

**THE INFLUENCE OF NATIONAL CULTURE AND ACCESS TO INNOVATION ON  
INNOVATION OPENNESS**

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## **INTRODUCTION**

Innovation offers a competitive advantage to most organizations, especially to medium and large sized companies. In current marketplaces, customers frequently seek new products and services that can attract them well. The capacity of innovation to impose unforeseen changes on organization member creates resistance to new ideas by many organization members who are uncomfortable with the uncertainty of the innovation process (Van de Ven, 1986). However, fast environmental changes have increased the importance of innovation for firms.

According to the Oslo's Manual definition (OECD, 2005), innovation is the implementation of any new or significantly improved product (goods or services), operational process, any new marketing methods or new organizational or managerial methods or process in business practices, workplace organization or external relations. Innovation can be viewed both as output and a process.

The innovation process is an open phenomenon and no longer restricted to the internal organizational environment (Kaufmann & Tödting, 2001; Tomlinson & Fai, 2013). Lundvall (2007) discovered that several national aspects may influence the motivation to innovate on the national level. Williams and McGuire (2010) argue that national culture powerfully shapes the character of innovation, that is, the culture does influence economic creativity, and economic creativity positively influences innovation implementation, which positively influences national prosperity. Innovation should therefore be analyzed, planned, and managed from a series of perspectives including national culture. Many definitions of culture exist. National culture is the set of collective beliefs and values that distinguish people of one nationality from those of another (Hofstede, 1991).

Fagerberg and Srholec (2008) found strong support that several factors linked with national innovation such as the quality of governance, the political system, and openness interact with the ability to innovate, and as Strychalska-Rudzewitz (2016) complements, "a society's values provide direction to the process of technological development, which can be fostered or inhibited". Jones and Davis (2000) found as result of their research that national culture affects innovation.

However, the access to innovation is also an important factor along the national culture to permit innovation openness to happen and to better the innovation process. Furman, Porter and Stern (2002) note that "innovative capacity" is a product of both the innovation infrastructure and the environment for innovation as well as the strength of linkages between them. This access to innovation can be acquired through alliances between partners. Steensma, Marino, Weaver and Dickson (2000) conducted a study to determine the effect that national culture has on the propensity for entrepreneurial firms to cooperate with other firms for technological innovation and to use equity ties in the formation of these alliances. That is, the access to innovation can be shared within these alliances.

Specifically, the following research tries to answer the following question: Do national cultural values influence the likelihood that entrepreneurial firms will pursue innovation openness? The objective is to verify whether the relationship between national culture and innovation openness is mediated by the access to innovation. It is believed in this study that the national culture has its importance for innovation openness, however the national culture cannot create an effective environment conducive to innovation openness only by itself lacking the access to innovations.

This study achieved contributions after testing some determinants for innovation openness, revealing the importance of two prior aspects for innovation openness: national culture and

access to innovation. It also confirmed that access to innovation show notable effects on openness to innovation practices, improving the relationship between national culture and innovation openness. This was important to emphasize previous studies about culture (Hofstede, 1985; Trompenaars, 2007) and innovation (Chesbrough, 2003; Zhou & Li, 2012).

The article includes, in addition to this introduction, the following structure: the theoretical framework presents the central aspects about the effect of national culture on preference and motivation for innovation openness. The hypotheses highlight the association between the national culture and innovation openness, the access to innovation and innovation openness, and the mediation of the access to innovation among the national culture and innovation openness. The methodology contemplates the database and the description of the dependent and independent constructs used. The results demonstrate the validity and reliability criteria and test the hypotheses through the modeling of structural equations. It follows the discussion of the results with the reflections on the results found and, finally, the conclusion and the references used in the article.

## **THEORY DEVELOPMENT**

Innovation has been widely acknowledged as a core source of competitive advantage for organizations and firms takes place when knowledge is commercialized, in the forms of new products, services, or business models. Firms that are entrepreneurial and able to sustain continual innovation are more likely to survive in a dynamic environment (D'Aveni, 1994).

Innovation is important for driving economic progress and competitiveness— both for developed and developing economies. Many governments are putting innovation at the centre of their growth strategies. The definition of innovation has broadened—it is no longer restricted to R&D laboratories and to published scientific papers (Dutta, Lanvin & Wunsch-Vincent, 2015).

