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Market Orientation and Sources of Knowledge to Innovate in SMEs: A Firm Level Study

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Abstract: This work examines the relationship between the three market orientation (MO) components, i.e. customer orientation, competitor orientation and inter-functional coordination, and the extension to which small and medium-sized enterprises (SMEs) use different sources of knowledge to innovate. Based on a sample of 181 Chilean SMEs, a confirmatory factorial analysis (CFA) was performed to analyze the relationship among constructs. The results show that the extension to which SMEs use different sources of knowledge to innovate depends on the interactions between MO components. This study addresses a gap in the literature, by linking and interrelating market orientation components to the innovation perspective in SMEs. Therefore, we provide insights into the role of each MO component in influencing the extension to which firms seek for and use different sources of knowledge to innovate and attempt to explain some literature inconsistencies on the theme.

Keywords: market orientation; sources of knowledge; innovation; small and medium-sized enterprises.

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Introduction

The development of a theoretical body on the market orientation (MO) theme addresses questions to "if", "when", and "how" MO affects business performance. Answer as to "if" MO affects performance seems to be confirmed, since a majority of research into this question has delivered positive results. These results show that MO enables improvements in business performance and that these results occur "when" corporate culture, internal conditions and capabilities combine to provide for MO development (Day, 1994). However, it is yet to be seen whether this improvement comes directly from MO or is moderated by other organisational practices and actions; i.e., "how" MO affects performance (Langerak, 2003).

From this perspective, the moderating role of innovation has been studied by various researchers in a variety of countries (Lukas & Ferrell, 2000; Im & Workman, 2004; Laforet, 2008). In general, studies focus on identifying the relationship between MO and innovation results, or further verify what cultural characteristics and internal capabilities facilitate innovation in organizations with a market orientation, as in innovativeness and the capacity to innovate (e.g. Gatignon & Xuereb, 1997; Kirca et al., 2005).

Despite some discordant findings, studies of this issue have demonstrated that MO has a positive impact on innovation outcomes. Assuming that the customer orientation – and the close relationship with them – is one of the components of market orientation (Narver & Slater, 1990), the results from marketing literature can be partially corroborated and reinforced in the literature of innovation in SMEs as well. For instance, findings of Kaminski et al. (2008) indicate that SMEs essentially collaborate with their clients for innovation. However, the mechanisms as to how the three market orientation components achieve these positive outcomes are less well conceptualized (Smirnova et al., 2011). Taking the three major MO components suggested by Narver and Slater (1990) i.e., customer orientation, competitor orientation, inter-organisational coordination, some inconsistencies has been observed in researches in terms of their influence on innovation (Lukas & Ferrell, 2000; Grinstein, 2008). Considering the component-wise approach to the MO construct one possible explanation of these discrepancies may refer to methodological deficiencies (Tsiotsou, 2010). Although the distinctive role of different MO components in innovation results and/or organisational performance has been admitted by marketing scholars (Lukas & Ferrell, 2000) the MO component-wise approach is not usually treated in empirical studies (Tsiotsou, 2010).

Among studies however, that do consider the component-wise approach, most of them consider that MO components are independent from each other and focus on their direct effect on innovation outcomes and/or organisational performance without examining possible indirect influences (Lukas & Ferrell, 2000; Smirnova et al., 2011). Other component-wise approaches are confined to certain dimensions of MO such as competitor and/or customer orientation (see Gatignon & Xuereb, 1997).

Taking into account the contradictory findings regarding the MO role in affecting innovation results and/or organisational performance, a deeper examination of the dynamics of the MO components becomes imperative (Tsiotsou, 2010). As noted by Han et al (1998, p.41) "it may be useful to take a component-wise approach to the MO construct, because the roles of different MO components may vary, contingent on the types of innovation strategies and turbulences present in the environment". Although the incomplete analysis

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of the component-wise MO approach has recently captured the attention of some scholars (Tsiotsou, 2010), further research is needed to understand the routes through which MO components influence innovation outcomes. To date, the role of MO components in supporting the initial forces leading to firm innovation has been little studied, especially in small and medium sized enterprises (SMEs). To the author's knowledge, no component-wise approach has examined the indirect influences of the three components of MO on innovation activities in the SMEs context. As Laforet (2008) noted, researchers often examine innovation in the context of large firms and overlook innovation within SMEs. As such, much remains unknown about the ingredients needed for successful innovation in smaller and medium sized firms. Seeking for sources of knowledge for innovation is one of the first stages of the innovation process in firms, which is a crucial decision for firms to engage in innovations (Hashi & Stojcic, 2012). In doing so, firms establish partnerships with suppliers, customers, universities, and others external and internal agents (Löof & Heshmati, 2002). Market-oriented firms could develop these partnerships in a successful way as these firms are more able to capture the market demands in terms of customer needs, competitor strategies and so forth (Kirca et al., 2005). Thus, market orientation could favour the firm activity related to seek for sources of knowledge for innovation, one aspect that has not been sufficiently explored in previous researches.

This research addresses these questions by examining the direct and indirect influences of the three major market orientation components on the knowledge for innovation in SMEs. Specifically, the objectives of this article are (a) to examine the direct and indirect effects of each market orientation component on sources of knowledge for innovation in SMEs, and (b) to investigate how MO components relate to one another in order to influence these innovation activities. Based on previous literature about innovative characteristics of firms (Löof & Heshmati, 2002; Hoffman et al, 1998), we consider the sources of knowledge for innovation as the different sources that firms use to capture ideas to innovate, both internal and external to organisation.

This study differentiates from previous studies relating market orientation with firm innovation, and thus contributes to expanding the existing literature in several ways. Firstly, it treats the three market orientation components as separate constructs and examines both their direct and indirect links to innovative initiatives in SMEs. As stated by Han et al. (1998) and Langerak (2003), the market orientation literature remains incomplete if studies do not explore how MO influences the firm 's overall performance. Specifically, a componentwise approach of the MO construct is important to the understanding of how MO works to influence innovative initiatives of the firms. This goes along with the assumption that the roles of different MO components may vary, contingent on the types of innovation strategies (Han et al., 1998). Furthermore, Langerak (2003, p. 460) notes that "although being market-oriented may lead to general benefits for the firm's marketing activities, the ability to develop and market innovations may be critical". This includes understanding the role of MO components in influencing innovation initiatives in firms. Secondly, this is one of the first studies which considers competitor orientation and inter-functional coordination as antecedents of customer orientation which in-turn is a mediator in the relationship between these two market-oriented components and innovative initiatives. A recent study considers this perspective in the service industry and applies the same Slater and Narver (1994) conception about MO (see Tsiotsou, 2010). Thirdly, this study relates MO to the initial actions that companies take on the path to innovation, an aspect that has been ignored on the whole in research. According to Hashi and Stojcic (2012), the probability that an organization will decide to innovate, which is the first stage of the process, increases the extent to which it improves its market orientation. Identifying the role take by MO components in this initial stage of the innovation process contributes to a deeper understanding of the theme and complements previous studies. Fourthly, it expands on the pool of knowledge about the initial context surrounding innovation in SMEs, under the perspective of market orientation. As stressed by Laforet (2008), literature on SME innovation is fragmented and generally concentrates on singular case studies or qualitative interviews with executives. Furthermore, the work in this area focuses mainly on firm-specific innovation characteristics instead of the strategic and market orientation of the firm (Salavou et al., 2004).

The article thus proceeds in the following manner. In the next section, we present the theoretical framework and the study hypothesis of the research, followed by the methodology. Subsequently, we present the analysis and discussion of the results found and finally, we present the managerial implications based on the results and limitations of the study as well as future research directions.

Theoretical Background and Study Hypotheses

Market oriented firms respond better to the requirements of their customers through the information obtained from the market and shared within the firm in a coordinated manner (Kohli & Jaworski, 1990). Market orientation is considered as an internal capacity of the enterprise and that is difficult to imitate (Day, 1994), as well as orienting the enterprise toward the search for growth opportunities and reduce the response time to these opportunities (Kirca et al., 2005). According to Narver and Slater (1990), market orientation consists of three behavioural components: customer orientation, competitor orientation, and inter-functional coordination. Customer orientation emphasizes the role of sufficiently understanding one's target customers in order to be able to create superior value for them, competitor orientation suggests that firms understand the short-term strengths and weaknesses and long-term capabilities and strategies of both key current and potential competitors, inter-functional coordination focuses on the coordinated utilization of company resources in creating superior value for target customers (Narver & Slater, 1990). Each of these components are engaged in intelligence generation, dissemination, and responsiveness (Han et al., 1998).

Market orientation is highlighted as a determining factor and the foundation for a company's innovation efforts (Salavou, et al., 2004; Hashi & Stojcic, 2012). Deepening this perspective in the context of small and medium enterprises, results obtained from the study by Verhees and Meulenberg (2004) signal that the basis for the

relationship between MO and innovation in SMEs is innovativeness: the initial efforts taken towards innovation are defined by a company's innovativeness, which positively influences market orientation and innovation. Innovativeness is understood as: "the notion of openness to new ideas as an aspect of a firm's culture" (Hurley & Hult, 1998, p.44). If, on one hand, innovativeness favours an organization's ability to successfully adopt or implement new ideas, processes or products, and on the other hand, is related to MO (Hurley & Hurt, 1998) it can be assumed that market orientation at least partially engenders a propitious environment for innovation and favours its initial stages. In fact, Hashi and Stojcic's results (2012) demonstrate that MO has a positive influence in a firm's decision to engage in innovation.

Traditionally, the literature has assumed that MO is an unidimensional construct and/or consider that the three components contribute equally to the construct (Narver & Slater, 1990; Slater & Narver, 1994). However, this perspective does not exclude the assumption that the three elements of market orientation may be interrelated (Kohli & Jaworski, 1990).Thus, the understanding of how market orientation affects other organisational processes and/or performance implies a detailed inspection of the mechanism responsible for transforming market orientation into superior performance (Han et al., 1998; Tsiotsou, 2010).The comprehension of how MO operates includes the understanding of causal relations between their three dimensions and the examination of both direct and indirect effects on performance (Tsiotsou, 2010).

Taking into account a component-wise approach for MO, the direct effect of each MO component on innovation is somewhat contradictory in the literature. Results from some researchers suggest that only customer orientation and/or competitor orientation affect innovation performance (Han et al., 1998; Lukas & Ferrell, 2000; Smirnova et al., 2011). Discordant findings also suggest a positive or a negative impact of inter-functional coordination on innovation consequences (Grinstein, 2008; Im & Workman, 2004).

Considering the indirect effect, previous literature highlights that customer orientation and/or inter-functional coordination could improve the impact of competitor orientation on performance results, including with it a new successful product (Smirnova et al., 2011; Grinstein, 2008). In the current study, it is contended that there is a causal relationship between MO components which in turn affects the early innovative efforts of organisations. We expect that customer orientation directly influence the intensity to which firms use sources of knowledge for innovation. We also expect that competitor orientation influence inter-functional coordination and customer orientation and, through them, influence the intensity to which firms use sources of knowledge for innovation. These linkages will be detailed in the following paragraphs. The model is illustrated in Figure 1.



Regarding the relationship between customer orientation and innovation consequences, the findings of Han et al. (1998) revealed that customer orientation is highly and positively significant for organisational innovativeness. As noted by Han et al. (1998), MO facilitates an organisational innovativeness which, in turn, positively influences its business performance. Customer orientation is the dominant factor responsible for this meditational phenomenon (Han et al., 1998). Grinstein's (2008) results for a meta-analysis about the effect of market orientation and its components on innovation consequences reinforce this perspective by confirming that customer orientation can be successfully used to develop innovative products. The findings of Frambach et al. (2003) also confirm that customer orientation has a positive influence on new product activity.

In spite of having some inconsistent results regarding the effect of customer orientation on innovation outcomes, the common view held in the marketing literature is that customer orientation enhances innovativeness because it involves doing something new or different in response to market conditions (Jaworski & Kohli, 1993). It has also been considered the most fundamental aspect of corporate culture and the fundamental element of a customer value strategy (Tsiotsou, 2010). In addition, the view is that customer orientation provides the foundation for a sustainable competitive advantage and contributes to firm performance (Kohli & Jaworski, 1990). Furthermore, customer-oriented firms generate new ideas and products aimed at satisfying customer needs and often work closely with customers in the early stages of the new product development process (Slater & Narver, 1998). In addition, customer orientation enhances innovativeness because it involves doing something new or different in response to market conditions (Jaworski & Kohli, 1993). Also, the literature about innovation in SMEs reiterates that cooperation with clients, which is a natural consequence of customer orientation, provides an important support to innovation of products and processes in those firms (Bigliardi et al., 2011). For instance, in studying Italian SMEs, Bigliardi et al., 2011, p.90) demonstrated that "innovations have been mainly obtained through know-how of users".

In line with these arguments, and considering that the initial stages of innovation involve sources of knowledge for innovation including cooperative arrangements with domestic suppliers, international research institutes, customers, trade fairs, universities, firm's internal resources (Hashi & Stojcic, 2012; Löof & Heshmati, 2002), we propose the following hypothesis:

 H_1 : Customer orientation affects directly and positively the extension to which firms use different sources of knowledge for innovation.

Competitor orientation complements customer orientation in creating value for customers and in allowing customer-oriented firms to satisfy demand and serve the needs of their customers better than their competitors (Tsiotsou, 2011). Defined as "understanding the short-term strategies of both the key current and the key potential competitors" (Narver & Slater, 1990, p.22), competitor orientation is considered a prerequisite of customer orientation (Day, 1994). The findings of Frambach et al. (2003) confirm this statement showing that competitor orientation depends on customer orientation to enhance new product activity. Testing the direct effect of competitor orientation on customer orientation, Tsiotsou (2010) showed that competitor orientation has a strong impact on customer orientation. Based on these statements, it is predicted that:

H_2 : Competitor orientation has a positive effect on customer orientation.

A recent meta-analysis about the effect of market orientation and its components on innovation consequences showed that the positive effect of competitor orientation on innovation consequences depends on a minimum level of customer orientation (Grinstein, 2008). This suggests that a balanced mix of competitor and customer orientation is needed to improve innovation in firms. In their study, Gatignon and Xuereb (1997) showed that both orientations are combined to technological orientation for designing innovations which have a strong relative advantage. Lukas and Ferrell (2000) examined the direct effect of competitor orientation on product innovation and indicated that a greater emphasis on that orientation increases some types of product innovation. On the contrary, Han et al. (1998) and Frambach et al (2003) revealed a negative influence of competitor orientation on innovation results. In fact, the findings of Frambach et al (2003) revealed that competitor orientation only influences new product activity indirectly via customer orientation. Considering new product performance as a measure of business performance, Smirnova et al. (2011) suggest that the direct and positive effect of competitor orientation on business performance is complemented by the indirect effects of customer orientation and inter-functional coordination. Therefore, we propose that:

 H_{3} : Competitor orientation influences indirectly and positively the extension to which firms use different sources of knowledge for innovation via customer orientation. Inter-functional coordination is characterized by the level of interaction of information sharing and coordination between all organisational departments (Narver & Slater, 1990; Im & Workman, 2004). Thus, the specific aspects of the structure of an organisation are responsible for facilitating the communication amongst the organisation's different functions (Gatignon & Xuereb, 1997). Considering that the three market orientation components may be interrelated, the findings of Gatignon and Xuereb (1997) demonstrate that inter-functional coordination is the mechanism which enables customer orientation, competitive orientation and technological orientation in an organisation. In line with this, and as result of field interviews with business executives, Kohli and Jaworski (1990, p.3) argue that "it is critical for a variety of departments to be cognizant of customer needs". The recent study developed by Tsiotsou (2010) has supported this statement. Examining the causal relations between the three MO components in the service industry, Tsiotsou (2010) showed that inter-functional coordination has a positive effect on customer orientation. Hence, our fourth hypothesis states that:

H_{4} : Inter-functional coordination influences positively and directly customer orientation.

Functional coordination plays a "crucial role in new product development" (Homburg et al., 2004, p.1334). Whilst considering different perspectives, many studies have explored the implications of organisational characteristics on innovation. Research studies include inter-functional coordination as an element that may influence the innovation consequences (Grinstein, 2008). However, some studies have not found this positive influence (Han et al., 1998; Lukas & Ferrell, 2000).

In a meta-analysis about the effect of market orientation and its components on innovation consequences, Grinstein (2008) has found that inter-functional coordination is positively related to innovation consequences. On the other hand, the findings of Lukas and Ferrel (2000) showed that inter-functional coordination is not related to new-to-the-world products. Likewise, Han et al. (1998) found that inter-functional coordination is not related to organisational innovativeness. Despite these discordant findings, marketing researchers agree that inter-functional coordination is important to organise the internal efforts for innovation (Gatignon & Xuereb, 1997; Kohli & Jaworski, 1990). Therefore, it is reasonable to suppose that the positive influence of inter-functional coordination on customer orientation (Tsiotsou, 2010) may result in an indirect and positive influence on the early efforts to innovate. This is due to the fact that customeroriented firms often work closely with customers in the early stages of the new product development process (Slater & Narver, 1998). Thus, we propose:

 H_{s} : Inter-functional coordination affects indirectly and positively the extension to which firms use different sources of knowledge for innovation via customer orientation.

Inter-functional coordination is understood as "the process that assimilates the results of being customer and competitor oriented and allows coherent action" (Wooldridge & Minski, 2002, p.31). Thus, competitor orientation is expected to influence positively the interfunctional coordination (Tsiotsou, 2010). This assumption may be reasonable because companies need to disseminate knowledge about their competitors throughout all business units and departments (Tsiotsou, 2010). As highlighted by Kohli and Jaworski (1990, p.5), "market intelligence must be communicated, disseminated, and perhaps even sold to relevant departments and individuals in the organization." Literature points out some evidence of the relationship between competitor orientation and inter-functional coordination. Using a Narver and Slater (1990) scale for MO, Tsiotsou (2010) proved the positive influence of competitor orientation on inter-functional coordination. Therefore it is reasonable to predict that:

$H_{\rm s}$: Competitor orientation has a direct and positive effect on inter-functional coordination

According Miller (1987, p.60), the introduction of new products "creates the need for more scanning of markets to discern customer requirements, the analysis and discussion of this information in group decision-making sessions which bring to bear marketing, R&D, engineering, production and finance perspectives". Two perspectives can be considered from this statement. First, the interfunctional coordination has an important role in mediating the intra-organisation efforts for innovation. In fact, inter-functional coordination may promote innovativeness in the organisation as it "involves open generation and sharing of new ideas, resolution of problems and disagreements by means of non-routine methods and different frames of reference" (Im & Workman, 2004, p.118). Second, inter-functional coordination is closely related to customer orientation and competitor orientation in promoting the initiatives for innovation in firms (Kohli & Jaworski, 1990). Considering that: (a) competitor orientation affects positively the inter-functional coordination (Tsiotsou, 2010); (b) inter-functional coordination plays an important role in promoting the innovation in firms (Grinstein, 2008); (c) customer orientation is important to generate new ideas and products aimed at satisfying customer needs, it is reasonable suppose that:

 H_{τ} : Competitor orientation influences indirectly and positively the extension to which firms use different sources of knowledge for innovation via inter-functional coordination and customer orientation

Methodology

The data used in this study were taken from the database of the project 'Demography of the Regional Small and Medium size Enterprises', undertaken by researchers at the Entrepreneurship and SME Center at Universidad Católica del Norte, Chile. The current database utilizes a sample of 550 micro and small to medium-sized companies in the district of Antofagasta, northern Chile. The data was collected via a cross-sectional survey and the respondents were the owners of the firms. Overall, owners are the decision makers in SMEs and they are able to respond about strategic questions. The criterion adopted for the definition of SME was the sales volume of each company, according to the government criterion in Chile. In accordance with this criterion, a SME has an annual sales volume of no less than US\$ 86,970.00 and no more than US\$ 3,623,763.00 (reference values in Chilean pesos, the national currency, converted to US dollars according to the exchange rate of 31th August, 2015). Considering this criterion and excluding micro firms and missing values, an initial sample of 325 SMEs was considered for this study. From that sample, we excluded SMEs which had not revealed investments in innovation relation to the development of new or improved products and/ or processes. Following this criteria, a final sample of 181 SMEs was usable for analysis.

Four constructs were considered in the measuring model: market orientation – represented by it three dimensions - (1) customer orientation - CUSTOR; (2) competitor orientation - COMPOR; (3) inter-functional coordination - COORD; (4) sources of knowledge for innovation - KNOWINN. Sources of knowledge for innovation were represented by six variables that corresponded to the extension to which companies use different sources of innovation (Hashi & Stojcic, 2012) – which includes customers, suppliers, competitors, firm's internal sources, fairs and exhibitions, universities and research centres. Market orientation components were assessed using Narver and Slater's (1990) measure, MKTOR. All constructs were measured in a continuous scale of seven points, ranging between the extremes of 'never' and 'always'.

In order to ensure statistical significance in the model, adjustments were made to the dimensions of the constructs. Three items were eliminated from the market orientation scale. Therefore, the final MKTOR measure resulted in twelve items that were grouped into the three market orientation components (customer orientation = five items; competitor orientation = four items; inter-functional coordination = three items).

Shorter versions of MKTOR have been previously utilized (see Tsiotsou, 2010) without diminishing the validity of the measure. Two items were also removed from the construct "sources of knowledge for innovation" considering the adjustment of the scale to the specific context of the analysis. The items exhibited low loadings and were eliminated to ensure statistical significance. The final model was represented with sixteen items (twelve items for the market orientation components; four items for the sources of knowledge for innovation).

Results

Confirmatory factorial analysis (CFA) using AMOS 16.0 was applied to verify the relationship among constructs, after verifying the reliability of the scale with Cronbach's alpha. Convergent and discriminant validity was verified using the procedures recommended by Fornell and Larker (1981). Table 1 shows the results of Cronbach's alpha, average variance extracted (AVE) and discriminant validity of constructs. Table 1. Results of Cronbach's Alpha, Convergent and Discriminant Validity

	А	AVE	1	2	3	4
1. Customer Orientation	0.71	0.52	0.72			
2. Competitor Orientation	0.81	0.53	0.53	0.71		
3. Interfuncional Coordination	0.73	0.51	0.67	0.45	0.73	
4. Sources of Knowledge for Innovation	0.67	0.63	0.45	0.47	0.34	0.79

Note: Bold numbers on the diagonal show the squared root of AVE

Overall, the results showed in Table 1 are above the recommended threshold values of .70 for Cronbach's alpha and .50 for AVE (Bagozzi & Yi, 2012) with exception of the construct 'sources of knowledge for innovation' that presents a relatively low alpha. However, it was decided to maintain

the variables with the objective of better capturing the relationships among the studied dimensions. Additionally, discriminant validity was examined using the square root of AVE and cross-loadings as recommended by Fornell and Larcker (1981). As shown in Table 1, the AVE square root values were greater than the correlation with other latent variables, which suggest discriminant validity in the model (Fornell & Larcker, 1981).

We also examined the data for empirical evidence of common method bias by applying the single-common-method-factors approach, as recommended by Podsakoff et al. (2003). The results revealed all item loading significantly on its intended theoretical construct, with no load in the unmeasured methods factor.

The model with final adjustments (Figure 2) showed good fit indices (CFI = 0.932, GFI = 0.906, RMSEA = 0.052) (Bagozzi & Yi, 2012). The relationships were calculated considering the direct and indirect effects among the constructs.





Table 2 shows the standardized results for the testing hypotheses.

Hypothesis				Path				Coefficient	p-values	Accept/Reject
H_1	CustOr	>	KnowInn					.534	.014	Accept
H_2	CompOr	>	CustOr					.383	.040	Accept
H_3	CompOr	>	CustOr	>	KnowInn			.205	.003	Accept
H_4	Coord	>	CustOr					.505	.014	Accept
H_5	Coord	>	CustOr	>	KnowInn			.269	.011	Accept
H_6	CompOr	>	Coord					.450	.013	Accept
H_7	CompOr	>	Coord	>	CustOr	>	KnowInn	.121	.003	Accept

Table 2. Results for Relationship between MO Components and Knowledge for Innovation

According to the results (see Table 2), the extension to which firms use different sources of knowledge for innovation is directly and positively influenced by customer orientation as predicted in H₁. The coefficient of 0.534 and p-value of .014 (p<0.05) confirm this relationship. This result indicates that customer oriented companies are engaged in action that target innovation, coming from searches for sources of information and knowledge that stimulate the development of new products and/or services. Such behavior reflect the initiative of generating new ideas and products aimed at satisfying customer demands, which is typical in a customer oriented firm (Slater & Narver, 1998; Kohli & Jaworski, 1993). In this process, customer oriented firms often work closely with customers in the early stages of the new product development process (Slater & Narver, 1998). Also, this result corroborates the evidences founded by Han et al. (1998), Grinstein (2008) and Frambach et al. (2003). These authors analysed different perspectives of innovation and their relationships with MO components and found a positive relationship between constructs. Han et al. (1998) found a positive relationship between customer oriented and organisational innovativeness. Grinstein's (2008) results for a metaanalysis about the effect of market orientation and its components on innovation consequences revealed that customer orientation influence positively the development of innovative products. Frambach et al (2003) confirmed that customer orientation has a positive influence on new product activity. Similarly, the literature about innovation in SMEs highlights that cooperation with clients plays an important role in providing know-how to SMEs that, in turn, translates in successful innovations (Bigliardi et al., 2011).

Taking into account the causal relationships between MO components, the results shown in Table 2 also indicate that competitor orientation has a positive influence on customer orientation. The coefficient of 0.383 and p-value of 0.040 (p<0.05) confirm H₂, revealing that competitor orientation has a role in enhancing customer orientation. In this perspective, competitor orientation is a prerequisite of customer orientation (Day, 1994) and complements customer orientation in creating value for customers (Tsiotsou, 2010). Furthermore, competitor orientation influences indirectly and positively the extension to which firms use different sources of knowledge for innovation via customer orientation, as hypothesised in H₂. The coefficient of 0.205 and the highly significance level of 99% (p-value = 0.003) confirm this positive relationship. This result reinforce that competitor orientation relate to customer orientation to enhance new product activity (Frambach et al., 2003). Specifically, the result suggests that both orientations are needed to start the process of innovation in firms. Companies will be encouraged to use the different sources of knowledge for innovation when they will exercise them skills in monitoring their competitors and customers. Although considering the earlier initiatives of innovation instead of examining the innovation consequences and/or innovation outcomes, this result somewhat corroborates previous findings of Grinstein (2008), Gatignon and Xuereb (1997) and Frambach et al. (2003). As indicated in the findings of Grinstein (2008), the positive relationship between competitor orientation on innovation consequences depends on a minimum level of customer orientation. Gatignon and Xuereb's (1997) findings revealed that competitor orientation and customer orientation are combined to technological orientation for designing innovations. The findings of Frambach et al (2003) showed that an extension of customer orientation is needed to competitor orientation influence new product activity. In addition, competitor orientation influences directly and positively the inter-functional coordination of the SMEs. The coefficient of 0.450 and the p-value of 0.013 indicate this influence and lead to accept H.. This result highlights that interfunctional coordination facilitates the dissemination of knowledge about competitors within firms and help them to create superior value for their customers (Tsiotsou, 2010). As suggested by Kohli and Jaworski (1990, p.5) "responding effectively to a market need requires the participation of virtually all departments in an organisation". This result also corroborates previous studies that examined the causal relationships between MO components (Tsiostou, 2010). The positive linkage between inter-functional coordination and customer orientation was also confirmed in our study. Showing a coefficient of 0.505 and a significance level of 95% (p-value = 0.014), this relationship leads to accept H. Previous studies in a component-wise approach of MO had found similar results. Tsiotsou's (2010) research showed that inter-functional coordination influences positively the customer orientation in a service industry context.

The results exhibited in Table 2 also highlight that inter-functional coordination has an indirect effect on the extension to which firms use different sources of knowledge for innovation through customer orientation. The positive coefficient of 0.269 and the p-value of 0.011 confirm this relationship and the H_e. This result confirms that interfunctional coordination has a role in supporting innovative initiatives in firms as stated by Homburg et al. (2004) and Grinstein (2008). Other researchers have not found evidences considering the direct effect of inter-functional coordination on innovation outcomes (Han et al, 1998; Lukas & Ferrell, 2000). Taking into account that interfunctional coordination is an activity which takes place within organisation, may it not sufficient to support innovation results. As stated by Wooldridge and Minski (2002), inter-functional coordination has a function of assimilating the results of firms being customer and competitor oriented and allows coherent action. Thus, we can assume that inter-functional coordination, competitor orientation and customer orientation work together to promote firm innovation. As revealed in our findings, customer orientation is an important link between inter-functional coordination and innovation initiatives. Similar linkages may are needed to support firm innovation results. Furthermore, our result highlight that inter-functional coordination is important to enhance the organisations initiatives for innovation which is likely related to firm innovativeness, as an aspect of a firm's culture (Hurley & Hult, 1998). This could not be enough to warrant innovation results like the introduction of new products to the market.

Our findings also revealed that the extension to which firms use different sources of knowledge for innovation is a result of a sequence of market oriented activities. As shown in Table 2, competitor orientation influences indirectly and positively the SMEs early innovation efforts through inter-functional coordination and customer

Conclusions, Limitations and Future Research Directions

This research applies a component-wise approach of MO to examine the linkages between the three MO components and the extension to which SMEs use different sources of knowledge for innovation.

Overall, the results showed that the interactions between the three MO components, i.e. customer orientation, competitor orientation and inter-functional coordination, influence the extension to which SMEs use different sources of knowledge for innovation in different ways. The research findings revealed that customer orientation influences directly and positively this innovation initiative in SMEs. Also, competitor orientation affects positively and indirectly the extension to which firms use different sources of knowledge for innovation both through inter-functional coordination and through customer orientation. Furthermore, inter-functional coordination affects indirectly and positively the extent to which firms use different sources of knowledge for innovation through customer orientation. In addition, results revealed that the extension to which market orientation influences innovation initiatives depends on the interactions between MO components.

This study contributes to the understanding of how market orientation influences firm innovation by exploring a MO component-wise approach in the MO relationship with innovation initiatives. In doing so, we provide several contributions to the existing literature (Lukas & Ferrell, 2000; Gatignon & Xuereb, 1997; Grinstein, 2008; Frambach et al., 2003; Han et al., 1998). Firstly, we posit that the way in which each MO component affects the earlier efforts for innovation in firms depends on the inter-relations between them. Such perspective helps shed light on "how" MO is inserted in the innovation context, and contributes in explaining the role of MO components with it. Corroborating previous findings of Tsiotsou (2010) we have demonstrated that, in order to improve customer orientation, a firm needs to increase its competitor orientation and inter-functional coordination. In doing so, organisations are able to begin the innovation process by looking for different sources of knowledge for innovation. Secondly, the study complements previous research into the antecedents of innovation in companies (Hashi & Stojcic, 2010; Löof & Heshmati, 2002) and adds market orientation as one of the motivating elements for innovation in SMEs. Overall, it is known that the access to knowledge and information, collaboration, markets, and specific institutional contexts all contribute to a company's innovative capacity (Verhees & Meulenberg, 2004). However, little is known about how MO acts as an antecedent for innovation, which involves more than just establishing relationships with clients and other agents, but

also the need for focusing on competitors and internal configurations that deliver value to clients (Narver & Slater, 1990; Kohli & Jaworski, 1990). The results encountered in this research reveal that such a focus on delivering client value translates, in its initial stages, favour innovative initiatives in companies (Bigliardi et al., 2011).

Regarding the limitations of this research, as well future research directions, this study is limited to examining the relationship between MO components and innovation solely in its initial stage. Future research could relate a MO component-wise approach to the different stages of the innovation process; i.e., the decision to innovate, the decision of how much to spend on innovative activities, the relationship between expenditure on innovation and innovation input, and the relationship between innovation output and performance (Hashi & Stojcic, 2012). This could allow the identification of in which stages of innovation MO is most relevant. Also, the specific context of the study (Chile) is a concern constraining the generalization and application of the results to other countries. Further research in a widevariety of countries is needed in order to reinforce our findings.

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Corporate Brand Value Shifting from Identity to Innovation Capability: from Coca-Cola to Apple

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Abstract: Corporate brand value, a key corporate asset, has traditionally relied on stakeholder interactions, heritage, and corporate identity. In dynamic fast clock-speed industries (information technology and consumer electronics), we note that brand values change dramatically within a few years based on their innovativeness. Using grounded theory approach and multi-case study method we examine how Apple, Samsung, Toyota, and Coca-Cola sustained their most valuable global brands while Kodak and General Motors eroded the same. Certain key dynamic innovative capabilities are identified as best practices. We conclude with implications for managers and future researchers, along with some limitations.

keywords: Corporate brand value; dynamic innovative capabilities; competitive advantage; brand equity; hyper-competitive industries

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Corporate brand value

Due to the intense proliferation of established and emerging brand offerings, the global markets are becoming highly crowded and turbulently dynamic with time-based competition (Gehani, 1995). Yet, some brands, such as Apple and Coca-Cola are able to stand out and are often preferred by customers over others. Brand value as a corporate asset is one of the primary measures of competitive advantage of an enterprise that is useful to gain customers' brand preference over rivals (Aaker, 2012). Enterprises also increase their brand relevance and gain brand leadership in their product categories to enact entry barriers for their rivals and new entrants (Porter & Happelmann, 2014).

For example, Google, Microsoft, Intel, and Samsung dominate their respective categories. With their innovations they have altered the way we live our lives in the 21st century. These corporate brands, therefore, lead the world's most valuable global brands. On the other hand, the 100-year old iconic Coca-Cola brand led the world's most valuable brands for more than a decade until 2012 (Interbrand, 2015). Thus, how does a corporate brand become a global leader in brand value?

Corporate brand and identity

In the past, a corporate brand was primarily managed by building a distinctive image. This gradually turned into a corporate identity (Aaker, 1991; 2004). This image was strengthened by clarifying brand relevance, which defined its product scope and the brand boundaries of its overall business. Thus, a corporate brand represented the enterprise with its unique characteristics and identity, such as credibility.

In 1960, the American Marketing Association defined a brand as a trademark, a distinctive name of a product or manufacturer, sign, symbol, design or any combinations used to identify the goods and

*University of Akron. Ohio, USA E-mail: rgehani@uakron.edu services of a seller to differentiate its offerings from those of its competitors. Corporate brands can block the trespass of a rival with their distinctiveness.

The different identities and characters of brands are built on their heritage. Budweiser and Anheuser-Busch brands promote their rich heritage with symbols such as the Clydesdales horse-drawn carriages. But, at the same time, they want to reach out to the young and more intensive users of Budweiser and Bud Light beers. So their brands introduce campaigns against drunk driving, and use humorous advertisements about Lizards, Was-Up, and quaking toads. This helps them balance their old heritage with a contemporary touch.

Relying primarily on the nostalgia of heritage or character may have worked for many years in slow moving commodity related industries. But intensity of rivalry and rules of market competition tend to change much more rapidly in dynamic markets for high-tech industries or global geographical domains (Porter & Heppelmann, 2014). In dynamic markets, new brands may rise to the top in 5-10 years, or the old established brands may crash and disappear in the same period (Gehani, 1995). Are corporate brands shifting from representing their heritage and identity to representing their innovativeness?

Brands and market dynamics

In fast moving industries or global markets, such as for tablet computers and smart-phones, new entrants can disrupt and dislodge well established brands in short periods of time with their innovations. Building a global corporate brand usually takes enormous time, resources, and efforts over multiple years (if not decades). But with globalization, social media, and disruptive innovations (Christensen, 1997; Gehani, 1998) some well established brands, such as Kodak, have lost billions of dollars of their corporate brand value in just a few years.



Eastman Kodak was an iconic corporate brand for over a century since 1880s. It was one of the 30 blue chip companies in Dow Jones Index. Kodak ranked #30 in the world's most valuable global brands until 2002, with a brand value of US\$ 9.7 Billion (www.Interbrand.com). But within a decade, the memorable 'Kodak Moment' became a nightmare for hundreds of thousands of stakeholders, including employees, suppliers, and stockholders when Kodak declared Chapter 11 bankruptcy in January 2012 (Daneman, 2014). This brand erosion took place because Kodak did not keep up with its innovativeness in digital imaging products, even though millions of customers around the world could easily recall the Kodak's brand with the iconic 'Yellow Box.'

Same is the case with the legendary auto leader General Motors (GM), with age-old household brands like Chevrolet, Buick, and their new monster gas-guzzler Hummer. GM declared Chapter 11 bankruptcy and requested government bailout in June 2009 (Isidore, 2009).

Aakers (2004) proposed that corporate brands, when they are struggling (such as Sony, Kodak or General Motors), they must go back to the roots of their heritages. Reflect how they had become so successful in the first place – against all the odds and hardships they faced. Hewlett-Packard started in a garage – with nothing but the intellectual capital and dreams of two young founders and \$550. Honda tinkered engines during the war-time shortages in the 1940s. and the post-war starvation in Japan in the 1950s. Corporations must not forget their founder-innovators' adventures. They must reflect and re-interpret their past innovations in today's global and more dynamic contexts (Gehani, 1995).

In this paper we explore how closely corporate brands have become related to the innovativeness of their owners. At the surface, brand recognition may seem to depend significantly on the eye-catching 30-second U.S. super-bowl or Olympics sponsorships. But over the years, the corporate brand value of an enterprise reflects the innovativeness of the owner and the functionality of its products. After all, the brand is a signal for the source of different goods and services. And, therefore, customer-delighting goods and services, which go beyond marginal customer satisfaction, are rewarded with brand loyalty (Gehani, 1998). Enterprises, therefore, must offer innovative and exciting goods and services that match the value of their brands (Gehani, 2013).

Global corporate brands, therefore, must impart their aspirational values by making statements not only about their quality, reliability, and prices, but also communicate images of the new desirables. Such as their innovativeness and sustainability (as Coca Cola and Apple often do).

Research Method

The focus of this study is to explore the role of dynamic innovative capabilities of enterprises in determining their corporate brand values. Based on such examination, we will recommend some common best practices about dynamic capabilities that leading global enterprises develop and employ. This research study uses a hybrid research design combining a grounded theory approach (Glaser and Strauss, 1967) with longitudinal evolutionary and cross-sectional analyses based on case studies and closely examined empirical evidence (Yin, 1994). The grounded theory approach and case studies are better suited to help explore innovative new propositions, and to elaborate "how" and "why" certain postulated relationships operate. On the other hand, the traditional comparative statistical research methods are effective to test "if" certain hypothesized propositions are supported by selected qualitative or quantitative data.

We will also use the guidance provided by Perrow (1967) recommending that researchers should try to control for the significant moderating effect of organizational technology in different industries. Therefore, our discussions and interpretations are limited to intra-case and inter-case analyses of intra-industry innovation capabilities and organizational performances measured by their corporate brand values (Eisenhardt and Graebner, 2007). No inferences will be conjectured or claimed regarding any inter-industry cross-sectional comparisons. Our level of inquiry is the firm or organization level. This permits using some of the publicly reported and audited financial information. Such secondary information will facilitate the use of grounded theory approach to develop new insights into our postulated relationship between corporate brand value and dynamic innovative capabilities of enterprises.

Literature review: from identity to innovation based branding

Brand identity and stakeholder interactions

Traditionally, a corporate brand value was considered to be driven from the interactions an enterprise has with its diverse stakeholders (Abratt & Kleyn, 2012). For example, many potential employees prefer employment with Apple over Microsoft. Millions of customers contribute to Toyota's brand equity by buying hybrid Prius over Ford Taurus. Many investors are willing to pay much higher stock price-to-earnings ratio for Google than for its predecessor and rival Yahoo (Abratt & Kleyn, 2012; Melewar et al., 2012).

Therefore, Balmer (2012) and others have noted that strategic branding must be constantly communicated with stakeholders inside an organization, and outside in its market environment. Such corporate brand development plays a significant role in business to consumer interactions as well as in business to business transactions.

Brand value and erosion

As a result of such efforts, over some years, a corporate brand value can account for a significantly large share of the overall market capitalization value of a global enterprise (see Table-1). Whereas this share of brand value becomes very noteworthy at the time of a merger or an acquisition, the brand value also plays a key role in the day to day survival and competitive growth of a global enterprise.

Table-1: Corporate Brand	Values of Global	Leaders (2000-2015)
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YEAR	COCA-COLA	APPLE	SAMSUNG	ΤΟΥΟΤΑ
\$ Billion	\$ Billion \$ Billio	n \$ Billion		
2015	78.4	170.3	45.3	49.1
2014	81.6	118.9	45.5	42.4
2012	77.8	76.6	32.9	30.3
2010	70.5	21.1	19.5	26.2
2008	66.7	13.7	17.7	34.1
2006	67.0	9.1	16.2	27.9
2004	67.4	6.9	12.6	22.7
2002	69.6	5.3	8.3	19.5
2000	72.5	6.6	5.2	18.8

Source: Adapted from various reports of BusinessWeek and Interbrand

Considering the strategic significance of corporate brand value, and its impact on an enterprise and its masses of stakeholders, it can be no more just managed functionally at the marketing department level. In fact, a growing distinction is being made between managing a product brand in the marketing department, and governing a corporate brand by the firm's strategic leadership. The focus in this paper is on the latter. (Balmer, 2012; Melewar, Gotsi & Andriopoulos, 2012).

Shifting tectonic terrain of innovation

The landscape for innovation has been shifting dramatically since the dawn of the 21st Century, and the ubiquitous growth and proliferation of first the Internet and then the social media such as Facebook, Twitter, and many more (Gehani, 1995). Innovative and inter-connected products are transforming competition as well as the value-chains of corporations (Porter & Heppelmann 2014). This shifts product development from mostly mechanical engineering to systems development. In the past, the corporations with deep pockets and high investments in inventions and research & development (R&D) were considered more innovative. Think General Electric (with Thomas Edison's legacy), AT&T (including Bell Labs), and DuPont (with Pioneering R&D Lab). But, the tsunami of computer-enabled digital technologies, starting in garages and college dormitories, altered all that. The Millennial "Me-centric" customers quickly switched from iconic long-established brands to newly emerging user-centric brands. Move over Levi's and Limited, welcome Abercrombie & Fitch and Zara. Design and user experiences have become the new imperatives for market success. Apple's late-founder CEO Steve Jobs was a major catalyst in this transformational movement from R&D driven innovation to design-driven innovation (Isaacson, 2011).

Where does the value of a corporate brand come from? How are these brand values determined?

Defining terms and boundaries

As mentioned before, the conventional practice of brand management was focused on shareholder analysis and identity building (Aaker, 1991; Kapferer, 1997; Keller, 1998). But over the past few decades, many researchers from different disciplines have been using certain common terms quite inconsistently. For example, there still seems no consensus on a shared definition of the terms brand value or brand equity, except that it adds value to the overall enterprise.

In accounting literature, brand equity is the value of a brand as a separable asset, as included on a balance sheet, or when sold (Kapferer, 1997). On the other hand, the market researchers consider brand as the strength of consumers' attachment to a brand, and its associated beliefs (Keller, 1998). When marketers use brand equity, they refer to brand strength. Some researchers, therefore, have started differentiating these different meanings by using a new term: 'consumer brand equity' (Wood, 2000).

Ambler and Styles (1996) consider brand equity as a dormant profit to be realized in future. Such expectations based definition is also supported by Srivastava and Shocker (1991), who consider brand as 'all accumulated attitudes and behavior patterns in the extended minds of consumers, distribution channels, and influence agents, which affect long term cash flows and future profits.'

In view of the various inevitable challenges for estimating brand valuation, in this paper we will use the brand values estimated consistently by the same leading brand management agency: Interbrand in collaboration with BusinessWeek. The Interbrand valuation is based on three key components: financial analysis of profit performance, brand's role in purchase decisions (relative to price, features, convenience etc.), and brand's competitive strength for creating future loyalty. Interbrand uses expert's panels as well as extensive data from Thomason Reuters's company annual reports, Datamonitor consumer goods data and Twitter's social media signal. We will, however, limit our discussions and comparisons within an industry, and will not imply any deeper significance to the value of a corporate brand.

In the next section, as stated before, we will use grounded theory approach to analyze the longitudinal development of four iconic global brands in the top-10 highest brand values in the world. They are the leaders in their global industries. We have chosen the period from the dawn of the New Millennium in 2000 to 2015.

Case study 1: Corporate brand value of Coca-cola

Coca Cola has sustained its brand leadership for more than a century with its Spencerian scripted logo and distinctive waist-band bottle shape (Acevedo, 2008: 2). Until 2012, for more than a decade, Coca Cola was the world's most valuable Best Global Brand that steadily rose from \$72.5 Billion in 2000 to \$77.8 Billion in 2012 (See Table-1). During this period, the corporate brand value of Coke consistently scored higher than brand values of technology giants such as IBM, Microsoft, Google, and even Apple.

Long before the arrival of social media, Coca-Cola built a lasting brand based on nurturing the social moments of sharing their drinks with family and friends. Interestingly, Coca-Cola still had 73.2 Million Facebook fan pages, far ahead of 15.1 Million for Google and 9.8 Million for Apple (Elliott, 2013). In 2015, Coca-Cola ranked third most valuable Global Brand in the world, with an estimated corporate brand value of \$78.4 Billion (Interbrand, 2015). Only Apple and Google exceeded Coke's brand value, as they innovated new digital ways to stay connected with their customers.

What efforts and practices have contributed to Coca-Cola's phenomenally high corporate brand value?

Customer connectivity

In 1886, Coca Cola started by promoting a medicinal drink to cure headaches. Some suspect that one of its secret ingredients may have been an intoxicant from the cocaine plant family. The company achieved exponential growth for sales of concentrate syrup by giving away licensing bottling rights to others for a low price.

