to identify and take in the knowledge originating from external collaborators, which contributes towards such processes.

The results provide empirical evidence that, in companies in the industrial sector in Colombia and Spain, IP can be explained as the (cognitive) capacity of internal collaborators to notice opportunities in the environment that motivate companies to make investment decisions in R&D activities, such as new or improved product (goods/services) innovations, and new processes, methods, and techniques. Companies can also operate internationally, either with their own resources or with public resources such as tax incentives. External collaboration enjoys a positive and significant relationship with IP, as emphasised by the literature on innovation ever since the concept of open innovation was coined (Chesbrough, 2003), a strategy that allows the use of external ideas in the processes of the identification and adoption of technologies in the creation of innovation.

From the perspective of the proposed model, the hypotheses are confirmed, making it possible to infer that the behavior of the variables is similar in an emerging and a developed country. However, it is observed that in Spain the returns on R&D are higher (Cirera & Maloney, 2020), which can be linked, in this study, to the fact that the cognitive aspects associated with company capabilities are determinant of opportunities being identified in collaboration networks in Spain. However, in Colombia, this relationship should be strengthened. The authors state that in developed countries, where there are more technological developments, the degree of collaboration is greater. This is mainly due to the fact that these relationships have been built over the years and the perceived quality of shared knowledge is higher. In emerging countries, the opposite holds true, but this may be influenced by the poor capability of companies to perceive the benefit of the stakeholders offering knowledge.

Spain is a country within the EU that has had moderate innovative performance compared to the other countries in the community. The effort made by Spanish multinationals since 1986 in the configuration of the national innovation system has been very important, to the extent that these companies have identified R&D opportunities in areas such as renewable energies, life sciences and the aerospace industry. However, this success has not been generated entirely within the local innovation ecosystem but is due to an open innovation strategy with universities where multinationals have subsidies, relying on global innovation networks. Public-private partnerships and international economic sources have become a strategy in the Spanish Innovation System (Santamaría *et al*., 2013). The country continues to seek to strengthen its system through a greater degree of knowledge exchange and collaboration between sectors through an innovation policy that improves the relationship between universities and public research organizations, defines incentives from the institutions for researchers to participate in knowledge transfer and collaboration, improves the practices of knowledge intermediaries and contributes to strengthening business (OECD, 2021).

Otherwise, according to Paternina *et al,* (2014), for instance, in the service sector in Colombia, knowledge development centres are not recognised as allies for innovation, which may be due to a trust issue. The business sector in Colombia has not taken advantage of the opportunity to connect with research and innovation agencies, as well as with universities, because companies still do not recognise in collaboration and knowledge networks the opportunities for business development (Hurtado-Ayala & Gonzalez-Campo, 2015).

Overall, the results show that DL and EC factors explain IP. The findings show that DL (proactivity) has a direct and positive influence on IP. Regarding the relationship of EC with IP, the literature is extensive, confirming this influence. However, since these are two different contexts, their interpretations must be made in conjunction with previous studies that account for the evolution of innovation in each country as described above.

The relationships between the factors cannot be considered as evidence to establish similarities and differences between an emerging and a developed country because comparative studies require that the secondary data be the result of applying analogous data collection instruments, and for the present study this was not the case, which in itself was a limitation in the exploratory analysis. This type of exploratory and correlation studies enable the analysis to identify practices in developed countries that can be used as a basis for making public policy recommendations on innovation in developing countries.

Furthermore, the results reveal that the proactivity of companies determines in part the propensity to collaborate with the actors of the innovation system. Although the study reveals the importance of competitors, customers, and universities as drivers of knowledge in the innovation process, the question remains as to what occurs with the degree of interaction of firms with technology development centres, regional productivity centres, technology parks, suppliers, among others.

The study contributes to the literature on operationalization of DL, providing a way to associate variables that measure STI activities with actions that predetermine entrepreneurial capability based on what is in the business environment. It is evident that working with primary data would offer more opportunities to delve into all dimensions of DL.

Regarding the limitations of this research, having comparable bases not only in time series but also in response options would strengthen studies in the field and would bolster the integrity of the models proposed in the future.

Future studies are required to illustrate the operationalisation of the DL from a range of perspectives. Regarding IP assessment, it would be convenient to conduct studies that incorporate more variables that allow the application of the Obloj model in its four dimensions, as well as to investigate the similarities and differences between emerging and developed countries to contribute public policy recommendations. Studies that can identify barriers to accessing different and less common partners in innovation ecosystems and propose strategies to increase the strength of collaboration between stakeholders decrease relational risk would also be of high importance.

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