Innovation has been associated to production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome (Crossan & Apaydin, 2010). Novelty can also vary depending on the referent dimension: a product or service can be new to the company (Davila, Epstein, & Shelton, 2006), the customer (Wang & Ahmed, 2007), or the market (Lee & Tsai, 2005).

Sung, Cho and Choi (2011) examine two widely recognized and clearly distinguished stages of innovation: adoption and implementation. Adoption refers to the decision to use an innovation as the best course of action to derive anticipated benefits from changes that the innovation may bring to the organization (Klein & Sorra, 1996; West & Anderson, 1996). Implementation refers to the transition stage between the decision to adopt the innovation and the consistent use or routinization of the innovation (Holahan, Aronson, Jurkat, & Schoorman, 2004; Klein & Sorra, 1996).

Companies decide to adopt and implement innovation to obtain some benefits or positive outcomes from a given innovation (Klein & Sorra, 1996), for increased innovative capability and organizational performance gain caused by the innovation (Holahan et al., 2004). Organizations adopt and implement innovations to improve their performance in the short term, as well as to increase their capacity to innovate in order to enhance long-term output (Caldwell, Herold, & Fedor, 2004).

### **Innovation Openness**

In times of increasing competition through globalization and new market players, shorter production cycles and higher pressure to innovate, decreasing research and development (R&D) budgets but simultaneously escalating R&D costs, companies are forced to find new

ways for strengthening their innovation potential (Gulati et al., 2012). A solution to escape this dilemma seems to be the strategic opening of innovation processes and the proactive use of external knowledge to increase innovation success (Zhou & Li, 2012).

There is still a lot of uncertainty regarding the question which factors determine successful innovation within the open innovation environment (Nitzsche, Wirtz, & Göttel, 2016). Although the concept of using external knowledge for innovation activities has not been entirely new (Dyer & Singh, 1998; Lane & Lubatkin, 1998), it has gained a lot of momentum through the integrative specification by Chesbrough (2003). Thereby, the capability to access knowledge is essential to become aware of external information (Garriga, von Krogh, & Spaeth, 2013) or changes. In more detail, being “open” to environmental influences is the core capability in this context (Chesbrough, 2006).

The concept of openness, in turn, has gained significant attention in the scientific discussion (Chesbrough, 2006a; Enkel, 2010; Verbano, Crema, & Venturini, 2011) and plays an important role for organizations trying to succeed in innovation openness. To this effect, Enkel (2010) emphasizes the significance of openness as follows: “The idea of openness lies at the core of the open innovation concept, meaning that the passing on of information and knowledge should be the rule rather than the exception, since it is perceived to be beneficial for all partners involved” (Enkel, 2010: 344).

For this study, innovation openness can be associated to opportunities. According to Teece (2007), sensing and shaping opportunities requires organizations to “constantly scan, search, and explore across technologies and markets” (Teece, 2007) and therefore incorporates a strong outside-in approach. Hence, the sensing of opportunities may also be especially important to innovation openness aiming at incorporating external information for innovation.

The existing literature on innovation shows studies based on a variety of predictors that promote organizational innovation, including organizational factors such as culture and climate (Baer & Frese, 2003; Choi & Chang, 2009), environmental factors (King & Anderson, 1995; Pierce & Delbecq, 1977), properties of the innovation (Klein & Knight, 2005; Sharma & Yetton, 2003), and individual characteristics and innovation receptivity (Jones, Jimmieson, & Griffiths, 2005; Klein & Sorra, 1996).

In this study, it is analysed the external factor related to the innovation process, that is, the external environment influencing the innovation openness. The environmental pressure or uncertainty and the efficacy or technical advantage of the innovation represent core external conditions to be considered (Klein & Knight, 2005; Pierce & Delbecq, 1977; Sharma & Yetton, 2003).

As a member of a larger system, an organization may not survive without persistently engaging in exchanges of information and resources with its external environment (Cohen & Levin, 1989; Nohria & Gulati, 1996). In this study, the national culture for innovation and access to innovations are seen as characteristics from the external environment that can contribute to innovation openness. The basic assumptions, traditions, beliefs and values, as well as the artifacts that characterize the culture of a company, are always originated from their correspondent national culture (Motta & Caldas, 1997).