In 1984, with fast creeping market threat from sweeter Pepsi Cola brand, Coca-Cola chair Robert Woodruff approved his successor CEO Roberto Goizuetta to launch the "New Coke" brand – based on their extensive 'blind' market research. The loyal customers of the original coca-cola were outraged and reacted strongly against the withdrawal of their favorite drink. The old drink was quickly brought back and re-branded as the Classic Coke. At Coke, customers always come first.

Coca Cola's brand strength was built on the company's primary empathy for their customers' delightful experience. Their ad campaigns such as "*The Real Thing*," and "*Enjoy*" became iconic components of American culture. In 1923, the company promoted "*Pause and Refresh Yourself*." This was changed to "*The Pause That Refreshes*" in 1929, when the Great Depression was kicking in. Then came "*Things Better with Coke*" in 1963, "*It's the Real Thing*" in 1969, and on and on, until "*Open Happiness*" in 2009. Coke's brands and slogans symbolize America all over the world.

Social Responsibility and Stakeholder Interactions

Coke has often strengthened its corporate brand by promoting the company's corporate social and environmental responsibility mission. CEO Robert Woodruff supported civil rights, and donated large sums of money to Emory University in Atlanta where Coca-Cola has global headquarters. Even after his retirement, the Woodruff Foundation has been a major philanthropic institution supporting arts, education, and medical research.

Coke's new corporate priorities are "Women, Water, and Well-being" for the "Me, We, World." 'Me' is for enhancing personal well-being. 'We' is for community development. And the 'World' is for protecting the environment.

In late 2010, Coca-Cola launched a 5by20 initiative to empower 5 million women around the world by 2020 (Overbolt, 2012). Coca-Cola noted that whereas almost 50% of its workforce is women, very few of the distributors are women. The company reached out to women entrepreneurs in Brazil and enabled them to acquire truck licenses and digital computing technology to become the company's first-generation distributors. In poor countries, Coca-Cola provided

solar-powered coolers to women shopkeepers to help them use solarpowered lanterns ad keep their shops open for longer hours.

In India, Coca-Cola has a very popular mango-based drink Mazza with 80% market share (Christensen, 2013). The demand was growing so fast that Coca-Cola was unable to keep up with the growing demand. The company worked with 30,000 small mango growers so that they could grow 2-3 times more mangoes than they could grew before. This was win-win-win as it helped the company get more supplies, the farmer earned more money, and the country boosted its gross-domestic-product (GDP)

The company has also adopted water stewardship in a big way. Water is a critical raw material for Coke's business. This is also in line with the United Nations' millennial goal of providing basic access to water and sanitation to the poor millions of the world. The company refers to it as connected capitalism (Christensen, 2013).

Environmental responsibility

Coca Cola is also focusing attention on re-designing and innovating its packaging for sustainability. In the 1960s, the Coke branded cans and bottles littered everywhere. The company mobilized its valueadding resources such as R&D, engineering, and manufacturing, all collaborating together, to re-design a more sustainable next-generation delivery packaging. Designers played a key role in introducing new thinking.

First was the use of recycled poly-ethylene-terephthalate (PET). The manufacturing process was altered to incorporate some recycled PET (Christensen, 2013). More recently, more dramatic innovations such as bio-degradable bottles have been launched to strengthen the corporate brand value.

Case study 2: Corporate brand value of Apple

Even when Apple had a minor share of the overall personal computer market, it held a relatively high ranking among the world's most valuable Top 100 corporate global brands. This was because of its widely acknowledged design elegance, technological innovations, and delightful user experiences. Apple developed high brand relevance, and a leadership in its product sub-category for design professionals (Wright, Millman and Martin, 2007).

In 2001, Microsoft with a brand value of \$65.1 Billion, and IBM with a brand value of \$52.8 Billion were more than 10 times more valuable than Apple's brand value of mere \$5.5 Billion. Google had yet to enter the Top 100 Global Brands. In 2008, Apple's brand was valued at \$13.7 Billion, ranking at #24 (see Table-1). Then it went to #17 in 2010 with a brand value of \$21.1 Billion, and in 2012 it landed on #2 position at \$76.6 Billion with an unimaginable 129% annual increase in brand value. With time-based competition, Apple overtook past Microsoft's brand value of \$57.9 Billion and even \$72.2 Billion brand value of IBM and Google's \$69.7 Billion brand value (Gehani, 1995).

In 2015, Apple's corporate brand sat at the pinnacle of the world's most valuable global brands. It was valued at \$170.3 Billion: \$50 Billion higher than Google's \$120.3 Billion, and over \$100 Billion more than Microsoft's \$67.7 Billion and IBM's \$65.1 Billion. Apple's brand value exceeded the combined brand value of Microsoft's and IBM's individual brand values. Legendary Coca-Cola's iconic brand value slipped to #3rd rank with \$78.4 Billion in estimated brand value.

By closely collaborating with his chief designer Joni Ives, Steve Jobs turned the product innovation process at Apple on its head. Prior to his return, the engineers and manufacturers at Apple decided the functionality and the technical components needed to engineering design a product. There was limited consultations with their designers. Or the marketers came in with what they claimed 'their' customers must have. The designers were called in at the very end – primarily to skin the pre-determined components with a decorative veneer. Jobs turned the whole product innovation process on its head. Designers, with empathy for their users' experiences, prototyped and decided what a product or service should look and feel like. Then the engineers were told to pack in the functional components, and marketers were told to wait for the millions of delighted loyal customers come knocking on their doors – as they actually did sometimes waiting all night in lines under rain or holiday snow.

Reviving design sensibility

In 1985, CEO Steve Jobs was mostly edged out by the board of the company he co-founded and raised since April 1976 with Steve Wozniak and Mike Markkula (Isaacson, 2011). Under CEO John Sculley who was brought in from Pepsi by Jobs to make Apple more retail savvy, Apple struggled for a over a decade.

From 1993 to 1996, Apple switched CEOs three times, from John Sculley to Michael Spindler, and Gil Amelio. In 1995 Microsoft launched its very popular Windows 95, and a year later Apple's sales for Macintosh desk top computers crashed precipitously.

In 1997, Jobs partnered with his arch-rival Bill Gates at Microsoft and received an infusion of \$150 million that Apple badly needed (Isaacson, 2011). Microsoft was able to launch Microsoft Office for Macintosh – a blockbuster for both.

Jobs completely re-innovated Apple's desktop computer between 1998 and 2001, and launched it with a radical new design as iMac. It came in bright unprecedented colors such as purple, green, and blue. This revived the Apple brand significantly. To promote the corporate brand further, in May 2001 Apple announced the opening of Apple's iStores to directly educate and interface with their consumers. It cost money, the sales stayed low in \$5 Billion range, and the net income hit rock bottom hovering below \$100 Million. With all these shortages, Jobs kept funding R&D by more than \$400 Million. (See Table-2). In October 2001, Apple innovated iPod digital audio player, which was seamlessly integrated with iMac, and legally downloadable iTunes - all visible and available to play in iStores. Jobs, thus took complete control of Apple's corporate brand, from end-to-end. All these rollouts cost money and took time to get the results in earnings. But gradually sales started running upwards.

YEAR (\$Mil.)	NET SALES	COST OF SALES	GROSS MARGIN	R&D	NET INCOME
1996	9,833	8,865	968	604	- 816
1997	7,081	5,713	1,368	485	- 1,045
1998	5,941	4,462	1,479	303	+ 309
1999	6,134	4,438	1,696	314	+ 601
2000	7,983	5,817	2,166	380	+ 786
2001	5,363	4,128	1,235	430	- 25
2002	5,742	4,139	1,603	446	+ 65
2003	6,207	4,499	1,708	471	+ 69
2004	8,279	6,020	2,259	489	+ 276
2005	13,931	9,888	4,043	534	+ 1,335
2006	19,315	13,717	5,598	712	+ 1,989
2008	32,479	21,334	11,145	1,109	+ 4,834
2009	36,537	23,397	13,140	1,133	+ 5,704
2010	65,225	39,541	25,684	1,782	+14,013
2011	108,249	64,431	43,818	2,429	+25,922
2012	156,508	87,846	68,662	3,381	+41,733
2013	171,910	106,606	64,304	4,475	+37,037

In 2004, as the financials perked up at Apple, so did its innovativeness and corporate brand value. In 2005, corporate brand value of Apple recovered by double digits to \$8.0 billion, and it ranked as #41 on the Top 100 Most Valuable Global Brands (See Table-1).

With financial success and growing net income, under Steve Jobs Apple become even more innovative. He innovated products with dramatic technological capabilities such as iPod Video and iPod Touch, which delighted his customers. And, then in 2007 he radically disrupted the phone market with the launch of innovative rulebreaking and elegantly designed mobile iPhone. Between 2007 and 2013, Apple kept upgrading iPod and iPhone product lines. Apple's corporate brand value rose with its innovation capabilities.

Case study 3: Corporate brand value of Samsung

Since 2000, Japanese enterprises have been steadily losing their brand values of their coveted brands relative to their global rivals not only from the US, but also from South Korea. In global electronics industry, in 2000 Samsung's brand value of \$5.2 Billion was less than 1/3rd of Sony's brand value \$16.4 Billion.

In just 15 years in 2015, Samsung's \$45.3 billion brand value had increased to approx. 7 times Sony's highly eroded \$7.7 Billion brand value, and more than 7 times Panasonic's \$6.4 Billion (See Table-1). In fact, Samsung's brand value was almost twice as much as the total brand value of Japan's top 3 brands Cannon, Sony, and Panasonic combined.

How did Samsung boost its corporate brand value so sky high, ahead of other consumer electronics makers?

Charismatic leadership and design-driven transformation

Until 1995, Samsung Electronics of South Korea manufactured imitative, inexpensive electronic parts and components for other originalequipment manufacturers (OEMs). They were made to make things according to the specifications and target costs mandated to them. The company's strategic leaders valued efficiency, scale, reliability, and speed – with low-cost leadership (Gehani, 2013).

In 1996, Samsung Group Chairman Lee Kun-Hee became quite visibly frustrated with Samsung's defective products and lack of innovation. He made a big public display of how frustrated he was by gathering thousands of defective phones produced by Samsung in the lobby of the corporate office. And then he ran a bulldozer over it (Khanna, Song & Lee, 2011). He often smashed phones against the walls to check how rugged they were built. His recommendation to senior Samsung executives: test the phones by throwing them against the wall (Gehani, 2013).

Chairman Lee supported the new design training programs with his personal attention and a high priority. Nobody could derail them even during the 1997 financial economic downturn. The newly trained designers developed a holistic view. The designers used the same tools as the ones they used for innovation: *empathy, visualization, and experimentation.* They combined these to rapidly develop Samsung's dynamic technological capabilities.

Outside-in & inside-out open talent development

Lee was acutely aware of need for world-class talent. To promote open innovation, he instituted a two-pronged global talent development program (Khanna et al., 2011). This involved sending Samsung managers with good mental capabilities to go abroad for 18-24 months. They learned the local languages, made contacts with some important local people, and completed an important value-adding innovation project. This was not unlike what Lee's predecessors had done by going to Japan to earn engineering degrees at some of the major Japanese universities like Tokyo Institute of Technology and Kyoto University.

The second prong of Lee's talent development program was Samsung recruiters going to the West and hiring the best Korean and non-Korean MBAs, engineers, and PhDs from leading companies and consulting firms in US and Europe (Khanna et al., 2011). They were then appointed in key positions. To facilitate their smooth entry in the Korean organizations, they were given extensive orientation and mentoring by senior Korean strategic leaders.

When Samsung Electronics branched out on its own from the conglomerate, it was in head-to-head in mortal combat with global electronics giants like Apple and Sony. In 2014Q3, Samsung's profit fell 60% year-to-year. In 2015Q1 it recovered a little, but it was still below the year before. In the face of world-wide popularity of iPhone, only Samsung survived. The phone divisions of former rivals such as Motorola, Nokia, Blackberry, and Ericsson are almost gone. Partly this is because since 2006, Samsung has retained its leadership in global TV market with its blockbuster brands like One Design, Curved Smart, Bordeaux and Touch of Color. Smartphone sales have also contributed to record earnings for Samsung (See Table-3).

Table-3: Samsung's Financials for selected turnaround years

YEAR (\$Mil)	NET SALES	COST OF SALES	GROSS MARGIN	R&D	NET INCOME
2009	117,821	81,756	36,065	6,384	8,436
2010	137,905	91,562	46,343	8,115	14,400
2011	142,403	96,785	45,618	8,613	11,853
2012	188,351	118,621	69,730	n.a.	22,333
2013	217,462	130,934	86,528	n.a.	28,978

So: Mergent Database.

Innovating Galaxy Note

Samsung has been constantly looking out for innovative entrepreneurial opportunities. After introducing Galaxy S smartphone and Galaxy Tab tablet, Samsung designers noted a market gap (Yoo & Kim, 2015). Many Japanese and Korean workers have been traditionally carrying a small pocket diary to take notes during their meetings. Neither the 4" screen phone, nor 9" screen tablet provided a good substitute for this pocket diary. Samsung realize that this would need a new technology platform. Samsung designers quickly developed a design concept for a smart diary with 5.5" screen and a pen interface. When this design concept was pitched to Samsung's senior managers, they questioned the new screen size. The conventional thinking by their marketing department was that screens for mobile pocket phones can not be larger than 5". The critics objected that the phone users will not put such a big thing next to their face. It will make their face look smaller.

The new phone platform required changing users' attitude towards mobile phones. Samsung designers created a mock-up that looked like a diary for test marketing. It had a smart cover that did not make it look that big. The innovative new 'phalbet' category made Galaxy Note series very successful and profitable. Samsung uses its smart cover strategy for other products, such as smaller Galaxy S.

Case study 4: Corporate brand value of Toyota

In the global automobile industry, brand values of Toyota (and Honda) continue to dominate far ahead of the global brand values of the rest of automakers. Toyota's brand value of \$49.1 Billion in 2015 is more than double the brand value of Honda's brand value of \$23.0 Billion, and more than four times the brand value of Ford with longer heritage at \$11.6 Billion. Just over a decade earlier, at the dawn of the 21st century in 2000, the \$36.4 Billion brand value of Ford was almost twice as much as Toyota's \$18.8 Billion brand value. Toyota achieved this by ramping up its production process innovation much faster than Ford's and others.'

Open innovation in collaboration with strategic suppliers

Toyota's brand became one of the world's most valuable brands with its production process innovation, often known as lean production system. One of the key components of Toyota's innovation strategy is its collaborative open innovation with its suppliers (Iyer, Seshadri, & Vasher, 2009). Compared to its American rivals, such as General Motors, Ford, and Chrysler, Toyota (as well as Honda) use a closeknit and integrated collaboration with its suppliers. Womack, Jones and Roos (1990) in their best-selling book *The Machine That Changed the World*, shared how Toyota's production process innovation disrupted the global auto industry in general, and the U.S. automakers in particular. Clark and Fujimoto (1991) identified the different stage operations and decision-making gates in the innovative lean product development process of Toyota. These observations have been validated by many other researchers (Gehani, 1992; Ulrich & Eppinger, 2008).

There is generally a much higher level of mutual trust between Toyota and its suppliers (Iyer, Seshadri, & Vasher, 2009). Many American auto corporations tend to swing between adversarial and collaborative open relationships with their suppliers. On the other hand, at Toyota there is much less contract-related paperwork and transactional cost than at Ford or GM. For example, Toyota has only a 16 page project requirement document with its major suppliers, whereas Toyota's North American rivals use 3.5 times longer 56 page project requirement document (Pereira, Ro and Liker, 2014: 547).

Toyota also uses a single-point of contact (a cross-trained engineer) for all communications with a supplier regarding a project's requirements. At rival American corporations, the project requirements are controlled by multiple persons in the purchasing department with different disciplinary backgrounds (Pereira, Ro and Liker, 2014). Toyota, invests much more in training and development of the competence of their engineers, but spends much less time coordinating with suppliers than do rival American auto makers.

Enterprise culture

Leaders at Toyota have often claimed that the most important secret to the success of their lean process innovation strategy is their culture (Takeuchi, Osono & Shimizu, 2008). It codifies certain problem-solving practices that are etched deep into the hearts and souls of their people

Schein (1984) noted that culture within an organization is like a threelayered wedding cake. What we see at the surface are the culture's artifacts. These artifacts are built on a layer of stated values, and the shared beliefs make the bottom layer. Whereas U.S. automakers have spent decades trying to imitate or replicate some aspects of Toyota's enterprise culture, they have barely scratched some surface artifacts of Toyota's culture (Pereira, Ro and Liker, 2014). There is still a chasm of differences in values and beliefs. Some key differences are as follows:

1. *Employee Engagement*. More designers and engineers are actively engaged in Toyota than their counterparts in rival U.S. auto enterprises. Through life-long employment, job-rotation, and job-enrichment, Toyota continually builds the capabilities and competencies of its work-forces deep down into the trenches of production and operations.

2. *Visual Communication*. Toyota uses more visual communication and illustrations than the rival U.S. automakers. There is frequent face-to-face and digital technology mediated communication. The communication intensity increases when key decisions need to be made. On the other hand, the communication

intensity at U.S. automakers increases when there is crisis – which happens quite frequently. The *Kanban* just-in-time production system encourages widespread sharing and visual display of key information (Gehani, 2001).

3. *Reduction of Variability Risks*: Toyota reduces its variability risk by using clearly articulated specifications and by production of products with consistent quality. The U.S. rivals add to their risk when they use unclear specifications and frequently change their suppliers on case-by-case or minimum cost-basis.

4. Fact-based Decision Making. Most Japanese enterprises, including Toyota, use collective decision-making (nemawashi) to reduce their risk of making wrong decisions (Gehani, 2001). At Toyota most of the design decisions are based on concrete objective facts rather than subjective judgments by individual supervisors - particularly managers far removed from the gemba work-site. Whenever there are disagreements, Japanese employees at all levels are mandated to go back to the basic facts. In many U.S. enterprises, design decisions are often made somewhat arbitrarily by the people higher up in the hierarchy because of their more authoritative power. For example, on one hand, an executive may fire a few designers in the guise of cutting cost and improving the bottom line. But at the same time, or soon thereafter, additional supporting administrators may be hired at many times more salaries (because they worked with the executive during their former employment).

Discussion

Lessons for corporate brand value from dynamic innovative capabilities

What lessons can be learned from the evolutionary grounded theory accounts of these multiple case studies. From the foregoing observations from four of the most valuable global corporate brands, it is quite clear that to sustain their brand values, enterprises must cultivate their unique value-adding resources, and build their dynamic innovative capabilities to improve their competitive advantage (Gehani, 1998). We explicate these briefly below to show how the rules of competition have changed.

1. Build dynamic capabilities

The dynamics of competition, value capture, and value creation is now changing fast in most industries (Ryall, 2013). Some resources and capabilities are ordinary and commonplace – which every other rival corporation can quickly access too. Enterprises use these resources to run their hierarchical or entrepreneurial organizations. Their staff must be recruited, paid wages, trained, organized, and motivated to contribute at their fullest potential. Government regulations must be complied. The workplace must be safe and free of hazards. Suppliers must be selected, certified, and coordinated. Sales deals must be closed. Banks and other lenders must be paid back on time – or else they can shut the enterprise down according to the contract terms signed. These ordinary resources and capabilities are necessary to run any enterprise – but these are not sufficient to win the market race. They do not help gain sustainable competitive advantage. To beat the competition in the market space, on a sustained basis, especially in turbulent and complex global markets, such as for electronic appliances and automobiles, enterprises must develop their unique, idiosyncratic value-adding, and hard to imitate resources and capabilities. This is known as the resource-based view of competitive strategy (Wernerfelt, 1984; Barney, 1991).

And then in fast clock-speed evolving industries and global markets, such as the information technology industry or the smartphone industry, the strategic leaders must accept that the intensity of rivalry as well as the market entry rules of the competitive games may altogether change periodically every few years (Ryall, 2013, Christensen, 1997). This requires new strategies for innovation.

2. Need for ongoing open innovations

Even for the well-established corporate brands, such as Coca-Cola, Kodak, or General Motors, heritage is not enough. They must keep innovating as Coca-Cola is doing, and Kodak and GM did not. The strategic leaders at Eastman Kodak in the 1990s thought that they would be able to continue to leverage their 100-year old iconic brand and continue to earn fat profit margins - forever (Gamble and Gehani, 2013). At first the resolution and quality of 'disruptive' digital images was inferior, and it did not pose a significant threat to Kodak's high quality photographic films (Gehani, 1993). But Kodak's digital rivals kept getting more innovative, and Kodak stood still. Kodak's loyal customers left and the new generation of Millennial consumers did not see any sizzle in the Kodak brand. In January 2012 Kodak was forced to file for Chapter 11 bankruptcy protection (Gamble and Gehani, 2012). After taking care of bankruptcy protection requirements, Kodak must innovate hard, like Apple and Samsung, to recover its lost market ground. Only with innovation, Kodak can re-rise like a phoenix and recover back its legendary reputation and brand value.

3. Appreciative culture

As we saw in the case of Toyota's culture, strategic leaders can not overlook the creative and innovative power of their people's imagination and trust. Leading brand owners like Google and Microsoft tap that regularly. The challenge is how to unleash this sub-merged intellect and vitality after the top and middle managements have been ill-treating their operations staff with mistrust and abuse of rampant layoffs. Every time Kodak's leadership felt that the Kodak's stock was slipping too low, they laid off a few more thousand employees to please the short-term expectations of their Wall Street shareholders (Gamble and Gehani, 2012). This sometimes temporarily increased their gross profitability (sales per employee), but very often Kodak paid the price with their employees' falling morale and long-term productivity. Many U.S. companies tend to do this under pressure from their aggressive short-term shareholders. Leaders must reverse years of such autocratic abuses. Only then employees will wholeheartedly follow their leaders and contribute their imagination and innovativeness. As noted before, the underlying beliefs and ingrained attitudes drive the employees' behavior and the corporation's culture.

The personality of an organization's culture also drives the corporate brand value (Aaker, 2004: 8). Credible leaders such as Tim Cook at Apple, Bill Gates at Microsoft, and Charles Bronson at Virgin Atlantic, can sway their thousands of followers distributed around the world into action. Such leaders use their own deeds as well as words to inspire others. Other leaders must earn such employee and customer following.

4. Perceived innovative

Almost all enterprises and their strategic leaders, including owners of falling brands such as General Motors, Chrysler, or Sharp, prefer to believe that they are innovative - and believe that they are perceived as innovative by their employees and customers. Whereas some employees may be forced to believe this for short periods of time, some of the employees and most of the savvy customers can make a quick comparison with their rivals' offerings. With Internet and social media, it has become easy to see through the veneer of purchased promotional haze. Unfortunately, many top management leaders, surround themselves with their supporters, and start believing their own hype. It is not hard for tire users around the world to compare tires offered by global brand rivals Goodyear, Bridgestone, and Michelin. Same is the case with smart phones, tablet computers, and automobiles. Every brand owner can spend money to buy media time, and claim great things. A key factor that many knowledgeable customers look for is whether a brand actually delivers on its brand promises.

Perceived quality and perceived innovation, sometimes, may be harder to achieve than delivering actual quality and actual innovation (Aaker, 2004: 8). Every small cue counts in building up the perception, trust, and reputation behind a brand.

4. Design thinking and user empathy

Finally, as we noted earlier, empathy with users' experiences, resonance with their emotions, and honoring customers' sensory perceptions are the new killer apps that design-driven innovative corporate brand leaders, like Apple, Google, and Samsung and others, frequently use. To facilitate this, Samsung's design teams hired artists, writers, and ethnographers. Coca-Cola has been doing this successfully for 130 years. Steve Jobs did this intuitively rather than through market research. If Toyota did this more, there would be less recalls.

Design thinking also promotes frequent risk-taking and prototyping. When Steve Jobs returned to Apple in September 1997, Apple was within weeks of filing for bankruptcy. He shut down many incremental improvements, and focused on a few bold and breakthrough innovations such as iPod, iTunes, and iPhone. This paid off enormous returns in profitability and brand value, for many years come. More Japanese brand owners like Sony, Sharp, Toshiba, and Nissan could emulate such bold risk-taking. It is now possible to innovate on the run.

Conclusion

In conclusion, most practicing managers around the world must recognize that corporate brand value is one of the most important strategic asset that they must manage. This paper, therefore, set out with a big challenge to re-examine the age-old tradition of building corporate brand values based on corporate identity, legacy, and stakeholder interactions. We did this by using a more appropriate research method of grounded theory approach coupled with case studies, and quantitative and qualitative data. Our evolutionary studies indicated that in the 21st Century, the corporate brand values are more closely correlated with the firms' dynamic innovative capability rather than their legacy or identity. We noted this in the case of the fall of the iconic brands of Eastman Kodak and General Motors, and we saw this in the phenomenal rise of corporate brand values of Apple and upstart Samsung. Legendary Coca-Cola keeps up its brand value with close connectivity with their customers and other shareholders such as women and environmentalists. Toyota does this through its reliable products coupled with an enigmatic and paradoxical corporate culture.

Future research studies, could explore these seminal findings for larger number of brands, and cull out the moderating influences of size of the firm, industry type, age or legacy, product features etc.. Another interesting line of inquiry will be to research the effect of cross-cultural and national differences. Corporate brand value has now become so critical that no managers and researchers can ignore it. Hopefully, this study paved the way for many more researchers to follow and more managers to practice.

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Absorptive Capacity, Alliance Portfolios and Innovation Performance: An Analytical Model Based on Bibliographic Research

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Abstract: The objective of this article is to present a model for analysing the role of absorptive capacity in the relationship between strategic alliance portfolios and innovation performance based on the results of bibliographic research on the subject published between 2000 and 2015. The research was carried out in three stages, involving both quantitative - bibliometric and bibliographic coupling - and qualitative content analyses. AP management capabilities were found to have a fundamental moderating role in the AP–IP relationship, and amongst these capabilities AC was highlighted by several authors. However, its role was found to vary according to AP characteristics, notably AP diversity – functional, geographic and institutional, but also centrality, size, stability and volume of resources, alliance and partner types as well as country type: emerging versus developed economies. This research formed the basis for the development of the model and the formulation of some propositions that focused on emerging countries.

Keywords: innovation; strategic alliance portfolios; absorptive capacity; emerging countries; bibliographic coupling; bibliographic research

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Introduction

Globalization and the pressure to launch new products have led to a greater interdependency between firms. This pressure has driven firms to engage not only in dyadic alliances, but, increasingly, in multiple alliances, configuring strategic alliance networks (Ahuja, 2000) or alliance portfolios – APs, so as to leverage innovation performance - IP (Faems et al., 2005; Duysters & Lokshin, 2011) more effectively and thus ensure their competitive advantage.

Cohen and Levinthal (1990) argued that the competency to explore external knowledge, i.e. absorptive capacity – AC, is a critical factor for organizations that intend to innovate. Literature reviews on AC (eg. Zahra & George, 2002) have emphasized this point.

Lane et al. (2006) affirm that AC has become one of the most important concepts in recent organizational research. Between 1990 and 2006, 900 articles were published in scientific journals on the subject.

Moré et al. (2014) conducted a bibliometric study (1990-2012 timeframe) and found 1447 articles published in international journals on AC and innovation.

Several empirical studies investigated the influence of AC in the relationship between R&D alliances and IP. Although some of these found a positive influence (Berchicci, 2013; Cassiman & Veugelers, 2006), others did not (Belussi et al., 2010; Mowery, 1996). In other words, results diverged.

Literature reviews have also been conducted on APs (Wassmer, 2010), knowledge networks, (Phelps et al., 2012), alliance networks and technological development (Stolwijk et al., 2013), and international APs and innovation (Macedo-Soares et al., 2016). But there is a lack of bibliographic research on the role of AC in the relationship, not just between dyadic alliances, but also between AP and IP.

This article attempts to fill this gap by presenting the results of bibliographic research on AC, AP and IP, as well as a model and propositions for analysing the role of AC in the AP-IP relationship based on this research. Considering the increasing participation of emerging countries in global alliances for innovation (Jacob, Belderbos & Gilsing, 2013), the model focussed on APs in emerging economies. Some studies investigate AC, AP and IP in emerging economies, but very few focus specifically on Latin America (García Fernández, Sánchez Limón & Sevilla Morales, 2012; Gomez, Daim, & Robledo, 2014; Oerlemans, Knoben & Pretorius, 2013) and all fail to consider their interaction, as proposed in our model.

Theoretical References

Innovation performance was defined as the implementation of a new or significantly improved product/service or process (OECD, 2005). We also distinguished between radical (new to the market) and incremental (significantly improved) innovation, characterized, respectively, as explorative and exploitative innovation (March, 1991). In emerging countries "reverse innovation" has become important: "innovation (that) is adopted first in poor economies before 'trickling up' to rich countries" (Govindarajan & Ramamurti, 2011, p. 191).

As mentioned above, increasingly fierce competition has driven firms to establish alliance networks or portfolios to enhance IP. Alliances were defined as voluntary arrangements between firms (Gulati, 1998) and classified as linkages according to their intensity (Contractor & Lorange, 1988), running the gamut from joint-ventures (most



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Research Methods

Our study was conducted in three stages. In the first – bibliometric - we collected data on the literature about AC, alliances, APs, networks and innovation between 2000 and 2015. Although studies on AC started in 1990 after Cohen and Levinthal's (1990) seminal article, we found that the publication of articles on AC, alliances and innovation has intensified more recently.

We adopted the ISI Web of Science - WoS that includes most journals with high impact factors (Thomson Reuters, 2012). We limited ourselves to "peer-reviewed" journals, and used the following combination of keywords: "AC" and "alliance" and "innovation"; "AC" and "linkage" and "innovation"; "AC" and "portfolio" and "alliance" and "innovation"; "AC" and "portfolio" and "alliance" and network" and "innovation". These combinations included keywords such as "linkages" because alliances were classified as linkages, and "network" because our definition of AP was in keeping with network theory, and therefore articles on alliance networks could be relevant, as indeed was the case. We thus obtained a sample of 402 articles.

In the second stage the abstracts of our sample were analyzed as well as those of articles cited in pertinent bibliographic studies. The articles identified as most relevant to achieving our objective were analyzed in greater depth.

For stage three, we used bibliographic coupling - BC (Kessler 1963) to identify articles from the most recent theoretical trends in the field to help formulate our propositions and develop the conceptual model. BC shifts the focus from "traditions to trends in the scientific literature" (Vogel & Guttel, 2013, p. 427). Furthermore, it "allows us to draw an overview of how this field of research has developed, eventually recognizing clustered research themes" (Dagnino, Levanti & Picone, 2015, p. 355). Indeed, BC groups recent literature with common references. The frequency of common citations between pairs of articles suggests a thematic similarity between them (Kessler, 1963). To perform the BC, we selected articles from the WoS data base, published between 2011 and 2015, using the same filters as in the first stage. We decided to limit ourselves to the last five years so as to focus on cutting-edge literature. We obtained 41 articles. BibExcel software (Persson et al. 2009) helped carry out the BC. After importing the articles' metadata and references into the system, we corrected duplicated references.

For the BC we considered articles that had at least ten references in common with the others. We thus considered 33 out of 41 articles. Next, we created a square matrix that featured the co-citations for all pairs of articles. This matrix was converted into another one using the Pearson correlation coefficients calculated for the original matrix (McCain, 1990); the higher the coefficient the greater the thematic proximity between the two articles.

intense) to agreements/contracts (less intense). Based on social network theory (Ahuja, 2000; Baum et al., 2000; Ozcan & Eisenhardt, 2009) AP was defined as an ego-centric network (Knoke, 2001), or ego-net: network formed by the focal firm, its direct ties to partners and ties between partners. AP and ego-net were considered synonyms. Although the focus was on the ego-net, second-tier ties (partners to their partners) were considered when strategically significant for the focal firm. Moreover, the AP was viewed in the scope of the firm 's value net (Brandenburger & Nalebuff, 1996) which includes all strategic actors (partners/non-partners) and their interdependencies. The expression "AP/network" (AP/net) was used to make this point and literature on firms' alliance networks was included in the review.

Wassmer (2010) investigated three research streams considered central to APs: (a) AP emergence; (b) AP configuration; (c) AP management. His literature review suggested that the way a firm configures its AP affects its AC and "therefore its ability to use knowledge accessed from its alliance partners" (p. 158). Referring to George et al. (2001), he highlighted two AP configuration characteristics: alliance structure and knowledge flows between the AP's partners.

Macedo-Soares's (2015) Strategic Network Analysis Innovation Framework - SNA-IF, for carrying out analyses of firms that establish APs to leverage innovation, and which was based on Macedo-Soares (2011), proposed four dimensions: 1) AP/Net Structure (AP size; AP density; AP scope; AP position/centrality; embeddedness; structural holes; AP's configuration of partners/resources in terms of heterogeneity/diversity; 2) AP/Net Composition (focal firm's identity and status; partners' identity and status; access to firm's innovation resources; access to partners' innovation resources); 3) AP/Net Linkage Modalities (strength; nature - international/local, collaborative/opportunistic, explorative/exploitative); 4) AP/Net Management. The latter included AP Management capabilities, which encompassed AC, as well as multiple alliance experience, dynamic capability, coordination, resource and information sharing, and AP/Net performance assessment. In Macedo-Soares et al.'s (2016) literature review of international APs (IAPs) and innovation, AC was highlighted by some authors as a management capability with a critical role in the IAP-IP relationship. Differences were found between emerging and developed countries. In the former AC could pose a problem, because of AP's institutional diversity. Since AC was not its focus, this finding prompted us to investigate AC more deeply and pay attention to the case of APs with partners from emerging economies.

AC was defined according to Cohen & Levinthal (1990) as the "ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (p. 128). These authors proposed the AC concept, observing that it is "critical to (the firm's) innovative capabilities" (p. 128). "Unlike "learning-by-doing," which allows firms to get better at what they already do, AC allows firms to learn to do something quite different" (Lane et al., 2006, p. 836). Using the latter matrix, we applied multidimensional scaling - MDS (Hair et al, 2013), to transform metric similarities into spatial distances for the selected articles. To verify the validity of MDS, the stress coefficient was calculated and a value less than 0.15 was considered acceptable (Dugard et al., 2010). The articles were plotted in a two-dimensional space according to the coordinates calculated by the MDS.

Next, we analyzed the articles' abstracts to separate them into thematically similar clusters, so as to identify those that contributed most to our model and propositions. An in-depth analysis of these articles was conducted as in the second stage.

Results

An important result of the first stage concerned the most productive authors on the subject. G. Duysters was the leading author with 11 articles in our sample, followed by W. Vanhaverbeke (9) and U. Lichtenthaler (8). Other significant data captured at this stage referred to the countries with most publications on the subject. The US led, followed by several European countries (Spain 2nd; Germany 3rd; The Netherlands 4th; UK 5th). Considering our concern with emerging economies, it was relevant that several leaders came from these, notably from the Far East (China 6th; Taiwan 7th; S. Korea 8th). This reflects the fact that global technological alliances increasingly involve emerging countries (Jacob et al., 2013). Note however that no Latin American country is ranked amongst the first 20.

The last significant result at this stage concerned journals with most articles on the wider subject of alliances, AC and innovation. *Research Policy* (26), *Technovation* (24), *Strategic Management Journal* (23) and *International Journal of Technology Management* (17) were the four leading ones.

As noted earlier, at the second stage of our study, we conducted an in-depth analysis of the articles in our sample and their bibliographic references, with greatest potential to contribute to our study's objective. Their findings are summarized in Table 1.

Reference & Theoretical Lens & Industry	Role of AC	AP/Network Characteristics	Implications for IP	AP/Net Dimensions
George, Zahra, Wheatley & Khan (2001)/AP approach Learning Theory/ Biopharmaceutical firms	-AC mediates AP-IP relationship	- AP structure – horizontal vs vertical alliances -AP knowledge flow patterns – generative (two-way) vs attractive alliances (one way)	-Horizontal alliances give access to multiple knowledge sources. -Vertical alliances to commercialization of innovations -Generative alliances - supply firm with new technology. Attractive alliances give access to new multiple knowledge sources.	-AP/Net Structure -AP/Net Linkage Modalities -AP/Net manage-ment
Gilsing, Nooteboom, Vanhaverbeke, Duysters, van den Oord (2008)/ Network Theory Pharmaceutical, chemical and automotive industries	-AC is one of the main (innovation) exploration tasks	-The elements of alliance network embeddedness are: i) position/centrality; ii) partner technological distance iii) density	-High alliance network centrality requires smaller partner tech. distance to influence positively exploratory innovation. -Low centrality increases exploratory innovation as tech. distance increases. -Intermediate degree of density is effective in central and peripheral networks.	-AP/Net Structure -AP/Net manage-ment
Tsai (2009)/ Network Perspective Knowledge-Based View Evolutionary theory Taiwan Traditional manufacturing sectors	-AC affects positively/ negatively relationship between network partners and IP, depending on partner types and degree of innovation.	-Diversity of partner types/ knowledge sources -Relationship between vertical network partners and IP (incremental/ radical) -Relationship between rival network partners and IP (incremental) -Relationship between research organization partners and IP	-AC positively moderates impact of vertical collaboration on IP -AC's impact varies according to firm size and industry.	-AP/Net Structure -AP/Net Composi-tion

Table 1. Summary of selected articles

Cui & O'Connor (2012)/ AP approach (but not as ego-net), RBV, TCE. AC/ International perspective/ Selected firms from 60 industries (Fortune ranking)	-Resource and information sharing, -Implicitly AC, AP composition and market factors are moderating factors in the AP resource diversity - IP relationship.	-AP partner resource diversity – degree to which partner resources are different -AP composition - functional heterogeneity and national dispersion -Resource & information sharing, coordination capabilities -Alliance experience -Market factors (uncertainty).	-High partner diversity can be negative for innovation because of high transaction and coordination costs, and reduced AC. -Effective resource and information sharing across functions is necessary to reap benefits of resource diversity.	-AP/Net Structure -AP/Net Composi-tion -AP/Net Manage-ment
Lião & Yu (2013/ OL, AC & IT, not explicit AP approach nor network, merely alliances/linkages International - focus Taiwanese firms in China	-AC has a stronger moderating effect on relationship between local versus international linkages and innovation in emerging countries.	-Diversity: Local alliances (with geographically proximate firms) vs International alliances; Institutional diversity. -Alliance management/learning capabilities	-International (versus local) diversity influences more positively innovation, as it involves informal ties and greater heterogeneity. -Institutional diversity influences differences in levels of AC between developed & emerging countries, related to technology gap.	-AP/Net Structure -AP/Net Composi-tion -AP/Net Linkage Modalities -AP/Net Manage-ment
Yu (2013)/ Recombinatory SearchTheory & Network at Ego-network level/ Taiwanese high-tech firms	-AC moderates the relationship between firm Network Composition and IP	-Network composition precisely Ego-network-level Technological Diversity (different and new technological information and resources) measured in terms of distribution of patents.	-There is an inverted U-shaped relationship between technological diversity of a firm 's network (ego-net) and its IP. -Firm size and industry are important influencing factors.	-AP/Net Composi-tion -AP/Net Manage-ment
Beers & Zand (2014)/OL, AC/TCE, KBV, AP/ R & D alliances Dutch and foreign innovating firms	-AC and learning mechanisms influence significantly IP. -AC enables firms to benefit from multiple partner type experience.	-Diversity: Functional (partners from multiple categories in AP/net) Geographic (partners in different countries in AP/net) -Radical IP vs Incremental IP -Prior experience with multiple partners.	-Both geographic and functional diversity contribute to innovation -The factors explaining functional and geographic diversity are prior partner experience, patenting, and IT infrastructure that helps manage complex and diverse networks.	-AP/Net Structure -AP/Net Composi-tion -AP/Net Linkage Modalities -AP/Net Manage-ment
Leeuw, Lokshin & Duysters (2014)/ AP approach, RBV, TCE/ International perspective/ Dutch innovative firms	-Reference to the AC problem from excessive AP diversity accounting for negative influence of high AP diversity on innovation.	-Diversity Partner types, alliance types (different categories of firms), Geographical (national vs foreign) -Radical vs incremental innovation: exploration vs exploitation -Management capabilities	-There is an inverted U-shaped relationship between AP partner diversity and radical innovation and a positive relationship with incremental innovation. -Exploiting synergies and complementarities in AP can lead to superior IP.	-AP/Net Structure -AP/Net Composi-tion -AP/Net Linkage Modalities -AP/Net Manage-ment
Wuyts & Dutta (2014) AP approach/ Contingency perspective/ AC/ Biopharmaceutical industry	-Management Capabilities have fundamental role in relationship -AP diversity and innovation. -Implicitly AC and experience have a moderating role in this relationship.	-Diversity Technological -Management capabilities to align internal knowledge creation and external knowledge sourcing.	-The relationship between AP technological diversity and superior product innovation is not linear; it is moderated by firm 's past strategies to create new knowledge internally and by management capabilities regarding internal and external knowledge.	-AP/Net Structure -AP/Net Composi-tion -AP/Net Linkage Modalities -AP/Net Manage-ment

A striking finding at this stage was that all but two of the selected articles that explicitly or implicitly address AC's role in the AP-IP relationship, highlight firm AP/net diversity as a significant AP/net-work characteristic for IP. The AP/net diversity considered is generally functional (different activities, alliance types, partner types) and geographic (AP/net partners/linkages from foreign countries). It thus relates to all key AP/Net dimensions: i) AP/Net structure, because of the heterogeneity and complexity associated with diversity; ii) AP/Net composition, because of the diverse partner types/resources; iii) AP/Net linkage modalities because of the different alliance types. Note that Wuyts and Dutta (2014), that investigate AP technological diversity, and Lião and Yu (2013), that also examine geographic diversity, stress the importance of institutional diversity of firm 's multiple linkages, especially when these involve emerging countries.

The two articles that do not analyse AP/network diversity are concerned with other AP/net structure characteristics. George et al. (2001), highlights the mediating role of AC in the AP structure - IP relationship, considering vertical versus horizontal alliance type and AP knowledge-flow patterns (one-way versus two-way). Gilsing et al. (2008) investigates three network structure characteristics: position/ centrality, partner technological distance and density, and the relationship between these and exploratory innovation. AC is considered one of the two fundamental exploration tasks - novelty creation and efficient absorption of it - that have to be delicately balanced to ensure successful exploratory IP. The authors emphasize the complementary effects of these characteristics on both novelty creation and AC. Although innovation requires non-redundant contacts to access new knowledge, network density is important for integrating diverse knowledge from these contacts. For exploratory innovation an intermediate degree of density would be most effective in both central and peripheral positions. Higher network centrality, that enables greater exposure to different levels of knowledge, requires smaller partner technological distance so as to have the necessary AC to absorb knowledge from all parts of the network and generate innovation. Conversely, low centrality could increase innovation when technological distance increases. Their research finds, however, that firms with high network centrality generally have superior explorative IP.

In Macedo-Soares et al.'s (2016) literature review on international AP/networks and IP, but where the focus was not on AC, diversity was also found to be the most significant AP/network characteristic in terms of influencing IP. This influence differed according to the types of diversity and IP (radical or incremental). Although there was no consensus among authors, a majority found that the AP/ network diversity – IP relationship was not linear (see also Wuyts & Dutta, 2014). Several suggested that it was curvilinear, precisely, an inverted U-shaped relationship. After a certain point, increasing diversity would have a negative impact on IP because of the difficulty of managing increasing transaction costs and of absorbing different knowledge; in other words because of an AC problem (Leeuw et al., 2014; Yu, 2013).

This explains why most articles reviewed in Macedo-Soares et al. (2016), and those in the second stage of our study, stress the need for AP/net management capabilities (see also Duysters et al., 2012; Faems et al., 2012), with several highlighting AC, or just referring to it implicitly or explicitly. Note that many also stress prior (multiple) alliance experience together with management capabilities (e.g. Cui & O'Connor, 2012; Beers & Zand, 2014) and/or AC, not only to contend with the challenges associated with high AP/net diversity or heterogeneity, but more generally to derive greater benefit from the AP/ net for leveraging IP.

Most of those that highlight AC view it as having a moderating role in the AP/net – IP relationship, but, as we saw they do not all focus on the AP diversity characteristic. George et al. (2001), is a case in point. On the other hand, Tsai (2009), Yu (2013) and Lião and Yu (2013) are all concerned with this characteristic.

Tsai (2009) takes a knowledge-based view of the firm when investigating the mediating role of AC in the relationship between alliance network diversity and product IP. The focus is on the diversity of different partner types whose collaboration "represents...the diversity of knowledge networks" (p. 776). This has to do with the author's evolutionary theory perspective that "asserts that diverse sources of knowledge allow a firm to create new combinations of knowledge (Nelson & Winter, 1982)" (p. 776). This article is of special interest because it analyses the case of an emerging country. An important finding was that AC has a positive moderating role in the relationship between vertical collaboration, i.e. with supplier and customer partners in the firm's network, and radical product IP. This is not necessarily the case, however, for incremental product IP. When the alliances in the network are with suppliers, firm size and industry type have a significant influence, and when the alliances are with customers, AC has a negative effect on the alliance network - incremental IP relationship. On the other hand, when the alliances are with competitors in the network, AC has a positive moderating effect in the relationship with incremental IP, in the case of large firms. Tsai (2009) also found that AC has a negative influence on the relationship between research organization partners and radical IP, and a positive one in the case of incremental IP.

Yu (2013) is interesting because it involves an empirical investigation into AC's role in the inverted U-shaped relationship between ego-network diversity - technological diversity - and innovation in an emerging country, and verifies that AC has an important moderating role in this relationship. AC increases the slope and amplitude of the positive effects of technological diversity on firm IP and reduces its negative effects. Firms that are embedded in technologically diverse ego-networks should invest significantly in increasing their AC so as to derive more benefits in terms of leveraging IP from this diversity. Lião and Yu (2013) do not take a network or portfolio approach. However, this article contributes to our objective. In the scope of their empirical research into multiple linkage diversity (international and institutional) of Taiwanese manufacturing firms, the authors make evident peculiarities of emerging countries regarding AC's role in the linkage diversity – IP relationship. Their research shows that AC has a weaker moderating effect in the relationship between international linkages with firms from emerging countries due to the fact that firms in such countries generally have lower levels of AC. Institutional diversity probably accounts to some extent for differences in AC levels between developed and emerging economies.

As for the remaining selected articles that also focus on the AP/network diversity characteristic, none explicitly refer to the moderating or mediating role of AC in the relationship between this characteristic and IP, although all mention the importance of AC. For Cui and O'Connor (2012) alliance management capabilities, notably, resource and information sharing as well as coordination capabilities are highlighted as having this role. Alliance experience is also stressed in that it would help firms overcome the reduced level of AC associated with high AP partner resource diversity.

Beers and Zand (2014) who finds a positive relationship between, on the one hand, functional AP diversity and radical IP and, on the other hand, geographic AP diversity and incremental IP, also emphasizes the importance of prior experience with multiple alliances in this relationship. However, in contrast to Cui and O'Connor (2012), AC is fundamental for deriving benefits from this experience. Thus AC and learning mechanisms, implicitly, have a significant influence on the relationship between AP diversity and IP. The authors recommend investing in R&D, as well as training, because they contribute to the firm's AC, increasing its ability to assimilate knowledge from diverse external sources which could benefit its innovativeness.

Leeuw et al. (2014) that found an inverted U-shaped relationship between AP diversity and IP, do not explicitly mention AC as having a moderating role in this relationship. AP management capabilities, specifically, combining resources of partners and exploiting synergies and complementarities in the AP, are stressed as contributing to superior IP from the AP. However, AC is implicitly considered critical in this relationship when the authors highlight the fact that excessive diversity can create difficulties to manage too many new ideas because of an AC problem.

Wuyts and Dutta (2014) that also consider the relationship between AP diversity (technological) and product innovation as a non-linear one, emphasizes AP management capabilities. These would be critical for creating new knowledge internally and aligning internal knowledge creation with external knowledge sourcing, thus involving AC. The authors believe that they contribute to the AC literature "by identifying concrete dimensions of internal knowledge creation that enable firms to benefit from external knowledge": "(1) low reliance on existing solutions, (2) attention to the unfamiliar, (3) attention to the nascent, and (4) a broad perspective on the technological field to help them in leveraging the value of extramural knowledge" (p. 1655). They hold that these dimensions have a moderating role in the relationship between portfolio diversity and superior product innovation.

As mentioned earlier, in the third stage, we used BC to analyze the 33 articles that had at least 10 common references. Next, we performed MDS using the Pearson correlation matrixes, generated by the BC, and we created a bi-dimensional map of thematically close articles (Figure 1). The stress index was 0.05618, which was lower than the threshold value that was considered appropriate. All articles were analyzed qualitatively in order to identify the three thematic clusters featured in Figure 1:

- Cluster 1 (6 articles) addresses AP, AC and IP jointly. These articles were considered the most important ones for developing our model. Two of these coincided with a couple of those selected at the second stage;
- Cluster 2 (9 articles) composed of the most recent articles (all except one published in 2015), two of which were considered highly relevant;
- Cluster 3 (8 articles) none explicitly address both AC and IP. None of these were considered relevant.



Figure 1. BC's Two-dimensional Plot

As frequently occurs in BC, a few articles in the clusters were included because they have similar bibliographic references to those of the other articles in the cluster, although they are not perfectly aligned with the cluster's main theme. Note, moreover, that ten articles were not included in any of the clusters, due to a lack of similarity regarding both themes and bibliographic references.

Our analysis enabled the identification of two critical dimensions: AC (vertical axis) and Time Frame (horizontal axis). The vertical axis indicates that most articles that explicitly address AC are found in the

upper part of the figure, while the lower one shows those that hardly address AC. The Time Frame axis points to the left indicating that a concentration of the most recent articles is found on the left side. Indeed, all those published in 2015 are on that side (see Figure 1). In sum, of the 33 articles analysed, seven were selected as contributing most to the development of our conceptual model, two of which had already been identified at the end of the second stage: Beers & Zand (2014) and Wuyts & Dutta (2014) (see Table 1). In Table 2 we summarize the most important findings of our in-depth analysis of the five other articles.

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Reference & Theoretical Lens/ Industry	Role of AC	AP/Network Characteristics	Implications for IP	AP/Net Dimensions
Caner, Sun & Prescott (2014) Alliance Network approach /AC/ Bio-pharmaceutical industry	-Inward knowledge transfer (amount of knowledge transfer from other firms to the focal firm), synonymous of the acquisition dimension of AC, has positive impact upon IP measured by invention output).	-Centrality – i.e. number. of direct ties in the firm's early stage R&D alliance (ego) network	-Centrality of R&D alliance network has positive implications for IP in the case of inward knowledge transfer (AC) and negative implications (risks associated with "invention dissipation effect") in the case of outward knowledge transfer. However, the latter when coupled with inward knowledge transfer enhances IP. The coordination of inward and outward knowledge transfer processes "has the potential to create a virtuous invention cycle" (p.206).	-AP/Net Structure -AP/Net Manage-ment
Lin, Wu, Chang, Wang and Lee (2012) AP approach / AC/ Biotechnology industry	-AC emphasized as fundamental for achieving innovation via AP/ networks. Emphasizes importance of R&D alliances in AP. AC's positive impact depends on the % of R&D alliances in the AP, technological distance, and R&D intensity.	-Percentage of R&D alliances in the AP -Technological distance (partner diversity in terms of differences in technology classes of partners' patents) -R&D intensity -Interaction of these three factors.	 -AC has a positive impact on IP especially when high % of R&D alliances in AP. -AC has a critical moderating role between AP and IP when technological distance between partners is high. -R&D intensity positively moderates effect of AP on IP. -Inverted U-shaped relationship between technological distance and IP. -The higher the proportion of R&D alliances in AP, the greater the positive impact of technological distance (technological diversity among R&D partners) on alliance IP. 	-AP/Net composi-tion -AP/Net Manage-ment

Table 2. Summary of findings - Stage 3

Hurmelinna- Laukkanen, Olander, Blomqvist & Panfilii V (2012) Alliance network approach /AC/ Finnish R&D intensive firms	-AC is positively related to IP. -AC is one of the 3 components of R&D alliance network "orchestration"	-Alliance network stability -Innovation appropriability -Network (partner) diversity -Network "orchestration" style as opposed to top down management.	-Innovation appropriability is relevant to a positive IP -Net stability did not influence IP according to the empirical findings. -Network diversity is positively related to performance. These three factors influence R&D network orchestration.	-AP/Net Structure -AP/Net Manage-ment
Vanhaverbeke, Belderbos, Duysters & Beerkens (2015) AP approach / AC/ integrated circuit industry	-AC reinforces IP for firms with both high technological and high alliance capital in early stages of the technology life-cycle	-Technological capital (focal firm 's number of patents weighted by citations) -Alliance capital (no. of existing technology alliances)	-Alliance capital has an inverse U-shaped relationship with IP -AP/net management capabilities are needed for recombining external and internal technology	-AP/Net size -AP/Net composi-tion -AP/Net Manage-ment
Srivastava, Gnyawali, Hatfield (2015) AP approach / AC/ US semiconductor industry	-Moderating role of AC in realizing innovation benefits from the alliance network technological resources	-AC measured according to 2 dimensions: technological effort and technological capability. -Network size -Level of technological resources of the network	 The two dimensions of AC have opposing moderating effects on IP. The higher the firm 's technological capability, the lower the impact of the network 's technological resources on its IP. The higher the firm 's technological effort, the higher the impact of the alliance network 's technological resources on its IP. Network size influences positively IP. 	-AP/Net structure -AP/Net composi-tion

It is interesting to compare Caner et al.'s (2014) findings with those of Gilsing et al. (2008) (second stage). Both articles emphasize the AP/ network centrality characteristic. Caner et al. (2014) finds that high alliance network centrality has positive implications for IP by increasing the positive moderating effect of the acquisition component of AC in the alliance ego-net –IP relationship. Gilsing et al. (2008) also found that, generally, firms with high centrality have higher exploratory IP. However, it highlights the importance of considering centrality in the light of both network density and technological distance. Contrary to Gilsing et al. (2008) Caner et al. (2014) is not explicitly concerned with the AP/network diversity factor. On the other hand, alliance network management capabilities, precisely, coordination of inward (AC) and outward knowledge transfer processes, are stressed as critical.

Lin et al. (2012) converges with Gilsing et al. (2008), with respect to technological distance and partner diversity, when emphasizing the importance for IP of not having too great a technological distance between AP's partners, and the role of AC as a moderator of the negative effects of significant technological distance on IP. It contributes by underlining the importance of the proportion of R&D alliances in the AP and AC's significant role when this proportion is particularly high. However, the article stresses the need for a certain degree of technological distance (diversity) between the R&D alliances as being fundamental for enabling innovation.

Hurmelinna-Laukkanen et al. (2012) that focusses on firms' R&D alliance networks, also finds that AC has a positive influence upon the network's and firm's IP. However, AC should be considered as one of the three central components of R&D alliance network "orchestration". The other components are network stability and innovation appropriability. It contributes by highlighting the need for an orchestration style of AP/net management and by investigating the innovation appropriability factor within the network. A certain level of network stability enhances AC and innovation appropriability; while dynamism and change are important to ensure the necessary variety for innovation. In fact, network diversity (different types of partners), although only briefly addressed in the article, was found to be positively related to performance.

Vanhaverbeke et al. 's (2015) main contribution lies in finding that AC reinforces IP for firms with both high technological capital and high alliance capital in their APs, only in the early stages of the technology life-cycle. This work converges with most of the other selected articles when it stresses the need for AP management "capabilities to recombine knowledge from external technology sourcing and internal technology development" (p. 560) so as to draw benefit from the AP/net.

Srivastava et al.'s (2015) main contribution is to have deepened the analysis of AC's moderating role of AC in the relationship between alliance networks, precisely, their technological resources, by contemplating two dimensions of AC – technological effort and technological capability - and verifying empirically that they have opposing moderating effects on IP. The former was found to have a positive moderating effect.

Discussion, Propositions and Conceptual Model

Our findings strongly suggest that AC is one of the critical moderating factors in the AP-IP relationship. Indeed, it is "AP/net management capabilities" that is generally viewed as having this moderating role. Amongst these, some researchers who investigated this relationship have highlighted capabilities for "orchestration" style AP/net management, and/or for resource and information sharing, for exploiting synergies and complementarities, for recombining knowledge from external technology sourcing and internal technology development, and/or for coordination of inward (AC) and outward knowledge transfer processes. However, practically all of these also consider AC as being an important factor, even if not having a moderating role in the relationship. We saw that this

role varies depending on the type of AP characteristic investigated as well as the type of IP at issue - radical/explorative or incremental/exploitative. Firm characteristics (size and age), and industry type, were also viewed as significant intervening factors. In the second stage of our study, AP/net diversity stood out as the most significant AP or alliance network characteristic but depending on the type of diversity, for e.g. partner type, AC affected the AP/net–IP relationship differently. The research in Tsai (2009) is a clear example of this.

In the third stage, while AP/net diversity was not explicitly addressed in most articles, other AP/net characteristics, such as centrality, size, stability and volume of resources were highlighted. AP/net management capabilities were stressed in all articles except one.

The finding that we viewed as particularly important concerned the AC level problem in emerging countries and the differences in these countries regarding AC's moderating role in the AP–IP relationship. Below we formulate a few propositions for analysing the role of AC in the relationship at issue with the help of our conceptual model (Figure 2) focussing emerging countries.

Propositions:

P1: In emerging countries, AC positively moderates the relationship between AP/Net functional diversity and radical/explorative IP

P2: In emerging countries, AC positively moderates the relationship between AP/Net functional diversity and incremental/exploitative IP

P3: In emerging countries, AC positively moderates the relationship between AP/Net geographic diversity and radical/explorative IP

P4: In emerging countries, AC positively moderates the relationship between AP/Net geographic diversity and incremental/exploitative IP

P5: In emerging countries, AC positively moderates the relationship between AP/Net technological diversity and radical/explorative IP P6: In emerging countries, AC positively moderates the relationship between AP/Net technological diversity and incremental/exploitative IP

P7: In emerging countries, AC positively moderates the relationship between AP/Net institutional diversity and radical/explorative IP

P8: In emerging countries, AC positively moderates the relationship between AP/Net institutional diversity and incremental/exploitative IP

P9: In emerging countries, the level - high/low - of AC influences positively/negatively AC's moderating role in the relationship between AP/net diversity and IP

P10: In emerging countries, firm characteristics (size and age) influence AC's moderating role in the relationship between AP/net diversity and IP

P11: In emerging countries, industry type influences AC's moderating role in the relationship between AP/net diversity and IP

P12: In emerging countries, partner country type - emerging versus developed - influences AC's moderating role in the relationship between AP/net diversity and IP.

In Figure 2 we present our conceptual model, highlighting in bold black the variables in the different dimensions to be focussed on first, in keeping with our propositions. These variables are AC in the AP/Net Management Capabilities dimension, AP/net diversity in the AP/net structure dimension, and Radical and Incremental Innovation in the firm IP dimension, as well as the control variables: firm size, firm age, industry type and partner country type - emerging versus developed country. Since AP/Net diversity relates to AP/Net composition and AP/ Net linkage modalities, these two dimensions are also in black.



Managerial Implications, Limitations and Future Research

We believe that our research has important managerial implications especially for firms in emerging countries. Compared with those from developed countries the latter generally have greater difficulty innovating because of their lower degree of technological capacity and development. Therefore, they should increasingly participate in fairly, but not excessively, diverse APs, in order to have access to a greater variety of knowledge. However, to transform this knowledge into effective innovation, it is fundamental that they also leverage their AC that, as we saw, is usually much lower in emerging economies, together with other AP management capabilities, notably, resource and information sharing, coordination, orchestration and recombining of internal and external technology. The development of the necessary AC implies investing in learning how to assess and apply knowledge through personnel training, contracting of qualified professionals, reverse engineering and internal R&D.

Our study had some limitations, including, specifically, a methodological one: the fact that we only used one data base – Web of Science, albeit one of the most comprehensive ones. The second stage that involved qualitative analysis of not only the articles in our sample but also those referenced in this sample as well as in other literature reviews related to our subject aimed at overcoming this limitation. However, the use of several other data bases would be highly recommended in a follow-up study.

Where future research is concerned, we suggest that it consider the variables in blue in our model together with the ones highlighted, in keeping with a systemic holistic approach and to appreciate their complementary effects on both AC's mediating role, when applicable, and different types of IP, as has been argued, among others, by Gilsing et al. (2008). In addition, we recommend that future research into emerging countries also consider the -reverse innovation- performance type (Govindarajan & Ramamurti, 2011).

Moreover, we believe that a comparison between AP characteristics, notably diversity (functional, geographic, technological and institutional), and their relationship with IP, respectively, radical and incremental, involving both emerging and developing countries and APs could reveal new very relevant insights.

As we noted, the Asian emerging countries are the most productive among the emerging economies in terms of number of publications on the topic at issue. Only four articles in our sample were from Latin American countries. Considering the increasing importance of APs and networks for leveraging innovation of firms in emerging countries (Jacob et al. 2013), we recommend that future research focus on Latin America and conduct comparisons with results from emerging countries in Asia.

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Board Composition and Innovation in University Spin-offs. Evidence from the Italian Context

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Abstract: Corporate governance issues are critical in university spin-offs because, since their substantially knowledge and technology-driven nature, investments are characterized by rapid growth and real investment opportunities, affecting innovative activity too. In this view, the paper investigate the role of the board of directors' composition on innovation performance of university spin-offs. Based on a panel sample of 478 Italian university spin-offs, the results show that board size has an inverted-U-shaped relationship with innovation, remarking that not too large boards are more efficient and work better, influencing in a positive way the innovation activity of the spin-off. Regarding the impact of the outside directors, the results seems to invalidate its positive and significant effect on innovation performance. Also the CEO-duality seems to have no influence on the innovative activity. These findings may represent potential indicators of the optimal configuration for board in university spin-offs in order to improve innovation.

Keywords: university spin-offs; innovation; board size; outside directors; CEO-duality; Italy.

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Introduction

Over the past years, the attention given by the literature to the growth and innovative dynamics of entrepreneurship through university spin-offs, i.e. new technology-based firms (NTBFs) generally small and medium enterprises (SMEs) created with the support of the university and its members, has significantly increased (Niosi, 2006; Sternberg, 2014; Guerrero et al., 2016). These university start-ups constitute a potential active tool in stimulating the creation of value, innovation and the development of knowledge-based economies (Sternberg, 2014). Therefore, the determinants related to their genesis and growth have become key issues in the policy actions about the dissemination and the governance of innovation in specific environmental settings.

The literature focus mainly on the macro, meso and micro determination factors of growth and innovation of university start-ups (Djokovic & Souitaris, 2008) but not among those have been deeply investigated the dynamics of the governance of the same. However, the relevance of corporate governance is recognized by the literature (Palumbo, 2010), also those involving companies with similar characteristics to the university spin-offs, such as new technology-based firms and high-tech SMEs (Colombo et al., 2014). The study of corporate governance assumes a particular prominence in the university spin-offs because, since their substantially knowledge and technology-driven nature, investments are often characterized by rapid growth and real investment opportunities. These elements may lead to generate a potentially high information asymmetry between management and owners (Gaver & Gaver, 1995). Simultaneously, they may generate agency problems, since the aims and attitudes to risk valuation of the principal does not always match with those of the agent, especially in high-tech business (Hayton, 2005). In addition, there are considerable evidence that corporate governance affect innovation outcomes of the firms (Belloc, 2012). In this context, internal governance mechanisms, such as those related to the evolution and composition of the board of directors of the spin-off were considered potentially advocates and influencers to create value and innovation (Bjørnåli & Gulbrandsen, 2010). On this view, the current study aim to investigate the role played by the board of directors, in its some different characteristics and composition, on innovation performance of university spin-offs by analysing a sample of 478 Italian university spin-offs extracted from Netval, Aida and Infocamere databases at 2015.The choice of Italy is not random; indeed, Italy is one of the major European countries reporting a rapid expansion of the university spin-off phenomenon (Iacobucci & Micozzi, 2014).

The study aims to adds some conceptual and methodological insights to the literature. First, we add to the growing body of research on innovation by highlighting board of directors' composition as a potentially important determinant of innovation in university spin-offs. Second, the results arising from the study could be generalized beyond the Italian context, as the European university spin-offs share more of the same characteristics and peculiar issues (Visintin & Pittino, 2014).

Theoretical background and hypotheses development

In the last years, the focus on corporate governance dynamics has grown significantly in management and innovation literature (Belloc, 2012). This also true especially with reference to the board composition and features of its directors. Nevertheless, governance studies



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have concentrated on large public firms instead in private small and medium sized firms (SMEs) and technology- and knowledge-based firms, as previously observed, the evidence on university start-ups are scarce. For this reasons, this paper focuses on the link between firm innovation and board composition, specifically refer to its size, the presence of outside directors and the CEO duality in university spin-offs.

Board size and innovation in university spin-offs

It was noted that larger boards are capable to provide the resources and know-how to perform additional and better monitoring, mainly in multifaceted contextual settings (Linck et al., 2008). Next, a greater amount of directors let the company to potentially access a superior pool of external resources, comprising financial and technological resources that are pivotal for innovation and spin-off in particular. Furthermore, according to the stakeholder theory, a greater board is able to hold other stakeholders in innovation, for instance strategic researchers, whose incentive might result in superior innovation activities (Adams et al., 2010).

With regard to the SMEs, evidences highlight that these firms have relatively a small number of directors on their board (Gabrielsson, 2007) and that increased board size may generate a positive impact on performance. The researchers in line with this vision claim that a greater board will bring together a better penetration of knowledge and, hence, lead to better strategic choices that finally affect performance.

Nevertheless, the benefits of add more directors can be compensated by the costs related to the inferior communication and decision-making linked with bigger board (Cheng, 2008). Indeed, greater boards are potentially less capable because the problems rising from the agency issues among the directors (Jensen, 1993). In this view, some studies highlight an inverse association between performance and the size of the board (Eisenberg et al., 1998). Hence, the influence of board size on firm performance and innovation is a trade-off between benefits and disadvantages (García-Olalla & García-Ramos, 2010). Consequently, it could be argue a non-linear association between the size of the board and innovation in university spin-offs. Therefore, in line with the previous arguments, the following hypothesis was developed:

H1. There is an inverted-U-shaped relationship between the size of the board and innovation performance for university spin-offs.

Outside directors and innovation in university spin-offs

Outside directors play an important role in a firm. In the corporate governance studies, agency theory suggests that better monitoring mechanisms are required in order to safeguard shareholders from administration's self-interests and outside directors are potential protectors of the shareholders' interests through monitoring activity. Hence, a high fraction of outside directors on the board might generate a positive effect on performance, also in term of innovation, by monitoring facilities (Fama & Jensen, 1983). Following the agency theory, some studies argue different theoretical clarifications about the determining factor of board composition, remarking the role of outside directors (Linck et al., 2008). Generally, different types of independent directors, such as financiers, venture capitalists, may bring different assets to the firm or constitute key stakeholders (Adams et al., 2010). An emergent body of study proposes that a resilient and vigilant board of directors may have a positive impact on the value creation in small and medium-sized businesses and start-ups such as university spin-offs, facilitating strategic change and innovation (Gabrielsson, 2007).

Taking into account the resource based view theory, small businesses such as university spin-offs are generally characterized by a lack of internal resources. In this context, it becomes critical the advisory role of the board (Daily & Dalton, 1993), as they can provide additional knowledge that can be used by the management in generating and applying their innovative strategies (García & García-Olalla -Ramos, 2010). In this view, the presence of outside directors on the board of small firms will reflect the missing resources needed to the CEO and the company, supporting performance and innovation efforts.

Furthermore and according to the resource dependency theory, outside directors are considered as a liaison mechanism between the firm and its environment, which can support managers in the implementation of the various objectives of the organization (Zahra & Pearce, 1989). This aspect is critical for start-ups and small companies such as university spin-offs, which require external access to financial and human resources (Daily & Dalton, 1993). Hence, in view of the above arguments, the following hypothesis was developed:

H2. The proportion of outside directors of university spin-offs is positively associated with firm' innovation performance.

CEO-duality and innovation in university spin-offs

The agency-based theory of corporate governance usually proposes that the positions of CEO and Chair of the board should be distinct. Indeed, merging the positions (CEO-duality), it is claimed prejudice the capacity of the board to monitor the company (Fama & Jensen, 1983; Coles et al., 2001), since the single individual may engage friendly directors and hinder the flow of communication. In the case the CEO and chairman are distinct persons, the boards of directors are more incline to be independent, as well as more effective and efficient in monitoring managers; consequently, superior firm performance are expected. Nevertheless, stewardship theory claims that the separation between CEO and chairman can potentially avoid harmony and effectiveness in decision-making (Finkelstein & D'aveni, 1994).

With specific regard to the SMEs context, such as the majority of university spin-offs, the position of chairman and chief executive officer is usually held by a single person. This practice has attracted much criticism based on the agency theory (Pugliese & Wenstøp, 2007). Also in the case of small firms, the need for a separation of the two

roles is linked to the fact of how the board is called to monitor the actions of top management and evaluate their performance (Gabrielsson et al., 2007). Indeed, in SMEs independent leadership may lead to a balance of power between the CEO and the chairman of the board, improving the firm's performance (Rashid & Lodh, 2011).

Furthermore, also if CEO-duality may potentially stimulate the interests of the close members of firms, it may limit the benefits from hiring the best existing professional managers that can be particularly large for innovative activities in university spin-offs. Accordingly, the following hypothesis was developed:

H3. There is a negative association between the CEO-duality and innovation performance for university spin-offs.

Method

Sample and Data

With the aim to empirically investigate the hypothesis developed, sample and data employed are drawn from the national network of Netval at December 2015, which collect updated information about the full population of active spin-offs in Italy, while data cover a period from 2010 to 2014. From the initial population were excluded those companies resulting inactive, in liquidation or ceased from the certified company registration of Infocamere extracted from the database of the Italian Chambers of Commerce. This results in a final sample of 478 Italian university spin-offs, whose qualitative data were sourced from the same database of Infocamere, from corporate and home university websites and, in relation to the accounting data from the Aida BdV database, which contains historical financial, biographical and merchandise data of about 700,000 Italian active companies.

Variables definition

Dependent variable

The dependent variable applied in this study, the innovation performance of university spin-offs, was measured by a dummy variable that takes the value 1 if the university spin-off had innovative activity and 0 otherwise, as declared by companies and reported in the original database used for the study (see Section Sample and Data for details).

Independent variables

With the aim to predict the effect of board size on the innovation performance of university spin-offs (BOARD SIZE), it was used the natural logarithm of total number of members of the board of directors. The transformation in log is due to problems with non-normal distributions.

The impact of outside directors on innovation performance of university spin-offs (OUTSIDE DIRECTORS) was calculated as the ratio of external directors on the board. The purpose of this variable is to measure the board's monitoring capability, with the aim to examine its impact on the firm' innovation. Finally, in order to measure the impact of CEO-duality on innovation performance of university spin-offs (DUALITY), it was used a dummy variable which takes value 1 if the chairman and the CEO are the same person and 0 otherwise.

Control variables

It is to note that firm size impacts on innovative efforts of the firm. Indeed small companies are more able to innovate compared to the bigger ones, consistently to the innovative efforts involved by the firm. Hence, we control for firm size (SIZE) by using the natural logarithm of total assets.

Furthermore, we control for firm age (AGE) by using the natural logarithm of the number of years since the firm was incorporated.

In addition, firm performance has also been remarked to affect innovation performance. The accounting performance was computed by using two profitability ratio, namely return on assets (ROA) and return on equity (ROE). Each measure was measured by dividing net income by total assets and total shareholder equity respectively.

Analytical approach

In order to test the research hypotheses developed it has been used a binary probit GLM in the estimation of parameters, which is particularly suitable in case of dichotomous dependent variables. The use of ordinary least square (OLS) regression is inappropriate for this type of dependent variables because the possible range of values is limited to two sides of the interval [0-1]. Furthermore, this statistical method is designed for a maximum-likelihood estimation of the number of rates of non-negative counts.

Results

Univariate analysis

Table 1 presents descriptive statistics for the variables in the analysis. We show minimum, maximum, mean and standard deviation values for the university spin-offs in the sample. The results indicate that the sampled university spin-offs show a medium-low degree of innovation performance, with a mean value of 14.9% of firms with innovation and a moderate dispersion in the sample (S.D. = 35.58%).

Furthermore, the results show that, on average there are 32.12% of outside directors on the board with a moderate dispersion in the sample (S.D. = 37.63). With reference to the leadership structure, in the 31.7% of the university spin-offs of the sample, both the figures of Chairman and CEO are the same person, although this value is quite heterogeneous in the sample (S.D. = 46.55). According to board size, the mean value is 2-3 members per board, with a medium-low dispersion in the sample (S.D. = 1.69). It seems that the boards of the university spin-offs in the sample are quite small. In relation to the control variables, the firms in mean have 8 years, a value with a medium-low homogeneity in the sample (S.D. = 3.78), remarking that spin-off is a recent phenomenon in Italy. Regarding firms size, the sample have on average 453,907.06 of total assets, although this value is high heterogeneous in the sample (S.D. = 1,167,610.94). Fi
nally, regarding the accounting performance of university spin-offs sampled, the results reveal a mean of ROE of 3.27 and a mean of ROA of 0.17, but the same values are quite dispersed in the sample, remarking the heterogeneity in the performance of this kind of firms and their difficulties in creating new value. Table 2 reports the bivariate Pearson correlations among all variables used in the study. Given the lack of sufficient high correlations among the independent variables, issues of nonsense correlation are not detected. To test for multicollinearity, the VIF was calculated for each independent variable. Myers (1990) suggests that a VIF value of 10 and above is cause for concern. The results (not shown in this paper) indicate that all the independent variables had VIF values of less than 10.

Table 1.Descriptive statistics.							
Variables	Ν	Min.	Max.	Mean	S.D.		
INNOVATION	2590	0.000	1.000	0.149	0.356		
BOARD SIZE	2590	1.000	11.000	2.726	1.692		
OUTSIDE DIRECTORS	2590	0.000	100.000	32.128	37.634		
DUALITY	2490	0.000	1.000	0.317	0.466		
AGE	2590	1.000	29.000	8.021	3.789		
SIZE	2139	2865.000	12072852.000	453907.066	1167610.943		
ROA	2137	-428.760	88.250	0.177	w30.496		
ROE	2016	-147.440	92.360	3.274	31.941		

Source: authors

	Table 2. Correlations.								
		1	2	3	4	5	6	7	8
1	INNOVATION	1	0.077**	-0.039*	0.039	-0.395**	-0.112**	-0.038	-0.012
2	BOARD SIZE	0.077**	1	0.088**	-0.441**	-0.073**	0.196**	0.125**	0.091**
3	OUTSIDE DIRECTORS	-0.039*	0.088**	1	-0.068**	0.042*	0.238**	-0.117**	-0.114**
4	DUALITY	0.039	-0.441**	-0.068**	1	-0.025	0.056*	-0.004	-0.016
5	AGE	-0.395**	-0.073**	0.042*	-0.025	1	0.375**	-0.050*	-0.048*
6	SIZE	-0.112**	0.196**	0.238**	0.056*	0.375**	1	0.065**	0.119**
7	ROA	-0.038	0.125**	-0.117**	-0.004	-0.050*	0.065**	1	0.749**
8	ROE	-0.012	0.091**	-0.114**	-0.016	-0.048*	0.119**	0.749**	1

*** p < 0.001; ** p < 0.01; * p < 0.05; (all two-tailed tests). Source: authors

Multivariate analysis

Table 3 shows the results of the binary probit GLM in the estimation of innovation performance of university spin-offs. The regression analyses are performed in a step-wise manner. column I includes all the control variables; columns II, III, IV and V refer to the three main effects, entered one by one, while column VI represents the full model.

H1 remarks an inverted-U-shaped relationship between the size of the board and innovation performance for university spin-offs. Our results (column II) show first a positive and statistically significant estimated coefficient on BOARD SIZE (coeff. = 0.377, p <0.05) and, then, a negative and statistically significant estimated coefficient on its square (coeff. = -0.330, p <0.01). However, our findings (column III) show a significant negative estimated coefficient on BOARD SIZE (coeff. = -0.169, p <0.01). Thus, these results support H1.

H2 states that the proportion of outside directors of university spinoffs is positively associated with firm' innovation performance. In the column IV, the estimated coefficient on OUTSIDE DIRECTOS is slightly positive and not statistically significant, so not supporting H2.

Finally, H3 states a negative association between the CEO-duality and innovation performance for university spin-offs. In the column V, the

estimated coefficient on DUALITY is negative and not statistically significant, thus not supporting H3.

Hence, the results of our regression evaluating the influence of board composition on innovation performance for university spin-offs seem to reveal that only board size have a critical function on the innovation activity of the firm.

Table 3. GLM binary probit regression estimation predicting the effect of board composition on innovation performance of university spin-offs.

Variables	(I))	(II)	(III))	(IV	.)	(V))	(VI)
	В	S. E.	В	S. E.	В	S. E.	В	S. E.	В	S. E.	В	S. E.
Control variables												
AGE SIZE ROA ROE	1.170**** -0.029 0.000 0.002	(0.0911) (0.0322) (0.0026) (0.0017)	1.144*** -0.008 0.000 0.002	(0.0914) (0.0333) (0.0027) (0.0018)	1.137*** -0.007 0.000 0.002	(0.0910) (0.0331) (0.0027) (0.0018)	1.171*** -0.031 0.000 0.002	(0.0917) (0.0326) (0.0026) (0.0017)	1.197*** -0.034 0.000 0.002	(0.0926) (0.0326) (0.0026) (0.0017)	-0.241*** 0.003 0.000 0.000	(0.0202) (0.0054) (0.0005) (0.0003)
H y p o t h e s i z e d effects BOARD SIZE	-	-	0.377*	(0.1906)	-0.0169**	(0.0639)	-	-			-0.030	(0.0420)
B O A R D SIZE ²	-	-	-0.330**	(0.1122)	-	-	-	-			0.047	(0.0255)
O U T S I D E Directors	-	-	-	-	-	-	0.000	(0.0011)			0.000	(0.0002)
DUALITY	-	-	-	-	-	-	-	-	-0.012	(0.0844)	0.033	(0.0191)
Likelihood-ratio chi-square	204.121***		221.024***		211.894***		204.172***		207.722***		254.203***	
DF	4		6		5		5		5		8	

*** p < 0.001; ** p < 0.01; * p < 0.05; (all two-tailed tests). Robust standard errors in parenthesis. Source: authors

Results discussion and conclusions

The paper aimed to study the role played by the board of directors, in its some different characteristics and composition, on innovation performance of university spin-offs. In detail, and based on existing literature and theoretical arguments, mainly referring to the agency theory, the resource based view theory and the resource dependency theory, it was stated that board size has a non-linear effect on innovation performance of university spin-offs, while the presence of outside directors and the CEO-duality have, respectively, positive and negative effect on the innovation performance of the university start-ups.

In order to test the developed hypotheses, a panel sample of 478 Italian university spin-offs was investigated during an exploration period of four years, from 2010 to 2014. The results show that the board size seems to have, first, a positive impact on innovation of university start-up and, then, a negative effect with the increase of directors in their composition. These findings is in line with those of De Andrés et al. (2005), remarking that not too large boards of directors are more efficient and work better, influencing in a positive way the innovation activity of the firm too. On the other hand, the findings contrast with other studies (García-Olalla & García-Ramos, 2010), which highlighted that increasing the board size improves firm performance. However, the results of the current study remark, according to Jensen (1993), that the benefits of adding more directors on the board appear to be outweighed by the issues link to inefficient communication and harmonization of great boards. Regarding the impact of the outside directors, the results seems to invalidate its positive and significant effect on innovation performance of the university spin-offs. This evidence appear to deny the postulation that outside directors have a key and superior monitoring, social and advising role compare to the internal directors. However, Hermalin & Weisbach (1991) propose that both inside and outside directors may be unsuccessful in accomplishing their function of representing shareholders' interests correctly, i.e., it cannot be argued that outsiders accomplish their functions better than insiders. Additionally, usually outside directors lack key knowledge of the firm compared to the insides, as well as they are unfamiliar with the activity and resources of the firms, including innovative ones. This lack of knowledge of outsiders seems to be potentially more evident in the university spin-offs.

Also the CEO-duality seems to have no influence on the innovation performance of the university spin-offs. The irrelevance of the duality effect, although in contrast with the findings reported by Coles et al. (2001), it is in line with the empirical evidences of Elsayed (2007) with reference to the firm performance. In line of the observations obtained from the study, it could be argued that in the university spinoffs context the separation of the figures of CEO and chairman is does not have implication in term of innovative activity of the firm. The reasons may be associated to the fact that for university start-ups the stewardship theory have major role compared to the agency theory; hence, the separation between CEO and chairman may be beneficial in term of coordination and effectiveness in decision-making. The study has some interesting practical and policy implications. The findings of the current study may represent potential indicators of the most proper configuration for board of directors in university spin-offs with the purpose to improve their innovation performance. First, it is important for university spin-offs have a good and better represented (with reference to the stakeholder's interest) board of directors, improving their monitoring effectiveness and commitment in innovative activities; although it is important that the board not becoming too large in order to avoid problems of coordination and effectiveness in decision-making process related to the innovation strategy. Second, since outside directors seem to no promote innovation, or not have influence on the correlated activities, maybe university spin-offs need to select and attract external directors that will be more suitable for the firm. Outsider selection is important because must give professionalism to the board. Indeed, outside directors are useful to the firms if they add further and complementary expertise and capability, which should to be able to improve together the innovation efforts of the university stat-ups.

Nevertheless, the study is not free of limitations. First, although the paper use panel data, the relative short period of investigation limit the robustness of the causal relations among the dimensions investigated. Therefore, future studies may will be benefit from collect additional time's series data in a medium-long period, in order to improve the effectiveness and clarification of the assumptions associated with the causality of the relations studied. Second, although the comparability of Italian university spin-offs data with those of the overall European context, additional data on European spin-offs and comparison among countries are needed in order to increase the probability of generalizing the emerging empirical evidence and build a more robust and specific theoretical background on the matter.

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Associations for Disruptiveness - The Pirate Bay vs. Spotify

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Abstract: Most studies on disruptive innovations adopt technology-centric assumptions when explaining how industries are affected by a technology's creative destruction. This paper argues that the power of a technology lies in how it performatively associates with the cultural and social norms of the wider society. Hence, a technology is not disruptive or sustaining in itself but is potentially a productive outcome of network linkages with other social and material elements. To illustrate this claim, two digital music services will be analyzed, respectively a misfit and a maverick both challenging mainstream providers of music – The Pirate Bay and Spotify – in relation to each other and how they are positioned toward the transformation of the music industry as a whole.

Keywords: Innovation; disruptive technologies; discontinuous innovation; radical innovation; digitalization; translation; Actor Network Theory; music industry; Spotify; The Pirate Bay

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Introduction

The idea of disruptive technologies (Christensen, 1997) has been often highlighted in the management and innovation literature in recent years. Much of this theorizing focuses on the "incumbents' curse" (Chandy & Tellis, 2000; Foster, 1986) and the difficulties for established firms to align to new technological paradigms (Dosi, 1982). Some have directed attention to how firms can manage radical, discontinuous and disruptive innovations in relation to existing internal knowledge structures and processes (Dewar & Dutton, 1986; Ettlie, Bridges, & O'keefe, 1984; McDermott & O'Connor, 2002). Others (e.g. Rogers, 1962; Utterback, 1994) have looked at how novel innovations form distinct diffusion patterns, where critical masses over time have the ability to weed out old regimes through positive feedback loops. Both these directions take the quasi-deterministic stance where the technology is seen to have an innate capacity to transform society and the focus of these authors is simply to record the processes. From this viewpoint, disruptive power is exerted through the technology's inertial force and the medium's way of transmitting its execution in an effective manner.

This article will highlight an alternative framework to explain disruptive outcomes, arguing in line with actor network theory (Callon, 1986, 2007; Callon & Latour, 1981; Latour, 1986) that the disruptive power of a technology is not found merely in its inner core, but rather in how it performatively *associates* with the cultural and social norms of the wider society. In this sense we need to focus on the numerous and complex ways that certain notions of technology "are (or fail to be) articulated and mobilized in diverse - academic, consumer, media as well as practitioner – discourses" (Knights, Noble, Vurdubakis, & Willmott, 2002, p. 113). A technology is not in this framework disruptive or sustaining in itself but just often labelled so (Knights & Vurdubakis, 2005) whereas it is more often a productive outcome of a network of enrolled linkages with other social and material elements (Callon, 2007). This actor network theory (ANT) approach is still comparatively rare in the theoretical analyses of disruptive innovation since generally precedence is given *either* to the material aspects (i.e. technology) *or* to the social aspects to explain disruptive outcomes (Orlikowski, 2007). Put differently, the most common approaches to innovation take either a technological determinist view where new technologies are seen to disrupt organizational and social routines or a social shaping approach in which it is the cultural and social interpretations of a technology that are seen as instrumental in creating change (MacKenzie & Wajcman, 1999). ANT breaks down this technical – cultural binary to facilitate a socio-material understanding of the enrolment of material artefacts and actors in the mobilisation of alliances that stimulate and sustain change and innovation.

To illustrate the socio-material link in disruptive innovations, two digital music services will be analyzed - The Pirate Bay and Spotify - in relation to each other and also in how they are positioned toward the transformation of the music industry as a whole. Both ventures could be seen as successfully implemented innovations, with the same Swedish geographical roots and performing similar tasks of distributing music to end-users through the application of new digital technology. But as they have gained acceptance among music consumers, the two initiatives have had a very different reception in relation to the dominant incumbents of the music industry. This facilitates a comparative analysis and a nuanced theoretical reflection on the performance of digital technologies in the music industry, and how 'disruptive' innovations rely on elements beyond their technological core (Knights and Vurdubakis, 2005). Indeed, the way digital media is designed but also organized and associated with various other elements poses radically different challenges and implications for the protection and creative development of the music industry.

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According to the International Federation of the Phonographic Industry (IFPI), global recorded music revenues fell from US\$ 25.1 billion in 2002 to US\$ 15.0 billion in 2013 (IFPI, 2014). The industry is often portraved to be in crisis and the main evil is piracy, facilitated through the 'digital revolution' of peer-to-peer file sharing. Digitalization is repeatedly said to strike hard on creative industries, such as music, film, books, and games, as the non-rivalry of digital goods are able to travel without necessarily taking copyright issues into consideration (Benkler, 2006; Lessig, 2004). 'Digitalization' is thus frequently equated with 'radical' and 'disruptive' movements on the market (Bower & Christensen, 1995). Interestingly, though, despite the decline in overall music revenues, sales through digital services have increased to a US\$5.9 billion business in 2013, making up for more than a quarter of the recording companies' current revenues (IFPI, 2014). Far too often, digital media is talked about in overly simplistic terms and lumped together as one technology with generalizable consequences, despite the obvious differences among the plenitude of digital media services emerging (Baym, 2010). Most of them can be seen as new and creative, but are they also inevitably disruptive to the incumbents' market positions in the sense that they challenge the oligopolistic corporate structure of the music industry? We seek to contribute to the debate by providing one possible answer to this question.

Method

The article is mainly conceptual, drawing on actor network theory as a lens through which to examine the organization and disorganization of radical innovation (e.g. digital technologies and peer-2-peer) in the music industry. A comparative case study is utilized to illustrate similarities and differences between radical innovations and their association and/or dissociation with industry incumbents and endusers. Case study research is a well-established method to generate new and empirically valid insights (Abbott, 1992; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Flyvbjerg, 2006; Stake, 2000). Keeping in mind that case studies do not allow for statistical generalisation, they can still provide analytical generalisation in the transformation of empirical data to theory, rather than to a population (Yin, 1994). Cases can provide good illustrations of dynamic processes played out over time (Siggelkow, 2007) and can generate insights about a particular issue or topic (Stake, 2000), such as the disruptive elements of music innovators.

The two cases in this article – Spotify and The Pirate Bay – as well as the industry as a whole, are all appropriate for the purpose of analysing radical and disruptive innovation. This is due to current transformations that are partly driven by technological advancements but also because of the rather intense rhetorical 'war' between the media corporations and the 'pirates'. The Spotify case represents the 'legal' actor, and the Pirate Bay case represents the 'illegal' actor. Over the years, both services have gained strong positions on the global music market and have taken active roles in transforming music consumption at large. The information about the two cases is based on official documentation in books, blogs, news articles, TV interviews, their websites, court material and through other similar references.

The article is structured as follows; in the first section we examine

the literature on radical and disruptive technologies where the predominant model is that of diffusion, which we challenge. The second section explores a theoretical framework that focuses on the sociology of translation as developed by actor network theory. We then turn to our comparative analysis of the two innovations in the use of digital technology in the music industry – the Pirate Bay and Spotify.

Discontinuous, radical and disruptive technologies

Technology is often argued to act as a central force in shaping conditions for organizations and societies (e.g. Dosi, 1982; Solow, 1957; Teece, 1986; Tushman & Anderson, 1986). Much in line with Kuhn's (1965) theories of science, Dosi (1982) introduced the ideas of technology paradigms and technology trajectories to explain continuous and discontinuous change. He suggests that technology evolves through certain trajectories based on taken-for-granted paradigmatic assumptions on possibilities and limitations, which occasionally are being disrupted to form new trajectories (ibid.). Of course, technologies such as the instant communications provided by mobile phones can be simultaneously positive in facilitating innovations in production while disrupting its uninterrupted continuity (Rennecker & Godwin, 2005). As technology advancement is path dependent (Coombs & Hull, 1998), firms develop installed bases (Farrell & Saloner, 1985) and dominant designs (Anderson & Tushman, 1990) with high switching costs in both core capabilities and materialized structures. Schumpeter's (1934) notion of creative destruction points to the proposition that the obsolete must be torn down in order for something new to emerge. Technological innovations, thus, always have a relation to the past if only to be a contrast with that which they supersede.

The type, level and effect of a technology's creative destruction have been portrayed in various ways. Tushman and Anderson (1986) suggest that technology change happens through a cumulative, incremental process until it is punctuated by a major advance, what they call a discontinuous innovation. Such major breakthroughs strongly improve the performance or price level in relation to existing technologies and their advancements are so significant that older technologies cannot compete through greater efficiency, design or economies of scale. Another, highly interrelated, way of distinguishing the degree of innovativeness in relation to incremental change is through so called radical innovation. Ettlie, et al. (1984) argue that innovations are radical when they are new to the firm and to the industry, and/or require substantial and costly changes in the firm's processes as well as output. Radical innovations have also been coined as breakthrough inventions (Ahuja & Lampert, 2001) or pioneering innovations (Ali, 1994) or highly innovative products (Kleinschmidt & Cooper, 1991) which are all based on substantial technolgoical advances that offer new technological trajectories and paradigms (Dosi, 1982). Chandy and Tellis (1998) classify innovations along two dimensions; newness of technology and degree of customer need fulfilment per dollar, arguing that incremental innovations are low on both dimensions, while radical innovations are high on both. All these ways of defining the extent to which innovations are radical relate to how they divert from established knowledge and practices.