Nevertheless, the access to innovations is as important as the national culture. Zhou and Li (2012) pointed out the proactive use of external knowledge to increase innovation success. Although the concept of using external knowledge for innovation activities has not been entirely new it has gained a lot of momentum through the integrative specification by Chesbrough (2003), the author argues that the key to success is a more open view of innovation and that firms “can and should use external ideas as well as internal ones, and internal and external paths to market”.

### **National Culture: Definition and Role**

Many researches have as object the cultural aspect and the behavior of organizations located in different locations. This research field, initiated in Europe has the interest in investigating the cultural contingency and its influence on organizations (Motta, 1997; Freitas, 2007). One of the most cited researches refers to the study developed by Hofstede (1985) who was interested in investigating the different systems of organizational and national values.

According to Hofstede (1985) the foreign subsidiaries of multinational organizations end up reproducing a hybrid organizational culture, reflecting the international organizational culture and local national culture. However, the author reinforces that even among the employees of subsidiaries of the same international business, differences are found in the values of labor relations, although in large international organizations whose culture is well shared, it is possible to identify a similarity among its members, even if from different nationalities. That is, there are similarities that this study seeks to evidence.

The national culture of innovation has relation to cooperation for innovation and development between firms created within a societal context and anticipated that cultural values will affect the organizational form used to pursue innovation. National culture is also alleged to impact the use and nature of cooperation (Steensma et al. 2000). Japan is known as innovative nation and Hill (1995) gives as example Japan's economic success in the 1980s and early 1990s, which has been partly attributed to its value system, which fosters efficient cooperation between firms by reducing transaction costs.

### **Access to Innovation**

The access to innovation is associated with the atmosphere that will help with the growth of innovative and entrepreneurial thinking. Universities and research centers that want to lead their nations forward will need to transform themselves from repositories of knowledge to centers of application of knowledge for the betterment of the human community, for the betterment of their nation, for the betterment of communities (Lane, 2016), furthermore governments can regulate the regional innovation environment by formulating science & technology policies (Wang, Fan, Zhao, & Wang, 2016). So, firms' knowledge networks will often combine relationships characterized by geographical proximity.

According to Fontes and Sousa (2016) recent research has extend the concept of proximity beyond the geographical boundaries; and has started to address the role of non-geographical forms of proximity – social, cognitive, organizational – on knowledge exchange (Broekel & Boschma, 2012). However there still is a limited understanding of how individual firms combine geographical and non-geographical proximity in their knowledge access strategies. Similarly, there is still limited knowledge on whether and how firms use these other forms of proximity to gain access to knowledge sources located at a geographical distance, whose access is recognized to entail greater difficulties (Bathelt, Malmberg, & Maskell, 2004).

### **HYPOTHESIS**

For this study, the main construct (Innovation Openness) refers to questions about how interested companies are for innovation, for instance, if in the countries companies like to experiment new technologies and with new ways of doing things; if innovation is highly valued by companies; and if established companies are open to using new, entrepreneurial companies as suppliers. Openness often refers to an organization's connections to suppliers and customers or being embedded in a network (Laursen & Salter, 2006; Enkel, 2010), thus focusing on an outward view of openness. This understanding of openness focuses mainly on the company's external environment (Nitzsche et al., 2016).

The openness includes all aspects that deal with the company's interaction with external entities. In this vein, researchers have earlier emphasized the importance of the firm's

connections to its environment, through alliances, cooperation or other relations, in several contexts (Mahmood, Zhu, & Zajac, 2011; Verbano et al., 2011; Afuah, 2013). Millson, Raj, and Wilemon (1996) argue that to overcome the limitations of internal resources, firms should make more use of formal or informal partnering arrangements with others to accomplish their innovative goals.

For this purpose, it is measured how much the independent variable, which is national culture for innovation, influence this interest by the companies for innovation, with access to innovation as a mediator variable of this relation. Drawing upon these views of openness in the literature, we express the first dimension of the construct for this study through the underlying cultural aspects of the environment, the national culture. Smale (2016) explores the role of national culture in innovation outcomes and argues that there is sufficient evidence to warrant inclusion of national culture considerations in designing innovation strategy and policy.