Abernathy and Clark (1985) argue that major technological shifts can have both creative and destructive effects on the existing industry. Innovations can disrupt the market by introducing new knowledge competences and/or relationships but they can also consolidate existing knowledge competences, linkages and market positions. This view is also repeated by Tushman and Anderson (1986) who characterize technological discontinuities as competence-enhancing or competence-destroying, suggesting that the former builds on embodied know-how in the replaced technology while the latter render the knowledge in existing technologies obsolete. Christensen (1997, p. xv) popularized the term *disruptive technologies*, arguing that they "bring to a market a very different value proposition than had been available previously". Disruptive technologies are often characterized as initially underperforming dominant alternatives in the markets along the dimensions that the mainstream customers currently value. However, over time they will displace the dominant technologies because they offer alternative other features, which customers earlier did not want or were unaware of, but eventually will learn to appreciate. Disruptive technologies are also associated with the displacement of market power, where new entrants tend to weed out previously successful incumbents (Chandy & Tellis, 2000). This could be seen as a specific type of technological change, operating through specific mechanisms and having particular consequences (Danneels, 2004). Disruptive technologies can therefore be understood as acting on different dimensions than radical innovations such that, for instance, "the radicalness is a technology-based dimension of innovations, and the disruptiveness is a market-based dimension" (Govindarajan & Kopalle, 2006, p. 14). In a sense, this moves the continuum further over so that the opposite of disruptive innovation becomes not incremental but sustaining innovation. As Sandström (2011) has shown, these displacements can take place in both low-end and high-end segments.

Danneels (2004) has raised some further critiques of the notion of disruptive technologies. One such is the problem of defining what a disruptive technology really is (e.g. What are the essential characteristics of a disruptive technology?). For instance, Christensen's early work (Christensen, 1997) focuses on the technology aspect of innovation, while his later work (Christensen & Raynor, 2003) brings in a larger variety of innovation types as potentially disruptive for the incumbent firms. Markides (2006) argues for the importance of separate disruptive business model innovations as opposed to technological innovations since they "pose radically different challenges for established firms and have radically different implications for managers" Markides (2006, p. 19). Danneels (2004) also points to the challenge of knowing at what exact time a technology becomes disruptive, and for the possibility of applying the theory to ex ante predictions. He urges further research to develop analytical tools for identifying (potentially) disruptive technologies - a call which has been accepted by, for instance, Govindarajan and Kopalle (2006).

Actor Network Theory as a framework to analyse disruption

In challenging the mainstream assumptions about disruptive technologies, this article raises questions whether it is possible to find the power of disruptiveness in the technology or the innovation itself. As Latour (Latour, 1986, p. 264) argues, "power is not something one can possess – indeed it must be treated as a consequence rather than as a cause of action". By this he separates out power *in potentia*, that is, something you perceive to 'have', and power *in actu*, i.e. actual power to enforce. The latter is always dependent on the actions of *others* rather than some intrinsic characteristics of the sender. Latour's argument is a continuation of Foucault's (1980, 1982) ideas that power is not possessed, but exercised, and that action is always action on the actions of others. Translating this discussion to the field of innovation, technologies can only be considered as disruptive if the surrounding elements act accordingly. True, to a large extent innovators try to inscribe the behaviours of the users (Akrich, 1992), but the intended scripts do often meet with anti-programs and descriptions that are unintended (Latour, 1987).

Callon (1991, 1992) explains the link between the 'social', 'technical' and 'economic' by introducing the concept of techno-economic network as "a coordinated set of heterogeneous actors which interact more or less successfully to develop, produce, distribute and diffuse methods for generating goods and services" (Callon, 1991, p. 133). For him, the dynamic relationships amongst these actors are being held together through the circulation of intermediaries such as money, artefacts, texts and human beings, and the durability and robustness of these associations determine the success or failure of the innovation. Latour (1986) argues in similar ways, that the power of a token (e.g. an innovation) lies in its ability to hold together associations with other material and non-material elements in durable forms. "It's not technology that is 'socially shaped', but rather techniques that grant extension and durability to social ties" (Latour, 2005, p. 238). Depending on which elements it succeeds in attracting and stabilizing, the innovation transforms activities and relations in different ways (Callon, 1986). In other words, an actor is a network of relations and it is from these relations that the innovation is perceived. In the making of such process, it is therefore not known whether the outcome will be sustaining or disruptive, and which actors or actants it will transform (Latour, 1996). For ANT, then knowledge and innovation is best understood as a hybrid of objects, social artefacts and discourses that are organized through material and non-material agents mobilised for purposes of securing the actor network, despite continual disruptions and processes of reassembly (Latour, 2005). Callon (1986) introduced four moments of translation; 1) problematization in which the actor is defining the nature and problems of stakeholder groups and making itself an 'obligatory passage point' for providing a good solution; 2) interessement, where the network locks the others into different proposed roles by building physical and mental infrastructures which tie the stakeholder groups to the network; 3) enrolment refers to the negotiations, seductions, argumentations and sometimes force to coordinate the emerging network; and 4) mobilization describes relations that have been strengthened in so far as the allies are (at least temporarily) obedient and opponents silenced, providing the initial actor with power in actu.

To illustrate this alternative framework inspired by the sociology of translation and actor network theory, a comparative case study of two digital music services will now be introduced and analysed in relation

to the copyright owners and the music consumers. It demonstrates how the often labelled 'disruptive', radical and discontinuous digital technologies related to music production and distribution have had a creative impact on the music industry and its various stakeholders over the years.

Case comparison

Many new digital services have emerged in the last ten years to take advantage of the 'radical' information technologies in the music industry. MP3.com, Napster, KaZaa, Limewire, BearShare, iTunes, Amazon MP3, Myspace, YouTube, Zune, the PirateBay, LastFM, Spotify, MOG, WiMP, Beats Music, Vevo, Pandora, Deezer and Google Play are only a few of the many actors which have gained much public recognition through information-pull rather than information-push technologies (Duchêne & Waelbroeck, 2006). Some of these ventures act in a grey zone of intellectual property rights (or even clearly overriding them), which have made them official enemies of the big recording companies. The user-friendly, cheap and not easily controlled distribution process brings a perceived threat to actors traditionally earning their profits from exploiting copyright material, in the fear that pirate copies will substitute the purchase of the original and thus reduce company profit. But, as (Baym, 2010, p. 17) argues, "even as we are concerned with their impact, we must avoid the temptation to look at new media only as a whole. Each of these media, as well as the mobile phone, offers unique affordances, or packages of potentials and constraints, for communication". Pirate Bay and Spotify are two different kinds of these digital music services that illustrate similarities but also differences in how digital music services develop their strategic attempts to make a mark in the industry.

The case of the Pirate Bay

The Pirate Bay (TPB) has been known as an open website for indexing so called torrents, i.e. small protocols including metadata for directing the file sharers to digital content. As such it has functioned as a virtual meeting place for exchange of, among others, music files (MP3 and music videos), and has gained much attention among file-sharers as well as in the news media. TPB has over the years often been argued to be the biggest search tool for torrents, with tens of millions of active users and access to more than four billion torrent files.

The site was first launched in 2003 on a server in Mexico, where the Swedish hacker and one of the alleged founders, Gottfrid Svartholm Warg, was then working. The venture had emerged from loose conversations on an IRC channel between him and Fredrik Neij, with the initial idea to build a tracker for local, Swedish material. As the usage expanded also internationally, more hosting capacity was needed and TPB was moved to bigger servers in Sweden in 2004. Peter Sunde, a friend of Neij, also become involved early on in the project. As the most politically active of the three, he became a public spokesperson for the platform (a post he formally left in August 2009). The people behind TPB have from the start been actively involved in the public debate on file-sharing, arguing for the users' right to copy and spread digitalized culture. The logotype of TPB is a pirate ship with set sails. It carries a modification of the Jolly Roger flag, in which the skull is replaced by a cassette band, as an ironic critique to an anti-copyright infringement campaign from the 80s, "Home Taping Is Killing Music". On the website, TPB openly published letters from various actors threatening to take legal action against them. They also publish their own replies, which are written with a mixture of scorn, mockery and humour.

TPB was designed to provide a searchable index of torrents. It was built on a software called open tracker, which is one of several free trackers on the market and they are all designed to be fast and to use minimal system resources. A torrent is a small data file with an address to a specific content and a link to all the other users of the same torrent. These torrents can be downloaded from search engines such as TPB, but to activate the link in order to start the actual uploading and downloading, the user needs to have a certain client software (there are many free so called BitTorrent clients on the market). Through this program, the torrent locates other active torrents, to start the file-sharing. A group of users which have activated the same torrent is known as a "swarm". As one user begins to download the file, other active users in the swarm can start downloading the finished content from him or her. This makes it a fast and resilient process even for large data files, since it distributes the load to many users. In fact, contrary to when a file is accessible from only one location, this peer-to-peer technology makes the process faster the more users are taking part.

TPB was not designed to allow much social interaction between users, above the actual peer-to-peer sharing of digital content. Possibilities were created for the uploader of the torrent to add information about its content (type, number of files, size, tags, quality, name of songs, artists etc.) to other users, and for other users to give comments on the content and do ratings on its quality. However, very few social cues about the anonymous users were embedded in the system. Members could create individual profiles based on their user names, but this profile only discloses the level of activity in terms of the number of uploads. While limited in the variety of social cues, the profiles provide the opportunity for active users to build a reputation in relation to quantity, quality and newness of their uploaded material. The imputed tag information in the torrents together with the aggregated ratings and possible content comments, may also affect the propensity for new users to download a particular file.

In terms of storage, early on TPB decentralized the location of the actual digitalized content to the participating users' own hard drives. This gives at least three advantages; it reduces the risk of legal threats toward the service (although TPB did face a trial and prosecution in 2009), it makes the peer-to-peer technique more effective, and it provide users total offline access to the material. The fact that the content is downloaded as digital files of standardized formats, it spurs the mobility of the content. Users can easily replicate or convert the files and spread them further - to other users as well as to other types of devices. TPB has been positioned as "the world's most resilient BitTorrent site" and as such it has a considerable reach, but it does not in any way prohibit or compete with other similar web services. Rather the opposite. On 31 May 2006, the police made a big raid against TPB, confiscating all its servers. A preliminary investigation was conducted which on January 21 2008 led to Swedish prosecutors filing charges against Neij, Svartholm and Sunde together with the businessman Carl Lundström who owned the company Rix Telecom where TPB servers were hosted in Sweden. All of them were charged with "promoting other people's infringements of copyright laws". In April 2009, they were found guilty to accessory to crime against copyright law by the district court and sentenced to one year in jail each, as well as fines of approximately \$3,5 million (30 million SEK) paid to a number of music-, movie- and game corporations. The lawyers of all four defendants appealed the verdict. On 26 November 2010, a Swedish appeals court returned the verdict, decreasing the original prison terms (Neij to 10 months, Sunde to 8 months and Lundström to 4 months) but increasing the fine to 46 million SEK.

The legal process did, however, not totally shut down the website, despite the fact that those initially involved at least officially left the project. Several further setbacks have however occurred since. Following a complaint from the British Phonographic Industry (BPI), on 30th of April 2012 the High Court in London issued a ruling that six major internet service providers in the UK should block their customers from using TPB site. Similar rulings have since then been taken in numerous other countries such as Belgium, Denmark, Finland, and Italy. Also web services such as Facebook and Microsoft Live Messenger have censored links to the Pirate Bay site. In August 2013, TPB announced the release of a free web browser which enables users to sidestep this type of "censorship", and there are also numerous other simple ways to circumvent the block that are readily communicated through social networks. In December 2014, the Swedish police raided a web server location in Stockholm which made the TPB site go down. In a few days, several new alternative sites emerged, mirroring the old version of TPB. These forms of hostile actions from the legal system pose a great threat to websites such as TPB, and these actions mainly lead the "pirates" to start looking for other, more effective alternatives. So despite a loss in the court leading to the closure of the TPB service, there have emerged new innovations and organizing mechanisms, or the enrolment of other actors that have developed less traceable interactions or other ways of commercializing the service. A few months later, the Pirate Bay opened again.

The case of Spotify

Spotify is a music streaming service founded in 2006 by the Swedish entrepreneurs' Daniel Ek and Martin Lorentzon. As summarized on Spotify's homepage in 2010;

Spotify is a new way to listen to music: Any track you like, any time you like. Just search for it in Spotify, then play it. Any artist, any album, any genre - all available instantly. With Spotify, there are no limits to the amount of music you can listen to. Just help yourself to whatever you want, whenever you want it. (2010-10-07)

The service was initially run as a beta version in a smaller invitationbased community until it was officially launched in October 2008. By signing licensing agreements with all the major record label companies, as well as a multitude of independent labels, Spotify positioned itself as a music provider, in contrast to "piracy" alternatives. From the start the service was available in Sweden, Norway, Finland, Germany, Italy, France, the UK and Spain, but it rather quickly spread to other countries. Starting as a small venture, it has been established as a company with 200 employees and headquarters in the UK. In September 2010 Spotify had a big party in London, celebrating their outreach to10 million users across Europe. At that time, it offered access to a catalogue of more than 10 million tracks. In July 2011, Spotify launched its US service after years of negotiation with the major record companies. In December 2012 the service reached 20 million users with 5 million subscribers, and in January 2015 it had reached 60 million users with 15 million subscribers.

The service is based on a free but proprietary client program which the user needs to download and install, and is therefore not a pure web-based service. From the application, the user can search and play music and also put together own playlists for easy access. Spotify was initially built on a combination of server-based streaming and peerto-peer technology where users transferred music in peer-to-peer fashion similar to the torrent technology. This technique allowed Spotify to reduce the huge costs for server resources as a startup, but as of the fall 2014, Spotify only stream from own servers. The fact that Spotify uses streaming technology where the music is not downloaded as a whole, makes it more complicated (although not impossible) to replicate and redistribute it to peers. Simultaneously, it gives a high flexibility and mobility for the user since the access to one's favourite playlists can be reached from multiple locations and hardware. For instance, the company launched applications for iPhone and Android mobile systems in 2009 and for Windows Mobile in late 2010, offering users access to their playlists through their mobile phones.

In 2010, Spotify opened up new social dimensions to their music service, as they introduced a function where users can create a profile and publish their playlists of artists and tracks for public view. The profiles in themselves are not including much information and functionality, but by linking them to social websites, such as Facebook, Twitter and Messenger, opened a possibility of sharing music tracks and playlists with peers. Initially, Spotify did not have features for users to communicate directly with each other via the client program, but in April 2013 they released such function. Still, however, Spotify does not allow its users to be directly involved in the development of functionality or content.

Unlike TPB, the users or artists themselves are not allowed to upload any content to the catalogues. This can only be done through the contracts signed with the record label companies or other established artist aggregators. Hence, Spotify retains a tight control over the music content, ensuring that property rights are not being violated. In that sense, Spotify has similarities to iTunes who use Digital Rights Management (DRM) to enforce users to respect copyright laws. But Spotify's streaming technology gives the user instant access to a large music content without needing to download and pay for each song. Spotify have a so called "freemium" business model, where a base functionality is free for the user (although with advertisements

interrupting between tracks), while premium functionality is offered to paid subscribers (approximately 10 euro per month) in terms of commercial-free, higher bit rate streams, access through mobile phone, and offline access to music. According to the license agreements, a proportion of the income streams are handed over to the copyright owners. The major record companies also received shares in Spotify when contracts were signed. The founders, Ek and Lorentzon, have been vocal in the debate about the digital revolution and its effect on the music industry, highlighting that Spotify is a legal alternative to the pirates. In several newspaper interviews, Ek has said that "Our point of departure is to generate a legal service which can compete directly with the pirate services". Indeed they seek to brand their offering precisely in opposition to illegal pirates in their internal promotions on the site, to the extent that on the free service, declarations of their being an alternative to pirate sites are as frequent as the commercial adverts. This approach probably helped Spotify to pronounce itself as a Technology Pioneer in the World Economic Forum 2010 and the entrepreneurs behind the web service have several times been collecting entrepreneurship prizes and awards. For instance, Daniel Ek was named by Wired Magazine as the greatest digital influence in Europe in 2014. As of 2012, the CEO and founder Daniel Ek was ranked 395th on the British rich list with a calculated worth of £190 million.

However, voices have also been raised concerning the inadequacy of the licensing deals with the artists, arguing for a more transparent income process. For instance, in 2009, it was claimed that the superstar Lady Gaga received just \$167 from Spotify for her hit "Poker Face" during a five month period when the song was streamed over a million times. The company then insisted that the money would increase vastly as more subscribers enter and advertising revenues escalate. In 2014, the American country singer Taylor Swift also voiced her critique against Spotify and pulled out her whole catalogue of songs in protest of the size of royalties. Spotify answered in a blog post;

Quincy Jones posted on Facebook that "Spotify is not the enemy; piracy is the enemy". You know why? Two numbers: Zero and Two Billion. Piracy doesn't pay artists a penny – nothing, zilch, zero. Spotify has paid more than two billion dollars to labels, publishers and collecting societies for distribution to songwriters and recording artists. A billion dollars from the time we started Spotify in 2008 to last year and another billion dollars since then. (2014-11-11)

The 'disruptiveness' of TPB and Spotify and an actor network analysis

TPB and Spotify are to be considered as 'radical' music services in terms of how they have opened up new ways of providing music to the public, and in doing so have challenged the existing business structure in the industry. Both ventures have utilized new digital technologies as a vehicle for music distribution, but TPB and Spotify have different *programs-of-actions* inscribed in their 'radical' technologies, in line with the purpose of enrolling their different defined stakeholder groups. The technological designs are, thus, closely linked to how

each initiative differentiates itself toward the incumbent firms, and how they are constructed to facilitate content and usage of content. This is what Callon (1986) calls *interessement*, i.e. the process of attracting selected parts of the environment to be mobilized into the venture.

For TPB, the end-users are considered the most relevant social group, and the interessement process is aimed at providing them a platform for sharing material in an easy, free, anonymous and effective way. For these users, the service provider has few restrictions as they do not censor any content or shut down any user accounts. TPB has instead chosen a highly distributed approach for uploading as well as downloading of content. The service is relying solely on user activities, and that is why it is important to involve the interest of the masses of active end-users. Due to its' nowadays millions of users' uploads, the website's search index includes a large variety of material - from the latest top hits to obscure bootlegs and private remixed versions. Often, a huge number of tracks are zipped into one big file, e.g. a collection of albums from one specific artist, a music era or a genre, which escalates the downloading process further. The sound quality can of course also differ, the tag information can be diverted and files may be destroyed or, in a worst-case scenario, infected with a virus. However, since the users' ongoing file-sharing activities are disclosed together with members' comments, preferences and discriminations can guide the seeker to 'good' content in a self-organizing way.

Another potential stakeholder group for TPB is the intellectual property owners of content. In this case, TPB representatives did not put down effort to align the web service in accordance to this group's interests. The website has no compensation structures in place to pay artists, producers, distributers or any other copyright holders. The anti-programs from some of these actors have also been very outspoken as the dominant music industry actors both sue TPB in court and use public media to discredit the website as 'evil pirate'. From the rhetoric of the music industry and the media it is easy to get an impression that all of the material is illegal, but TPB hosts torrents directed toward both copyright- and non-copyright material and it can sometimes be difficult for the file-sharer to know which one is which. To answer the anti-programs of aggressive copyright owners, representatives of TPB earlier replied in a rather ironic and ridiculing language. This language war led to a positioning of the web service as an illegal copyright intruder, but also as a rebellious place for the young generation of music lovers. In fact, it could be argued that the design of the web service is enhancing resilience not only to an effective spread of digital content per se, but also to the shielding of file-sharers with illegal intentions; it is distributed to a large population which makes it difficult to trace and to sort out who is doing what, it is anonymous and accessible from any internet connection, and the interaction with the site is limited to the torrent downloading which is a very short time. The site's name and logo - indicating a calm bay for pirates - also supports this rather deliberate positioning in favour of piracy on almost ideological terms. Hence, the dissociation from the big record labels made them simultaneously one of the most important actants for mobilizing the website. The distributed

users embraced to a large extent this 'pirate' position, and continued its 'mission' even after the initial founders were legally stopped by the court. Even for some property owners (predominantly smaller record labels and artists) TPB – with its radical image and effective distribution channels – was appreciated as a means to fight the dominant incumbents of the industry.

While sharing the same problematization of how to access music freely or at economic prices, Spotify differs from TPB both in the range of content it offers but also in the process of interessement through which it mobilizes parts of the environment. Rather than demonize the suppliers of its products, it has mobilized them, the law and advertisers as allies by which it can differentiate itself from those networks such as TPB that alienate suppliers by facilitating the breaching of copyright by users. Spotify has established a gatekeeping authority over the offered material, being an obligatory passage point (Callon, 1986) in deciding which tracks are allowed to be streamed by the users. This makes it possible to secure good sound quality and opens up possibilities to organize the content in a user-friendly way. Context information about the artist and the album can be imputed and changed whenever necessary and related music can be linked making it easy to find new favourites. In addition, because it is not illegal, Spotify is linked to other social media as means of enrolling and mobilizing additional users through its network of existing users. The established licensing agreements with record labels have formed a business model where copyright owners receive income from the activities on Spotify, and through the gatekeeping role it is possible to make sure that no illegal material is accessible. This also means that Spotify can remove access to a streamed track whenever they want, even if the users have bookmarked it in their playlists. The fact that Spotify has proprietary ownership of the technology allows them to support this strategy through Digital Rights Management (DRM) and to continuously upgrade and improve its functionality and copyright protection simultaneously.

Spotify has, hence, several parallel relevant social groups that they need continuously to enrol; (e.g. users, advertisers and content owners). Instead of opposing or ignoring intellectual property issues, the web service has rather utilized the copyright and DRM to accelerate their businesses although the business model operates on two distinct fronts - a free service with restrictions on users extending their network of use to non-internet connections or a subscription service that frees the user from these restrictions as well as from advertising interruptions. While funding the free service comes from advertising, this facilitates enrolment of users by giving them a basic service from which large numbers upgrade. The design of the music service facilitates, in terms of establishing control over content as well as technology, a positioning in direct opposition to the "evil" pirates. By contrast, Spotify can claim to act as the noble knight who will rescue the confused music industry facing disruptive or destructive aspects of the digital revolution. While TPB can be seen as a service mainly delivering value to the file-sharers, Spotify is balancing the inclinations of various actors as well as mobilizing nonhuman actors in the network; copyright owners are protected from illegal file-sharing and receive new income streams, and users get a well-functioned, user friendly and accessible music service with a large up-to-date music catalogue within the confines of intellectual property.

The comparison between TPB and Spotify suggests that digital music services should not be lumped together into a homogeneous group since they differ on several key technological, organizational and intellectual property dimensions. These aspects are highly linked and congruent for TPB as well as for Spotify and their various combinations position them rather differently in relation to the industry incumbents and to the overall industry development as such. Put differently, their mobilized associations and dissociations to other social and technological elements make up the unique identity and direction of each venture.

From Christensen's (1997) argumentation on sustaining and disruptive innovations, TPB as a macro actor (Callon & Latour, 1981) shows many disruptive aspects. Due to its mobilization of millions of users and the hosting of about 5 million torrent files, TPB can speak with a disdainful or irreverent voice against the established power structures of the music industry. In this way it questions the view of consumers as passive content recipients and the business logic of paying for the carrier (e.g. cassette, LP, CD, DVD) of music. Continuing the journey that predecessors such as Napster and Kazaa started, TPB could be seen as having a transforming potential on the music industry and its enrolment process poses a threat to the big recording firms' oligopolistic structure in a vein not dissimilar to the independent labels' attempts in the 1950s. This is in line with the Schumpeterian (1934) view of entrepreneurship - as a function of creative destruction to the market, enforcing imbalances and opening up new opportunities. Actor network theory, however, provides a more detailed perception on *how* the creative destruction emerges in practice, as a translation and mobilization process of technical as well as social elements.

Spotify, on the other hand, has aimed to mobilize both the users and the intellectual property owners (including large incumbent music corporations) in parallel. This means a balancing of different problematization and interessement activities toward the two stakeholder groups. To users, the focus is put on quality, instant availability and user friendliness – above the fact that it is digital, free(mium) and legal. To content providers, the focus is put on being a new distribution channel to a large customer base through a service safe from illegal use and with a business model in place to protect the income streams of intellectual property owners. In this way, Spotify rather acts as a saviour to the music industry, supporting the big corporations in the war against pirates. And as legal music services such as Spotify are being incorporated into the income streams of large incumbent firms, peer-to-peer and streaming technologies are largely being transformed from a disruptive to a sustaining force.

Despite obvious differences in their associations with social and material elements, TPB and Spotify can be considered as having a symbiotic rather than conflicting relation. Although the Spotify founders speak loudly about pirates as a threat to the music industry, the existence of piracy is in fact one of the strongest door-openers for legal digital music services to be accepted by the dominant market actors. In effect, piracy provides Spotify with the conditions for generating their own legitimacy. Piracy is the unacceptable Other (Derrida, 1982) through which Spotify can secure its existence. In similar ways, TPB partly legitimizes itself as a revolt against the big corporations' power over the passive users. TPB and Spotify are in basic terms performing a similar service – i.e. providing music to a large population of music lovers utilizing 'radical' digital technology – but they have mobilized themselves differently in terms of rhetoric and associations to social and material elements. One of the actors is positioned as the biggest enemy of the established music industry and the other as the Entrepreneur of the year.

Streaming- and peer-to-peer technologies are arguably as radical to the music industry as the phonograph, the radio and the cassette tape recorder was earlier in history. But as the comparison between TPB and Spotify shows, it is not only the 'inner' features of the technologies that define their level of disruptiveness on the behaviours of users or the structure of the market. To an equal degree, it is the associations each venture has developed and maintained with respect to other elements, such as to the acceptance or rejection of the rights of dominant proprietary owners and to the discourses of piracy as good or evil, which energize its impact as a sustaining or disruptive innovation. The power of disruption is, hence, to be found in the music service's associations in actu, and will therefore always be up for grabs (Latour, 1986). Associations holding together a disruptive innovation could be strengthened or diminished, depending on how the various actors interact and intersect, but it is not only in the core technology that one will find the answer for what impact a certain initiative will have on the market, what direction it will move in, where it will be displaced. It is much more in the actor networks that are rendered more or less robust through complex relations within and between technological artefacts and socio-political associations.

Conclusion

Inspired by actor network theory, this article suggests an alternative framework for looking at disruptive innovations which challenge the mainstream approaches based on technology-centric and diffusion model-based assumptions. It agrees with previous critiques of the notion of disruption as non-precise and with limited predictive use (Dan & Chieh, 2010; Danneels, 2004; Markides, 2006; Tellis, 2006). What is or isn't a disruptive innovation has not been the main question for this article, but it is arguably important elsewhere to sort out the differences between disruption in terms of altered value propositions, consumption patterns and/or market structures. Regardless of the definition and in contrast to the above critiques of ideas around disruption, however, we argue that the solution to the 'innovator's dilemma' (Christensen, 1997) is not to be found in a further examination of technological features and design, finer categories and classifications, and internal organizational structures and attitudes. Rather, one needs to thoroughly examine and describe the innovation in relation to its processes of establishing obligatory passage points around certain problematization and interests that enrol material and human actors around networks mobilized to a point where alternatives seem implausible or are denied. Hence, the disruptive power of innovation depends on how it succeeds in associating itself with certain cultural, political and social norms.

Determining the disruptive innovations through studying what is already-made rather than its development in the making (Latour, 1987) is rather unproblematic (although not necessarily useful), as all the associations then have been silenced and black-boxed (Callon & Latour, 1981). But we follow the proposition that innovations are travelling ideas (Czarniawska & Joerges, 1996) in continual processes of becoming constituted through associations that they themselves constitute. Here there is no presumption of stability since actor networks can implode as readily as reproduce themselves (Latour, 1986), but it forces analysts as well as network members to move away from a preoccupation with technology per se, and instead to examine more carefully the technology's linkages with social and organizational content in the contexts of innovation management.

For practitioners, to highlight not only the material but also the social, does perhaps not solve the 'incumbent's curse' (Chandy & Tellis, 2000), but it would potentially release the decision makers' energy toward actively enrolling and mobilizing new associations rather than solely protecting the already stabilized ones. Furthermore, the focus on social, economic and technical interactions rather than mainly on technological features illuminates the highly difficult managerial challenge of predicting *future* disruptive threats, as these forms of 'association battles in the making' often lead to unpredictable outcomes and unforeseen consequences (Callon & Law, 1982). It also facilitates the understanding that a technology's potential for disruption resides as much with followers as with inscribers (Latour, 1987) – including the industry actors (i.e. producers), but more so the users (including 'pirating' music lovers).

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World-First Innovations in an Open Innovation Context

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Abstract: This study contributes to the current literature on open innovation by analysing the effects of open innovation activities on the introduction of new-to-the-world innovations versus imitation. We base our analysis on data provided by the Eurostat Community Innovation Survey (CIS) carried out in Germany in 2012, which for the first time made a distinction between world–first innovation and imitation. We use both logit models and CHAID trees. The results of both analyses show that traditional in-house innovation and patents continue to make the largest contribution to world-first innovation in the so-called open-innovation era, while some specific open innovation activities contribute to a lesser extent: cooperation with customers, information from universities, cooperation with suppliers, and acquisition of machinery. Thus, promoting open innovation can be advantageous not only for imitative innovation but also for introducing world-first innovations. The European Commission should continue to include open innovation policies in its agenda.

Keywords: open innovation; world-first innovation; invention; imitation; appropriation instruments

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Introduction

The Open Innovation paradigm is characterized by an increased and faster flow of information between firms (Dahlander & Gann, 2010). More than a decade after the term 'open innovation' was coined by Chesbrough (2003) we believe that it is fitting to analyse whether this flow of information is beneficial for both product innovators (in the sense of inventors or world-first innovators) and imitators or is detrimental to either of them, and to analyse whether the rules of the game in this arena (such as the role of the sector, the size of the company and the use of appropriation instruments) remain the same or have changed. By product innovation, we refer to both innovative goods and services.

In 2010 and 2012 changes were made to the EUROSTAT Community Innovation Survey (CIS) - the microdata for which were simultaneously released in late 2015 - that made specific data about worldfirst innovation available for the first time. The new CIS classification concurs with the directives of the Oslo Manual; 'new to the firm' is the minimum degree of novelty of the innovation and refers to introducing products that are new for the firm but not for the market; 'new to the market' refers to being the first firm to launch the new product in its market; and 'new to the world' is the maximum grade of novelty, namely being the first to introduce the innovation in any market.

In general, world-first innovations can bring product innovator firms competitive advantages as they allow them to get a head start on their rivals and influence consumer preferences as well as gain the benefits of the protection and concession of patents. However, existing products provide imitator firms with the information needed to develop them, improve them and thus compete more effectively (Lieberman & Asaba, 2006). In addition, the costs of imitation are often much lower than the costs of innovation as an imitator company does not have to spend so much of its resources on R&D (Zachary et al., 2015). Open innovation could affect the balance between innovation versus imitation and their relative advantages and disadvantages by easing the flow of information.

If considered in the Schumpeterian framework, open innovation could contribute to diminished incentives to invent through easing imitation and thus lowering the rents from inventions. However, from other perspectives, imitation (or more competitive markets) may also serve as a spur to innovation, with firms who do not innovate finding themselves penalized (Aghion et al., 1997). In some settings, where innovation is both sequential and complementary, the inventor firm might even be better off from having other firms imitating and competing against it (Bessen & Maskin, 2009). Imitation can thus stimulate rather than dampen innovation under certain market competition conditions. In this regard, the fact that open innovation could encourage imitation through an increased flow of information and knowledge between firms (Dahlander & Gann, 2010) does not mean that it would necessarily have negative effects on innovation (West et al., 2006).

The results of this study may be relevant for EU innovation policy design. Indeed, the European Commission's interest in open innovation has led to their commissioning various studies (European Commission, 2014) and funding different projects that aim to encourage open innovation (see the Horizon 2020 projects). The Commission has also included open innovation in some of their initiatives to promote innovation (see, for example, the Open Innovation Strategy and Policy Group's [OISPG] recent initiatives).



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Similarly, the results of this paper may also be relevant for managers as they shed light on the effects of particular open innovation activities and instruments that they may include in their firms' innovation or imitation strategies.

This article aims to use the 2012 CIS data from Germany to study the relationship between launching innovative goods or services that are new to the world, carrying out open and traditional innovation activities, and using appropriation instruments. The structure is as follows: it first briefly reviews the theoretical and empirical literature on open innovation and on the introduction of innovations as opposed to imitation; it then presents the data and methodology used and the results with two alternative analysis methods. Finally, it draws conclusions and comments upon limitations and future lines of research.

Review of the literature

In this review, we concentrate on three issues. The first is the classifications of the various degrees of product innovation, the second is the relationship between open innovation activities and innovation versus imitation, and the third is the relationship between appropriation instruments and innovation versus imitation.

By definition, all innovations must have some degree of novelty. According to the Oslo Manual, there are three degrees of novelty, 'new to the firm,' 'new to the market' and 'new to the world'. 'New to the firm' is the minimum grade of novelty, 'new to the market' refers to the innovations that the enterprise is first to launch in its market and 'new to the world' is the maximum grade of novelty.

This classification corresponds to the most recent CIS data. CIS editions before 2010, however, only distinguished between innovations that were 'new to the firm' and the rest. The fact that CIS data is widely available across Europe means that there was much literature based on this reduced version of the concept of imitation versus innovation (Barge-Gil, 2010; Laursen & Salter, 2006; Spithoven et al., 2013). To the best of our knowledge, only Amara and Landry (2005) and Hanel (2008) have modelled world-first innovation from innovation activities, and used Canadian data that was collected before the term open innovation was coined.

Taking advantage from the richer recently released CIS data, in this article we opt for the Oslo Manual definition of 'world-first innovations' and use a variable indicating whether any of the product or service innovations by the company between 2010 and 2012 were world-firsts or if they were all at most new to the market. Therefore, the so-called imitators in this paper could have been the first to launch products in their respective markets, but without their being world-firsts.

Imitation and innovation as defined above cannot be understood nowadays without taking into account the trend towards being more open. Since the term open innovation was first used by Chesbrough (2003), different theoretical and empirical studies have evaluated this change in the innovation paradigm (Dahlander & Gann, 2010; Giannopoulou et al., 2010; Huizingh, 2011; Laursen & Salter, 2006; Van de Vrande et al., 2009; Wikhamn & Wikhamn, 2013). The ease in the flow of information that characterizes open innovation may have had an effect on both the costs and benefits that innovation has for both inventors (world-first innovators) and imitators. On the one hand, many studies sustain that openness helps companies to optimise available resources and share the costs of innovation with other collaborators, in addition to facilitating the acquisition of the means to develop new technologies (Huizingh, 2011; Van de Vrande et al., 2009). On the other hand, some studies conclude that this increased circulation of knowledge can make retaining the value difficult for the innovator firm, especially when the innovation cannot be protected – thus facilitating imitation (Laursen & Salter, 2014).

Open innovation activities are classified as inbound (those that use external sources to drive and develop innovation) and outbound (processes by which firms reveal information or sell their technology). We focus on inbound innovation in this section (evidence of validity of inbound activities as measurement of openness can be found in Hochleitner et al., in press), while taking into consideration the fact that some appropriation instruments can also be used as outbound open innovation activities (see below).

Some studies sustain that inbound open innovation helps firms to improve their innovation performance through cooperation, and through exchanging and acquiring knowledge that comes from other external sources such as clients, suppliers, universities, technological centres, and competitors (Chesbrough, 2003; Dahlander & Gann, 2010; Huizingh, 2011; Van de Vrande et al., 2009; Temel et al., 2013). This practice allows them to create synergies and to increase their chances of success in innovation projects (Lichtenthaler & Lichtenthaler, 2009).

Inbound open innovation can even include other concepts that are closely related from the field of innovation management such as absorptive capacity, defined by Cohen and Levinthal (1990) as a firm's ability to evaluate, assimilate and apply knowledge that comes from external sources (Lichtenthaler & Lichtenthaler, 2009). From this perspective, Cohen and Levinthal (1990, p. 131) sustain that absorptive capacity is driven by two interrelated ideas: 'Learning is cumulative and learning performance is greatest when the object of learning is related to what is already known'. Absorptive capacity can thus be built by engaging in in-house R&D activities and can occur as a side effect (Cohen & Levinthal, 1990).

Absorptive capacity in the context of open innovation has gained in importance in the literature (Dahlander & Gann, 2010; Lichtenthaler & Lichtenthaler, 2009), mainly because open innovation is one of the principal means by which firms can absorb external knowledge. Furthermore, it can generate advantages for both imitating and innovating, and it allows benefits from possible spillovers to be obtained (Dahlander & Gann, 2010).

On the other hand, imitating can be more economical than innovating (Lieberman & Asaba, 2006; Zachary et al., 2015), although this optimistic view of costs is not unanimous. Keupp & Gassmann (2009) sustain that the transaction costs of using external sources of knowledge and intellectual property are factors that can negatively affect the appeal of imitating. Finally, a new consensus is being formed around the idea that imitation and innovation are not opposites but can, in fact, reinforce each other and coexist (Bessen & Mankin, 2009).

Drawing from all the above-mentioned points, we formulate the following hypothesis:

H1. Inbound open innovation activities increase the likelihood of introducing world-first product innovations

As regards appropriation instruments, the traditional use was to protect inventions from being imitated by rivals (Levin et al., 1987). The literature on the protection of innovations places appropriation activities into two major categories: legal and strategic. Legal instruments involve formal registration: patents, trademarks and copyrights are included in this group. Strategic instruments are the rest of the actions taken by the company to impede or make the copy and appropriation of innovation rents more difficult. The complexity of products, leadtime advantage and secrecy are in this group (Arundel, 2001).

Many studies sustain that the effectiveness of appropriation instruments and the relative importance of each instrument vary significantly between industries and depend on the size of the company (Arundel, 2001; Levin et al., 1987). Arundel (2001) upholds that the category and number of appropriation instruments used by a firm to protect inventions can also vary according to what phase the innovation is in; that is, the company can make use of secrecy initially and then patent later.

In this regard, it must be pointed out that the use of patents and secrecy (commercial or industrial) has been widely studied both in the theoretical (see Hall et al., 2014 for a review) and the empirical literature (e.g. Arundel, 2001; Levin et al, 1987). There are also numerous studies that consider other appropriation instruments to protect innovations such as, most notably, confidentiality agreements, copyrights and trademarks, among others (e.g. Amara et al., 2008).

Levin et al. (1987) show that some of the strategic protection mechanisms, such as lead-time advantage and secrecy, are among the most effective instruments to protect a firm's innovations. Arundel (2001) provided quite similar results, indicating that firms usually opt for secrecy rather than for patents to protect their inventions, mainly because they prefer not to reveal valuable information to their competitors, especially in potentially profitable areas of research. Additionally, secrecy does not have to comply with the requirements demanded by the law of patents, which allows the firm to protect more of their valuable assets. However, secrecy does not detract from the fact that patents are better instruments for safeguarding the innovation, especially when it is relatively easy for competitors to imitate (Arundel, 2001). In conclusion, it must be pointed out that such findings refer to protecting and safeguarding innovations that have been produced in a traditional innovation context based on technology and knowledge within the firm (Chesbrough, 2003). The author, however, sustains that companies can also benefit from outbound open innovation (processes by which companies reveal information or sell their technology).

While traditional innovation has considered appropriation instruments to be a way to protect innovations from imitation, open innovation considers them to be a way of selectively revealing knowledge and capturing the knowledge rents produced without having to introduce it to the market themselves. Dahlander and Gann (2010, p. 704) conceptualize these practices: selling 'refers to how firms commercialize their inventions and technologies through selling or licensing out resources developed in other organizations' and revealing 'refers to how firms reveal internal resources without immediate financial rewards, seeking indirect benefits'. If we link this to patents and secrecy, selling usually involves employing some sort of patent, while revealing involves failing to employ secrecy, at least partially.

Another line of the literature (e.g. Bessen & Maskin, 2009) suggests that firms adopt strategies to selectively reveal some of their technologies to the public in order to elicit collaboration, but without any contractual guarantees of obtaining it. According to Dahlander and Gann (2010) being open and focusing less on ownership increases the opportunity to attract interest from other parties.

Thus, within the framework of open innovation, firms in a favourable business environment can make use of patents to take advantage of exploitation. In other words, patents can be positively related to world-first innovation even under the open innovation paradigm. While the widespread use of secrecy is opposed to the concept of open innovation by its very nature, it could continue to be used by world-first innovators with a traditional profile, or selectively within an open profile.

Drawing on the above, we formulate the following hypothesis:

H2. Some appropriation instruments, notably patents, increase the likelihood of introducing world-first product innovations.

Data and variables

The data used in this study come from the Eurostat Community Innovation Survey (CIS) carried out in Germany in 2012. We turn to the CIS because it follows the directives of the Oslo Manual and its data are standardised, trustworthy, comparable and taken from large samples that are representative of the country's economy as a whole and not only of the high technology sectors (Laursen & Salter, 2006). Regarding the country, we opted for Germany because this economy is one of the leaders for innovation according to the Innovation Union Scoreboard. In the CIS 2012 microdata for this country, we find the highest frequency of firms with world-first innovation, both in absolute terms and in the percentage of the total sample (8.2%). Statistical models predicting qualitative behaviours lose statistical power when the behaviour under study is only observed in a small number of cases. Therefore, the German market is the best option to see whether traditional innovation practices or open innovation practices contribute most to the introduction of new products onto the world market.

The sample includes firms with 10 or more employees which represent all sectors of the manufacturing and service industries. Of those surveyed, only enterprises that declared they had innovated goods or services were taken into account. In accordance with this filter, once the cases with missing values were excluded, we identified 1,715 firms who, during the period 2010-2012, declared that they had carried out at least one innovation related to goods/services, of which 406 (23.7%) affirmed that at least some of their innovations could be classified as world-firsts.

The variables we considered are (Table 1):

1. Dependent variable. The dependent variable indicates the presence of world-first goods or services. The CIS 2012 question 'To the best of your knowledge, were any of your product innovations during the three years 2010 to 2012 a world-first?' (referring to a previous question about new or significantly improved goods and services introduced during the same period) was used. 'yes' was coded as 1 and 'no' as 0.

2. *Explanatory variables.* As explanatory we used the range of appropriation instruments available in the CIS for the analysis: (i) patents, (ii) trademarks and copyrights, (iii) complexity of products and (iv) secrecy. On the one hand, we used the two typical variables of innovation activities: (1) in-house R&D and (2) information sources from

within the enterprise; and, on the other hand, inbound open innovation activities: (3) cooperation with suppliers, (4) cooperation with customers (5) cooperation with competitors, (6) information sources from consultants, (7) information sources from universities and government, (8) external R&D, (9) acquisition of machinery, equipment and software and (10) acquisition of knowledge. The CIS contained a longer list of variables of cooperation, information and appropriation instruments. We decided on the definitive list of 14 variables by carrying out a collinearity analysis. For example, information from universities and cooperation with universities were highly correlated, as were information from competitors and collaboration with competitors; so, in each case, the variable that made more theoretical sense was chosen. Van de Vrande et al. (2009), for example, suggest that obtaining information from customers is within the possibilities of any organization, including those that practice traditional innovation, while on the other hand, cooperating with customers is a clearer indicator of openness (Barge-Gil, 2010). We converted all of the variables into binaries. The variables In-House R&D, External R&D, acquisition of machinery and acquisition of external knowledge were already binary in the CIS (1='yes', 0='no'). For the information sources and appropriation instruments, the categories 'not used' and 'low' were grouped together (0) and the categories 'medium' and 'high' were grouped together (1). For the cooperation variables the category 'yes' (1) included any cooperation regardless of geographical location. A similar approach was followed by Hochleitner et al. (in press).

3. *Control variables.* As controls, we included the size of the company, measured by the number of employees (following the directives of the Oslo Manual, 2005). We classified the companies into three different groups: large firms, SMEs belonging to a group and independent SMEs (reference category). We also included industry, which we grouped into 9 major categories following the NACE classification. Other services act as a reference category.

		% Within Imitators	% Within world- first Innovators	% Total
Innovation activities				
In house P&D	NO	35.3	6.4	28.5
III-House R&D	YES	64.7	93.6	71.5
Inf. sources from within the enterprise	NO/LOW	12.6	6.7	11.2
mi. sources from within the enterprise	MED/HIGH	87.4	93.3	88.8
Cooperation with supplices	NO	87.2	74.4	84.1
Cooperation with suppliers	YES	12.8	25.6	15.9
Cooperation with customers	NO	84.3	71.2	81.2
Cooperation with customers	YES	15.7	28.8	18.8
Comparation with commutitors	NO	92.7	87.4	91.5
Cooperation with competitors	YES	7.3	12.6	8.5
Te for a second for the second for the	NO/LOW	77.2	84.7	79.0
Inf. sources from consultants	MED/HIGH	22.8	15.3	21.0
T. C	NO/LOW	68.0	49.5	63.6
Inf. sources from universities and government	MED/HIGH	32.0	50.5	36.4
	NO	69.6	48.0	64.5
External R&D	YES	30.4	52.0	35.5
	NO	28.7	20.0	26.6
Acquisition of machinery, equipment and software	YES	71.3	80.0	73.4
	NO	70.6	64.3	69.1
Acquisition of knowledge	YES	29.4	35.7	30.9
Appropriation instruments				
Detento	NO/LOW	59.1	29.3	52.0
ratents	MED/HIGH	40.9	70.7	48.0
Tradamarka and Converiant	NO/LOW	48.4	34.5	45.1
frademarks and Copyright	MED/HIGH	51.6	65.5	54.9
Complexity of goods on complexity	NO/LOW	37.4	27.3	35.0
Complexity of goods of services	MED/HIGH	62.6	72.7	65.0
Sacracy	NO/LOW	43.7	30.8	40.6
Secrety	MED/HIGH	56.3	69.2	59.4
Size				
Large enterprise		17.6	34.2	21.6
SME in an enterprise group		22.8	22.2	22.7
Independent SME		59.5	43.6	55.7
Nace				
Food, mining, construction		10.7	5.2	9.4
Textile, fur, wood, paper industries		10.4	13.8	11.2
Publishing printing and recorded media industries		5.7	6.9	5.9
Rubber and plastic manufacturing		6.4	7.9	6.8
Metal manufacturing		17.3	38.9	22.4
Machinery and equipment manufacturing		3.5	5.4	4.0
Other manufactures		9.5	6.9	8.9
Retailing, repair and transport		16.3	7.4	14.2
Other services		20.2	7.6	17.2

Table 1. Frequencies of independent variables and imitators and world-first innovators

Statistical analysis

The relationship between introducing or not world-first good and service innovations, the activities, the appropriation instruments and the controls are specified as a binary logistic regression model (Hosmer & Lemeshow, 2004) as:

$$y_i^* = \mathbf{x}_i \beta + u_i$$

where y_i^* is an underlying continuous dependent variable, which is not observed. The categorized y_i variable with two categories is observed instead as $y_i=0$ if $y_i^* \varsigma \tau$ (imitators) and $y_i=1$ (world-first innovators) if $y_i^* \succ y_i^*$ thus shows the propensity to introduce world-first innovations. \mathbf{x}_i is a row vector of explanatory variables, which in our case includes dummy coded innovation activities and appropriation instruments as well as dummy coded controls. u_i stands for the coefficient vector. u_i is a disturbance term with a logistic distribution with null location parameter and unit scale parameter. The exponential transformation of the coefficients can be interpreted as odd-ratios. Groups of firms with combinations of activities, appropriation instruments or control characteristics leading to a particularly high proportion of world-first product innovations were identified by means of using the Chi-Squared Automatic Interaction Detector technique (CHAID), a particular case of decision and regression tree (Magidson, 1994). The maximum depth of the tree was specified as 4 with a minimum terminal node size of 50 firms and alpha risk equal to 0.05 applying Bonferroni's inequality to prevent the accumulation of risks due to multiple testing.

Modelling world-first innovation from innovation activities and appropriation instruments

As regards the application of the logit model, according to Table 2, the Nagelkerke's R-squared of the relationship between innovation activities, appropriation instruments, controls and world-first product innovation is 0.261.

Table 2. The relationship between innovation activities and appropriation instruments and world-first product innovation.

	β	Standard error	p-value	Odd ratio
Innovation activities				
In-house R&D	1.418**	0.227	0.000	4.13
Inf. sources from within the enterprise	0.414	0.238	0.082	1.51
Cooperation with suppliers	0.186	0.160	0.246	1.20
Cooperation with customers	0.377*	0.165	0.022	1.46
Cooperation with competitors	0.217	0.213	0.308	1.24
Inf. sources from consultants	-0.715**	0.177	0.000	0.49
Inf. sources from universities and government	0.284*	0.137	0.039	1.33
External R&D	0.011	0.146	0.942	1.01
Acquisition of machinery, equipment and software	0.156	0.156	0.316	1.17
Acquisition of knowledge	0.085	0.144	0.557	1.09
Appropriation instruments				
Patents	0.570**	0.149	0.000	1.77
Trademarks and Copyright	0.256 0.143		0.073	1.29
Complexity of goods or services	0.268	0.150	0.074	1.31
Secrecy	-0.198	0.149	0.183	0.82
Size				
Large enterprise	0.381*	0.165	0.021	1.46
SME in an enterprise group	0.005	0.160	0.973	1.01
Independent SME	0 ^a			1.00
NACE				
Food, mining, construction	0.143	0.320	0.655	1.15
Textile, fur, wood, paper industries	0.898**	0.265	0.001	2.45
Publishing printing and recorded media industries	0.889**	0.314	0.005	2.43
Rubber and plastic manufacturing	0.940**	0.305	0.002	2.56
Metal manufacturing	1.238**	0.235	0.000	3.45
Machinery and equipment manufacturing	1.019**	0.349	0.004	2.77
Other manufactures	0.573	0.305	0.060	1.77
Retailing, repair and transport	0.199	0.285	0.486	1.22
Other services	0 ^a			1.00
Nagelkerke's R2	0.261			

**: p-value <0,01; *: p-value <0,05. a Reference category

The results show that in-house R&D ($\hat{\beta}$ =1.418; p <.01; odd-ratio=4.13), the traditional innovation activity, has the greatest positive effect on the launch of world-first goods and services. The use of internal sources of information, on the other hand, does not have a significant effect. According to the percentages in Table 1 this activity can be taken for granted in most firms (88.8%).

However, it must be highlighted that some of the inbound open innovation activities have a positive effect on launching new-to-the-world goods and services. This is the case for cooperation with customers ($\hat{\beta} = .377$; p <.05; odd-ratio=1.46) and information sources from universities and the government ($\hat{\beta} = .284$; p <.05; odd-ratio=1.33). This result partially confirms hypothesis 1. On the other hand, the use of information sources from consultants has a negative effect on world-first products ($\hat{\beta} = -.715$; p <.01; odd-ratio=0.49). This could be attributed to the level of consolidation of the information that is usually transmitted by consultation, which is often not the type of leading-edge knowledge that is needed for world-first innovation. The other open innovation activities have no significant effect on world-first products.

Patents are the only appropriation instruments to exercise a significant positive effect on world-first products ($\hat{\beta} = .570$; p <.01; odd-ratio=1.77). No instruments have a significant negative effect. This result partially confirms hypothesis 2.

With respect to the control variables, large firms are the only ones that stand out from both independent SMEs and those that belong to a group, and they are also the ones that are more likely to introduce world-first products. With regards to NACE, metal manufacturing has the highest likelihood of introducing world-first products, closely followed by machinery/equipment manufacturing, rubber/plastic manufacturing, textile/fur/wood/paper manufacturing and the publishing, printing and recorded media industries. The other manufacturing industries are somewhere in the middle, and the primary sector, construction, and services are at the bottom.

Combinations of firm characteristics, appropriation instruments and activities leading to world-first innovation

Regarding the application of the CHAID method (Figure 1), the following variables contribute to identifying groups of firms with varying degrees of success in introducing world-first innovations. The first variable is in-house R&D, which appears to be a necessary condition for success in new-to-the-world innovation (only 5.3 % of firms without in-house R&D achieve world-firsts). For the sake of brevity, from here on we will only comment on combinations of characteristics with particularly high world-first innovation rates.

Among firms with in-house R&D activities, a medium or high use of patents contributes most to increasing the world-first innovation rate. The sample includes 40.2% of cases with both in-house R&D and patents, with a rate of world-first innovations of 39.8%.

Among firms with in-house R&D activities and patents, being a large

enterprise contributes to increasing the world-first innovation rate. The group that combines these three characteristics includes 14.1% of sample cases, with a rate of world-first innovations of 52.5%. Among large firms with in-house R&D activities and patents, cooperation with suppliers contributes to further increasing the world-first innovation rate. 4.8% of firms combine these four characteristics, and this subgroup has a world-first innovation rate of 65.1%.

In the case of SMEs (both independent SMEs and those belonging to a group), combining in-house R&D and patents, the acquisition of machinery, equipment and software contributes to increasing the world-first innovation rate. 19.4% of firms combine these four characteristics, with a world-first innovation rate of 37.3%.

In the case of firms with in-house R&D activities that do not use patents, belonging to manufacturing industries contributes to increasing the world-first innovation rate. The node includes 14% of sample cases, with a rate of world-first innovations of 29.2%. Among firms with in-house R&D activities that do not use patents and belong to manufacturing industries, trademarks and copyright contribute to increasing the world-first innovation rate. This combination of characteristics includes 5.4% of cases, with a rate of world-first innovations of 37%.

Figure 1. CHAID tree of world-first product innovators



Discussion

The results of this study provide significant evidence that above all German companies continue to use activities and appropriation instruments from traditional innovation to introduce good and service innovations to the world.

The logit model and the CHAID technique provide complementary and convergent insights. In both cases, in-house R&D and patents are the main variables related to world-first innovators. Furthermore, in both techniques, all of the inbound and the remaining outbound open innovation activities appear to have no adverse effects on world-first innovations. The only exception is consultants. Certain inbound open innovation activities do have a favourable effect on world-first innovation; they appear with moderate significant coefficients in the logit model and at the bottom of the CHAID tree.

These results can be classified as typical in the sense that the activities that characterise innovations at a world level are internal R&D and the use of patents, coinciding with the results that studies on innovation carried out previous to the open innovation context tended to give (e.g. Amara & Landry, 2005; Hanel, 2008). This statement does not undermine the open innovation paradigm. This study shows that cooperation with customers, information from universities and the government, cooperation with suppliers and the acquisition of machinery play to the advantage of world-first innovators, at least in some cases. The only open innovation activity that is detrimental to world-first innovation is the use of information from consultants, as discussed above.

The refinement that discriminates between firms that launch innovations at a world level and those that launch innovations only at a market or firm level sheds light on the distinction between the creation and the imitation of innovations. This distinction is relevant because it coincides with the classification that has been established in a large part of the theoretical literature (Lieberman & Asaba, 2006; Zachary et al., 2015), while the empirical literature has tended to consider innovation at a market level to be sufficient, at least in the European context (Barge-Gil, 2010; Laursen & Salter, 2006). This distinction is important, for example, when considering the effects of innovation on the growth of an economy and, consequently, when shaping policies to encourage innovation (European Commission, 2014). The results of this study show that promoting open innovation can be advantageous for the introduction of world-first innovations, thus lending support to initiatives like Open Innovation 2.0, which is included in the Digital Agenda for Europe.

Conclusions

The aim of this article is to study the relationship that open innovation activities and appropriation instruments have with the introduction of new-to-the-world innovations. To this end, we use the data of the CIS 2012 carried out in Germany. The statistical analysis produces several significant results. First, beyond the still decisive role of traditional innovation, our results show that some inbound open innovation activities have a positive effect on world-first product innovation. Second, amongst the appropriation instruments, only patents exercise a significant positive effect on world-first product innovation.

As regards the main implications and contributions of this study, besides helping to determine the appropriateness of policies supporting open innovation as mentioned above, our results are relevant for practising managers as they assist them in identifying which open innovation practices might be more productive. For instance, we show that when it comes to world-first innovation, large enterprises may find greater benefit from cooperating with suppliers and SMEs from acquiring machinery. Several limitations of this study need to be noted. First, the data used are based on German firms and therefore the results are specific to that country. The effects of open innovation activities and appropriation instruments on world-first innovation from other countries could be significantly different. Future research is required to verify whether these results can be applied elsewhere. Second, our results are specific to the innovation of goods and services and do not include other types, such as the innovation of processes. Despite the fact this study considers a wide range of innovation activities in the analysis, the CIS information is limited regarding outbound open innovation. Appropriation instruments may or may not be used for outbound open innovation purposes. This limitation is related to the use of official statistics data, whose range of variables is not controlled by the researcher. Last, the broad definition of innovation used by the OCDE - 'Did your firm offer new or significantly improved products (goods or services)?' - has advantages over a narrower vision - R&D spending and obtaining patents - but on the other hand it runs the risk of counting relatively minor improvements to goods or services as innovations at a world level. In any case, the results obtained from this study, where in-house R&D and patents stand out when explaining the originality of the innovations, could be an indicator of convergent validity. Further research on world-first innovation in an open innovation context is required, using data from diverse sources.

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Human Capital as Source of Innovativeness in Subsistence Small Businesses

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Abstract: Subsistence small businesses (SSB) are very important in developing countries for reducing poverty. Companies in developing countries need innovation in order to compete, and innovation is particularly significant for SSBs, as they are usually less well-prepared for competition. Human capital is the key to improving the situation of poor countries as such human capital improves innovativeness in companies. Nevertheless, human capital is scarce in SSBs and these businesses possibly need the alignment of human capital with strategy to improve their performances. This alignment is achieved by exploiting the dynamic capabilities of human capital management. The aim of this paper is to analyse human capital management and innovativeness in SSBs in the timber industry in a region of Latin America using PLS techniques. The findings suggest that SSBs build human capital management to improve innovativeness as dynamic capabilities and use human capital management to improve innovativeness.

Keywords: Innovativeness; human capital management; Subsistence small business; Latin-America; timber industry; dynamic capabilities

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Introduction

Reducing poverty is one of the Millennium Development Goals (UNO, 2000). The existence of areas of extreme poverty is usual in developing countries, (Christensen, Parsons, & Fairbourne, 2010). One of the tools used by people in these areas to alleviate this situation and to create a means of subsistence for the entrepreneur and his family (Schoar, 2010) is the creation of small businesses (Toledo, Hernández, & Griffin, 2010). Such subsistence small businesses (SSB) are significant and normal in developing countries; because people in such countries are forced into self-employment or start-up businesses, as there are no other alternatives available.

Companies in developing countries need innovation to compete, being particularly important for SSBs, as they usually are less wellprepared for competition (Wu, Lin, & Hsu, 2007). As noted by Gopalakrishnan & Damanpour (1997, p. 22) the "ability of the firm to innovate" is called innovativeness, which is an important dynamic capability, obtained by building, integrating, and reconfiguring resource packages (Teece, Pisano, & Shuen, 1997). The deployment of organizational capabilities and the harnessing the environment supplement the process to obtain dynamic capabilities, which generate value for the customer..

Innovation may serve as the basis for competitive advantage. In this case there are a link between knowledge and innovation (Santos-Rodrigues, Figueroa Dorrego, & Fernandez-Jardon, 2008), which is a consequence of the essence of innovation, characterized as the pursuit of new knowledge for discovery.

Human capital (HC) is the key to improving the situation of less developed countries as it enhances the performance of companies. Bruhn, Karlan & Schoar (2010) propose that managerial capital is the missing ingredient in developing countries. This capital is part of the HC of managers. The intellectual capital based-view suggests that HC is a source of competitive advantage (Jin, Hopkins, & Wittmer, 2010), and in particular, a source of innovativeness (Leitner, 2011).

The SSBs have few tangible resources; therefore, the creativity of people in generating competitive advantages is of pivotal importance. The alignment of human capital with an innovation strategy improves innovativeness, which may enhance performance and culminate in competitive advantage (Yen, 2014). This process needs human capital management (HCM). Previous literature proposes different HCM issues as a source of innovativeness (Leitner, 2011); however, the limited resources afforded by the environmental conditions in which SSBs operate potentially limit the development of HCM and innovativeness. In consequence, to improve the growth of SSBs and the economic development of the poorest areas in developing countries, this paper aims not only to analyze HCM and innovativeness in SSBs as dynamic capabilities but also to explore the possible relationships between these capabilities.

Most studies on entrepreneurship have focused on Western Europe or the United States. In Latin American countries, there is a mixture of Western immigration and indigenous cultures that influence business characteristics. This study analyses the subsistence entrepreneur (Toledo et al., 2010), as the characteristics of such entrepreneur, are seen most clearly in SSBs, as their managers and employees often have little training.

In Part 1, the paper expounds the theoretical structure of the study, introducing the working hypotheses. In Part 2, the methodology is presented, followed, in Part three by a case study that analyses the questions addressed. Finally, in Part 4, the conclusions and considerations for the management are discussed.



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Theoretical structure

SSBs are businesses created to "merely provide an alternative employment opportunity to the entrepreneur and potentially their family members" (Schoar, 2010; p. 59). Such businesses involve family businesses or single-family member entities. They tend to move on the border of the formal and informal sectors, and may become sucked into the underground economy (Schoar, 2010); this makes it both more difficult for them to obtain public support and also exposes their rivals to unfair competition.

The concept of HC has its origins in the economic literature, defined by Becker (1964) as '... the knowledge, information, ideas, skills, and health of individuals' (Becker, 1964: 1). The skills can be different for managers and workers. Managerial skills comprise technical, human, and conceptual abilities. Technical abilities are described as a manager's specialised and analytical abilities within his or her speciality. These abilities are unusual in SSBs. Human abilities are a manager's ability to work effectively with people. Managers of SSBs probably have these abilities. Conceptual skills are a manager's ability to view an organization from a broad system perspective. Conceptual abilities are unusual in managers of SSBs. These skills belong to managerial capital, which capital is needed in developing countries to not only identify customer needs, but also to help better predict financial needs, and to further facilitate the hiring of top employees (Bruhn et al., 2010).

Workers' skills include technological and relational skills technological abilities comprise problem-solving skills, operations knowledge, and creativity (Jin et al., 2010). Such skills are not usual in SSBs. Workers' relational skills include the ability to relate to others; they are of extraordinary significance in a teamwork environment. Such skills can exist in SSBs.

Individual abilities are often linked to local knowledge, showing expertise in traditional production techniques and knowledge of the specific products and systems of the territory.

SSB entrepreneurs have a strong motivation to support families (Schoar, 2010), and use intuition, personal experience and business sentiment to take decisions (C.M. Jardon & Martos, 2012). However, they tend to be individualistic, preventing cooperation between competitors. Owner-managers often have a little formal education (London, Anupindi, & Sheth, 2010), and a poor strategic vision, limited technical and management skills, and little or no strategic planning. They are often bereft of professional expertise, without a market orientation (Jardon, Gutawski, Martos, Aguilar, & Barajas, 2007) and deficient in experience in costing products (London et al., 2010). SSBs have unskilled workers, as they have greater difficulties in finding trained personnel (Carlos Maria Jardon et al., 2007).

While HC checks the characteristics which distinguish a source enjoying a competitive advantage, it is unclear whether the resulting impact is direct or it must be combined with other factors to generate better performance. Theorists are usually focused on the need to develop a pool of HC that "has either higher levels of skills (general and/or firm specific), or [can achieve] a better alignment between the skills represented in the firm and those required by its strategic intent" (Wright et al., 2001,704). The ability to calibrate the alignment is limited in SSBs as their strategic management is deficient. The stock of HC can change over time and, consequently, it must constantly be supervised to match the strategic needs of an organization. Possibly this mechanism is dependent on the organization's dynamic capabilities (Teece et al., 1997).

Organizations require dynamic capabilities to adapt effectively to changing market conditions and to create an appropriate value for each situation. This issue is valid for SSBs as they need to innovate using their resources and capabilities. In light of their limited technological and financial resources, SSBs must, necessarily, have recourse to human resources to innovate. The core dynamic capability associated with HC is the HCM.

HCM is a strategic approach to people management, focused on the knowledge, skills, abilities and capacities possessed by individuals in an organization to innovate and to compete. It involves the development of all labor-related issues influencing an organization's strategic and operational objectives. It includes not only the utilization of people but also the development, use, and maintenance of resources, as well as the provision of compensation for services rendered according to the requirements of the job and organization. In consequence, the management system is essential to HCM (Marrewijk & Timmers, 2003) mostly on SSBs. The relationships between workers are usually informal in SSBs; therefore, instruments, such as teamwork or internal communication-that facilitate relationships-are necessary. The corporate culture depends on a particular territory and the specific characteristics of the owner. This culture conditions the attitudes of workers (Ritchie & Brindley, 2005); therefore, in SSBs, a way of management integrated with local culture is essential to HCM. Similarly, the ability to transmit experiences facilitates the management of HC, because the learning in SSBs is basically acquired through experience (Hatch & Dyer, 2004).

Innovativeness is the capacity and commitment of a firm to innovate by reflecting its activities regarding its technological and behavioral aspects (Santos-Rodrigues et al., 2008). We consider innovativeness to be a dynamic capability. Dynamic capabilities are a combination of resources and competencies oriented to performance by the firm. In consequence, innovativeness is the combination of organizational culture, processes, resources and abilities, oriented to innovation. These resources are scarce in SSBs and the central one is usually the creativity of workers. Innovativeness in SSBs is not formalized, being based rather on the necessity to generate elemental innovations to compete. In fact, the processes in SSBs are incipient. SSBs have not design and research and development (R&D) departments. In consequence, design and R&D processes are informal, oriented to improving particular issues relating to the organization itself or to enhancing products. Logistics processes and marketing are poorly developed and based on the intuition of the manager. The most formalized activity is the production process, but it is frequently very basic and not oriented

to innovation. Organizational capabilities are thus in their developmental phase, because technological resources and intellectual capital are very limited, there is little routinization. The innovation culture depends on the entrepreneurial ethos and commonly, on entrepreneurial creativity. Technology is scarce and associated with tangible resources as the source of innovation. Mendoza-Ramírez & Toledo-López, (2014) suggest, however, that entrepreneurs are introducing innovative and proactive practices to SSBs.

Previous literature, citing various reasons, suggests that HC increases innovativeness (Yen, 2014). For example, firms with highly skilled and knowledgeable employees have higher levels of HC and are more likely to create knowledge and make decisions, resulting in better organizational innovativeness (Saá-Pérez, Díaz-Díaz, & Ballesteros-Rodríguez, 2012). Firm-specific training is necessary because it improves technical abilities to solve problems. The firm must reorganize training activities in ways that generate new understandings and new ideas. Thus, training in core skills is useful for product innovation, although such training in SSBs rarely occurs. On the other hand, Latin American SSBs, in particular, have little concern for the customer, but often have great concern for product quality (Jardon et al., 2007). This interest facilitates product innovation.

Nevertheless, it is hard to know how to encourage employees to contribute their knowledge for the advantage of the organization. In large and medium companies, "people may be reluctant to share crucial knowledge for fear of losing ownership, a position of privilege or superiority" (Tsan & Chang, 2005, p. 7), but in SSBs this problem is unusual, as the shared knowledge is not a strategic asset. For the benefits of the organization, managers should thus raise awareness of the importance of innovation and provide incentives for employees to develop innovative mindsets. SSBs do not generally provide financial incentives; therefore, they should motivate using social incentives based on values and attitudes. Managers should emphasize the development of employee capability as well as employee zeal. Therefore, HC should focus both on employee competencies (e.g. skills, know-how, and aptitudes), and on employee commitments (e.g., willingness to devote themselves to, and work for, the company). Previous studies have suggested that organizational innovativeness is closely related to HC and organizational learning (Santos-Rodrigues et al., 2008). Subramaniam and Youndt (2005) tested the relationship between HC and innovativeness, concluding that HC negatively affects the potential for radical innovation, but indirectly influences the capacity for incremental innovation. Possibly, HC needs a mediator to affect innovativeness. Usually SSBs, in adopting an innovation, favor incremental. The mechanisms used to adopt an innovation are generally based on people; however, the people need to know the underlying aim of the chosen strategies. Thus, SSBs should combine HC with organizational issues, processes and systems to constitute a dynamic capability to improve innovativeness. The literature defines this dynamic capability as HCM.

HCM combines HC and organizational capabilities with strategy for innovating. The culture and training of workers facilitate their ability to innovate on processes and products (McAdam, Reid, & Shevlin, 2014) the emergence of the knowledge economy may enable leveraging of knowledge to address such innate limitations. The aim of this study is to twofold. First, the study explores how SMEs in peripheral areas, i.e. challenging regions, seek to implement innovation from a path perspective by examining the contributions from antecedent and mediator variables or constructs, including knowledge-based factors identified in the literature, using a cross-sectional survey of SMEs at firm level. Second, to further examine how these path model constructs and relationships contribute in a causal manner to innovation implementation at an activity level of analysis based on knowledge-based view and dynamic capability theory, using a case study analysis. Design/ methodology/approach - A sequential mixed method approach is used. In relation to the first aim a hypothetical path model is tested using structured equation modelling techniques based on a cross-sectional survey of SMEs in peripheral regions (n=604. The existence of internal communication fosters relationships between workers, providing an information system that is usually very informal, but providing flexibility to the company, and facilitating innovation (Jin et al., 2010). The management system enables the organization of the processes and systems associated to innovate; and the professionalization of HR, and the ability to transmit experiences, enhance training and the better use and deployment of limited technology-thereby also fostering innovation.

Local knowledge in developing countries is different than local knowledge in developed countries. Therefore, taking cognizance of such cultural variations and ensuring that local knowledge is harnessed and put to the service of innovation enhances the competitiveness of enterprises. This local knowledge is part of HC. The process of transforming this local knowledge to innovativeness depends on the ability to manage the HC, that is, the HCM. Consequently, we can thus introduce the following hypothesis:

H1: SSBs need to organize their HC through HC management to improve their innovativeness.

Methodology and information sources

This study focused on SSBs, and, particularly, the timber SSBs, located in Oberá ('the shining', in Guarani) Department. This area is in the northeast of Argentina. A large proportion of immigrants has brought singular cultural characteristics to this area. It is a landscape studded not only with agricultural and forest crops—yerba mate, tea, and snuff—but also large wood plantations occupying more than 75% of the territory (INDEC, 2002). The population includes 162 timber companies (MERNRyT, 2003)—mainly sawmills and carpentry. The wood industry is under development, albeit, with little evidence of professionalism. Of the few companies that have imported hardware from abroad, the machinery is mostly outdated. Support services and complementary activities are scarce (Carlos Maria Jardon et al., 2007). Usually, the companies in existence are small or micro enterprises which—due to the low survival rate—have traded for only a few years (see Table 1). All these features suggest that these companies are SSBs.

Data were collected from a survey of owners and managers of timber SSBs in Oberá in late 2005 and early 2006, resulting in 113 responses, with a sampling error of 5.09%. The study realizes a test of homogeneity to ensure that the conformation of sample and population.

	Number of employe					
Date of born	Without employees	From 1 to 9 employees	From 10 a 24 employees	From 25 to 50 employees	Total	No answer
Before 1980	1	7	0	0	8	
Between 1981 and 1990	2	10	3	2	17	
Between 1991 and 2000	2	18	6	1	27	
After 2000	3	30	1	2	36	
Total	8	65	10	5	88	25

Table 1: Characteristics of the sample (number of firms)

To measure the constructs related to the process of generating dynamic capabilities oriented to innovation, the study used a questionnaire with a Likert scale according to Jardon and Martos (2012) and based on scales referred to in the literature (Tsan & Chang, 2005). It questioned owner-managers on the importance of each item (see Table 2) as a source of competitive advantage for their companies, ranging from 1 (not important as a source of competitive advantage) to 5 (very important as a source of competitive advantage).

		D.C.
Competency	Source	Reference
	The capacity for innovation in processes, products or markets	(Verhees, Meulenberg, & Pennings, 2010)
	Process and product technologies	(Camisón-Zornoza, 2004)
T	Technological resources of facilities and equipment	(Verhees, Meulenberg, & Pennings, 2010)
Innovativeness	The Design process	(Hausman, 2005)
	The Research, development and innovation process	(Hausman, 2005)
	Information system	(Khasawneh, 2008)
	The training of managers and workers	(Camisón-Zornoza, 2004)
	Internal communication	(Camisón-Zornoza, 2004)
	The Corporate Culture	(Ritchie & Brindley, 2005)
	Team working	(Jardon & Martos, 2012)
	The professionalism and attitude of managers and workers	(Camisón-Zornoza, 2004)
Management	Human resources	(Hatch & Dyer, 2004)
	The Ability to transmit experiences	(Jardon & Martos, 2012)
	Management system	(Marrewijk & Timmers, 2003)
	The ability to evaluate investment risks	(Jardon & Martos, 2012)
	The attitude of cooperation and partnerships by the company	(Jardon & Martos, 2012)

Table 2: Competitive advantages items

The research used the partial least squares technique (PLS) (Vinzi, Wynne, Chin, & Henseler, 2010) to test the relationships between HCM and innovativeness. The aim of PLS-based solutions is to minimize the variance of all dependent variables regarding causal variables. This technique does not require an assumption of the normality of variables—which was problematic to verify in this case, as the study measures the items on a Likert scale. Also, this approach avoids problems such as identification parameters, a common problem in covariance models (Vinzi et al., 2010). PLS uses the average variance extracted (AVE) and Cronbach's alpha (CA), as criteria to validate the model. AVE assesses the variance caught by a latent construct. CA determines the internal consistency to establish the reliability of the measuring instrument and data collection (Nunnally & Bernstein, 1994). The limits used were 0.5 for AVE (Vinzi et al., 2010) and 0.6 for CA (Nunnally & Bernstein, 1994). The law of distribution of the estimators was unknown. In consequence, the study used bootstrapping to evaluate the t-statistics and calculate p-values (Vinzi et al., 2010). The software used for data analysis was Smart-PLS (Ringle, Wende & Will, 2005).

Empirical analysis

The constructs of HCM and innovativeness were used to test the model. First, the study verified the components of each construct. Table 3 shows the final estimate of the factor loadings, CA and AVE, for each construct. The items that comprise the constructs are weighty, confirming the previous analysis. The relationships between latent and manifest variables are all significant.

HCM is fundamentally constituted by three influences: the HC of the company (Jin, Hopkins & Wittmer, 2010); the culture and the internal communication that facilitate HR management; and, the organizational capabilities related to management (Marrewijk & Timmers, 2003). SSBs present issues similar to those of large enterprises, but the contents of these issues are different. HC includes the training and professionalization of human resources, but, in SSBs, training is scant, informal, and is consequence of the accumulation of knowledge or skill that results from direct participation in events or activities, therefore, the ability to transmit experiences is essential to HCM (Jardon & Martos, 2012). Professionalization of HR is limited and oriented to local know-how (Jardon et al., 2007). Managerial capital in SSBs shows an authoritarian leadership (Gibbons & Connor, 2005). Companies need management systems to orient HR to strategy. SSBs have a management systems based on intuition, personal experience and business sentiment (C.M. Jardon & Martos, 2012); these characteristics necessarily shape the organization of HR. These companies often adopt a conservative strategic posture; therefore, they often have to undergo incremental strategy formation processes (Gibbons & Connor, 2005). The lack of organizational systems in SSBs highlights the need for a cohesive corporate culture incorporating the different components of HCM. In consequence, the manifestation of local norms in the company culture is essential to HR management (Ritchie & Brindley, 2005).

Innovativeness includes elements that directly facilitate innovation, such as technologies (Camisón-Zornoza, 2004), the innovation capacity of HR (Verhees, Meulenberg, & Pennings, 2010) and the organizational capabilities directly related to innovation such as the information system (Khasawneh, 2008) or R & D and design processes (Hausman, 2005). Again, although the aspects that make up innovativeness are similar to those of other companies, SSBs, in particular, understand these components. The technology of SSBs is very rudimentary and it utilizes fundamentally the tangible resources. The intuitive management system leads companies to use their tangible resources for innovativeness. This result may be a consequence of the fact that technologies are scarce in SSBs and, so, the companies use their technological resources as a source of innovation (Verhees, Meulenberg, & Pennings, 2010). The innovativeness employs principally the creativity and, as with the process of design and R & D, is oriented towards the improvement of a particular process or product. The information system is informal and closely associated with the internal communication of HR.

Construct	item	weigth	T-Stat	P value
	The design process	0.18	8.05	0.000
	Information system	0.188	10.26	0.000
INNOvativeness	The Research, development and innovation process	0.155	6.57	0.000
AVE=0.588	The capacity for innovation in processes, products or markets	0.267	10.22	0.000
	Process and product technologies	0.242	10.24	0.000
	Technological resources of facilities and equipment	0.262	11.11	0.000
	The management system	0.103	5.96	0.000
	The attitude of cooperation and partnerships by the company		8.02	0.000
	The ability to transmit experiences		7.34	0.000
	Internal communication	0.129	9.93	0.000
HC management	The training of managers and workers	0.155	11.68	0.000
CA=0.919 AVE=0.534	The professionalism and attitude of managers and workers	0.129	10.16	0.000
	The ability to evaluate investment risks	0.139	11.81	0.000
	The corporate culture	0.16	9.54	0.000
	Human resources	0.15	10.26	0.000
	Team working	0.137	6.651	0.000

Table 4 shows the results of the model estimation by PLS. We accept H1. In this sense, SSBs exhibit a behavior similar to other companies regarding innovativeness (McAdam et al., 2014)the emergence of the knowledge economy may enable leveraging of knowledge to address such innate limitations. The aim of this study is to twofold. First, the

study explores how SMEs in peripheral areas, i.e. challenging regions, seek to implement innovation from a path perspective by examining the contributions from antecedent and mediator variables or constructs, including knowledge-based factors identified in the literature, using a cross-sectional survey of SMEs at firm level. Second, to

further examine how these path model constructs and relationships contribute in a causal manner to innovation implementation at an activity level of analysis based on knowledge-based view and dynamic capability theory, using a case study analysis. Design/methodology/ approach - A sequential mixed method approach is used. In relation to the first aim a hypothetical path model is tested using structured equation modelling techniques based on a cross-sectional survey of SMEs in peripheral regions (n=604. Hayton (2003) shows the importance of HCM in improving innovativeness in SMEs in developed countries. SSBs use an intuitive management system (Gibbons & Connor, 2005); therefore they use generic elements of HC—such as the training and attitude of HR—as the basis of HCM. The management system associated with the characteristics of the owner-manager is crucial in allowing these companies to innovate.

	Effect	T Statistics	P-value
HC management -> Innovativeness	0.779	23.62	0.000

Conclusions

The wealth of the poorest areas of developing countries depends on the growth of SSBs (Toledo, Hernández, & Griffin, 2010). Innovativeness is very necessary to grow SSBs (Mahemba & Bruijn, 2003); therefore, it is desirable to detect the factors that encourage innovativeness. The research shows that HCM improves innovativeness in SSBs. HC is a source of innovation (Leitner, 2011); however; the mediators of this effect are not well established. Some authors suggest that this impact occurs through dynamic capabilities (Santos-Rodrigues et al., 2008); however, this process can be different in SSBs. This paper has provided further research by introducing mechanisms of dynamic capabilities as mediators between HC and innovativeness in SSBs.

The findings suggest that the training and attitude of HR (Jin et al., 2010; Saá-Pérez et al., 2012), corporate culture (Ritchie & Brindley, 2005), the ability to transmit experiences, internal communication (Jardon & Martos, 2012) and the management system (Marrewijk & Timmers, 2003) constitute HCM in SSBs. Innovativeness includes elements that directly facilitate innovation, such as technological resources (Verhees et al., 2010), the innovation capacity of HR (Verhees et al., 2010) and organizational capabilities directly related to innovation such as the information system (Khasawneh, 2008) or R & D and design processes (Hausman, 2005).

In consequence, this paper provides ideas for improving the strategic management of SSBs. First, the basis of innovativeness is HC, (Leitner, 2011; Wu et al., 2007; Yen, 2014). Managerial capital is needed in developing countries to improve innovativeness (Bruhn et al., 2010). The training of human resources improves innovativeness (Saá-Pérez et al., 2012). Actions to foster HC are, thus, needed; therefore, training policies should be pursued, especially in organizational and strategic management and technology (Anand et al, 2006). In SSBs, this learning is especially needed in the case of the owner-manager, to determine the organizational structure and the cultural foundations of the company (Jardon et al., 2007). The training of managers and workers requires the joint action of social agents.

Second, innovativeness requests technology and technological resources (Correia da Silva Andrade, Will, Breda Mascarenhas, Campos da Silva, & de Oliveira Gomes, 2015); therefore, it is necessary to promote modernization of technological structures and training. To foster the use of technology, educational systems must look towards professionalizing their students to meet business needs, as these are increasing in proportion to the technological advancement of society. SSBs need the support of regional governments (McAdam et al., 2014)the emergence of the knowledge economy may enable leveraging of knowledge to address such innate limitations. The aim of this study is to twofold. First, the study explores how SMEs in peripheral areas, i.e. challenging regions, seek to implement innovation from a path perspective by examining the contributions from antecedent and mediator variables or constructs, including knowledge-based factors identified in the literature, using a cross-sectional survey of SMEs at firm level. Second, to further examine how these path model constructs and relationships contribute in a causal manner to innovation implementation at an activity level of analysis based on knowledge-based view and dynamic capability theory, using a case study analysis. Design/methodology/approach - A sequential mixed method approach is used. In relation to the first aim a hypothetical path model is tested using structured equation modelling techniques based on a cross-sectional survey of SMEs in peripheral regions (n=604, possibly by programs based on mentoring and 'learning by doing' (Ambrosini, Bowman, & Collier, 2009). Also, a lack of experience in costing products can also increase the capacity to benefit from formal institutions that disseminate business or technological information (London et al., 2010).

Third, companies need to adopt HCM to achieve dynamic capability, combining different elements of HC with organizational capabilities to improve their innovativeness; HCM is the mechanism that connects HC and the innovativeness of SSBs. This combination needs the strategic orientation of owner-managers. In consequence, training institutions should promote entrepreneurial competencies, possibly by professionalizing the managers of SSBs by integrating dynamic capabilities with short-term economic performance, thereby enhancing their strategic vision.

Fourth, the impact of HCM on innovativeness suggests that the effectiveness of HC is a consequence of social context. The introduction of SSBs in a social context facilitates the management of HC and therefore improves the innovativeness of such entities (Wright et al., 2001).

This research studied SSBs in the timber industries in a particular region of Argentina, qualifying its applicability to other industries or areas. Nevertheless, the economic organization of these SSBs is very similar to other types of activities, especially those based on natural resources. To support the findings is convenient to extend studies to other activities in developing countries.

The study employed cross-sectional data, which does not allow support temporal causality. Also, the conjuncture of causes may imply relations of an accidental type, as the data solely related to a given period. A possible alternative in the context of a future study to improve the research would be to use panel data.

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Gender and Social Legitimacy of Entrepreneurship: Contribution to Entrepreneurial Intention in University Students from Chile and Colombia

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Abstract : The research extends the application of TBP model including gender and SLE as moderator and mediator, respectively, and see if the prior results in developing countries are coincident with those of this research. In sum, the results could strength the contribution of TBP model including SLE as mediator and gender as moderator through EI. The research is a bi-country study based on 351 University students of business management in Chile and Colombia (245 students corresponds to Chile and 106 corresponds to Colombia). The data were subjected first to a confirmatory factor analysis (CFA) using Lisrel package. A structural equation model (SEM) analysis by the method of partial least squares (PLS) was used to test hypotheses. The results show that the Ajzen's model explains the EI in Chile; while in the case of Colombia, only two of the variables suite the model. The social legitimacy of entrepreneurship is a factor that mediates attitude toward entrepreneurship and entrepreneurial intention for both countries. Finally, gender moderates perceived control behavior for the less male culture, Chile, according to Hofstede dimension.

Keywords: entrepreneurial intention; Ajzen Model; gender; social legitimacy of entrepreneurship; Chile; Colombia

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Introduction

The entrepreneurial intention is a good predictor of the action to be performed. In this case, the effort refers to create a new venture. Several models try to explain EI (EI) such as Shapero y Sokol (1982) and Krueger y Brazeal (1994). However, they are not the ones that have the major influence in the empirical analysis of EI. The model that best explains EI is the Theory of Planned Behavior (TPB) of Ajzen (1991). In this sense, this study adopts Ajzen 's model to analyze the relationship between their factors and two more variables: gender and social legitimization of entrepreneurship to determine the influence on intention.

Around the world, some studies have compared EI in different countries and regions. Efforts can be documented, for example, Garcia et al., (2013); Liñán et al., (2011) and Sánchez (2009). Liñán et al. (2011) compare EI for students in two Spanish cities by verifying that there are different effects in both places. Sánchez (2009) performed a comparison between EI in two countries of the European Mediterranean and one in Latin America, identifying variation between self-efficacy and EI in both regions. However, the literature on regional comparative analysis regarding EI and related variables is scarce and there is even less in emerging economies such as Colombia and Chile.

Hofstede (1980), distinguishes four dimensions that characterize the cultures: power distance (PDI), uncertainty avoidance (UAI), individualism-collectivism (IDV) in a country and masculinity-feminity (MAS). Later, Hofstede (1995) includes a new dimension, the fifth orientation toward the short/long term of individuals (LTO). Mc-Grath et al. (1992) design a profile of a potential entrepreneur as a person with high PDI, low UAI, high IDV and high MAS. Indeed, entrepreneurial activity has been positively linked to high PDI (Busenitz and Lau, 1996), ranking low on UAI (Shane, 2000), individualistic cultures (Gupta et al. 2008; Hofstede, 2004) and high MAS.

Chile and Colombia differ mostly on the MAS and IDV dimension, so the analysis of the EI impact considers these dimensions. According to those two dimensions, Chile has pair individualism and a less masculinity culture than Colombia's. Taking into account these cultural characteristics, the research will contribute determining if the cultural differences generate the different impact of SLE to EI through subjective norms and attitude toward entrepreneurship. It is interesting to know how SLE can mediate the further action of creating a new business (Kibler et al. 2014) through EI.

This study makes its contribution in two points of interest. First, the research goes deeper on the study of the Ajzen's Theory of Planned Behavior (TPB). Specifically, the study includes two additional variables (social legitimacy of entrepreneurship and gender) that could reinforce the relationship of subjective norms (SN), personal attitude toward entrepreneurship (ATE) and perceived behavioral control (PBC) over EI. The first variable introduced in the analysis is the social legitimacy of entrepreneurship (SLE). The SLE could influence the positive or negative perception to become an entrepreneur. These beliefs probably affect ATE directly or indirectly, within will affect EI, either in a direct or indirect way. Specifically, the research compares the impact of SLE over EI in two Latin American countries (Chile and Colombia). Cultural differences in either country could show different effects.

The second variable included on the TPB, goes deeply and to identify the moderate gender effect over EI in Chile and Colombia. In agreement to Hofstede's dimensions, Colombia is a society with great differences in the allocation of roles. The MAS level for Colombia is similar to Germany and USA. So, Colombian culture should be more oriented to the competitiveness, independence and aggressiveness and autonomy (male stereotype). Furthermore, women who



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are trying to create a new venture in less developed countries have to face challenges, like lack of training, networks access and low levels of social support and high fear of failure (Amorós et al. 2014). So including the gender variable as a moderator in the TPB model, it could be found new insights to understand deeply the way TBP explains EI in Latin American and emerging countries.

In addition to checking the bond of SLE and gender on EI in the TPB model, the study contrasts these constructs between two developing economies. With respect on SLE, few studies connect the social legitimacy of entrepreneurship with EI, but there are no comparisons of Latin American countries linking SLE with EI. This point is of interest, given that while both Chile and Colombia during recent years have been in the process of constant economic growth, there is no data to infer differences or similarities to EI and possible factors associated with SLE that affect one or another. There is an opportunity to present new evidence about the relationship between culture gender, and EI for developing countries of South America. Also, it is relevant to take account that most of EI literature has done in Northern Hemisphere countries, and some scholars suggest then it is not convenient to extrapolate results of development countries through economies in development (De Vita et al., 2014). Consequently, it is a contribution extending the application of TBP model including gender and SLE as moderator and mediator, respectively, and see if the prior results in developing countries are coincident with those of this research. In sum, the results could strength the contribution of TBP model including SLE as mediator and gender as a moderator through EI.

It is necessary to clarify that although Chile and Colombia are two emerging economies, there are another differences that are worth mentioning. Chile has 17.7 million inhabitants, Colombia 47.7 million by 2014. Chile has a GDP per capita of the order of USD 16700 while in Colombia was USD 6571. For the same period detailed previously, 2008 - 2013, unemployment in Chile stood at 7.6%, while in Colombia was 11.2% on average. These data allow us to find differences on the macroeconomic situation in these two countries. Thereby its results motivated to analyze the entrepreneurial reality of these Latin American countries but with macroeconomic indicators with some differences.

The organization of the paper is as follows. The next section presents the theoretical framework about EI, gender and social legitimacy of entrepreneurship, as well as the detail of the hypothesis. The third section describes data, variables, and methodology used during the investigation. The following part analyzes the results and discussion. The last section includes the conclusion and future lines of research.

Theoretical Framework and Hypothesis

Models of Entrepreneurial Intentions

The EI is the key concept to understand the process of creating a new business, i.e. one that mobilizes people to become entrepreneurs, those who choose a career of setting up their own company. About this, there is a great group of studies relating to personal characteristics (orientation to achievement, self-efficacy, propensity / tolerance to risk, leadership, and ability to generate networks). There is also another approach to research linking individual character variables with those of the environment (Liñán et al. 2011). Additionally, EI seems connected with employment creation/decision, economic environment, availability of resources. In consequence, EI is related to behavior, attitudes, subjective norms and perceived behavioral control (PBC).

There are essentially three models that have tried to explain the EI of people. First, the model of business conduct, Shapero and Sokol (1982) with their perceived desirability and feasibility variables are reinforced with the propensity to act. Then the Theory of Planned Behavior of Ajzen (1991) has three explanatory variables: attitude towards entrepreneurial behavior (ATE), subjective norms (SN) and perceived behavioral control (PBC). Finally, Krueger and Brazeal (1994) combine both approaches, creating the model of the entrepreneurial potential. In all three models, there are individual as well as environment variables. Shapero and Sokol (1982) and Krueger and Brazeal (1994), consider the variable of perceived feasibility which includes the individual's own capabilities. This variable studies the internal characteristics that the person perceives to possess internally and thereby reinforces his interest in carrying out an unknown behavior, such as the start of a new business. In essence, the point is self-efficacy (Krueger and Brazeal 1994) and locus of internal control (Shapero and Sokol 1982; Ajzen 1991).

Theory of the Planned Behavior (Ajzen 1991) is the model that has been widely used because of their empirical results (Krueger et al., 2000; Liñán et al., 2011; Veciana et al., 2005). The TPB framework is the result of the three factors mentioned above: personal attraction to entrepreneurial activity and a positive/favorable or negative/unfavorable vision of the behavior (ATE), perceived social pressure of their nearest persons to develop the action or not (SN) and the feel that the individual has the capabilities to carry out the conduct (PBC). In this case, the behavior is to decide to create a new firm (Robledo et al. 2015).

In the literature or TPB the dimension of attitude, which is usually permanent and stable, is a psychological construct that influences and predicts many behaviors (Krauss et. al. 2005). In general, the more favorable the attitude towards entrepreneurship is the EI's perform should increases. Additionally, PBC relates the election of an action than the individual thinks will be able to control and master. Perceived behavioral control is similar to self-efficacy of Bandura and is also included in the model of Krueger and Brazeal (1994). Finally, in the TPB model the dimension of subjective norms. Notice that if an individual perceives that his/her significant people (family or friends) endorse (or disapprove) the decision of become an entrepreneur, he/ she in more (or less) likely to try to perform it.