The correlation between innovation and national culture has been done by various authors when they argue that human dynamics and national culture play a major role in the efficacy of the innovation process (Frederick & Chittock, 2006; Hofstede, 2001; Shane, 1995), whereas Rank, Pace, and Frese (2004) and Pohlman (2005) observe that creativity and innovation are culturally moderated responses to environmental stimuli. Several studies have explored this relationship between dimensions of national culture and innovation development, sometimes having different conclusions.

To analyze the impact of national culture on process management and technological innovation, Lin (2009) investigated data from 36 considerable car manufacturers in 14 countries. The findings have shown that the dimensions aversion to the uncertainty and long-term orientation of Hofstede's classification significantly and positively affect innovation performance (measured by patents).

After analyzing the relationship between the cultural dimensions of Hofstede and the Global Innovation Index (GII) of 72 countries, Prim, Filho, Zamur and Di Serio (2017) revealed that three cultural dimensions were associated with the results of innovation (technology and creativity), such as individualism, long-term orientation and indulgence. The study showed that the intrinsic values of a national culture can further the innovation development, increasing the competitiveness of countries and organizations.

Chen, Podolski and Veeraraghavan (2017) examined how cultural norms in the dimensions of individualism-collectivism and aversion to uncertainty affect corporate innovation. Considering a sample of 41 countries, the results showed that companies located in countries with higher levels of individualism generate higher impact patents and are more efficient in converting R&D into innovative performance, while companies located in countries with higher levels of Aversion to uncertainty generate less significant patents and are less efficient with their R&D expenditures. In general, the authors have shown that national culture plays an important role in influencing corporate innovation around the world.

In this sense, supported by the literature, the first hypothesis tests the direct relationship between national culture and innovation openness, given the findings of previous studies:

**Hypothesis 1:** The national culture is positively related to innovation openness.

However, even the direct relationship between national culture and innovation openness is evidenced, it is propose that the path leading to openness to business innovation starts with the influence of the national culture, but is enhanced by an environment of access to innovation. Here, the access to innovation through business-to-business co-operation, technology alliances and development partnerships represent the importance of this dimension for the innovation openness.

Given that national culture can be considered a predecessor of access to innovation, Steensma et al. (2000) did a study to determine the effect that national culture has on the propensity for entrepreneurial firms to cooperate with other firms for technological innovation and to use equity ties in the formation of strategic alliances. One of the findings is that national culture directly and indirectly affects the formation of technology alliances. Technology alliances occur when two or more firms contribute their technological expertise to achieve an agreed-upon innovation (Dodgson, 1993), which in turn characterizes the variable of access to innovations.

In this context, the possibility of companies joining different partners emerges through several interorganizational relations strategies, which include networks, alliances, joint ventures and other forms of collaboration (Cropper, 2008; Tidd, Bessant, & Pavitt, 2008) and all those forms can be a good combination along the national culture for the innovation openness.

Referring to the literature, one can understand connectivity in general as a relational capability (Lorenzoni & Lipparini, 1999), thus the same approach can be used to partnering arrangements. In more detail, based on Luhmann (1995), the company's network serves as a kind of external knowledge memory which the company can access through its ability to connect. Building on this definition, the present study follows a very similar understanding of connectivity as openness.

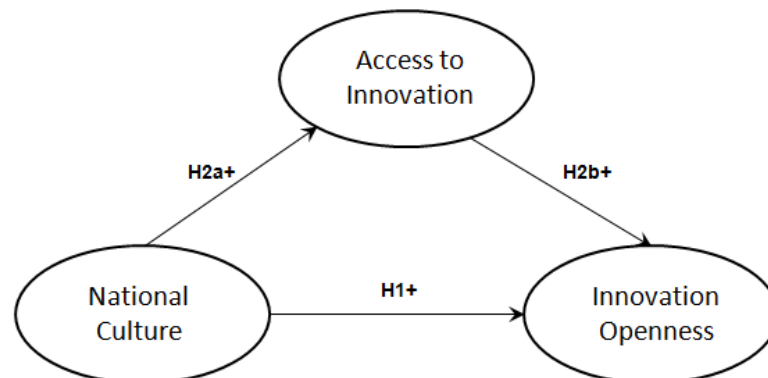
However, according to Smale (2016) the wider innovation ecosystem impacts innovation practice is central to understanding, strategizing and managing the innovation process. Therefore, only the impact of the national culture does not reflect the context of openness to innovation when it does not have an environment with access to innovation composed by partnerships and alliances between different actors. In this sense, there are two hypotheses that express the proposed path to innovation openness in this study:

**Hypothesis 2a:** The national culture is positively related to the access to innovation.

**Hypothesis 2b:** The access to innovation is positively related to innovation openness.

Bellow, it is represented the proposed model of the study with the three hypotheses of the study showing the linkage between national culture and innovation openness (H1), national culture and access to innovation (H2a), access to innovation and innovation openness (H2b), with all the hypotheses having a positive relationship.

Figure 1 presents the proposed model with the hypotheses of the study.



**Figure 1:** Proposed model.

Source: Authors.

## METHODOLOGY

The approach adopted in the article presents quantitative character, through the use of secondary data survey collection method. The database comes from The Global

Entrepreneurship Monitor (GEM) which is the world's foremost study of entrepreneurship. In each economy, GEM looks at the national context and how that impacts entrepreneurship, considering several categories as: Financing for Entrepreneurs; Governmental Support and Policies; Taxes and Bureaucracy; Governmental Programs; Basic School Entrepreneurial Education and Training; Post School Entrepreneurial Education and Training; R&D Transfer; Commercial and Professional Infrastructure; Internal Market Dynamics; Internal Market Openness; Physical and Services Infrastructure; Cultural and Social Norms. For this study it was used the GEM 2013 NES Global National Level Data, the same database used on many other researches published in high-index journals (Alvarez & Urbano, 2011; Turró, Urbano, & Peris-Ortiz, 2014).

Three constructs were used from the base in question that allowed the achievement of the research objectives. These constructs are measured through the Likert scale of five points. At one extreme, one has the value "1", which indicates "strongly disagree" and the other, represented by the value "5", which indicates "strongly agree" (Figure 2).

Construct	Variables
National Culture of Innovation	In my country, the national culture is highly supportive of individual success achieved through own personal efforts.
	In my country, the national culture emphasizes self-sufficiency, autonomy, and personal initiative.
	In my country, the national culture encourages entrepreneurial risk-taking.
	In my country, the national culture encourages creativity and innovativeness.
	In my country, the national culture emphasizes the responsibility that the individual (rather than the collective) has in managing his or her own life.
Access to Innovation	transferred from universities and public research centers to new and growing firms.
	In my country, new and growing firms have just as much access to new research and technology as large, established firms.
	In my country, there are adequate government subsidies for new and growing firms to acquire new technology.
	In my country, the science and technology base efficiently supports the creation of world-class new technology-based ventures in at least one area.
	In my country, there is good support available for engineers and scientists to have their ideas commercialized through new and growing firms.
Innovation Openness	In my country, companies like to experiment with new technologies and with new ways of doing things.
	In my country, innovation is highly valued by companies.
	In my country, established companies are open to using new, entrepreneurial companies as suppliers.

**Figure 2:** Constructs and variables.

Source: Authors.

To test the hypotheses of the study, it was used the data analysis technique of structural equations modeling (SEM) estimated using Smart PLS software version 3.2.4 (Ringle, Wende, & Becker, 2015). The structural equations modeling (SEM) is a multivariate analysis technique, which, based on statistical models, seeks to explain the relations among multiple variables, thus examining a set of relations of dependence simultaneously (Hair Jr., Hult, Ringle, & Sarstedt, 2014).

The minimum sample size was calculated from the software G \* Power 3.1.9.2, indicated for the studies that adopt the modeling of structural equations based on partial minimum squares (Ringle, Silva, & Bido, 2014). To do so, the technical parameters used in the software were as follows: family (F tests), type of statistical test (Linear multiple regression: R<sup>2</sup> deviation from zero), type of analysis (a priori: compute required sample size - given, power, and effect size),



effect size of 0.15, level of significance of the allowed error of 0.05, significance level of 95%, statistical power of 0.80 and 2 as number of predictors. The test delineated a minimum sample of 68 questionnaires and, as presented previously, the final sample of the study was composed of 2.636 valid questionnaires, therefore satisfactory, since it represents almost 39 times the recommended one.