One concept, which is common to the three models mentioned before, is related to the culture or the environment of potential entrepreneurs. According to North and his Theory of Institutions (2005), the culture of the society reflects the collective learning, and these can affect the perceived desirability, which in turn can determine how the entrepreneurial environment is perceived. A favorable environment facilitates the desire to begin a business. The rules may reflect the influence of social values and attitudes. Also, it can be considered as the principal barrier to creativity and innovation (Shane, 2000). In the models described above, subjective norms are part of the variables that explain the EI of the model Ajzen (1991) and perceived desirability in the case of Shapero and Sokol (1982) and Krueger and Brazeal (1994).

This research uses the Ajzen's TPB to analyze the entrepreneurship process. In this sense, TBP used to explain the formation of EI three elements described above, the personal's attitude toward the action, subjective norms as the perception of closest person's opinions about entrepreneurship and the subject's perception of behavior control, defined as the perception of the difficulty or ease to become an entrepreneur. The application of the TPB in the entrepreneurship literature indicates that ATE, SN, and PBC typically explain 30%-45% of the variance in intentions Kautonen et al., (2013). Besides, Moriano et al. (2012) suggest that the strength of their influence on intentions varies between studies.

The TPB model has been verified in various countries over the past two decades, without inquiring into Latin American economies such as Chile and Colombia. Firstly, it is proposed to explain the EI, the relevance that may it has in young university students from the cities of Coquimbo (Chile) and Bogotá (Colombia). The first hypothesis would be to verify the fit of TBP model for each country considered in this research.

H1a: Personal attitude toward entrepreneurship, subjective norms, and perception of behavior control positive influences EI in Chile

H1b: Personal attitude toward entrepreneurship, subjective norms, and perception of behavior control positive influences EI in Colombia

Social legitimacy of entrepreneurship (SLE)

We assumed that the social legitimacy of entrepreneurship is part of the culture; that is to say that SLE can influence the intention and subsequent action to be taken. This factor is recognized as such in the Theory of Institutions, Kibler et al. 2014. As they mention, beliefs and behavior of people are structured according to the rules and regulations prevailing in the institutional environment. These aspects may encourage or put up barriers to individual decisions, such as creating a business.

There are several definitions for the SLE. Generally, they tend to agree that SLE is a "generalized perception or assumption that the actions of an entity are desirable, proper and suitable" (Suchmann 1995). This document follows the definition used by Kibler et al. (2014). That is, it includes three dimensions for the social legitimacy of entrepreneurship: pragmatic, moral and cognitive. It is notable that the pragmatic recognition refers to the interests of the individual; while the moral appreciation has to do with the analysis of rules. Finally, cognitive identification relates to the fact that there may be a negative/ positive valuation or none towards entrepreneurship.

García-Rodriguez et al. (2015) indicate that empirical studies have demonstrated how the cultural aspects of a particular region can affect intention, even more than economic variables. The four principal dimensions of Hofstede (1980), help to differentiate the culture among countries. As it was said before, Chile and Colombia have differences in two of the four dimensions of Hofstede (1980). Specifically, Chile seems to have a more individualism and less masculinity culture than Colombia. So, it is reasonable to expect differences in the effect to EI in both countries.

The entrepreneurship literature has studied the influence of cultural aspects on EI through cognitive mechanisms. Culture is made up of ideas, norms, and values. Also, Hofstede (1980) pointed out that culture is defined "as a collective programing of the mind that distinguishes the members of a group of people form others", Liñán et al. (2011). Besides, culture shaped individual 's cognitive scheme.

Indeed with the research, culture could influence entrepreneurship through two ways. By one hand, through the social legitimization; and, by the other, promoting positive attitudes related creating a new firm (Davidsson 1995). Hofstede (1980) indicated that culture shapes people. Besides, the cognitive schemes derived from culture can help entrepreneurs in some aspects like reducing the uncertainty of making decision; facilitate the opportunity recognition and increasing the EI, focus of this study (Busenitz and Lau, 1996)

With the background described, the cultures differences in either country are expected to affect in different ways the variables of the TBP model. Especially, it is considered that SLE should be related the much greater extent to subjective norms and attitude toward entrepreneurship, because both are more linked with the environment. Taking account that Colombian culture is more cooperative than the Chilean's one, it is acceptable to expect that there could be differences in the effect of SLE over EI. This suggests the following hypothesis, considering that Chile is more individualistic than Colombia.

H2a: Social legitimacy of entrepreneurship mediates the impact of attitude towards entrepreneurship through EI with more strength in Chile.

H2b: Social legitimacy of entrepreneurship mediates the impact of subjective norms through EI with more strength in Chile

Gender

In the analysis of papers linked with EIs made by Liñán and Fayolle (2015), 30 documents were related to gender issues from the total of 409. The gender stereotypes in entrepreneurship is the focus of Gupta's contribution of Gupta et al. (2008 and 2009). Males are found to exhibit a more positive attitude towards entrepreneurship and a higher EI (Strobl et al., 2012), also a more positive feasibility. Several reasons can be argued to explain this fact. For example, women may perceive disadvantages in the self-employment option because of pregnancy and maternity leave in comparison with being an employee (Díaz-García and Jiménez-Moreno, 2010).

Additionally, women also perceived their environment to be more difficult, and they will be likely to have a lower sense of personal control over activities associated with entrepreneurial career than men (BarNir et al. 2011). Males and females have a difference impact in on EI; that is why a moderator for the three dimensions of the TPB model is gender.

There is a growing interest in research focused on women entrepreneurship (Gupta et al., 2008; Díaz-García and Jiménez-Moreno, 2010; Noguera, et al., 2013; y Ruizalba et al., 2015). So, the role of gender continues to be an area that could help to generate entrepreneurial education programs to reduce the gender effect in the creation of new firms. Some studies that have discussed this result indicates that males have a larger preference for entrepreneurial behavior than females (Ventura and Quero, 2013; Ruizalba, et al., 2015).

In regard to the link between SN and gender, some authors have emphasized the existence of business culture's predominantly masculine nature (Gupta et al., 2008;Ventura and Quero, 2013). In this sense, culture shows the women's entrepreneurship as less preferable and, the society gives less support for female, so women themselves perceive the option of creating a firm less desirable (Díaz-García and Jiménez-Montero, 2010).

Finally, women fill that they have less PBC required to develop a new business. In this sense, scholars have identified the fact that women choose not to become entrepreneurs because they perceived the lack of locus of internal control or self-efficacy (Maes et al. 2014). In the same way, female are less likely to be proud of their success and frequently attribute their exit to external sources or luck than to their own ability or effort (Verheul et al., 2012). So, gender might also have a moderating effect on the impact of EI. Negative feedback about their entrepreneurial abilities alters female student expectancies on their potential creation of a new firm more than in the case of their male partners.

The moderate effect of gender on TPB factors and the impact on EI is tested within the analysis. According to the Masculinity dimension of Hofstede (1980), Colombia has a culture more characterized by male stereotype. So with the arguments above described the research we aim to propose the following hypothesis.

H3a: Gender moderates the relationship between attitude towards entrepreneurship behavior and EI with more strength in Colombia.

H3b: Gender moderates the relationship between subjective norms and EI with more strength is Colombia.

H3c: Gender moderates impact of perceived behavioral control and EI with more strength in Colombia.

Figure 1 summarizes the hypothesis under study. It displays the interest of checking the mediate effect that could have the social legitimacy of entrepreneurship on the decision to start a new business and also if there exists the moderate effect of gender.





Data and Variables

Our empirical analysis is based on data obtained from a survey of university students in Chile and Colombia, between the months of January and July 2015. The study analyzes the responses of 351 University students in the area of business management from Chile and Colombia. The sample has 245 students from the Universidad Católica del Norte (Coquimbo, Chile) and 106 students from the Universidad Piloto de Colombia (Bogotá, Colombia). We did estimation using the structural equations model. The target population of this study was students of business administration. There are at least two reasons for selecting a sample of students to carry this research. Firstly, Sexton and Bowman (1986) observed that students of business administration are a convenient sample which provides good control in the comprehension and completion of these type of questionnaires. Also, they represent the best sample for interest of becoming an entrepreneur (Veciana et al., 2005)

The students answered the survey in a voluntary basis. They were provided with a link to access the survey. The principal results of the sample analyzed are shown in Table 1. Of the total sample, 150 students are men and 201 are women (43% and 57%, respectively). Respondent's age ranges from 18 to 39 years, with an average of 21 years and a standard deviation of 3 years. The 71 percent of Colombian and 56 percent of Chilean students indicate they have some previous work experience. Finally, 39 percent of Chilean students have a monthly family income lower than USD1000. So, the undergraduate in Colombia, in average, have a higher income. Only 12 percent of the sample have family incomes over USD1000. In Chile, 68 percent of the students' household income is lower than USD 2001, while the 40 percent of students in Colombia are in this range.

Table	1:	Characteristics	of th	e sample
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	Total	Chile	Colombia
Number of students	351	245	106
Gender			
Men	150	101	49
Women	201	144	57
Monthly family income (percentage of the sample)			
Less than USD 1000	31%	39%	12%
Between USD 1001 and USD 2000	29%	29%	28%
Between USD 2001 and USD 3000	17%	13%	25%
Between USD 3001 and USD 4000	10%	8%	15%
Between USD 4001 and USD 5000	5%	5%	8%
Between USD 5001 and USD 6000	5%	4%	6%
More than USD 6000	3%	2%	6%
Labour Experience			
Yes	60%	56%	71%
No	40%	44%	29%

The following is a description of the variables. Each question in the survey has a Likert scale from one to five, where 1 indicates strong disagreement and five total agreement.

1. Entrepreneurial Intention (EI): Dependent variable. It is constructed from a set of six phrases adapted from the instrument designed by Liñán and Chen (2009) and Thompson (2009).

2. Perceived Behavioral Control (PBC): A set of five sentences define this variable. They were taken from the instrument of Liñán and Chen, (2009).

3. Subjective Norm (SN): A basis of three questions represents this independent variable and it concerns the relevance that has the immediate environment of the student about entrepreneurship. The questions were taken from the instrument and Liñán and Chen (2009).

4. Attitude towards Entrepreneurship Behavior (ATE): This variable is measured through seven sentences, describing the attitude of the person in different circumstances. They are taken from the instrument created by Liñán and Chen (2009).

5. The social legitimacy of entrepreneurship (SLE): This variable is measured through seven phrases that describe the person's environment. It considers the valuation of the city of the student's current residence. Kibler et al., (2014) used this statements.

Results

A structural equation model (SEM) analysis by the method of partial least squares (PLS) was used to test hypotheses. The data obtained by the instrument described above were subjected first to a confirmatory factor analysis (CFA) using Lisrel package.

Table 2 shows the questions that explain each of the latent variables. Questions not charged well for each construct were eliminated, leaving only those that altogether point out and have the better goodness of fit indices. The results show acceptable composite reliability index (IFC) for each of the constructs, the same as the extracted variance (AVE). By measuring the validity of the scales used, it can be observed that the criterion of Hair et al. (1998) are acceptable and valid each of the scales, the lowest being that of subjective norms (SN).

When analyzing goodness of fit index, we show that the ratio Chisquare/degrees of freedom is acceptable, being well below the 1.8 maximum acceptable is 3. The same applies to the RMSEA 0.049 being well below the maximum acceptable 0.8 and NNFI, GFI and AGFI still all very close to 1.
		eability		Validity	
Constructs and ítems	T-values	IFC	AVE	standardized charges	Hair et al. (1998)
Entrepreneurial Intention (EI)					
EI1. I am determined to create a firm in the future.	16.15			0.793	
EI4. I will make every effort to start and run my own firm.	12.07	0.76	0.53	0793	0.722
EI6. The likelihood that I will ever run my own business is very high.	16.97			0.793	
Perceived Behavioral Control (PBC)					
PBC1. To start a firm and keep it working would be easy for me	13.91			0.696	
PBC2. I can control the creation process of a new firm	17.08	0.79	0.49	0.810	0.688
PBC3. I know the necessary practical details to start a firm	9.75			0.521	
PBC4. It will be easy for me to develop a business idea	14.76			0.727	
Subjective Norm (SN)					
SN1. I have some friends who have started or are starting a business.	7.51	0.76	0.52	0.413	0.701
SN2. My close family thinks I should start a new company in the future.	18.04	0.76	0.53	0.862	0.701
SN3. My best friends think I should start a new company in the future.	17.15			0.828	
Attitude towards Entrepreneurship Behavior (ATE)					
ATE1. Being an entrepreneur implies to me more advantages than disadvantages.	16.26			0.758	
ATE2. A career as an entrepreneur is attractive for me.	19.35	0.86	0.60	0.851	0.767
ATE3. If I had the opportunity and resources, I would like to start a firm.	20.71			0.889	
ATE5. Among various options, it would entail great satisfaction for me.	11.25			0.571	
Social Legitimacy of Entrepreneurship (SLE)					
SLE4. Local entrepreneurs operate according to the commonly accepted norms.	12.71	0.69	0.43	0.748	0.649
SLE5. The activity of the entrepreneurs in my place of residence supports the local economy.	10.67	0.07	0.15	0.621	0.017
SLE7. The absence of entrepreneurs is inconceivable.	9.90			0.579	
$\chi^{2}(109)=196.71$, p=0.00 ; RMSEA=0.049 ;SRMR=0.044 ;NNFI=	0=0.984 ;CFI=0	.987 ; GFI	=0.936 ;AG	FI=0.9105	

Table 2: Confirmatory Factor Analysis

Table 3 shows the correlations of each construct with others. We show that the most intense relationships between different constructs are: EI with the ATE with close to 76% levels: followed, by PBC with ATE

with a correlation value of 66%. The lowest and negative correlation lies with the gender with SLE.

Table 3 Item - Construct Correlations									
	EI	ATE	SN	PBC	SLE	GEN			
EI	1								
ATE	0.764	1							
SN	0.562	0.520	1						
PBC	0.644	0.657	0.518	1					
SLE	0.328	0.435	0.346	0.305	1				
GEN	0.032	0.001	0.002	0.006	-0.094	1			

After evaluating the reliability of the variables and identifying each of the constructs with their respective items, it proceeds to use SEM for EI models, both for Chile and Colombia.

	Chile	Colombia
	Model 1	Model 1
Main effect		
Attitude Toward Entrepreneurship	0.5437***	0.5828***
Subjective Norm	0.2138***	0.07051
Perceived Behavioral Control	0.1744***	0.2267***
Gender	0.0384	-0.371
Age	-0.0124	-0.1319
Study	-0.0034	-0.07761
Income	0.0044	0.1028
Adjusted R Square	0.6573	0.6318
F	64.94***	24.02***

Table 4: Regression results in Ajzen's Model: Chile and Colombia

*** p<0.01, ** p<0.05

In the above table, the model results Ajzen (1991) for both countries are observed. We point out that for the standard model, the results are better for Chile than Colombia, being non-significant subjective norms for the latter, so that they can give support to the hypothesis H1a and only partial H1b. Results show that ATE and PBC are the only significant variables for Colombia, but have a robust impact to EI than in Chile.

Table 5 shows the mediate effect of social legitimacy of entrepreneurship. We compared the results for model 1 (Ajzen: ATE, SN y PBC) with model 2, which include SLE as the dependent variable and Ajzen's variables (ATE, SN y PBC). Later the third model incorporates SLE as an independent variable for EI. All of these three regressions are considered to measure the SLE mediator effect in the Ajzen's model of EI. Test of Sobel is used to verify the mediate effect.

The results show that SLE only mediates the attitude toward entrepreneurship for either country. This mediate effect is a positive one. This relationship has partial support to H2a; that is to say, a significant mediate impact between ATE and EI, but Chile has a more strength in the effect through EI (0.5757 vs. 0.5402). We could not prove the second hypothesis related to SLE as a mediator. Besides, we prove that PBC is significant in model 1 and model 3. It is interesting to note that SN explains SLE in Colombia, so there is a direct effect between SN and SLE, but not through EI neither direct or indirect.

Table 5: Regression results SLE as Mediator: Chile and Colombia							
	Chile				Colombia		
	Model 1 EI	Model 2 SLE	Model 3 EI	Model 1 EI	Model 2 SLE	Model 3 EI	
Main effect							
Social Legitimacy			-0.057			0.1052	
Attitude Toward Entrepre- neurship	0.5487***	0.3553***	0.5757***	0.5859***	0.4342***	0.5402***	
Subjective Norm	0.2118***	0.1167	0.2206***	0.0681	0.2492**	0.0419	
Perceived Behavioral Control	0.1690***	-0.0002	0.1689***	0.2273***	-0.0185	0.2292***	
Control							
Age	-0.0085	0.0692	-0.0032	-0.1263*	-0.0711	-0.1188	
Study	-0.0061	-0.0812	-0.0123	-0.0773	0.0299	-0.0805	
Income	0.0071	0.0851	0.0135	0.1027	0.1203	0.09004	
Adjusted R Square	0.6447	0.1756	0.6479	0.6082	0.3023	0.612	
F	74.78***	9.662***	65.15***	28.17***	8.583***	24.66***	
Sobel Test- ATE	Test- ATE 3.997***				3.	308***	

Table 5: Regression results SLE as Mediator: Chile and Colombia

*** p<0.01, ** p<0.05

After evaluating the hypothesis testing Ajzen model and mediate impact of SLE, we will analyze if there exists a moderate effect of gender through EI. It proceeds to use SEM for two models of EI, both for Chile and Colombia. We run two. The first one includes only the standard variables in the models and Gender as another independent variable. In the second regression, we incorporate gender as a moderator. When we incorporate interactive effect of gender with ATE, PBC, and SN, the moderate relationship is significant only for Chile, and specifically for PBC. These results allow accepting H3c. So gender does not affect ATE for either country through EI.

	Chile		Colc	ombia
	Model 1	Model 2	Model 1	Model 2
Main effect				
Attitude Toward Entrepreneurship	0.5437***	0.54732***	0.5828***	0.5939***
Subjective Norm	0.2138***	0.21564***	0.07051	0.0760
Perceived Behavioral Control	0.1744***	0.15111***	0.2267***	0.2261***
Gender	0.0384	0.0368	-0.371	-0.0238
Age	-0.0124	-0.0097	-0.1319	-0.1342
Study	-0.0034	0.00071	-0.07761	-0.0802
Income	0.0044	0.01106	0.1028	0.1065
Interactive effect				
Attitude Toward Entrepreneurship ^x Gender		-0.03384		-0.0408
Subjective Norm [*] Gender		-0.07862		0.0179
Perceived Behavioral Control [*] Gender		0.15158***		0.0025
Adjusted R Square	0.6573	0.6731	0.6318	0.6327
F	64.94***	48.19***	24.02***	16.37***

*** p<0.01, ** p<0.05

Discussion

The results indicate that the Ajzen model fits perfectly to explain IE in Chile (H1a) as in Mei, et al. (2016). However, this model fails to explain in full the EI for the case of students in Colombia. Subjective norm is the variable excluded. It is noteworthy that in previous studies, precisely SN is the variable that has been less tested empirically. Colombia fits this research group as the results shown by Ruizalba et al., 2015, Tsordia and Papadimitriou, 2015 and Garcia-Rodriguez et al., 2015. Garcia-Rodriguez et al. (2015) show that in a context of less economic development, the role of SN (perceived social pressure) to carry out or not a new firm loses its capacity to EI. It is likely that in this type of economy, other indirect relationships favor EI through SN, which still must be tested for the case of Colombia. It is a fact that there are cultural differences. García-Rodríguez et al. (2015) indicate the existence of cultural differences between both countries in the determinants of EI. Spain showed personal attitude as the principal antecedent, whereas in Senegal, it was PBC.

Results of Rueda Sampedro et al. (2013) are curious for the case of Colombia. Attitude toward entrepreneurship is significantly and SN

not directly; however, SN shows an indirect effect through ATE to EI. To the extent that students perceive a favorable attitude towards their immediate surroundings entrepreneurship, this will influence EI through ATE. That is, ATE would be a mediator between SN and EI.

Another important point of the result is the verification of direct and indirect effect (mediator) of PBC to EI through SLE. Social recognition of entrepreneurship succeeds in linking the capabilities they perceive to have people to create their own business and thereby foster entrepreneurial intention. This finding is very stimulating for public policy for the educational and communicational level. First, the capabilities that people have can be enhanced through a scholarly system that strengths entrepreneurial initiative throughout society. Second, the communicational level is also relevant, the culture could be more pro-entrepreneurship if media give a decisive diffusion about cases of enterprise and availability of resources. The environment could be well perceived working together with government policies and programs that promote an entrepreneurial culture.

The proposed mediating effect followed the approach of Hofstede. It indicates that economies with lower individualism should have more

enterprising culture. In turn, we expected that social recognition is more forceful in economies with a profile more biased towards a pioneering culture, which, we hoped that the mediating effect both between ATE and PBC to EI is more powerful in Colombia than in Chile. The results show that SLE is a usual mediator role for both countries but only for one variable, ATE (H2a). However, according to the coefficient, the most individualistic country, Chile, would achieve a greater mediating effect. This result is consistent with the proposal of McGrath et al. (1992), who notes that the most enterprising cultures tend to be characterized by a more individualistic profile, unlike indicated by Hofstede. He considers the entrepreneurial activity related to collectivism. This can be understood by the possibility of requiring more collaboration and support networks.

The results partially match Liñán et al. (2011), Khoung and Ann (2016) and Abina et al., (2015) They found that the worth of the venture seems to exert a stronger influence over ATE in the most developed area (Catalonia). Social valuation of entrepreneurship also affects PBC in a restrictive way for the less developed region (Andalusia). The results of Khoung and Ann (2016), who analyzed 401 students in Vietnam, indicate that external environment (proxy of SLE) and perceived feasibility (PBC) were independent variables and they have a positive and significant impact toward EI. So, foreign climate has an indirect positive effect on EI. Abina et al. (2015) found that selfefficacy (PBC), environmental concern (SLE) and perceived support and perceived barrier have a significant effect on EI.

Finally, it is surprising that gender does not affect all model variables. The results only show that there is no difference in the results of gender as moderator over PBC for both countries. Notably, Colombia has the highest coefficient, which verifies that the economy in which raw biased culture to the stereotype of a man, (the highest rate of MAS according to Hofstede), has a greater impact moderator gender. This variable is nearly related to the capabilities perceived to have a person to orient himself by starting a business. In this case, it is men who have more level of EI related to PBC, as shown in the figure below. Also, as can be seen from the graph, the highest level of recognition of social entrepreneurship more power magnitude effect on the propensity to act on EI. In the research of Zhang et al., (2014) males and population from technological universities and backgrounds have higher EI than females and people from other institutions and backgrounds. There are also significant positive interactive effects by gender, academic type, and study major on the relationship between entrepreneurship education and EI.

We could compare our results with other related. Mueller and Conway (2013) found that among American business students the view of "entrepreneur as male" is fading. This stereotype persists in Spain. Karimi et al. (2013), using TBP explored the effects of gender and role models on EI. No gender differences in the relationship between PBC and EI. Gender affected ATE weaker in females and SN stronger predictor of EI in female students. The results of Sánchez-Escobedo et al. (2014) show the existence of gender differences in EI. More develop country indicates less explanatory power also more conclusive in men than women. Díaz-García and Jiménez-Moreno (2010), both, men and female with a firm EI perceive successful entrepreneurs to have feminine attributes. This result may explain the lack of gender difference in EI. Noguera et al. (2013) indicated that the main findings highlight that "fear of failure" and perceived capabilities are the most important socio-cultural factors on the probability of becoming a woman entrepreneur. Maes et al. (2014) point out diverse factors that predict gender differences in EI. Female are also more motivated to comply with normative role models; this did not influence their EI over PBC and ATE. The moderating effect of gender has a positive impact for women in the relationship between those SN and PBC (Ruizalba et al., 2015).

Results indicate the importance and sensitivity and ATE with SLE and gender PBC with the two Latin American economies. They show that culture, related to social recognition of entrepreneurship, works as a mediator between perceived desirability or attitude toward entrepreneurship and EI. This finding is consistent considering that this is a factor related to the environment, which promotes and enhances the desire to start a new business. In this case, given the low levels of individualism of both economies, this cultural factor does not affect the direct and indirect effects of ATE on EI. The results are very similar for the two countries, the greater light impact for Chile. On the other hand, gender is seen as moderator for the pair variable person, i.e. that referred to the individual perceives that has the capabilities and enough to start a new business control. In this plays an important role masculine characteristics of competitiveness, independence, and aggressiveness.

Conclusion

Based on information collected for students of business management from two Latin American universities, the study shows that the Ajzen's model best explains EI in the case of Chile and partially for Colombia. Subjective norm does not result significantly for the sample analyzed. The effects of moderation are similar for both countries. The social legitimacy of entrepreneurship mediated attitude toward entrepreneurship. So ATE shows direct and indirect effects through EI. On the other hand, greater SLE does not affect the impact of perceived feasibility or PBC of EI. The last result is that the moderate effect only is appreciated for Chile, the less male stereotype culture. Gender moderates PBC variable, and men have higher EI.

Besides the stimulating results discussed above, there have to recognize some limitations of the research. The size and type of sample may have been a constraint in this study. In each country, we include students from a single university in each city. However, given the limited number of studies on EI in Latin American countries, our investigation may open news lines of future studies. For example, next researchers may incorporate different factors as moderators or mediators. Such as role models, age, entrepreneurial education, public policies toward entrepreneurship, thus broadening our perspective on the effect that culture and the entrepreneurial environment may have on EI. This work will help others to look forward to more and different relationships with a wider sample, more institutions, careers, and countries.

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Technological Entrepreneurship: A Multilevel Study

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Abstract: New technology-based firms play an important role in the business world, as they accelerate innovation processes and increase competitiveness. In the study of these businesses, it is necessary to involve variables of different levels of analysis. With the responses of 103 new technology-based firms, the relationship between variables at the individual, organizational, and contextual level was analyzed. The results show no clear and convincing relationship between entrepreneurial passion and creativity but there is between creativity and innovation. Also, the environmental dynamism showed no moderating influence on the passion-creative relationship but there was in the creativity-innovation relationship. The document presents a discussion of the main findings and conclusion of this work.

Keywords: new technology-based firms; entrepreneurial passion; creativity, innovation; environmental dynamism.

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Introduction

In the study of technological entrepreneurship, the importance of the binomial individual-opportunity has been recognized as well as the impact it can have at an organizational level (Wright, Hmieleski, Siegel, & Ensley, 2007). This is especially important in the field of startups, where the entrepreneur has strong influence on the organization's behavior, as it promotes a corporate culture and defines the direction of the firm (Montiel, Nuño, & Solé, 2012).

New technology-based firms (NTBF) are special players in today's competitive environment, as they develop and offer products or services through the application of new technologies (Carayannopoulos, 2009). Because of the competitive nature of these firms, the entrepreneur must be more alert to changes and opportunities generated in the environment, which he should take and translate into better performance for the firm.

Despite the importance of the entrepreneur in the competitiveness of a NTBF, the question remains of how he influences the firm's performance. Therefore, the objective of this research is to explore the relationship between personal characteristics of the entrepreneur and the innovativeness of the firm. To address this approach, we used a model of multilevel research in the sense described by Hitt, Beamish, Jackson, and Mathieu (2007), which is increasingly recurrent in research on technological entrepreneurship (Baron & Tang, 2011).

This research makes three important contributions. Based on existing theory (Cardon, Wincent, Singh, & Drnovsek, 2009; Cardon, Foo, Shepherd, & Wiklund, 2012), this work places entrepreneurial passion as a variable that influences the creativity of the entrepreneur. Also, in the study of innovation, the importance of creativity as a key ingredient stands out; however, it is necessary to study this relationship directly (Sarooghi, Libaers, & Burkemper, 2015). Therefore, this study examines the relationship between creativity of the entrepreneur and the innovativeness of the firm. Finally, the environmental dynamism is included as a variable that moderates previously raised relationships. The environmental dynamism is important for the decision-making entrepreneur and influences the firm's innovativeness (Sarooghi et al., 2015).

The following section of this document shows the literature review and the establishment of the research hypothesis. Subsequently, the methodology is explained and the main results are shown. Finally, a discussion and the conclusion of this work are presented.

Literature review and hypothesis

Entrepreneurial passion and creativity

The literature review suggests that the affect plays an important role in the entrepreneurial process (Cardon, Gregoire, Stevens, & Patel, 2013). In particular, a positive affect has been considered an element that triggers creative problem-solving (Baron & Tang, 2011; Bledow, Rosing & Frese, 2013). The conclusions in the work of Baas, De Dreu, and Nijstad (2008) suggest that positive affect increases creativity, but this is more likely when combined with high levels of activation. However, the results of George and Zhou (2002) are contradictory in this regard, so there remains insufficient evidence to generalize this relationship.

A line of research on the entrepreneurial passion has been recently added in the field of entrepreneurship, which is considered a positive affective state. The entrepreneurial passion is a positive and intense feeling that is accessible and is experienced by participating in business activities that are meaningful and important to the identity of the entrepreneur (Cardon et al., 2009).

In this perspective, passion allows the entrepreneur to creatively participate in the identification, invention, and exploration of new entre-



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preneurial opportunities. Previous work suggests that the passion of the entrepreneur, among other factors, significantly influences their behavior, particularly in generating entrepreneurial opportunities (Dalborg & Wincent, 2015; Thorgren & Wincent, 2015).

This argument leads us to consider that a strong emotional state, as is the passion, promotes the identification of new patterns, standards, or trends that indicate the possible existence of an entrepreneurial opportunity. In increasingly uncertain environments, where technology plays an important role, the entrepreneur is typically more creative when identifying and seizing an entrepreneurial opportunity. With this reasoning, the following hypothesis is proposed:

H1. The higher the passion of an entrepreneur NTBF, the higher will be your creativity to identify and exploit entrepreneurial opportunity.

Creativity and innovation

Creativity has been considered a precursor of innovation; and innovation generally leads to the successful implementation of a creative idea (Unsworth & Luksyte, 2015). Creativity in the field of organizational theory is typically defined as "the generation or production of ideas that are both novel and useful" (George, 2007, p. 441). In this context, the reconfiguration of the resources of a business can be considered a creative act because such reconfiguration may lead to the exploitation of business opportunities and, consequently, innovation (Helfat & Martin, 2015).

Entrepreneurs of NTBF significantly contribute to innovation, either through the decisions that guide the innovation process or by identifying new technologies that are of potential use in business, which can cause changes in the organizational structure (Helfat & Eisenhardt, 2004). In addition, creativity is required not only to generate the initial idea for innovation but also for further development and adjustment thereof (Unsworth & Luksyte, 2015).

The relationship between creativity and innovation has been approached for different reasons. First, the proposal to create and introduce new products and services in the market is a response to a problem that the entrepreneur has identified. In this process, creativity plays an important role in conceiving new ideas and offer solutions that can be implemented and is results-oriented; hence, Baer (2012) mentions that creativity is a necessary but insufficient condition for further innovation.

Second, a high interest in creativity by the entrepreneur of NTBF is essential to outline the business model, which will compete with the firm (Leibold, Voelpel, & Tekie, 2004). Finally, Leiblein (2007) mentions that originality is important in the development of a new product, service, process, or business model. That is why organizations must be constantly changing or adapting their tactics and objectives. The approaches discussed above lead to the following hypothesis:

H2. The higher the creativity of the entrepreneur to identify and exploit entrepreneurial opportunities, the higher the number of innovations developed/adopted by a NTBF.

Environmental dynamism

The literature review shows that the environment has an influence on entrepreneurial actions, thereby demonstrating that the change in the environment leads to an increase in entrepreneurial activity (Edelman & Yli-Renko, 2010). Changes in the environment (technological or regulation) create opportunities that can be identified by entrepreneurs. However, the speed with which changes occur is what characterizes a dynamic environment, which brings instability and high levels of uncertainty to the environment.

Environmental dynamism creates the possibility for entrepreneurs to make images of potential entrepreneurial opportunities, and these perceptions will help inspire creativity. Regarding the relationship between entrepreneurial passion and creativity, the work of Baas et al. (2008) indicates that the relationship "positive affect-creativity" is stronger when there are high levels of activation.

A dynamic environment can generate a high level of activation; therefore, an "entrepreneurial passion-creativity" relationship can be stronger. A dynamic environment, unlike a stable environment, involves greater risks, which brings more stress; this, in turn, causes high levels of activation (Stranks, 2005). For this reason, the "entrepreneurial passion-creativity" relationship is not isolated but occurs under the influence of a dynamic environment. Based on this reasoning, the following hypothesis is proposed.

H3. The environmental dynamism moderates the relationship between entrepreneurial passion and creativity of the entrepreneur; with that said, the relationship will be stronger in dynamic environments than in stable environments.

With regard to the relationship between creativity and innovation, so that ideas are materialized, it is necessary that the entrepreneur is motivated to consider these ideas and develop them until reaching innovation. Industries may experience a high dynamism due to changes in the technological capabilities of enterprises, the entry of new competitors, or by changes in customer preferences (Helfat & Eisenhardt, 2004).

Highly dynamic conditions may limit the size advantage of large firms, which may represent opportunities for innovation for smaller firms. Smaller firms can be successful in a dynamic environment by developing newer technologies and using its flexibility to quickly introduce new products (Wiklund & Shepherd, 2005). Usually, technological advances are rapidly disseminated in dynamic environments, which is why it is unlikely that a firm will survive without the constant development and updating of its product or service, no matter if it has to cannibalize its own products (Davila, Epstein, & Shelton, 2006).

Moreover, Davila et al. (2006) mention that, in relatively stable environments, where competition depends more on efficiency and cost reduction, firms focus their efforts on incremental innovation processes. Hence, the dominant designs have more life in stable environments, which favors innovation opportunities revolve around the dominant design. That is why a creativity-innovation relationship in a dynamic environment should be stronger, as a result of the pressure to be generating ideas that help strengthen the competitive position of the firm through constant innovation. With this reasoning, the following hypothesis is proposed.

H4. The environmental dynamism moderates the relationship between entrepreneur creativity and innovation of NTBF, so that this relationship is stronger in dynamic environments than in stable environments.

Methodology

Sample and procedure

We used a database of firms that received support from business incubators in Mexico in order to identify those that would participate in the research. Also, firms that had previously participated in previous researches were identified.

To select the firms, two criteria were observed. First, the firm had to be technology-based, thus developing and providing products or services through the application of new technologies (Carayannopoulos, 2009). The second was that the firm should have started operations between two and five years prior to the implementation of the survey (Montiel et al., 2012). Thus, 173 firms were identified that met both criteria and whose operation centers were located in different states of Mexico.

The first contact with the firm was made by electronic means, specifically sending a letter to the contact person identified in the available information of the firm. The letter explained the project's nature and promised to share the results of work once the investigation was completed. Participants in this study were NTBF entrepreneurs.

The information was collected through the survey. Prior to the final application, a pilot test was conducted to incorporate feedback and corrections. The final survey was sent to the firms between April and November 2015: 105 of the initially identified 173 firms answered the survey. Two incomplete surveys were eliminated, so the final analysis was done with 103 surveys.

Entrepreneurs and their firms operated in a variety of industries, including agriculture, manufacturing, health, information technology, and design. Among the 103 entrepreneurs, 88% were male, and the average age of the entire sample was 31.4 years. The average size of firms in terms of number of employees was 14.2

Measurements

To measure the entrepreneurial passion, this work used a subscale passion, developed by Cardon et al. (2013), for developing new organizations. This subscale is related to the growth and strengthening of the firm after it was founded (Cardon et al., 2009; 2013). Entrepreneurs who experience this kind of passion enjoy activities that are related to sales increase, new product development, the conquest of new markets, etc. The passion for developing is measured through three items that assess the experience of intense positive feelings toward this activity and one item that evaluates the centrality of this activity for the self-identity of the individual. The four items were rated on a 5-point Likert scale. It is noteworthy that it cannot be combined the items of intense positive feelings with identity centrality, as they represent different aspects of passion (Cardon et al., 2013). The reliability analysis for the items that value the experience of positive feelings was 0.81

Creativity measuring was performed using the scale that has been used by Baron and Tang (2011). With this scale, entrepreneurs were asked to what extent its role and work as founder-manager of the firm is involved with these aspects: (1) promoting new ideas and approaches to solving customer problems; (2) generating new applications for existing technology; (3) taking risks; (4) generating radical ideas or proposals; and (5) developing innovative long-term applications. These items were rated on a 5-point Likert scale. Cronbach's alpha obtained in this scale was 0.75

Innovation was measured with items that represent the dimension of innovation in the concept of entrepreneurial orientation. From the entrepreneurial orientation, innovation is considered as the tendency of a firm to support new ideas and to foster creative processes in which to develop new products and services (Wiklund & Shepherd, 2005). The scale consists of three items, which were evaluated in a 5-point semantic differential scale. Cronbach's alpha for this scale was 0.77

Environmental dynamism was measured with the 5-point semantic differential scale, as proposed by Miller and Friesen (1982), and consisted of three items. The alpha value was 0.78. Finally, three control variables were used: age of the entrepreneur, gender (0 = female, 1 = male), and firm size (number of people directly employed by the firm).

Analysis

Once the information was collected through surveys, we created an analysis to test the validity of the scales. For this, the Cronbach's Alpha was calculated. All values were obtained above 0.70, which are considered acceptable (Hair, Black, Babin, & Anderson, 2007). Although the passion for developing, creativity, innovation, and environmental dynamism are variables that conceptually can be distinguished from one another, a confirmatory factor analysis (CFA) was performed in order to empirically assess the discriminant validity.

For the CFA, two models were identified. The first one considered all the items on a single factor. This is a baseline model that estimates routinely, based on the idea that all variables can be captured in a single factor. The second model was obtained with four factors, ex-pecting that the four variables loaded in their respective factor.

Table 1 shows the threshold values for each of the test values (Hu & Bentler, 1999) and the results for each model. The results indicate that the four-factor model is a better fit because all the items loaded signi-ficantly in their respective latent variables. This suggests satisfactory discriminant validity.

 Table 1. Overall fit indices for passion, creativity, innovation, and dynamism (threshold values in brackets)

Model	CFI (>.90)	NFI (>.90)	GFI (>.90)	RMSEA (<.05)	c²/df (<3.0)
One factor	.68	.86	.70	.101	4.22
Four factors	.91	.92	.90	.047	2.88

To test the hypothesis correlation analysis, we determined the degree of relationship between variables. We further determined the degree of association between the study variables with hierarchical regression analysis and, thus, the test hypotheses. Thus, we identified 10 models in which independent variables were added, along with the multiplicative effect between them. Finally, the possibility of multicollinearity in the regression analysis was considered. To do this, tolerance was calculated and the variance inflation factor (VIF-test) was done. A lower than 0.20 tolerance value and/or VIF value greater than 5 indicated a multicollinearity problem (O'Brien, 2007). The results of these tests indicated that the regression analysis showed no multicollinearity.

Results

Table 2 shows the descriptive statistics and correlations between the variables involved in the study. An analysis of correlation coefficients shows a positive relationship between the two dimensions that make up the passion for developing, that is, between intense positive feelings and identity centrality (r = 0.23; p < 0.05). Also, these two variables are positively related to creativity (r = 0.27, p < 0.05 and r = 0.19, p < 0.05 respectively). Creativity, in turn, is positively related to innovation (r = 0.25, p < 0.01).

Tal	ble	2.	Descrip	tive	statistics	and	correl	lation	S
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Variables	Average	S.D.	1	2	3	4	5	6	7	8
1. Age	35.40	7.13	1.00							
2. Gender	.87	.20	10	1.00						
3. Size	9.11	2.65	.05	.00	1.00					
4. Passion – IPF ^a	4.31	.25	.08	.13	.15	1.00				
5. Passion – IC ^b	3.97	.36	.02	.15	.13	.23*	1.00			
6. Creativity	4.05	.41	09	.07	.05	.27*	.19*	1.00		
7. Dynamism	3.58	.42	.00	.14	.01	08	03	.09*	1.00	
8. Innovation	3.97	.22	.04	.07	.08*	.17	14	25**	0.11	1.00

^a Intense Positive Feelings; ^b Identity Centrality

 $^{*}\!p < .05 \ ; \ ^{**}\!p < 0.01$

To test the hypothesis, hierarchical regression analysis was performed. Hypothesis 1 states that the entrepreneurial passion is positively related to the entrepreneur's creativity level. The results shown in Model 2 of Table 3 indicate that intense feelings are significantly related to the level of creativity (B = 0.19, p < 0.01), but not the intense centrality (B = 0.16, not significant). When both dimensions are considered at the same time, its relationship to creativity is better. Model 3 shows that the combined effect of intense feelings and centrality has a better relationship with creativity (B = 0.23, p < 0.01). These results lead us to partially accept Hypothesis 1 because the idea of centrality is not shown as significant. With regard to Hypothesis 3, which referred to the moderator effect of the environmental dynamism in the passion-creative relationship, Model 5 of Table 3 shows that the dynamism does not have an influence on the relationship between intense positive feelings and creativity (B = 0.20, not significant) and the relationship between centrality and creativity, in which there is no significance (B = 0.13, no significance). This result holds at the time we considered the combined effect of intense positive feelings, centrality, and environmental dynamism, which can be seen in Model 6, in which there is no significance (B = 0.22, not significant). This result leads us to reject Hypothesis 3, considering that the dynamism of the environment does not have a moderating effect on the passion-creative relationship.

Variables	Creativity					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	.17	.11	.08	.01	.01	.02
Gender	.00	.02	.02	.04	.02	.02
Size	.19	.09	.04	.00	.00	.01
IPF ^a		.19**	.17*	.18*	.21*	.22*
IC ^b		.16	.22	.19	.22	.17
$IPF^{a \star} IC^{b}$.23*	.21*	.23*	.21*
Dynamism				.22	.14	.16
IPF ^a * Dynamism					.20	.20
IC ^b * Dynamism					.13	.10
IPF ^a * IC ^b * Dynamism						.22
R ²	.03	.11	.16	.17	.19	.21
Adjusted R ²	.02	.09	.15	.15	.18	.19

Table 3. Relationship entrepreneurial passion-creativity and the moderating effect of environmental dynamism

^a Intense Positive Feelings; ^b Identity Centrality

p* < .05 ; *p* < 0.01

The results that analyze the creativity-innovation relationship and the moderating effect of environmental dynamism in this relationship can be seen in Table 4. Hypothesis 2 states that, while the greater the entrepreneur's creativity, the greater the number of innovations the firm developed or adopted. Model 2 of Table 3 shows a positive and significant relationship between creativity and innovation of the firm

(B = 0.28, p < 0.01). Thus Hypothesis 2 is accepted. In regards to the moderator effect of the environment dynamism in creativity-innovation relationship (Hypothesis 4), it is shown in Model 4 that the dynamism itself exerts a moderating effect on the relationship between creativity and innovation (B = 0.30, p < 0.01). Thus Hypothesis 4 is accepted.

Table 4. Relationship creativity-innovation and the moderating effect of environmental dynamism

Variables	Innovation						
	Model 1	Model 2	Model 3	Model 4			
Age	.16	.13	.14	.15			
Gender	.05	.08	.06	.08			
Size	.21	.12	.05	.06			
Creativity		.28**	.23*	.21*			
Dynamism			.29*	.27*			
Creativity * Dynamism				.30*			
R ²	.02	.13	.16	.19			
Adjusted R ²	.01	.11	.14	.18			

^a Intense Positive Feelings; ^b Identity Centrality

p < .05; p < 0.01

Discussion

This paper provides empirical evidence of the relationship between variables that are at different levels of analysis: passion and creativity at the individual level, innovation at the organizational level, and environmental dynamism at the context level. The results indicate that the passion for developing, in one of its two dimensions (intense positive feelings), has a significant relationship with creativity. This was previously discussed in the literature (Baas et al., 2008). However, the second dimension, the passion for developing (identity centrality), did not show significance. Strictly speaking, Cardon et al. (2013) noted that the two dimensions of passion should be equally important; however, in the results obtained here, only one dimension showed significance. In general, previous studies suggest that the affect brings benefits to the activities of the entrepreneur. However, some studies have already shown bucking this trend (Baron, Hmieleski, & Henry, 2012), something that also can be discussed with the results obtained here. Moreover, the results confirm a significant relationship between creativity and innovation, as is indicated by previous works (Helfat & Martin, 2015; Baer, 2012). In the scope of this work, it was considered that the relationship previously discussed was not isolated, but there was a moderating effect of the environment. This effect was presented in the relationship between creativity and innovation but not in the relationship between passion and creativity. In other words, the relationship between creativity and innovation is stronger in dynamic environments than it is in stable environments, which coincides with previous work (Wiklund & Shepherd, 2005).

The four variables used in this research are complex; thus, for measurements, we used scales that have previously been used. The scale of the passion for developing is the most recent. Not enough jobs have tested this scale, however. Future work should consider this aspect to enhance the results.

The relationship that arises in this work is that the entrepreneurial passion influences innovation through creativity. However, it can be considered that other variables share the same role, so future work should consider the mediating effect on other variables in the entrepreneurial passion-innovation relationship. Finally, this work does not identify the mechanisms through which the environmental dynamism moderates the relationship between entrepreneurial passion and creativity and between creativity and innovation; thus, future work should be made in this matter.

Conclusion

This work adds to the recent initiative to study the effect of passion in the business process. That is why "passion" was studied as a predecessor variable of creativity. It also supported the proposal to study more openly the relationship between creativity and innovation in order to better understand the role of the entrepreneur in this process in NTBF. In addition, the effect of the context in these relationships is studied. This aspect becomes more important in the reality of a new firm, especially when competitiveness is based on technological development.