## RESULTS

In this section, it is presented the analysis of validity and reliability criteria concerning the structural equations modeling and in sequence the results obtained by testing the proposed hypotheses. Table 1 presents the coefficients of the validity and reliability parameters of the proposed model. It should be noted that the values of Average Variance Extracted (AVE) above 0.50, Cronbach's Alpha (CA) greater than 0.60 and Composite Reliability (CR) higher than 0.70 that are considered satisfactory (Hair Jr. et al., 2009; Ringle et al., 2014).

**Table 1:** Cronbach's Alpha, Composite Reliability and Average Variance Extracted

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
<b>Innovation Openness</b>	0,681	0,825	0,611
<b>Access to Innovation</b>	0,759	0,837	0,508
<b>National Culture</b>	0,878	0,911	0,672

Source: Authors.

In relation to the discriminant validity of the model, which is understood as an indicator that constructs or variables are independent of each other, the method of Fornell and Larcker (1981) was adopted. According to Table 2, the values of the diagonal in bold (roots of the AVE) are superior to the others ( $R^2$ ), taking into account the prerogatives of this method that validates the existing difference between the considered constructs.

**Table 2:** Discriminant Validity Fornell-Larcker Criterion (1981)

	Innovation Openness	Access to Innovation	National Culture
<b>Innovation Openness</b>	<b>0.782</b>		
<b>Access to Innovation</b>	0.358	<b>0.713</b>	
<b>National Culture</b>	0.373	0.340	<b>0.820</b>

Source: Authors.

Other adjustment indexes of the model were also satisfactory given the nature of the study, according to Table 3. The coefficient of determination of Pearson ( $R^2$ ), in the scale proposed by Cohen (1988) for the area of social and behavioral sciences, when it presents value of 2% should be classified as small effect, 13% as medium effect and 26% as large effect (Ringle et al., 2014). Among the constructs, the greatest effect was found in Innovation Openness (20%), while the lowest, in the construct Access to Innovation (11%).

**Table 3:** R Square ( $R^2$ ), Crossvalidated Communalities ( $f^2$ ), Crossvalidated Redundancy ( $Q^2$ )

	$R^2$	$f^2$	$Q^2$
<b>National Culture</b>	*	0.489	*
<b>Access to Innovation</b>	0.116	0.278	0,054
<b>Innovation Openness</b>	0.200	0.248	0.116

Source: Authors. \* Not applied (explanatory variable)

In the analysis of how much each construct is "useful" to fit the model ( $f^2$ ), the National Culture has a value superior to large (35%) and the other constructs showed closer to the value considered large than the value considered average (15%) in the classification of Hair Jr. et al. (2009). Finally, as to the accuracy of the adjusted model, the constructs obtained Crossvalidated Redundancy ( $Q^2$ ), as they presented values of  $Q^2 > 0$  (Ringle et al., 2014).

In the last analysis, it was done the mediation (M) verification tests of the proposed model with the latent variables, national culture → | access to innovation | → innovation openness, representing the proposed path by hypotheses H2a and H2b. The statistical term mediation is used to indicate that the effect of an independent variable (IV) is transmitted to a dependent variable (DV) through a third mediator variable (M). Therefore, statistical mediation refers to a causal sequence, such as IV → M → DV (Merino & Román, 2013).

A mediating variable is very useful in helping to understand the mechanism by which a cause (independent variable) produces an effect (dependent variable). In order to verify the model mediation, the chosen method is the analysis of the paths, which according to Vieira (2009), was initially suggested by Judd and Kenny in 1981 and improved by Baron and Kenny a few years later. The assumption is that four conditions are necessary for which there is mediation: (1) the independent variable significantly affects the mediator; (2) the independent variable significantly affects the dependent variable in the absence of the mediator variable; (3) the mediator has a unique significant effect on the dependent variable; (4) the effect of the independent variable on the dependent variable weakens at the moment of the addition of the mediator variable. At this point, if any of the two relations, IV → M or M → DV, is not significant, it must be concluded that there is no mediation.

As a way of complementing the path analysis, the Sobel test was performed to verify if the mediator variable carries significantly the influence of the independent variable for the dependent variable, that is, if the indirect effect of the independent variable on the dependent variable through the mediator variable is significant (SOPER, 2013). A second type of test for mediation analysis is the Arovia test. Based on the Sobel test, this test includes the addition of one more term, termed as the multiplication of errors squared (Vieira, 2009).

The variance accounted for (VAF) determines the size of the indirect effect in relation to the total effect. Thereby, it shows how much of the dependent variable's variance is explained by the indirect relationship via the mediator variable. If the finding value is under 20% that means there is no mediation. If the value is between 20% and 80% it is noticed a partial mediation of the relationship. And if the obtained value is above 80% one can assume a full mediation (Hair Jr., 2014).

Table 4 presents the results and mediation analyzes of the model proposed in the article.

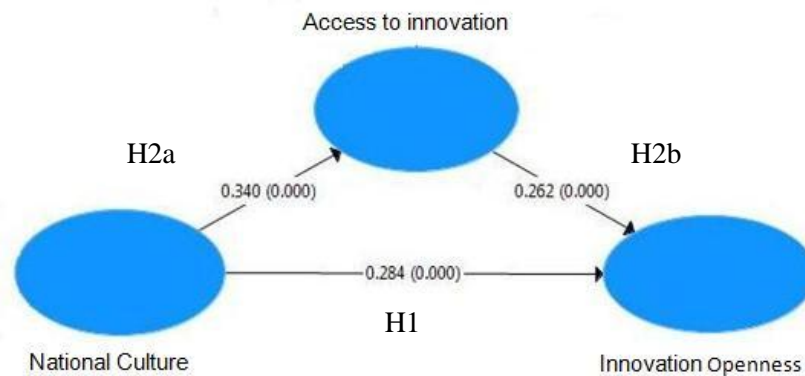
**Table 4:** Test and mediation analyzes of the proposed model.

Condition	Independent	Dependent	R <sup>2</sup>	β Path Coefficients	Sobel	Arovia	VAF
<b>Isolated</b>	National Culture	Access to Innovation	0.117	0,341*	11.14	11.13	0.239
	National Culture	Innovation Openness	0.139	0,373*			
	Access to Innovation	Innovation Openness	0.129	0,359*			
<b>Joint</b>	National Culture	Access to Innovation	0.116	0,340*	11.14	11.13	0.239
	Access to Innovation	Innovation Openness	0.200	0,262*			
	National Culture	Innovation Openness	0.200	0,284*			

Source: Authors. \* significance level p < 0,001

## DISCUSSION

The results show that the national culture for innovation is associated with the innovation openness, and the access to innovation has influence on the association. The final model after the tests of the hypotheses and other associations is presented in Figure 3.



**Figure 3:** Results of the tests of the proposed hypotheses.

Source: Authors. Note: (0.000) is the significance level.

Following, after verifying the assumptions and indexes of fit of the model, the results of the tests of the proposed hypotheses are presented. Table 5 shows the significance of the hypotheses H1, H2a and H2b.

**Table 5:** Hypotheses test of the study

Hypotheses and relationship between constructs	Outcome
<b>H1: National Culture → Innovation Openness</b>	Supported
<b>H2a: National Culture → Access to Innovation</b>	Supported
<b>H2b: Access to Innovation → Innovation Openness</b>	Supported

Source: Authors.

The first hypothesis was supported and established that H1: The relation between national culture and innovation openness. According to table 4 and 5, in the isolated condition, the national culture is associated to innovation openness with  $\beta$  coefficient 0,373, with significance level  $p < 0,001$  and the coefficient of determination of Pearson 13,9% ( $R^2$ ). This result agrees with several studies made previously (Frederick & Chittock, 2006; Hofstede, 2001; Shane, 1995) about the relationship between innovation and national culture. Besides that, the result corroborates with authors, such as Chen, Podolski and Veeraraghavan (2017) showing that national culture has an important role in influencing the innovation process.

The hypothesis H2a: The national culture is positively related to access to innovation, was supported. According to Table 4 and 5, in the isolated condition, the national culture is associated to access to innovations with  $\beta$  coefficient 0,341, with significance level  $p < 0,001$  and the coefficient of determination of Pearson 11,7% ( $R^2$ ). This finding is in accordance with Smale (2016) by showing that the national culture has a fundamental role for the dissemination of innovation at the national level. Therefore, the national culture has its contribution to build access to innovations through cooperative alliances and this way it plays an important role to facilitate innovative practices (Steensma et al., 2000).