In short, the results of this work contribute to different lines of research, which have been exposed throughout this paper. The results also reinforce the need to carry out multilevel studies to consider different variables at different levels of analysis at the same time due to the nature of the business process. This becomes especially important in the field of NTBF, as it accelerates innovation processes and regenerates businesses. The study of technological entrepreneurship has a long way to go, and there is confidence to believe that this work has made a small contribution.

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Does the Size Matter for Dynamics Capabilities? A Study on Absorptive Capacity

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Abstract: The objective of this study is to understand how organizational size influences dynamic capabilities in Brazil. To arrive at this understanding, structural equation modeling analysis was performed using the Brazilian Innovation Survey (PINTEC) database to test for differences between SMEs and large companies in respect to the relationship between absorptive capacity (AC) dimensions and innovation performance. The results show that in large companies, Potential AC and Realized AC impact innovation performance, whereas in small and medium-sized enterprises (SMEs), only Realized AC has an influence. In addition, SMEs are, in fact, better at converting Realized AC into innovation performance than large companies, probably due to their flexibility and agility. These findings reveal that organizational sizes influence the impact of dynamic capabilities on performance.

Keywords: dynamic capabilities; absorptive capacity; innovation performance; SME; ICT.

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1. Introduction

The objective of this paper is to understand how organizational size influences dynamic capabilities (DC). This topic is particularly relevant because while size is one of the most analyzed organizational characteristics in the innovation field, its relation to DC theory remains an open question.

DC is recognized as the ability of an organization to create, extend and modify intentionally its resource base (Constance E. Helfat et al., 2007). Resources understood here refer to tangible resources, intangible resources, human resources or a combination of them. The capabilities of these resources are required to achieve long-term competitive advantages over competitors. Additionally, in terms of the assumptions of DC theory, capabilities are path dependent and rely on organizational routines that are strongly standardized and repeatable by the company (Teece, Pisano, & Shuen, 1997; Zollo & Winter, 2002)

However, there are controversies. According to Eisenhardt & Martin (2000) and Schilke (2014), DC is not necessarily part of standardized routines, particularly in high-velocity markets. The authors state that the development of DC for high-velocity markets depends on new knowledge created for specific situations. In this context, routines become interactive, adaptive and nonlinear. Therefore, the processes yield unstable and unpredictable results.

This duality leaves open the following question: does understanding DC as a result of past trajectories and well-defined routines, which are generally more evident in large companies, present a difficulty for small and medium-sized enterprises (SMEs) in developing DC? The objective of this paper is to shed light on this issue by analyzing the AC of companies in Brazil. Absorptive capacity (AC) is

understood as DC (Zahra & George, 2002) responsible for enabling a company to value, assimilate, and apply new knowledge to develop new products (Cohen & Levinthal, 1990). Since, in most cases, the relevant external knowledge presents itself in a complex and poorly coded form, this capability is important because it plays a leading role in the company's ability to understand the value of that external knowledge and to recombine it with its existing knowledge base.

Cantú, Criado, & Criado (2009) note that large companies typically rely on systematic mechanisms to manage knowledge-based resources, while SMEs still need to understand their knowledge and how to explore and share it to improve competitiveness. Moreover, large companies usually have more management structures, more sophisticated routines, and more resources to invest in R&D, while SMEs rely heavily on the technical and industrial experience of the company owner to develop AC, which in turn affects the innovation performance of SMEs (Wang, Wang, & Horng, 2010). Because SMEs represent usually more than 90% of a nation's business, improving their innovation performance may significantly increase national income (Wang et al., 2010).

Therefore, this paper seeks to contribute to the literature, since most of the publications on DC are conceptual. Moreover, the more limited number of empirical studies happens mostly in companies in developed countries. Hence, emerge the contribution of studying DC empirically, and doing so in an emerging country. To achieve the goal, this paper is divided as follows: the theoretical review will cover first, the conceptual basis of DC and AC, and secondly, the consequences of organizational size to the development of capabilities. Then, it's presented the method and results. And finally, the discussion and closing remarks are presented.

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2. Theoretical background

2.1 Dynamic capabilities and absorptive capacity

The definition of DC must go through the definition of capability, as Constance E. Helfat & Winter (2011) defined as a reliable and minimally satisfactory manner to perform an activity repeatedly (for example, a factory that builds computers that work). In this sense, all firms have capabilities, in particular the so-called operational or zeroorder capabilities, which allow them to manufacture or sell goods or services (Arend, 2014).

Although research on DC has not reached maturity, the term DC can be seen as "the ultimate organizational capability that conducts performance in the long run" (Wang & Ahmed, 2007). Teece (2007) defines DC as a set of capabilities to sense and shape opportunities and threats, seize opportunities and sustain competitive advantage through assets reconfiguration when necessary. Following this view, it is safe to say that all firms have capabilities, but not all firms have DC, as the latter need to be developed with a view toward long-term competitive advantage (Arend, 2014; Teece, 2016).

AC is a specific kind of DC. In general, AC means to evaluate and use external knowledge, that is, to learn with potential partners, integrate external information and turn them into an ingrained capability within the organization (Teece, 2007; Wang & Ahmed, 2007), allowing the company to respond quickly to strategic changes (Sun & Anderson, 2010). Given the implications of the learning process for competitiveness, Zahra & George (2002) conceptualize AC as DC itself. For them, AC is defined as "a set of routines and organizational processes through which firms acquire, assimilate, transform and exploit knowledge" (Zahra & George, 2002, p. 186).

AC can be analyzed in two distinct and complementary dimensions: the potential capacity (Potential AC - knowledge acquisition and assimilation) and the realized capacity (Realized AC - knowledge transformation and exploration) (Zahra & George, 2002). This study adopts this framework (Figure 1), where Realized AC mediates the relationship between Potential AC and Innovation Performance.





Note. Adapted from Zahra and George (2002).

The dotted line represents an indirect effect (mediation) expected to be not significant.

By acquiring and assimilating external knowledge, Potential AC allows the company to receive external knowledge (Zahra & George, 2002). It is important to emphasize that the higher the level of Potential AC is, the greater is the organization's ability to understand and interpret, increasing the likelihood of the company to anticipate changes, modify strategies and achieve appropriate qualifications (Ben-Menahem, Kwee, Volberda, & Van Den Bosch, 2013). The acquisition process within Potential AC represents the intuition and interpretation required of individuals and groups on the new external knowledge (Sun & Anderson, 2010). On the other hand, assimilation is influenced by team members' experience and is strengthened by the prosperous environment for innovation; it is implemented at the group level and not just at the individual level (Sun & Anderson, 2010).

Realized AC transforms knowledge that has been assimilated as a result of developing routines that facilitate the integration of newly acquired knowledge with existing knowledge and is formed by the dimensions of transformation and exploitation (Zahra & George, 2002). Leadership and expertise of individuals to stimulate the shared understanding of newly acquired and assimilated knowledge influence the transformation process (Sun & Anderson, 2010). The exploration process happens on the organizational level and is related to the rewarding of activities, recognition and effective timely implementation of the company's resources, creating an organizational memory (Sun & Anderson, 2010).

2.2 Dynamic capabilities and organizational size

DC were identified primarily in studies concerning large and multinational firms, within highly dynamic sectors, such as ICT, but recent work has shown that such capabilities also exist in young firms and SMEs in different sectors (Alves, Zen, & Padula, 2011; Arend, 2014). Business administration and management studies in general have traditionally focused on large organizations as a background for research, arguing that in these firms, problems are more clearly identified or that there is little differentiation between managing large firms and SMEs. Following this concept, it would be enough to attack the deficits that a given SME has when compared to a large firm (Frank & Roessl, 2015).

Recent work has emphasized the need to expand research on the identification and development of DC in SMEs because of the lack of studies on the issue. Economic theory encounters difficulties with explaining different performances among firms in cases where this relates to the capacity of orchestrating resources and perceiving opportunities ahead of competitors (Arend, 2014; C. E. Helfat & Martin, 2015; Teece, 2016). In addition, SMEs are the world's most common form of enterprise structure, representing one of the most urgent research topics in the social sciences and in economics (Frank & Roessl, 2015).

Most SMEs find stability and operate successfully without ever becoming a large firm, while only a few actually grow into larger enterprises. Nevertheless, this smaller group has been the focus of research in DC, making it almost impossible to draw generalizations due to firm heterogeneity (Curran & Blackburn, 2001). Nevertheless, a small business is not a "small big business". Therefore, such a relation cannot be established without some loss for studies on SMEs. This is because the differentiations go beyond quantitative data regarding size and concern mostly qualitative peculiarities (Curran & Blackburn, 2001). SMEs demand a specific set of DC to survive and search for abilities and competencies that allow the firm to pursue the necessary adjustments for growth and development (Zahra et al., 2006). According to Frank & Roessl (2015), SME management studies traditionally relate to issues that can be characterized in the following way:

- They possess less favorable prerequisites to achieve economies of scale and economies of scope;
- Changes in the company size strongly influence the internal resource organization;
- Smaller sizes and bigger transparency combined with less formality promotes advantages with organizational costs;
- Growth related decision or personal hiring involve comparatively riskier decisions, which have more potential impact on the whole business;
- Exclusive individual knowledge creates a high dependency on a small number of people;
- Managerial decisions are critical and usually without the support of specialists or multiple decision makers;
- A high level of uncertainty increases business related risks, demanding higher efforts in managing stakeholder relations;
- An individual SME is not economically relevant, demanding a need to acknowledge the relevance in trade associations and networks;
- There is a high dependence on external forces, as they are more susceptible to regulations and economic policies.

While several authors have recognized the dominant role played by the decision maker in the development of DC (Helfat & Martin, 2015; Rindova & Kotha, 2001; Teece, 2016), the decision maker/manager/ entrepreneur in SMEs usually is the same person. This entrepreneurial manager is more related to the day-to-day operations and responsible for the administrative, strategic and operational decisions in SMEs (Adner & Helfat, 2003; Arend, 2014).

The usual DC view on management studies already has an entrepreneurial approach that emphasizes the importance of internally and externally related processes, recognizing the importance of critical resources and strategy (Teece, 2016). Entrepreneurial firms discover, create, define and exploit opportunities ahead of competitors, indicating a higher level of DC use (Zahra et al., 2006). The development of DC is directly related to the entrepreneurial, management and leadership skills to draw, develop, implement and modify processes to adapt to the market (Constance E. Helfat et al., 2007). These statements are in accordance with Schumpeter's (1934) definition of the entrepreneur as someone who takes risks in search of innovation and new combinations of resources to satisfy the consumers' needs. Considering AC, doubt still remains as to how SMEs have the capacity to absorb external knowledge, as they have limited financial resources, simpler structure, more simplified organizational routines, and little access to the scientific community compared to large companies. According to Wang et al., (2010) the AC of these companies resides not only in financial investments but also in the experience of their owners and their team of R&D . In these companies, it is usually the managers' behavior, personal characteristics, skills, beliefs, and method of work that strengthen AC (Talebi & Tajeddin, 2011; Wang et al., 2010), mainly in respect to Potential AC (Branzei & Vertinsky, 2006). Other aspects that are seen as influencers of an SME's AC are R&D investments (Talebi & Tajeddin, 2011), systems thinking and alliances for exchanging knowledge with other companies (Tranekjer & Knudsen, 2012) as well as the constant adoption of new processes and development strategies (Branzei & Vertinsky, 2006).

Branzei & Vertinsky (2006) state that AC in SMEs is relevant to reshape the stagnant capabilities of the company and enable better adaptation of external changes in organizational strategies (Branzei & Vertinsky, 2006). According to these authors, the Potential AC in SMEs is influenced by the capacity of human resources and the constant search to renew organizational routines. Additionally, SMEs seeking market growth develop Potential AC more easily, since they periodically redesign layout, train employees and update their routines and technology. Realized AC is positively influenced by the development strategies of human resources in the organization but is negatively influenced by changes in routine processes, that is, when the SME puts less emphasis on process, changes achieve greater Realized AC. Similarly, Realized AC is enhanced by new product development strategies.

Large companies have abundant resources to create new knowledge; thus, external knowledge exploitation is not so important as it is for small firms (Wang et al., 2010). On the other hand, the lack of resources in small businesses makes them more dependent on external sources to develop new knowledge and products (Wang et al., 2010), which demonstrates the relevance of AC in the innovative performance of these companies.

A holistic view of AC depicts the concept of DC, which cannot be separated from systems, processes and organizational structures (Sun & Anderson, 2010). Thus, the present study compares SMEs and large companies in respect to the influence of DC in innovative performance. For this, we adopted the framework of AC and its dimensions, Potential AC and Realized AC (Zahra & George, 2002) and previous studies that support the relationship of AC to innovation performance (Moilanen et al., 2014; Wang et al., 2010). The research hypothesis that this study seeks to verify is thus the following:

H1: Organizational size moderates the relationship between absorptive capacity dimensions and innovation performance.

3. Method

3.1 Data

To evaluate the research framework based on Zahra & George (2002) and the research hypothesis (H1), we use cross-sectional data from PINTEC 2008 (Brazilian Innovation Survey), a biannual-triannual innovation survey conducted since 2000 in Brazil. For the 2008 survey, data were collected on the innovation activities of companies during the 3-year period from 2006 to 2008. The methodological approach adopted by PINTEC follows the one utilized by CIS (Community Innovation Survey) in Europe; both are structured by the guidelines of the Oslo Manual. Since it covers all countries and provides a firm data level, the PINTEC is a relevant source of information for the research question posed by this study.

Because this survey has been conducted for more than 10 years, there are scattered studies that place the data in a theoretical framework going beyond the data itself. For example, while Derbyshire (2014) analyzed the relationship between ambidexterity and firm performance in Europe using CIS dataset, most of the studies in Brazil examine only the characteristics of the firms (Kannebley, Porto, & Pazello, 2005). Furthermore, there is a gap in prior studies concerning the use of up-to-date editions of PINTEC (2008 and 2011). Santos, Basso, Kimura, & Kayo (2014) have published one of most recent studies using PINTEC data, which analyze the relationship between innovative investments and financial performance, but the study draws from PINTEC 2000, 2003 and 2005.

Considering the gaps above, this research adds to the literature in two ways. First, it addresses the lack of studies that have drawn from the most recent versions of PINTEC. If one compares the two most recent editions available, 2008 and 2011, the 2008 edition was chosen because the final sample for the selected sector was larger. That is relevant because of the statistical technique used: structural equation modeling (SEM) demands a larger sample, and this need is intensified by the fact that the PINTEC has an ordinal scale ranging from 1 to 4 (more details in Section 3.3). Second, we place representative firm data collected in a national survey in a consistent theoretical framework. That is, this study uses the PINTEC dataset to evaluate the differences between SMEs and large companies in respect to the impact of Potential and Realized AC on innovation performance.

The changing nature of a competitive environment stimulates the necessity of AC development, but in the information and communication technology (ICT) industry, this need becomes even more evident once this sector is characterized as high-growth and knowledge-intensive in the midst of global competition (Saarenketo, Puumalainen, Kyläheiko, & Kuivalainen, 2008). Therefore, this study is restricted to this sector, and this type of sectorial boundary delimits a sample of companies facing comparative knowledge flows and competition levels.

Thus, due to our methodological choices and the design of the PIN-TEC questionnaire, the companies comprising the final sample (1) are established in Brazil, even the foreign-controlled ones, (2) have implemented some innovation between 2006 and 2008 (3) and operate in the information and communication technology sector (ICT), and they are all identified through the National Classification of Economic Activities (CNAE) accordingly to the IBGE's categorization for the sector (Instituto Brasileiro de Geografia e Estatística, 2009). These boundaries have resulted in 1443 companies in the final sample.

3.1 Measures

3.1.1. Organizational size

According to the IBGE criteria, the sample was split into two parts, considered SMEs: the manufacturers with 500 or fewer employees and services firms with 100 or fewer. This measure takes into account the differences related to labor intensity among manufacturers and service firms. Therefore, the sample comprises 1118 SMEs and 325 large firms.

One may argue that as organizations grow, they incrementally change, which would lead to choosing a continuous rather than dichotomous measure of organizational size. However, in Brazil, companies have tax incentives, preferences in public bids, free technical and managerial training, and other distinctive conditions that shape organizational behavior based on strict ranges of size. Moreover, the strategy of splitting the sample into groups clearly addresses the research objective of comparing SMEs to large companies.

3.1.2. Potential and Realized AC

Consonant with the DC vision, the choice of the indicators for each construct of the model followed an evolutionary approach (Nelson & Winter, 1982). Instead of using a single measure of AC (e.g., R&D intensity), which is contrary to the usual convention of studies with national innovation, this study measures each dimension of AC (Potential AC and Realized AC) individually with multiple indicators.

Considering the critiques of Andersén & Kask (2012), an evolutionary approach to AC cannot conceive itself along the dimensions of Potential AC and Realized AC exactly in the way stated by Zahra & George (2002). In this way, the measurements of Potential and Realized AC capacities are related to the effective use of the capacities, which is in contrast to static approaches based on the qualification for use (Andersén & Kask, 2012).

Thus, Potential AC indicators represent an organizational disposition to capture external knowledge that is measured by the effective capacity of use of external sources of knowledge for innovation. As the Potential AC promotes the continuous renewal of the stock of knowledge, items were selected for transfer and assimilation This includes items related to the explicit flow of external information, which is considered the initial input of AC (W. M. Cohen & Levinthal, 1990; Zahra & George, 2002).

Realized AC indicators were selected concerning the modification of the resource base that provided evidence of internal changes in the organization. In other words, Realized AC indicators capture the firm's capacity for action, that is, the indicators convert the external knowledge into results (Andersén & Kask, 2012; Zahra & George, 2002). As was done in the Potential AC, all indicators necessarily follow from the R&D activities. These measures represent an improvement over the usual measures, such as patents and intensity of R&D, by (1) capturing a wider range of innovations and (2) reflecting efforts to change the competitive level of the organization.

3.1.3. Innovation Performance

Finally, innovation performance is measured through market impacts of a given firm's innovations during the given period (Ritala, 2012).

Table 1

Indicators of the constructs

The indicators take account of the market effects of the innovation of products and processes in the period evaluated on the belief that these effects are the best representatives of innovation performance. This is because the external knowledge internalized through processes and routines acquires tangibility in technology, whereby a technique overcomes a given problem (Nelson & Winter, 1982).

Table 1 details the indicators selected for the study. In terms of empirical support, there is research on AC in Brazil (Alves, 2015; Alves & Galina, 2016) and in Europe with the CIS (Archibugi, Filippetti, & Frenz, 2013; Escribano, Fosfuri, & Tribó, 2009; Kostopoulos, Papalexandris, Papachroni, & Ioannou, 2011) that supports this choice.

Potentia	al AC	Realized AC			
(Cronbach's $\alpha = 0.7951$)		(Cronbach's α = 0.7640)	<u>Innovation performance</u> (Cronbach's $\alpha = 0.7326$)		
Importance attributed to each category of information source used for development of new or substantially improved products and/ or processes in the study period:		Importance attributed to each category of information source used for development of new or substantially improved products and/or processes in the study period:	Importance attributed to each category of external impact resulting from new or substantially improved products and/or processes in the study period:		
 Processor Proc	esses in the study period: C1: Suppliers of machines, quipment, materials, components or oftware C2: Clients and consumers C3: Competitors C4: Consulting companies and adependent consultants C5: Universities and other higher eaching centers C6: Research institutes or technology enters C7: Professional qualification and echnical assistance centers C8: Establishment of tests, trials and ertifications C9: Conferences, meetings and	 Period: RC1: Improved the quality of goods and services RC2: Extended the range of supplies RC3: Increased the capacity of production or services RC4: Increased the flexibility of production or services RC5: Reduced the production costs RC6: Reduced the labor costs RC7: Reduced the energy consumption 	 IP1: Allowed the company to maintain participation in the market IP2: Extended the company's participation in the market IP3: Allowed the company to open new markets 		
sp	Clus Fairs and expositions				
- P(C11. Computer information natural				
• P(e.g. Internet, extranet, intranet, etc.)				

Note. Elaborated by the authors.

3.3. Analysis strategy

The data analysis consisted of two steps to test the theoretical model (Stage 1) and two steps to test the hypothesis of the study (Stage 2). First, the model was evaluated through confirmatory factor analysis (CFA) and, second, through structural equation modeling (SEM). Given the categorical scale adopted by PINTEC (4-point scale concordance), estimation was performed by using the asymptotic distribution-free method (Jöreskog & Sörbom, 1996). These two steps allowed a robust test of the theoretical framework (Hoyle, 2012) with a single sample (Stage 1).

After validating the model, the third step involved testing the difference between when the model adjustment was unconstrained and when the model adjustment was constrained for the parameters to be equal between the two groups (SMEs and large companies). Next, the fourth step tested the differences between the models' coefficients. To compare the model adjustment, the chi-square test was used (Hoyle, 2012), and to compare the coefficients of the models, the z-test procedure was used (Paternoster, Brame, Mazerolle, & Piquero, 1998). This

Table 2

Results of convergent validity and internal consistency reliability

two-level analysis strategy strengthens the results because they were evaluated to yield the difference between the models overall as well as the degree to which the relations are different (Stage 2).

4. Results

4.1. Stage 1

Following technical procedures and cutoffs suggested by Hoyle (2012), the CFA results shows that the final model presents good quality measures because it achieved validity in terms of convergent, discriminant, and nomological, besides internal consistency (Table 2). The mean variance extracted should be higher than 0.50 to obtain a convergent validity (Nunnally, 2010). The constructs of Potential AC and Realized AC have slightly lower values, but small values do not have any negative effect if the composite reliability is higher than 0.70 (Fornell & Larcker, 1981). Therefore, because the lowest composite reliability value is 0.747, the validity of the model is ensured. Moreover, the heterotrait-monotrait ratio (HTMT) of correlations with the conservative cut-off of 0.85 (Henseler, Ringle & Sarstedt, 2015) assures the discriminant validity of the model (Table 3).

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Construct	Indicators	Mean	Loading	CR	AVE
Potential AC	PC1	2.674	*	0.747	0.426
	PC2	3.261	*		
	PC3	2.432	*		
	PC4	2.053	*		
	PC5	1.831	0.630		
	PC6	1.738	0.715		
	PC7	1.723	0.662		
	PC8	1.968	0.598		
	PC9	2.493	*		
	PC10	2.599	*		
	PC11	3.385	*		
Realized AC	RC1	3.354	0.715	0.762	0.447
	RC2	3.087	0.727		
	RC3	2.888	0.602		
	RC4	2.835	0.621		
	RC5	2.199	*		
	RC6	1.427	*		
Innovation Performance	IP1	3.270	0.848	0.851	0.656
	IP2	2.993	0.814		
	IP3	2.845	0.767		

Note. Elaborated by the authors.

* Indicators removed in the final model due low loadings.

Table 3

Results of discriminant validity

Relationships	HTMT
Potential AC and Realized AC	0.346
Realized AC and Innovation Performance	0.437
Potential AC and Innovation Performance	0.856

Note. Elaborated by the authors.

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statistics due to the sample size. For example, chi-square statistics

relationship between absorptive capacity and innovation perfor-

mance (p < 0.01). Chi-square difference in Table 5 shows that

the model is significantly different, which means that when the

parameters of the model are forced to be equal between the two groups, the statistic adjustment is degraded (139.65 vs. 332.43).

Since the AC model is different, it is worth noting the way in

tend to be significant for samples greater than 200.

In light of the results of CFA, Table 4 provides the results of the structural model. The fit statistics of the model were found to be satisfactory, although the model had been penalized by some of these

Table 4

Structural model fit indices

5		
Fit Indices	Model Results	Reference Values
χ^2	139.647	
$p > \chi^2$	0.000	p > 0.05 (Nunnally, 2010)
χ^2 / df	3.675	< 5.00 (Wheaton, Muthen, Alwin, & Summers, 1977)
RMSEA	0.043	< 0.10 (MacCallum, Browne, & Sugawara, 1996)
RMSEA (p-close)	0.928	p > 0.05 (Nunnally, 2010)
CFI	0.948	> 0.85 (Marsh, Hau, & Wen, 2004)
TLI	0.925	> 0.85 (Marsh et al., 2004)
SRMR	0.040	< 0.10 (Marsh et al., 2004)
CD	0.985	> 0.26 (J. Cohen, 2009)

Note. Elaborated by the authors.

These results comprised the first two steps of the analysis, the sample not being split (Stage 1). Due to the limited space and the fact that these results are not central to the discussion regarding H1, they are not discussed in detail here.

4.2. Stage 2

Table 5 and Table 6 present the main results. The first one supports H1: SMEs differ from large companies in terms of the

Table 5

Test of invariance

lest of invariance				
Model	χ^2	df	$\Delta \chi^2(df)$	
Unconstrained	139.65	38	-	
Constrained	332.43	115	192.78 (77)***	

which they are different.

Note. Elaborated by the authors.

* p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01 level.

Table 6 shows two main findings. First, the two first structural paths (Potential AC \Rightarrow Realized AC and Realized AC \Rightarrow IP) are statistically significant for both groups (p < 0.01), but they differ in respect to the effect of Realized AC on innovation performance (p < 0.01). It means that for SMEs, the effect of Realized AC in innovation performance is 18% higher (0.8933 vs. 0.7547).

Second, while SMEs follow a model without indirect effects from Potential AC to innovation performance, large companies present a model with a relationship between these constructs. The difference between the two groups is statistically significant (p < 0.05), that is, Potential AC impacts innovation performance in large companies, but it does not in SMEs.

Table 6

Structural coefficients comparison

Structural Path	SMEs	Large companies	Z-test
Potential AC \rightarrow Realized AC	0.2206***	0.1840***	0.4790
Realized AC \rightarrow Innovation Performance	0.8933***	0.7547***	2.7978***
Potential AC \rightarrow Innovation Performance	0.0013	0.0961*	-1.6702**

Note. Elaborated by the authors.

* p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01 level.

Finally, the R-squared of Innovation Performance construct is 79.8% for SMEs and 60.5% for large companies. This result indicates that not only the model behavior is different between the groups (as presented before), but also the percentage explained of the variation of Innovation Performance is more than 30% higher in SMEs.

5. Discussion and final remarks

This study examines how the firm's size affects the behavior of DC, more precisely, it analyzes the AC. The hypothesis was tested empirically, and we found strong statistical support for our position: AC impacts 30% more innovative performance of SMEs than of large companies. The analyses indicated that both SMEs and large companies build their Realized AC from Potential AC. However, only large companies can improve innovation performance directly from Potential AC. The study also confirms that SMEs are more efficient in converting Realized AC in innovation performance.

These findings add to the existing literature in different forms. First, it shows that capability building to learn from external sources relies on individual and group level (Potential AC) to achieve organizational levels (Realized AC) no matter the size of the company, as disclosed by Sun & Anderson (2010). That is, SMEs and large companies need to develop intuition and interpretation processes to obtain variation, in evolutionary terms. Traditional barriers such as rigid structures and systems do not seem to matter in regard to developing organizational level capabilities, such as Realized AC.

Second, this study shows that large companies capitalize on Potential AC for innovation, which does not happen within SMEs. This can be understood as a strategic rather than operational use of AC in respect to Realized AC. Large companies have greater access to market and financial resources where external knowledge can drive strategic changes and improve performance. Beyond that, large companies create around themselves a complex network of other companies that allow them to outsource the process to transform and explore external knowledge; thereby they reduce risk. This last explanation is consistent with the existing literature: large companies are less willing to take risks.

Third, (this is in some ways complementary to the last point) the analysis of organizational size in this study shows that SMEs convert Realized AC into innovation performance better than large companies. This suggests that flexibility and agility play a more relevant role than access to resources. For evolutionary economics, Realized AC is concerned with a selection process that drives changes. As companies become larger, they reduce their capacity to change and adjust to environmental circumstances, and, more importantly, their path dependence makes them more likely to experiment competence traps. Furthermore, the different business units and the complex networks that involve large firms make it difficult to apply external knowledge and improve performance. In another way, SMEs have more easily reduced costs of coordination and deals through tacit knowledge. Because Realized AC relies on the organizational level but is driven by experimentation and leadership, size is important to converting it into performance.

Fourth, this study contributes to open the black box of DC. In a broader view, this study connects a traditional stream of research related to organizational size with the DC view. This adds to the existing literature because it shows that even with reduced resources and evolutionary routines not established, SMEs develop DC. However, this happens differently from large companies. More specifically, this study shows that the model, which conceived AC as DC, is surprisingly more adhesive to SMEs than to large companies. While in SMEs, Realized AC fully mediates the relationship between Potential AC and innovation performance, as predicted by Zahra & George (2002), large companies also present an effect not mediated.

In sum, the results contribute to show that in high-velocity markets, as is the case of companies in the study sample (ICT sector), may be positive for the development of DC to be a SMEs, which are usually characterized as having limited financial resources, simpler structure, more simplified organizational routines, and little access to the scientific community when compared to large companies.

In addition, probably the most important theoretical implication is to contribute a response to following question: "under what conditions does the presence of DC in firms generate competitive advantage?" (Verona & Zollo, 2011, p. 537). Instead of providing an answer establishing boundaries or optimum levels, the results suggest that the presence of DC assumes different configurations depending on the organizational size. Thus, DC indeed do generate performance in SMEs and large companies, but they do so in distinct ways.

In terms of managerial implications, this study suggests that building up DC is an investment with returns for both SMEs and large companies. However, the way the capabilities deploy the resources to impact performance demands managerial attention. The structure of a firm needs to be taken into account while managing DC. The recognition of how routines can assume many forms and even become rule-based due to the organizational size may allow managers to realize the potential of DC. Concerning specifically AC, the results indicate that the benefits of this dynamic capability related with external knowledge are higher for SMEs. Consequently, these companies can expect more returns engaging in these routines.

As expected, given the exploratory nature of the research concerning organizational size and DC, this study has limitations that may drive future studies. The two most important are that it deployed only cross-sectional data and that the size was operationalized along two groups. To address the first limitation, it would help to understand the temporal dynamic of capability building. To address the second limitation, it would help to allow for the exploration of the effect of size on DC in terms of the curve's shape resembling a linear or inverted U.

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Evaluation of Open Innovation in B2B from a Company Culture Perspective

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Abstract: This article is written for innovation managers, business developers or employees in similar positions in a company selling in a B2B environment. Decision criteria are presented which will help to find the right open innovation tool for the desired goals and also for the given company culture. Aiming to increase business successfully by involving externals cannot be seen independently of the attitude and openness of an organization as a whole to this approach.

Keywords: Open Innovation; B2B; Decision Criteria; Innovation Culture; Company Culture

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Introduction

The use of open innovation for business development in the B2B industry sector still cannot be considered as daily business, different to B2C, where customer feedback and integration has become an integrated part. However, according to Chesbrough and Crowther (2006) even traditional and mature industries can profit from open innovation. Skepticism and lack of experience are major hurdles, and they can be overcome more easily by companies with foreign market activities (Abulrub and Lee, 2012). However, this does not mean that open innovation is done primarily on a global scale. Their study reveals that these firms are simply more open to external sources. According to Pilav-Velic' and Marjanovic (2016), a company philosophy open to collaboration with external partners can also have a positive impact on business process innovations, leading to a higher probability for the successful introduction of radical innovations. Open innovation can be used for problem solving either locally or distantly, in an experiential or cognitive way, which is described in detail by Lopez-Vega et al. (2016). It is important to note that they do not distinguish between a good or bad pathway. Instead, the optimum solution depends on the objective, for instance in terms of timescale or the expected outcome, e.g. incremental or disruptive innovation.

Having said this, it must be noted that even for collaborative and globalized companies the jungle of open innovation cannot be entered easily. This especially counts for companies in a B2B environment. The following overview and qualitative evaluation can be seen as a guideline to innovation managers responsible for deciding which methodology to use. Not only do the desired output and the acceptable input, especially in terms of time and money, have to be taken into account. The culture of the company is a very decisive factor when it comes to the use of open innovation.

Methods

In this chapter a short introduction to the open innovation methods discussed in the paper is given. The authors do not intend to give an instruction on how to use the tools in detail, but rather aim at giving a definition for each method.

Bilateral Innovation Workshop:

According to Gersbach (2004) bilateral innovation is a process which both partners benefit from. Bilateral innovation projects will only be successful if the participating companies have a very close relationship or a willingness to build it up. The latter is valid if the approach is started by the top management of the participating companies. In other cases at least one internal champion in each organization has to be found who first promotes the cooperation internally, and then keeps up the conversation and does the ongoing planning with the partner. The method of "Bilateral Innovation Workshops" is very successful if used for information exchange between the members of a supply chain. Doing so, the workshop would be beneficial to both parties (Mitussis, 2010). In practice a "Bilateral Innovation Workshop" goes much beyond regular conversation between customer and supplier, which in many cases means a limitation on the exchange of information of members of the purchasing and the sales department on specific issues. An Innovation WS acts differently regarding people and topics. It brings together engineering, product management, front sales, marketing and decision makers to discuss predetermined topics, which purposely are not limited to existing products or business. It can be designed like a roadshow, i.e. the supplier presents new ideas, products, and services etc. as a basis for discussions. Alternatively, it starts with technology and market trends, and from there collaboration opportunities are derived.

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Innovation Journey:

The innovation journey, a methodology which guides the innovation process in companies, is often described as a nonlinear cycle of divergent and convergent activities that may repeat over time and at different organizational levels if resources are obtained to renew the cycle. The methodology maps the innovation process in a company and describes it from the initiation to its termination (Van de Ven, 1999). The journey is a descriptive name for a long-term process, starting with the company's internal preparation and ending with business opportunities. However, different to the bilateral WS the partners are often non-customers and the applications and potential products are hardly ever specified in the beginning. Finding an "internal champion" who promotes such a journey is not always easy. Teaser presentations incorporating news and information interesting for the partner can be used as a starting point. During the whole journey the goal of both parties is not primarily to do business together but also to understand market demands, unfulfilled needs, products, technology and applications better. Other methods introduced in this paper such as certain workshops can be integrated in the "Innovation Journey" as active sessions in order to generate ideas or to enlarge the network and knowledge base. This also includes an enlargement of the participant base beyond the two companies active in the journey.

Lead User Workshop:

Combining solution and need information not only in one workshop but also in one person is the principal benefit of the lead user concept. To invite many of those combined talents to a workshop provides the opportunity to identify needs and find market orientated solutions within 2 - 3 days. Finding the right participants and extracting the sticky information from them is hard work (von Hippel, 2008). In literature a lead user is defined by "his/ her leading edge position on an important market trend" and "his/ her level of expected benefit from an innovation" (Hienert, 2007). With his knowledge a lead user may also provide ideas to improve products. According to Lüthje (2004) the lead user method allows to include user experiences into the design process. The user experience does not come from a wide field of different customers, but from customers that are "ahead of the market" (Lüthje, 2004). The lead user's market origin and source of benefit influences the novelty of the products greatly (Hienert, 2007). In the further development of the lead user concept after 2000 it was shown that lead users do not have to be from the target market, but can also be from markets with similar requirements (Lilien, 2002). A large benefit of the method is that lead users are able to create new concepts much faster than traditional methods (Herstatt, 2003) and

that the method is applicable to various different industries (Hienert, 2007). The lead user method usually consists of four phases. The first phase is also the initiation of the lead user process. In it an interdisciplinary team is formed, the target market is defined and the goals of the method are defined. In the second phase, the needs and trends in the market are identified. This is done by interviews with experts, the scanning of the literature, the Internet and databanks. Then the most attractive trends are selected. The third step consists of the search for lead users and their identification. The search is done by methods based on networking like broadcasting. Analogous markets can also be investigated. In the fourth and final phase, the concept design is developed. Finally, the workshop with the lead users is held to generate or to improve existing product concepts (Lüthje, 2004).

Cross Industry Workshop:

The Cross Industry Workshop works best when integrating at least three different parties originating from various industry sectors and which intentionally have no or very limited overlap between their business. Gassmann et al. (2012) show that workshops also among suppliers and customers are beneficial to integrate partners along the value chain. Creativity derives from the transfer of existing and approved processes, products and business models. The ideas generated do not have to lead to a relationship between the partners, but instead each partner can make use of ideas and key learnings for their own benefit. Support and input can come from additional scientific partners, i.e. from universities or institutes. Also a neutral moderator is recommended for maximum output. In a second step a validation of the ideas becomes necessary which can continue in an open innovation approach with the same or new partners.

Idea Contest:

An idea contest is mainly an online method for a certain period of time, usually restricted to one specific topic (Bullinger, 2010). The task to be worked on can differ from textual descriptions to prototypes or even fully functional solutions (Bullinger, 2010). Usually some kind of reward (intrinsic or extrinsic) is offered to the winner at the end of the contest. According to Bullinger (2010) table 1 shows design elements for idea contests and their common attributes. As Cooper showed in 2008, idea contests were not a very popular Open Innovation method at that time. Only less than 5% of the corporations were using it. In many cases the task to be worked on is limited to simple consumer products. One of the major benefits is the massive marketing impact documented by the integration of many users, but as Cooper emphasizes, there is always the downside of the enormous cost of setting up an idea contest (Cooper, 2008).

Design element: definition	Attributes							
Media: environment of IC	C	Online		Mix	Mixed		Offline	
Organizer: entity initiating IC	Company Public organization		Non-p	profit Individu		idual		
Task/ Topic specificity: solution space of IC	Low			Defined		High		
	(ope	en task)						
Degree of elaboration: required level of detail for submission to IC	ldea Sketch		Con- cept	Proto- type	Solu	tion	Evol- ving	
Target group: description of participants of IC	Specified					Unspecified		
Participation as: number of persons forming one entity of participant	Inc	dividual		Tea	Team Both			
Contest period: runtime of IC	Very sh	Very short term Short te		ort term	Long term		Very long term	
Reward/motivation: incentives used to encourage participation	Monetary			Non-monetary		Mixed		
Community functionality: functionalities for interaction within participants	Given		1		Not g		given	
Evaluation: method to determine ranking of submissions to IC	Jury eva	aluation	Pe	eer review Se assess		f- ment	Mi	xed

Table 1: Design elements for idea contests and their common attributes (according to Bullinger, 2010)

Practical experience shows, idea contests are often the invitation to externals to answer specific questions or do tasks in a certain way. Depending on the type of contest the ideas of others are visible for anyone or not, ideas can be brought to the next level on top of ideas of others, also sometimes externals are allowed to vote and select the winners. The legal issue is very critical here, as the IP situation is tricky: if the idea is visible on the Internet to anyone, it becomes state of technology. Another option is to transmit ideas within a closed community only with some NDA-rules. This way they can still be patented, but the question is by whom, which depends a lot on the details of the proposed idea compared to the patent claims. The information provided to the community up-front, the definition of the task and the template for the answers are very crucial for the quality of ideas developed in this process

	Bilateral Innovation WS	Innovation Journey	Cross Industry WS	Lead User WS	Idea Contest
Number of Total Parties involved	2	≥3	≥3	≥ 5	≥20
Typical total number of people involved	5-10	>6	>10	>10	>100
Duration from internal kick-off to completion of idea generation	1 – 4 months	4 – 10 months	2 – 6 months	3 – 6 months	3 – 6 months
Time spent on organization and execution of activity	Ð	ØØ	U	ØØØ	ଡ଼ଡ଼ଡ଼
Amount of money spent (excluding own staff)	\$	\$ \$ - \$\$\$	\$\$	\$\$\$	\$\$\$
Complexity of legal issues	\$	\$\$	\$ \$ - \$ \$ \$	§-\$\$	\$\$
Average no. of business or product innovation ideas	+	+	+	++	+++
Quality of ideas regarding usability either short or long term	+++	++	+	++	+
Type of idea (incremental – I, disruptive – D; market current – C; new – N)	I, C	D, C	D, N	I, D, C	I, D, C, N
Chance for short term new business / turnover	++	0	+	+	0

Table 2: Output / Effort Matrix for Selected Open Innovation Methods based on the experience of the authors.

'o' means not relevant

'+' means low

'++' means medium

'+++' means strong / high

Cultural Aspects

Besides the benefit / effort matrix summarized in the table above a very important further issue must be taken into consideration for the decision on which methodology to be chosen: the company's innovation culture. According to Meyer (2014) four types of innovators can be identified, depending on the degree of innovation and the innovation speed:

i) "Proactive Innovators" who are pioneers for further development,

ii) "Strategic Innovators" who usually experience a strong leadership and thus innovation is seen as top down approach

iii) "Innovative Optimizers" who focus on incremental innovation and

iv) "Operative innovators" who have a creative potential, however, they focus on core operational business and processes and lack strategy beyond these topics. Not every culture category can handle all open innovation approaches discussed in this report. And this is not necessary anyhow, as the goals are different and so is the expected outcome of the methods. In Figure 1 the fit of the above introduced open Innovation methods to the company culture types according to Meyer (2014) is shown. "Operative innovators" in principal have limited interest in external input, especially regarding disruptive or new ideas. The only tool of value for this group are bilateral innovation workshops as their output focuses on incremental ideas valuable for the current market but with only small budget and time input. On the other hand, all methods are valid for "Proactive Innovators", especially innovation journeys and cross industry workshops as they allow for mid- and long-term approaches not only limited to product ideas but also taking into account new business strategies and cooperations. The results for the "Strategic Innovators" are similar, however, as they want to keep control over the whole process their fit is a little bit more limited to those methods focusing on disruptive ideas. "Innovative Optimizers" have a strong focus on lead user and bilateral workshops as in both methods the targeted business, product or process can be well defined upfront and the benefit/effort ratio is optimal.

Figure 1: Fit of Selected Open Innovation



The opennes for external input of the company as a whole is crucial for a successful open innovation approach. On top of that the individual employee is either a limiting or driving force as described in detail by Salter et al. (2015). The ideation performance of scientists and engineers correlates with the use of external sources of knowledge. Thus the quality of the output and the commercial success coming from open innovation tools depends to some extend on the indiviual.

A further issue is the need for a presence of a permeable innovation funnel in two directions:

i) Outside-In

Ideas from outside have to be identified and then to be integrated into the organization's R&D funnel. This does not end with the presentation to the team. The company's culture must allow for external input to be built on. The "Not-Invented-Here"-Syndrom has to be overcome, i.e. typical reactions such as the listing of reasons why the idea will fail instead of constructive adjustments. Especially "Operative Innovators" and "Innovative Optimizers" tend to block ideas from outside. Furthermore, an internal champion, a team or a certain process needs to be established in order to have a clear responsibility on who takes care for external input. Time and ressources have to be allocated before even starting an ideation WS or any other tool. Otherwise the momentum from such an event cannot be transferred into the stage-gate pipeline of the internal innovation management process.

ii) Inside-Out

On the other hand, product or business model innovation ideas should be able to leave the boundary of the company. Otherwise a mismatch with the traditional habits or current customer and product base would lead to a dead end. The inside-out transfer means a change in the conventional pathways of the company and requires the need to think out of the box. New opportunities can be harvest by entering new applications or markets, changing sales structure, service level or value chain integration, opening new business lines or creating joint ventures or even spin-off. Leaving the comfort zone is the buzz word for helping achive a breakthrough. It is important to mention that this should be clear and thus prepared before starting an open innovation project. Otherwise not only the company will miss chances but also the external partner in the innovation process will get dissapointed as their needs and requirements are not met as expected.





Motivation and Topic Search

Typical reasons for companies to involve externals into their development process are summarized in Table 3. On purpose the motivation is seen from the perspective of the internal champion triggering and pushing the open innovation approach. Especially if these methods are new to a company, the hurdles will be numerous and without the right attitude and intrinsic passion they will not be completed. The main drivers for open innovation can come from marketing, sales or top management as they deal with externals each day anyhow and as such have access and more feedback already. The R&D department is a common source also, as innovation is their daily business. Production is not mentioned as their job is to make the current products and not to develop the next generation. Business Development, Strategy or other departments fall between sales, management, marketing and R&D depending on the definition within the company and thus are not listed here.

Top Management	Research & Development	Sales	Marketing
New tool to achieve the strategic goals such as turnover, new product sales etc.	Method to close internal gaps coming from reduced budgets by externals	Increased turnover by new products / new customers / new business model	Chance for publicity e.g. via open Idea Contest or via press releases regarding joined development
Head start compared to colleagues leading other businesses within the same company or external leaders.	Shorter innovation cycles (expected by management due to market demand or forced by strong competition)	More profitability via innovative products or new business models	Relationship build-up, Networking, Customer loyalty
Chance to build or strengthen alliances with other companies	Merging of technologies for disruptive ideas	Reduced risk and higher prices on the market when introducing new products with USP	Chance for new markets / appli- cations

Finding the right topics and the best matching external partners is the key to using open innovation methods efficiently. But what criteria are to be used to identify the optimum topic? Different approaches have been established, which vary in effort for preparation and evaluation as well as room for specific or more general expected outcome. Some will be explained in the following:

1) From Mega-Trends to Search Field

The approach starts with mega-trends such as climate change, urbanization, lack of resources, digitalization etc. From there industry trends have to be derived especially via interviews in various industry sectors. The focus should be on the question how the mega-trends will influence the availability of raw materials, the production process, the legal boundary conditions or the markets served. This will lead to a list of unfulfilled needs and requirements which can be matched with one's own current or desired competences to find the optimum starting points for a search field, which determines the topic of the open innovation activity. This approach is especially suitable for "Strategic Innovators" and "Proactive Innovators".

2) Micro-Trend Clustering for Inspiration

Especially if the involvement of externals via interviews already in the phase of finding the right search field is not suitable, micro-trend clustering is an interesting alternative. Various companies offer data-bases of trends in research or industry regarding products, processes, business models or other issues. They are called "micro-trends" as they are usually quite unique, local or outstanding and it cannot be predicted whether they will succeed or not as they have just started. You can look for attractive or matching micro-trends and cluster them, on your own or with the support of such trend-searchcompanies. This will allow getting a more independent and secure view on how stable or important certain trends will be. The open innovation activity will be related to the cluster. Again this approach is especially suitable for "Strategic Innovators" and "Proactive Innovators".