The hypothesis H2b: The access to innovation is positively related to innovation openness, was supported as well. According to Table 4 and 5, in the isolated condition, the access to innovation is associated with innovation openness, showing  $\beta$  coefficient 0,359, with significance level  $p < 0,001$  and the coefficient of determination of Pearson 12,9% ( $R^2$ ). Since interorganizational relationships manifest themselves in different ways (Cropper, 2008; Tidd, Bessant, & Pavitt, 2008), the environment becomes more propitious for companies to gain openness to innovation. Hence, in this context of greater ease of access to external resources, as advocated by the theoretical strand of open innovation (Chesbrough, 2003), organizations become less resistant to the uncertainties that avoid the creation of innovation openness.

The mediation analysis comprised the path analysis, the Sobel test and Arovia test. From the path analysis, the mediation process was confirmed, whereas the four conditions of the technique were satisfied. The effect of the independent variable upon dependent variable decreased when the mediator variable was added, reducing from  $\beta = 0.373$  in the isolated perspective to  $\beta = 0.284$  in the joint condition.

To complement the path analysis, the Sobel test also reiterated mediation, as it has presented the value 11.14 (Table 4), with significance level  $p < 0.001$ . Furthermore, the Arovia test also has confirmed the mediation relation as its value (11,13) presenting the same level of significance for  $p < 0.001$ . Finally, the VAF resulted was 0.239 what characterizes a partial mediation. Both tests supported the mediation by means of the hypothesis H2a and H2b.

Given the different factors that may be precedent for the decision to open up to business innovation (Choi & Chang, 2009; Klein & Knight, 2005; Jones, Jimmieson, & Griffiths, 2005), the external factors become underlying (Nitzsche et al., 2016), represented by environmental pressure or uncertainty and the efficacy or technical advantage of the innovation (Pierce & Delbecq, 1977; Sharma & Yetton, 2003). Both the national culture and the access to innovation represent external aspects, so the second is relevant for enhancing the effect on openness to innovation from a national culture that favors creativity, entrepreneurship and development based on innovation. Only national culture has a limited effect on the configuration of innovation openness, so if there is no access to knowledge and new technologies through alliances and partnerships, innovation openness gets restricted to some organizations.

## **CONCLUSION**

The objective of the study is to verify whether the relationship between national culture and innovation openness is mediated by the access to innovation, the results confirmed the proposed hypotheses. Thereby the national culture has its importance for innovation openness, but the access to innovations has the power of complement this relationship to a better innovative environment.

Findings from this study have two contributions. The first one was the advanced analysis of the determinants for innovation openness, since this phenomenon is recent and has been evidenced as important by several authors (Chesbrough, 2003; Zhou & Li, 2012) in this way the study tested empirically some of these determinants.

The second contribution reveals the importance of two prior aspects for innovation openness: national culture and access to innovation. Trompenaars (2007) writes about the importance of national culture into the management of creativity and innovation, that identifies which groups will provide supportive cultures for the innovation process. If the national culture is innovative, companies tend to adhere to this type of culture and consequently become more susceptible to innovation openness because institutional arrangements, financial systems, attitudes to risk and failure, and so on are all functions of national culture (Spolaore & Wacziarg, 2010), institutions performing the innovation process are inevitably impacted by that environment (Smale, 2016).

In more detail, this study conceptualizes openness to innovation as consisting of the national culture and access to innovation as mediator. The role of access to innovation evidenced by partnerships (Luhmann, 1995; Lane, 2016) has a greater meaning on the innovation openness because provide many resources as information access, infrastructures and knowledge transfer to improve and benefit the innovation process.

Summing up, the openness to innovation is a product of both the innovation infrastructure (access) and the environment for innovation (culture) in comparison with the “innovative capacity” mentioned by Furman, Porter, and Stern (2002). This also supports maintaining

national culture in practice for the innovation openness context that aligned with the access to innovation can promote and complement this purpose. Overall, managers should not consider the confirmed factors as individual measures but rather in an integrated manner, as a whole.

For future research, aiming to overcome some limitations of this study, it is recommended testing in different empirical contexts considering the distinction between developed and emerging markets, or sectors, or even testing a joint analysis with internal factors. Furthermore, while also both the national culture and access to innovation show notable effects on openness to innovation practices, they can involve a high degree of novelty together, so it would be interesting to identify whether the innovations from this openness are more disruptive or incremental compared to innovations developed internally.

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