3) Technology Development Driven

Another very reasonable way to find the right topic is to look at your last developments and the markets behind them. Is there room for more as the company is still a newcomer in the field or the application is still growing and, therefore, still changing its needs and demands? Of course this method will most likely stay closer to the existing business than methods 1) and 2), but on the other hand, the effort to get a starting point is far lower and also the search for the right partners will be a lot easier as major players are already known and also existing customers can be chosen. This approach is especially suitable for "Innovative Optimizers" and also for "Operative Innovators".

Conclusion

Open innovation is an umbrella term for very different methodologies to get in contact with externals to achieve specific goals together. The main focus is typically on products and services, but also processes or business models can be discussed. The success of these activities depends strongly on the innovation culture of the company because the cost/benefit ratio is often unclear in the beginning and the risk of failure is high. Accordingly the employees responsible for open innovation need to have a strong intrinsic motivation for doing so and top management support is very important, too. In principle any company can do open innovation, however, the method has to fit the company's culture and its strategic goals. If this is the case money, time and effort are well spent.

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Sustainable Transport in Upper Austria – Case Study for Setting up a Living Lab Concept to Accelerate Innovations

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Abstract: The research team is currently working on defining a suitable path towards the design and implementation of a Living Lab for developing, testing and demonstrating innovations in sustainable transport operations. There are several examples that focus on transport and mobility, either addressing individual or freight transport. The combination of both topics is seen as a unique chance to find new ways for a sustainable transport system and mobility behavior. The region of Upper Austria is used as a research case in order to demonstrate results and findings of an applied research project, called "Mobility Lab Upper Austria."

Keywords: Living Lab; sustainable transport; stakeholder integration;

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Introduction

Within the following paper, a geographic focus will be laid on the region of Upper Austria, based on its strongly shaped industrial structure. Between 2001 and 2012, a general increase in the use of motorized private transport and a decrease in the use of environmentally friendly transportation (e.g. bikes, pedestrians, and public transport) has been noted. As a result, the high rate of individual motorists is forcing companies to spend sufficient resources in order to provide appropriate facilities (mainly parking) for commuters. Out of 195,900 trips to Linz (capital of Upper Austria), 140,500 are made with the use of private vehicles.¹ The industry is therefore particularly responsible for motorized passenger and freight traffic. Hence, the paper focuses on the term "industrial mobility." This addresses those traffic streams that are mainly induced by economic activity, such as commuter traffic, business trips, customer and visitor traffic. Mobility of goods mainly includes supply, production and distribution transport as well as waste disposal. Those research fields are supplemented by transition-oriented approaches, allowing them to work in comprehensive focal areas, such as energy, communication and information technology, and social innovation.



Figure 1: Characteristics of the term "industrial mobility."

Industrial mobility can be explained by the company's need to produce goods, including the distribution afterwards. This is implemented by freight traffic. Freight traffic can be undertaken using different kinds of transport modes and vehicles. The more alternatives a company has to transport their goods, the greater is the mobility level of the company. Industrial mobility also includes the individual mobility of employees. This traffic takes place within different forms, e.g. individual and public transport, with a bike or by walking. Again, the more alternatives a person has to get to and from the company, the greater is the personal mobility level. The overall mobility level of a company also depends on the impact factors of the surrounding area and the included infrastructure.

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(1) Traffic survey done by the federal province of Upper Austria (available here: https://www.land-oberoesterreich.gv.at/23652.htm).



The development of a Living Lab concept allows for the inclusion of perceptions, perspectives and values of the actors involved in the industrial mobility sector. Hence, the research team analyzes research structures that support the creation of innovative solutions within the transportation and mobility sector in Upper Austria. The aim of this paper is therefore the demonstration of a conceptual Living Lab path that can facilitate value-driven and democratized innovation.

In this paper we will first describe the general theoretical idea of Living Labs based on a literature review. Subsequently we indicate the methodology of the project that we use as a case study, exploring and explaining the model for setting up a Living Lab concept from an applied point of view. We illustrate the contextual components of each single step within the implementation path with the case study project material and conclude with a reflection of its use for future activities.

Theory - Living Lab

A Living Lab setting should enable a "new way of thinking" to understand and manage the complex issues within defining sustainable transport solutions. Therefore, it is central to differentiate the use of the term 'laboratory' in this paper with the classical use of the term. Conventionally, the term 'laboratory' refers to an area or a place where researchers and scientists carry out specific experiments (e.g. chemistry, soil analysis) ((Nguyen, Bosch, & Maani, 2011). The authors of this paper define a Living Lab as a real-life test and experimentation environment where users and producers co-create innovations, often operating in a territorial context (e.g. city, region) (Veeckman, Schuurman, Leminen, & Westerlund, 2013). The purpose of such a laboratory is to enable different stakeholders to experiment, test their mental models (assumptions, values, understandings) and to anticipate the consequences of their actions, policies and strategies (Maani, & Cavana, 2007).

For a common definition of Living Labs, we use the official statements from the European Network of Living Labs (ENoLL). ENoLL is the international federation of benchmarked Living Labs in Europe and worldwide.

A Living Lab is a real-life test and experimentation environment where users and producers co-create innovations. Living Labs have been characterized by the European Commission as Public-Private-People Partnerships (PPPP) for userdriven open innovation. (ENoLL, 2006)

Conceptual Frame and Case Study Method

The harmonization cube (Mulder, Velthausz, & Kriens, 2008) serves as groundwork on which the single implementation parts for Living Labs will be conceptualized. The cube represents the most important perspectives of a Living Lab. It describes the following six views upon a Living Lab to communicate the essentials:

- <u>User involvement</u> focuses on co-creation with final consumers (prosumer)
- <u>Service creation</u> focuses on the process of developing new ideas and testing these in a real-world setting
- <u>Infrastructure</u> focuses on the technologies required to perform measurements and analyze collected data
- · Governance focuses on the organization of the Living Lab
- <u>Innovation Outcomes</u> focus on the results produced in the Lab knowledge, products and services
- Methods & tools show how to acquire the data

Due to the exploratory nature of this paper, the authors employed a qualitative research approach. Case studies have close cooperation with practitioners, which is also the case when dealing with multistakeholder approaches (Gibbert, Ruigrok, Wicki, 2008). The authors of the article restructured this frame to show how Living Lab parts need to be focused.

Results

Part 1) Living Lab - strategic orientation

First, a strategic orientation (harmonization cube "governance") needs to be defined in order to evaluate the concrete conditions of a specific region.

• Who are the stakeholders for the definition of future challenges in the central region of Upper Austria within the thematic field of industrial mobility?

The "industrial mobility" approach discussed above, however, has been developed primarily based on researchers' perspectives and understanding of the term in question. In order to validate the need for the topic it was essential to involve relevant stakeholders in a confirmation process to help refine the approach and to identify key topics addressed within the Living Lab setting. Therefore, a joint expert workshop was conducted in Linz (capital region of Upper Austria) to unravel the regional scoping and propose strategies to address the identified issues concerning sustainable transport operations. Workshop participants came from government and private sectors (industry), academic institutions (including research institutions) and representatives from logistics/mobility service providers in Austria. Alongside to this expert discussion, face-to-face meetings were also conducted as they provide a good atmosphere for additional insights. In the "Mobility Lab Upper Austria" the involvement of stakeholders has a number of purposes and goals defined by the research team. First of all, the common purposes are to (i) create better and faster ideas through various inputs and (ii) to create solutions that are better accepted, as they have been developed by taking into consideration all the relevant stakeholders' views. But, in addition, the proposed "Mobility Lab Upper Austria" also places emphasis on (iii) fostering societal dialogue, as issues of industrial mobility are directly linked to different other societal challenges, thus (iv) empowering various societal groups by involving them. Another purpose lies in (v) educating people, by offering experience with the innovation methods used thus supporting an innovation culture, and by learning about industrial mobility topics in another form that usually taught in schools/universities.

- 1. Government on national and regional level (e.g. Land OÖ, The City of Linz
- 3. Industries (e.g. chemical industry)
- 5. Providers in the logistics and automotive sector
- 7. R&D units and experts
- 9. Related organizers (e.g. other innovation labs/platforms, clusters, museums, etc.)
- 11. Public

The stakeholder groups one to six seem equally important for the long-term performance of the "Mobility Lab Upper Austria," as they will play an important role in implementing solutions, but each of them can also be a promoter of a particular topic within the lab. The strategies used to involve them are keeping regular personal contact, showing them the concrete benefits of their work and developing a common strategy within a vision and mission statement. The group R&D units and experts play a slightly different role. Their typical role of delivering solutions mainly in the form of studies could be enriched by involving them in the development of existing topics, in creating ideas and in developing and testing prototypes. They will also be involved through regular personal contact. The media (8) can act as important multipliers of the "Mobility Lab Upper Austria" - in particular towards the stakeholder groups 9, 10, and 11 - and will be involved at an early stage and through regular information and participation. Related organizers (9) and educational organizations (10) refer to organizations that organize either innovation activities or educational activities in the field. The either or information seems particularly important in order to differentiate what they offer, but also to act as vice versa multipliers and to exchange participants. The involvement of the broad public (11) is considered as a one main characteristic of a Living Lab. The "Mobility Lab Upper Austria" will be open to the public. But, in addition to that, particular groups within the public, which are closely related to the main topic of the lab, will

In order to detect the relevant stakeholders for the "Mobility Lab Upper Austria" an intense stakeholder analysis was carried out. Around 220 stakeholder organizations or groups were analyzed according to their (i) possible contributions to the project, (ii) their interest in the project, (iii) their power to support and influence it, and (iv) their involvement to date. The analysis showed that the following stakeholder groups are most relevant for the "Mobility Lab Upper Austria":

- 2. Representatives of interests (e.g. industrial associations)
- 4. Small and Medium-Sized Companies
- 6. Service providers on behalf of governmental organizations
- 8. Media
- 10. Educational organizations (e.g. schools, universities)

be focused on when inviting them to activities: employees, commuters using transportation to get from and to work, drivers of trucks, drivers of public transport, individual drivers.

The governance part of the harmonization cube also stresses the business model perspective. As the Living Lab research highlights this aspect as being one of the missing links for keeping a Living Lab alive (Mastelic, Sahakian, Bonazzi, 2014), the research team deals with this perspective in the section that follows.

Part 2) Living Lab - business model perspective

Recent studies on the coordination of and cooperation within Living Labs have shown that there are several types and subtypes possible concerning the driving actors, the aims, the main financial contributors as well as the innovation and cooperation approaches. Leminen, Westerlund, and Nyström (2012) introduced four main types of Living Labs according to the driving actors. Another study by the Alcotra Innovation Project (2011) recognized six typical Living Lab profiles by analyzing all Living Labs of the first wave of ENoLL in 2007/2008. Later, Leminen (2013) added to his four-type model the underlying innovation mechanisms. Those three studies together provide a comprehensive model of the types and subtypes of Living Labs as shown in the following table.

LIVING LAB TYPE*	Provider-driv	ven		Utilizer-driven				
SUBTYPES **	Network-oriented and University spin-off	High-tech R&D Laboratory	Open innovation- prone enterprise	Single-sector business association	Business services provider			
Main financial contribution by	Enterprises	PPPs	Single Enterprise	Group of enterprises, mostly of the same	Enterprises	Тор		
Driving actor	Universities, other educational organization consultants	Universities	Enterprise	Enterprises as umbrella association	Private or public, business-oriented, real or virtual (cooperative) organization	o-down *		
Typical aims	Foster research and theory development, solutions for specific (societal) problems; improve the everyday lives of users	Testing facilities to a qualified network of stakeholders	Cooperative design and validation of novel ideas, products and service	Promotion and aggregator of the thematic R&D and innovation initiatives in the territory of reference	Provide testing and validation services to local enterprises	**		
LIVING LAB TYPE*	Enabler-driv	ven	User-driven					
SUBTYPES **	Enabler-driven	Policy-driven government initiative			Bot			
Main financial contribution by	Regional or city government or regional development organizations	Regional or city government	Enterprises, sometimes regional or city government					
Driving actor	Often universities, also government, nonprofit	Sometimes managed by NPOs or cooperative clusters	End user			*** dr		
Typical aims	Societal improvements or regional problems/needs	Local development	Solve everyday life problems of users					
	Exhalation-domi	Inhalation - dominated ***						

Table	1.	Types	and	subtypes	of	Living	Labs
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Two different types of mainly university-driven Living Labs form the group "provider-driven": Either as a network-oriented university spinoff, they foster research and theory development, mainly financed by enterprises; or as a high-tech R&D laboratory, financed by PPPs, their typical aim is to test facilities for a qualified network of stakeholders. Those Living Lab types rather follow top-down structures, just as does the group of utilizer-driven Living Labs. Utilizer-driven Living Labs are typically financed and driven by a single enterprise or groups of enterprises or private or public, business-oriented organizations and are rather inhalation-dominated, meaning the needs of a driving party are fulfilled by engaging outside stakeholders in an innovation process (Leminen, 2013). The group of user-driven Living Labs, driven by end users to solve everyday life problems, can also be considered inhalation-dominated, but definitely as a bottom-up process. The fourth group, the enabler-driven Living Labs, is mostly financed by regional or city governments or development organizations in order to foster regional development and improvements, and can be divided into two types: The "policy-driven government initiative," often managed by Nonprofit Organizations or cooperative clusters, and the one often driven by universities. Both are rather bottom-up initiatives and exhalation-dominated, inviting parties to offer their knowledge, expertise and resources to an open innovation network, whereby the latter compares to the participation approach of provider-driven Living Labs.

Based on the above literature review, the authors analyzed comparable existing Living Labs dealing with transportation issues all around the world by comparing their aims, structures, approaches and stakeholders. This led to a number of comparable Living Labs concerning structures and approaches, although none of them deals with industrial mobility in the way it is defined here. The industrial mobility Living Lab for the region of Upper Austria proposed in this article can best be captured through the following structure: As the aim of the Living Lab is to develop solutions for a multisectorial, multilevel topic and for a whole region, neither single organizations nor certain users should be the drivers, nor certain technologies (and thus businesses) will be in favor. It seems most appropriate to develop a Living Lab driven by a higher-education organization, willing and

²⁾ according to Leminen, S., Westerlund, M., & Nyström, A.-G. (2012). Living Labs as open-innovation networks. Technology Innovation Management Review, September 2012, pp. 5-11.

³⁾ according to Alcotra Innovation Project (2011). Deliverable 2.3. Best practices database for Living Labs: Overview of the Living Lab approach –Living Lab Best Practice Database Specification.

⁴⁾ according to Leminen, S. (2013). Coordination and participation in Living Lab networks. Technology Innovation Management Review, November 2013, pp.4-14.

able to collect requests from all stakeholder groups as well as to act as a moderator and intermediary between the public and private sector in order to foster co-creation. According to table 1, the Living Lab type would rather be an "enabler-driven" one, but with the strong aim of including the business sector such as industry, logistics suppliers, alternative transportation providers etc. equally, right from the beginning. Concerning public participation, the industrial mobility Living Lab would thus provide stability through a top-down structure, but with the strong aim of opening up to any bottom-up initiatives.

As a next step the research team addresses the whole innovation part of a Living Lab as this also represents the services offered by the implemented structure. Within the harmonization cube this task is presented by the parts user involvement, service creation, innovation outcomes and methods & tools. The last part (methods & tools) is seen as the most relevant part as it determines all the other aspects. If a Living Lab applies a good methodology with effective tools the user involvement as a core part for co-creating solutions in a systemic way (method) creates services, products and know-how. Also included here are the technologies required in order to perform measurements and analyze collected data.

Part 3) Living Lab - creating an innovative environment

Within this section, we will go into the theory of innovation. From the first step (orientation part) the strategic topic "Mobility as a Service" was identified as the main topic. Therefore, we start by looking at the innovation process from a service-oriented perspective (see harmonization cube "service creation). Mobility as a Service (MaaS) describes a mobility distribution model in which a customer's transportation needs are met over one interface. This is done within one bundled package. The system typically contains information about transport infrastructure, transportation and payment services. Mobility as a Service is seen as a new approach as the transport performance of the system is not evaluated primarily on speed, convenience and affordability. The new purpose will no longer be to improve the transport system by doing more or building more capacity, but by doing things in a smarter way (Hietanen, 2014). Therefore, mobility providers should focus on influencing factors addressing the innovation success of their services:

- · Time-to-market speed at which innovations are introduced,
- · The competition intensity and
- The availability and accessibility of information (Klokgieters & Chu, 2013).

Thus, the MaaS-paradigm strongly shapes the usage of Information and Communication Technologies (ICT) in order to link the mentioned factors (harmonization cube "infrastructure"). ICT solutions are seen as main drivers in the service economy. Technology is changing the way services are characterized due to their consumption as well as production (Maffei, di Milano, Mager, & Sangiorgi, 2005). Next to the high level of technical support, MaaS should also address the transformation to the so-called "supplier-user interface." The innovation theories highlight the fact that the underlying processes no longer take place within the boundaries of a single organization. They now involve complex relationships among several players, both private and public, some of which are competitive, while others are collaborative (Gabison and Pesole, 2014). The harmonization cube considers one specific stream of Gabison's research as relevant for innovation processes that focus on the role of external knowledge led by users:

• Open User Innovation (von Hippel, 2005): "economically important innovations are developed by users and other agents who divide up the tasks and cost of innovation development and then freely reveal their results."

The customer-oriented perspective has especially facilitated new methods of innovations. They are characterized by a more designdriven approach that is oriented toward generating new service ideas or products, through the use of technology potentials or the interpretation and proposal of new models of behavior (Maffei et al., 2005). Service design methods are both an evolution of existing marketing, management and design tools and the result of a dedicated design approach. The main and distinctive focus of service design tools concerns the design, description and visualization of the user experience, including the potentials of different interaction modes, paths and choices (flow diagrams, storyboarding, use cases, customer journey, video sketching, video prototyping, dramaturgy, etc.). Other tools try to support the representation of the complexity of service organization, like blueprint, service ecology, service system map, social network mapping, etc. (Maffei et al., 2005). Due to the definition of the underlying Living Lab, the service design approach is also appropriate for the case in question, Mobility Lab Upper Austria. The areas in which innovation can take place can be divided into three categories.

- Real-life context: social setting that involves stakeholders within the several innovation steps directly on site, where the action takes place.
- Virtual-life context: e-participation possibilities via online platforms or other (technical) supporting systems.

• Laboratory context: physical place where stakeholders can get together and experience actions within a neutral setting.





Conclusion

In order to link the single parts (1–3) into a conceptual picture, the following figure gives a first idea of how to align Living Labs on a theoretical level. This is also the construct of the "Mobi-Lab" in Upper Austria.



Figure 3: Mobi-Lab construction

The inner circle represents the strategic orientation part by focusing on stakeholder integration. Within the research team, this part is seen as the most crucial task for the future. In particular, the group "people" will be defined as a rather small group of persons in their roles as employees or workers coming from or going to work, employees of logistics providers, and persons affected by particular traffic situations. Future research needs to be done in order to analyze different motivation/participation strategies. Therefore, values for stakeholders are mentioned (second inner circle) to point out clearly the advantages of using a Living Lab structure for future cooperation. This circle can be seen as a short summary of advantages in the Living Lab research also relevant for the value creation part within the business model part:

- Enabler for participation (from the business perspective)
- New research (infra-) structure
- · Early involvement of (end-) users
- · Innovative solutions within a real-world context
- · Creation of a sustainable network/think tank
- · Trial and error is allowed

The third circle demonstrates the topics identified during the stakeholder workshops already held. The linkage of passenger and freight transport solutions is especially seen as a big challenge for future research. All these parts need to be organized in an innovative way. Therefore, the outer circle represents an innovation process. Through the integration of relevant stakeholders in every single step, new and innovative solutions should be developed. To analyze the mechanism behind the Living Lab additional research will be done in the future. The measurement of innovation and participation tools is required to evaluate the impact of the Living Lab structure compared to classic project settings used.

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Open Innovation in Agrifood Chain: A Systematic Review

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Abstract: Despite the practice of open innovation being consolidated, scientific publications are still limited, particularly when related to agribusiness. Through bibliometric technique and content analysis, this study aimed to analyze the state of the art on the subject, explaining the development of open innovation in agribusiness and highlight future research opportunities. The risk of sharing valuable knowledge is the main barrier to adoption. For mitigate it, there is a need for internal organizational changes, the support of communication tools and an intellectual property model that encourage knowledge sharing. Open innovation is a field that needs to be explored in different links in the chain, locations and contexts, in order to help ensure that organizations can benefit from this strategy.

Keywords: food industry; partnerships; property rights; university; company; research and development.

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Introduction

The current agribusiness scenario is influenced by a variety of factors, such as the growth of the world population (Food and agriculture organization of the United Nations [FAO], 2009), the intense economic competition (Läpple, Renwick & Thorne, 2015), the limitation of fossil resources (Preschitschek, Curran & Leker, 2011) and the climate changes and their possible effects on food security (Knickel, Brunori, Rand & Proost, 2009). Under these conditions, there is a need to increase the production of food, fiber and energy with greater efficiency in the use of available resources. To achieve this goal, it is essential that organizations of this sector promote innovation throughout their supply chains (Roucan-Kane, Gramig, Widmar, Ortega & Gray, 2013).

The revolutions in information and communication technology have reduced marketing and coordination costs and allowed organizations to establish more complex and efficient relationships (Organisation For Economic Co-Operation And Development [OECD], 2014). Consequently, the way innovations are designed, developed and marketed was also affected.

An increasingly evident practice is the open innovation, by offering opportunities to generate shorter innovation cycles of products, services and techniques (Grieve, Bushell, Lant, Georghiou, & Malik et al., 2009), reduced R&D costs, in addition to meeting the shortage of resources (Gassman & Enkel, 2004). This concept admits that knowledge is very widely available and that organizations must use the external environment to complement the assets needed to generate innovation (Chesbrough & Bogers, 2014), at the same time that may externalize internal results of R&D that are inconsistent with their current business model (Gassman & Enkel, 2004).

Notwithstanding, the transition to the opening of the innovation processes involves considerable management challenges for organizations, such as the transformation of business models (Saebi & Foss, 2015), the implementation of new types of R&D management structures (Chiaroni, Chiesa & Frattini, 2010) and the cultural shift to a vision more oriented towards the external environment (Huston & Sakkab, 2006). Still, recent academic studies and the practical business discussion highlight the collaborative nature of innovation activities, as in a systemic world, almost all of these are generated by cooperation between different actors (Mäkimattila, Melkas & Uotila, 2013), positivey impacting the final performance (Omta & Fortuin, 2013).

Open innovation can represent a new paradigm for the development of agribusiness (Dong, Yang, Bai, Wang & Zhang, 2013), therefore, it is assuming increasing importance in theory and in practice (Gassman & Enkel, 2004). However, empirical scientific evidence on agrifood chains are still scarce (Sarkar & Costa, 2008; Bigliardi & Galati, 2013). Since no review synthesizing the subject in this sector was identified, this study aims to present the state of the art on open innovation in agribusiness, identifying how it is adopted, the factors that influence this process and future research possibilities.

Open innovation

Chesbrough (2003) first used the term open innovation when identifying erosion factors that undermine the traditional model of R&D. According to the author, increased mobility of employees, more qualified universities, the decline of the US hegemony and the increased start-up's access to venture capital changed the conditions under which the organizations innovate. To these, Chesbrough and Bogers (2014) added the expansion of the Internet and social media, which increased the access and the sharing of knowledge.

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As a result, a new paradigm is imposed on organizations: open innovation. An innovation process based on the purposeful management of knowledge flows within the limits of the organization, supported by financial incentives or not, which should be aligned with the business model of the same (Chesbrough & Borgers, 2014). This model is more dynamic and less linear, because innovations are based on capturing external knowledge assets through cooperation; as well as on the outsourcing of assets that are not part of the core business and that will be better developed and marketed by others (De Backer, Lopez-Bassols & Martinez, 2008).

Significant implications result from this recent conception and can be seen in the representation of Chesbrough, Vanhaverbeke and West (2006) of the organization as a funnel. One can check the permeability of the organization's boundaries, which is willing to acquire and make knowledge available externally, in order to generate greater value for the innovations, through the current market, new markets or new businesses.

The distinct forms of this practice are based on the direction of flow of knowledge across the organization's boundaries, which may occur from the outside in - inbound - or from the inside out - outbound (Gassman & Enkel, 2004). Those of the first type occur in relationships established with external actors in order to access technical and scientific knowledge that will improve innovation performance internally (Chiaroni et al., 2010).

In the case of inbound practices, organizations can access these resources through various collaborative and contractual agreements, involving organizations and individuals with relevant knowledge to complement the internal efforts of R&D (Von Hippel, 2005). Some mechanisms include the acquisition of licenses of intellectual property rights, research programs with universities, foundation of start-ups with other companies, crowdsourcing, competitions and tournaments and collaboration with links in the supply chain and the community (Chesbrough & Bogers, 2014).

On the other hand, the results of investments in R&D can generate spillovers, ie, knowledge assets, from which the company has no capacity to benefit or that are not compatible with its current business model (Chesbrough & Bogers, 2014). In the open innovation view, these spillovers are transformed into inputs and outputs that can be managed through outbound processes.

In other words, organizations can create channels for this knowledge, that would be useless or not used internally, to be transferred to external partners (Maarse & Bogers, 2012; Chesbrough & Bogers, 2014). The sale or donation of intellectual property rights and technology licensing, corporate incubators, joint ventures and alliances are some of the examples by which this practice can be achieved (Chesbrough & Garman, 2009).

Moreover, inbound and outbound flows can occur simultaneously, combined to generate and/or market an innovation cooperatively (Enkel, Gassmann & Chesbrough, 2009; Chesbrough & Bogers, 2014). The process known as couple open innovation involves two or more partners who purposefully manage mutual knowledge flows, developing innovation and/or marketing activities jointly (Bogers, Bekkers & Granstrand, 2012).

Although involving knowledge flows in both directions, the application in the form of technologies can be performed in different ways. That is, the dual processes can be further classified as bidirectional, when only one partner develops innovation (Gassman & Enkel, 2004), or co-creation, when this is done in a shared way (Piller & West, 2014). This combination of processes "from the inside-out" and "from the outside-in" can be implemented through strategic alliances, joint ventures, consortia, networks, ecosystems and innovation platforms (Chesbrough & Bogers, 2014).

Open innovation represents an innovation in itself, first adopted by the industries referred to as high-tech, such as information technology and pharmaceuticals (Gassman & Enkel; Chesbrough, 2010). However, gradually it has also been used as a strategy of the so-called mature and traditional industries (Chesbrough & Crowther, 2006), such as the case of agribusiness.

Bibliometric analysis

The studies were collected from the ISI Web of Science, Scopus and Science Direct databases. The search resulted in 37 studies in English, being 23 articles, 1 book, 4 book chapters, 4 conference papers, 1 review conference and 4 reviews (Table 1). Despite the small number, the evolution of publications since 2006 signals the growing discussion on the subject. The reviews on the food industry and the development of functional foods are highlighted.

Author(s)	Year	Document Type	Study Object
Juriaanse	2006	Conference paper	Food Industry
Sarkar & Costa	2008	Review	Food Industry
Fortuin & Omta	2009	Article	Food Industry
Grieve, Bushell, Lant, Georghiou & Malik	2009	Conference paper	Agri-eletronics
Siedlok, Smart & Gupta	2010	Article	Nutraceuticals
Bellairs	2010	Article	Food Industry
Wolfert, Verdouw, Verloop & Beulens	2010	Article	Agri-food SME's
Top, Koenderink & Rijgersberg	2010	Book Chapter	Agri-food Supply Chain
Traitler, Watzke & Saguy	2011	Article	Food Industry
Enzing, Pascucci, Janszen & Omta	2011	Article	Food Industry

Table 1. Open innovation studies in agrifood chain.

Saguy	2011	Article	Agri-food companies
Petroni, Venturini & Verbano	2012	Article	Food Industry
Kumar, Boesso, Favotto & Menini	2012	Article	Food Industry
Thornblad & Hedner	2012	Article	Agriscience Companies
Klerkx & Nettle	2013	Article	Dairy production
Beckeman, Bourlakis & Olsson	2013	Article	Food Industry
Filieri	2013	Article	Food Industry
Di Guardo & Castriotta	2013	Article	Agri-food sector
Martinez	2013	Article	Restaurant
Roucan-Kane, Gramig, Widmar, Ortega & Gray	2013	Article	Food Industry
Moskowitz & Saguy	2013	Article	Fertilizers
Caudill	2013	Book Chapter	Food and Beverage Industry
Martinez	2013	Book Chapter	Beverage Industry
Wognum & Curran	2013	Book Chapter	Agri-food sector
Dries, Pascucci, Török & Tóth	2013	Conference paper	Beverage Industry
Saguy, Singh, Johnson, Fryer & Sastry	2013	Conference Review	Food Industry
Martinez	2013	Book	Food and Beverage Industry
Bigliardi & Galati	2013	Review	Food Industry
Khan, Grigor, Winger & Win	2013	Review	Functional Food
Omta & Fortuin	2014	Article	Food and Beverage Industry
Chesbrough, Kim & Agogino	2014	Article	Agri-food sector
McAdam, McAdam, Dunn & McCall	2014	Article	Artisan Bakeries
Dries, Pascucci, Torok & Tóth	2014	Article	Beverage Industry
Ruitenburg, Fortuin & Omta	2014	Article	Seeds
Pellegrini, Lazzarotti & Manzini	2014	Article	Food and Beverage Industry
Saguy & Sirotinskaya	2014	Review	Food Industry
Bombaywala & Riandita	2015	Conference paper	Food Industry

The results showed a certain concentration of the studies regarding the geographical distribution, in which Europe stands out (Figure 1). Either when mentioned by a member country or by several countries inserted in the European Union bloc, the continent is portrayed in almost 90% of the work.





This can be explained by the existence of traditional research centers in the agribusiness area, which can be confirmed by analysis of the institutions in which the authors are allocated. In relative numbers, the researchers of the Dutch Wageningen University were the ones who participated most in the studies identified. In this sense, The Hebrew University of Jerusalem, from Israel, and the University of Kent, UK, also stand out.

Later, one can observe the contribution of North America, which can be supported by the presence of Professor Henry Chesbrough of the University of California, who coined the term open innovation, being the executive diretor, founder of the Center for Open Innovation and lead author of one of the selected articles. Asia and Oceania were also represented, however, no study was identified in Africa and South America, important global agribusiness markets.

The authorship of publications is diverse: although five authors have published alone, a significant part of the work was carried out between two and four researchers. The representation of the authorship network displays the most complex connections to the center, among which stand out Saguy and Dries, working with five co-authors, and Grieve, as the author of four papers and co-author of another (Figure 2). Considering the contemporary theme of the discussion, it is believed that this configuration features that research groups are still being structured.



Figure 2. Authors' network representation of selected studies.



■ = coauthors

Despite some literature searches (Juriaanse, 2006; Siedlok, Smart & Gupta, 2010; Moskowitz & Saguy, 2013), most studies have sought to identify and understand the practice of open innovation through empirical studies. Therefore, surveys (Dries, Pascucci, Torok & Toth, 2014; Pellegrini et al., 2014) and interviews with managers (Beckeman, Bourlakis & Olsson, 2013; Ruitenburg, Fortuin & Omta, 2014) were conducted, but a significant part was based on single or multiple case studies (Hergenröther & Siemes, 2010; Remon, 2011; Thornblad & Hedner, 2012; Klerkx & Nettle, 2013).

It is noted that the empirical evidences have a significant focus on the manufacturing industry, specifically of food and beverage. This may be related to the proximity of this link to the final consumers, which enables the early identification and fulfillment of their demands. Nonetheless, some new trends emerge inside and outside the industry, such as functional and nutraceutical foods and food services, respectively.

Functional and nutraceutical foods are increasingly becoming the focus of R&D activities in the food industry. Notwithstanding, this process is complex and its success depends on factors other than those of the traditional food product development (Khan et al., 2013). They require high levels of systemic innovation, that is, besides the inter-organizational level, an inter-industrial and inter-institutional convergence and a sector reorientation process (Siedlok, Smart & Gupta, 2010). Thus, this new segment results from the convergence of the food, chemical and pharmaceutical industries, which in turn requires the integration of technologies, markets and value proposition (Bröring, 2013).

But, in general, the food and beverage industry is in transition, still starting the opening of innovation processes (Pellegrini, Lazzarotti & Manzini, 2014). The fact of involving an increasing number of chain actors to meet the needs of consumers, increasingly heterogeneous (Bigliardi & Galati, 2013), makes it a complex and dynamic system, based on a number of vertical and horizontal relationships (Sarkar & Costa, 2008).

Partnerships

In line with the amount of studies applied in the food industry, the adoption of open innovation has shown to be facilitated in this link, either with their suppliers (Dries, Pascucci, Torok & Toth, 2012), with the final consumer (Moskowitz & Saguy, 2013) or with both (Dries et al., 2014). The success of innovation in the market is the main benefit attributed to these types of partnerships, as it enables the product development process to better capture the expectations of consumers (Dries et al., 2012; Moskowitz & Saguy, 2013; Dries et al., 2014).

Organizations must recognize the strategic role of the involvement of the end consumer in their innovation activities. This can spontaneously provide valuable, original and feasible ideas that can initiate or accelerate the innovation of products and services (Filieri, 2013). In particular, their integration in the initial design phase is a market orientation, which has generated higher quality products (Omta & Fortuin, 2013). In contrast, innovations have been more incremental, due to the dependence that arises from the contributions of consumers (Omta & Fortuin, 2013). Thus, it is crucial for organizations to ally themselves to other types of partners simultaneously, since the extent of their links with the external environment can extend the possibilities of innovation.

Among these alternatives, one occurs between private companies and universities. For example, the alliance between Syngenta and the University of Manchester, which is directed to the development of technologies for precision agriculture, the "agri-eletronics" (Grieve et al., 2009). The university can benefit from the ability to attract more financial resources, even with the spin-outs that can be licensed, in addition to the academic insights into business strategies; on the other hand, intellectual property rights restrictions may prevent publications (Malik, Georghiou & Grieve, 2011).

The long-term interactions between scientists in the company and in the academy allow access to broad expertise and technological combinations still missing, whose results can lead to new markets; but if the practice is not accommodated by the culture of the organization, it can restrict the intrapreneurship and generate conflicts, especially if there are multiple external partners (Malik, Georghiou & Grieve, 2011).

Hence, it is clear that these alliances can be realized in a productive, but still challenging, model of open innovation. It is essential to create a relationship of mutual trust, which runs through the change of some paradigms, such as the reformulation of the old system of learning and the involvement of students, the reflection on the role of the industry and the awareness of social responsibility of both parties (Saguy, 2011).

Factors influencing the opening of the innovation process

The main drivers of open innovation can be summarized to technological and market pressures. As a consequence, the need for a technology that does not exist demands from the organization an appropriate architecture for collaboration with external actors, able to access and integrate this knowledge (Martinez, Lazzarotti, Manzini & Sánchez García, 2014). As for the pressures exerted by consumer demand, they can be answered by the communication between the areas of R&D and marketing (Fortuin & Omta, 2009).

Some agribusiness companies that have resisted the opening of their innovation activities obtained as a result more incremental innovation at the expense of the ability to generate more significant advances in their products (Bayona-Sáez, García-Marco & Sanchez- García, 2013). The cases reported by Beckeman, Bourlakis and Olsson (2013) confirm that, when developed internally, the resulting innovations were mostly incremental and with invisible benefits to the consumer, such as the reduction of costs and production time.

Enzing et al. (2011) attested that the involvement of different actors related to technology and market impacts positively on the performance of new products in the short and long term, but its effect was not seen in the improvement of existing products. This corroborates other evidence in the literature, which attach greater degree of innovation radicalness when the product development is conducted openly (Bayona-Sáez et al., 2013); mainly if driven by dual processes, in which there is mutual exchange of knowledge between partners, which resulted in greater number of innovations, reflecting directly the growth of organizations (Brink, 2014).

As mentioned, there are different patterns of knowledge acquisition and these may vary according to the sector, place of origin and, especially, the size of the organization (Acosta, Coronado & Ferrándiz, 2013). In agribusiness, while large companies often prospect innovations, small and medium-sized enterprises position themselves in a reactionary way; only a small part of these innovate successfully, which is possible by adopting the open innovation model (Kumar et al., 2012).

Notwithstanding, regardless of their size, organizations are challenged by the primary internal changes to accommodate this practice. In addition to a new structure of R&D, network or matrix organizational models emerge, together with professionals that integrate scientific knowledge and entrepreneurial expertise, the T-men; and as a result, techniques for managing people also tend to change (Petroni et al., 2012).

Regarding the establishment and maintenance of partnerships with external actors, organizations may have to deal with technical and perspective barriers (Bombaywalaa & Riandita, 2015). The lack of technological expertise among partners, possible legal requirements and the difficulty of predicting future needs for the development of innovation are some technical elements; yet the skepticism about new technologies and conflicts of interest can generate perspective barriers, the lack of confidence being the most imperative (Bomba-ywalaa & Riandita, 2015).

This lack is closely related to the inherent risk of knowledge sharing (Bigliardi & Galati, 2013) and often prevents organizations from making use of the opportunities to open their R&D activities (Beckeman, Bourlakis & Olsson, 2013). So there is a tension on the part of organizations, between the urge to open and to benefit from external knowledge and the will to remain closed, preventing others to make use of strategic knowledge.

In this sense, information systems technologies represent valuable tools to integrate the actors and enable transparency of products and processes (Trienekens, 2008). Similarly, mechanisms of protection of intellectual property, be they formal or informal, can protect organizations, although generally they are expensive or limit flexibility and creativity (Ruitenburg et al., 2014). Since, along with communication, intellectual property protection mechanisms influence the level of trust in the partnership, which is positively related to innovation performance (Saguy & Sirotinskaya, 2014), these elements must be negotiated and balanced in order to facilitate the advancement of the relationship (Oguamanam, 2013). With this, the new intellectual property model should not only consider the financial returns, but allow greater sharing of rights rather than the accumulation of these as a form of protection; besides creating value for the licensing of unused technology or the sale of ancillary patents (Saguy & Sirotinskaya, 2014).

Finally, another key aspect that could represent an incentive or a barrier to the adoption of open innovation is related to the institutional environment, essential for actors to play their role effectively (Klerkx & Nettle, 2013). This is manifested by the reduction of technical and regulatory risks, the clear communication of requirements, procedures, expectations and regulatory processes and the creation of funding programs (Roucan-Kane et al., 2013), especially when it comes to small and medium-sized companies, whose resources are scarcer (Khan et al., 2013).

Despite the government's participation in partnerships between companies and research institutions being fundamental in agrifood chains (Wolfert, Verdouw, Verloop & Beulens et al., 2010; Roucan-Kane et al., 2013), public policies to encourage innovation are still scarce (Dong, Yang, Bai, Wang & Zhang, 2013). In this sector, policy makers can act relevantly, raising awareness and encouraging their adoption; financing projects that include issues such as food safety, animal welfare and sustainable use of resources; ensuring compliance with legislation; and supporting the harmonization of relevant international standards for the regulation of innovations (Verdouw & Wolfert, 2010).

Conclusions

Organizations from various sectors are increasingly opening their innovation processes, streamlining their R&D activities with the expectation of better results. By being more widely consolidated in the areas of information and communication technology, it was considered appropriate to present the state of the art on open innovation in agribusiness, analyzing how this is adopted and the factors that influence this process.

The challenges of agribusiness today demand more complex and systemic innovations that can be achieved through more open processes of product development. Nevertheless, despite the socio-economic importance of the sector to the world, it was found that the scientific publications in the area are incipient and research groups are still being structured.

The phenomenon is reported in empirical studies mainly in the food and beverage industry, where partnerships proved to be facilitated between different actors in the supply chain. On the other hand, some difficulties were related between input suppliers and the academy, especially regarding intellectual property rights. In general, the main barrier in establishing innovation alliances refers to the inherent risk of knowledge sharing, which creates a lack of trust between partners. Proof of this is that no study was identified reporting outsourcing processes of knowledge assets, which would be unused or underused internally. This is a valuable opportunity for the organizations in the sector to create value, but which may be being ignored by managers.

To assuage the fear of the organizations regarding the exposure of strategic internal resources, communication tools and a new intellectual property protection model are critical, which should encourage the sharing of rights and foster cooperation among stakeholders. Internally, it is also necessary for the organization to create a collaborative design that is receptive to external links. This includes some changes both in the hierarchical and in the R&D structure, in addition to new professional profiles that must be managed differently.

The external environment is another aspect that significantly influences the development of innovation through regulatory elements and the targeting of goods and services to be created through requirements and financing tools. This latter mechanism is especially important for small and medium-sized enterprises, whose financial resources are often scarce.

Several studies indicate considerable advantages for organizations that use open innovation as a strategy, which led to more innovations and with greater radicalness. Although considering that the products and services resulting from interactions between different actors have higher chances of market success, there are no quantitative measures comparing the performance of these in relation to those which are internally generated, whether in terms of tangible or intangible assets.

Thus, the field of open innovation lacks empirical research that attempts to understand and measure the possible benefits and harms of this practice and in different links of the chain, locations and contexts. As a result, these studies can help organizations benefit from this strategy and create the innovations necessary for the development of agribusiness in all its breadth.

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Tensions between Teams and Their Leaders

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Abstract: The intersection of teamwork and leadership results in tensions, dilemmas, and paradoxes for both individuals and for institutions such as simultaneously empowering individuals at the same time it frustrates them when our naive, cultural understanding of leadership centralizes power and values leaders who can impose their will and vision on others. Perhaps the fundamental paradox of teamwork and leadership is that the more leadership is focused on an individual the less likely a team's potential will be realized. Six specific domains where tensions arise are: at team boundaries; culture; who is in charge, rationality/cognition; diversity; and collaborations. Three approaches - clarifying different levels of analysis, temporal factors, and overarching concepts - to resolving tensions are discussed. New conceptions of leadership and the importance of the larger cultural frame within which they are embedded are needed for the management of technology and innovation.

Keywords: paradox; teams; leadership

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Tensions between teams and their leaders

These findings illustrate what we found to be a clear paradox in the external leader role. ... managers were asking the leaders to delegate authority and in the same breath telling them to 'make' their teams comply (Druskat & Wheeler, 2003, pp. 451).

Teamwork has become central to the operation of the modern organization. People from diverse backgrounds culturally, professionally, and demographically must work together to develop the well-rounded decision making organizations need to survive in our contemporary economy. The ability to work in teams is one of the most commonly mentioned, mission critical skills that potential employers cite when they are looking for prospective employees. Managers spend almost 40 percent of their time working in teams and the vast majority of organizations over 100 members rely on teams for accomplishing their everyday work (Solansky, 2008).

A compelling feature of research on teamwork is that it stands at the intersection of so many important theoretical and policy issues such as the converging trends surrounding globalization and the 'flattening' of our world; the increasing complexity and blurring of boundaries represented by new organizational forms, the growing importance of diversity and inclusion, and the intersection of technology and of human performance.

Teamwork focuses us on the collective, the wisdom of crowds. A major advantage of group decision making is the possibility of corrective action, individuals acting alone may not consider all of the alternatives or the consequences of their actions (Gouran, 1982). However, particularly in the US, a focus on individual effort often mitigates against people working successfully in teams. While over 80% of American workers report collaborating with others at least occasionally to learn from them, to accomplish specific tasks, or because it is required, most do not like to do so (Business Week, 2008).

On the other hand, leadership embeds Western cultural values that give primacy to the individual. Leadership, and relatedly management, have more traditionally been the focus of organizational operations. Leaders serve several critical functions: they provide direction often through a unique vision; they respond and adapt to evolving organizational environments through changing strategies; and they influence others to exert more effort than they might normally give. There is a broader cultural consensus embedded in great men (sic) approaches that views leadership in terms of a dominant individual who forces their will on others.

The intersection of teamwork and leadership results in tensions, tradeoffs, oxymorons, conundrums, puzzles, dilemmas, and paradoxes for both individuals and for institutions such as the possibility that it both simultaneously empowers individuals at the same time it subjects them to frustration when our naive, cultural understanding of leadership centralizes power and values leaders who can impose their will and their vision on others. Perhaps the fundamental tension of teamwork and leadership is that the more leadership is focused on an individual the less likely it is that the full potential of a team will be realized.

Leadership research has uncovered dualisms, contrasts throughout its history: headship vs. leadership; transformational vs. transactional; consideration vs. initiating structure; formal vs. emergent leadership; individual vs. collective needs, and so on (Fairhurst, 2001). But interestingly, except for perhaps the tension between cohesiveness and creativity, this has been less characteristic of theory and research focusing on teams.

Systems theories, however, point to three fundamental contradictions in organizational life: balancing the need for stability with the need to change; subsystems do not necessarily agree about goals and structures for achieving change; and objective performance demands must recognize unique needs of people (Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000).

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Such tensions reveal contradictory and/or inconsistent qualities, statements that seem absurd but which may be true in fact. They stimulate us to deeper thought and a desire for resolution that needs to be approached deliberately as we will do in the following sections of this essay. Here we will explore six specific domains where tensions arise: at team boundaries; culture; who is in charge; rationality/cognition; diversity; and collaborations. Next we apply three approaches - clarifying different levels of analysis, temporal factors, and overarching concepts, -to resolving tensions in these domains. We conclude with a discussion of new conceptions of leadership and the importance of larger cultural frames within which they are embedded.

Teamwork

The impact of internal organizational groupings has always been of central interest to organizational behavior, dating back at least to the Hawthorne studies which clearly demonstrated that informal groups had profound effects on organizational performance (Kilduff & Tsai, 2003; Scott, 2000). Fundamentally teams allow organizations to accomplish tasks that are too big for one individual. They are the building blocks that make organizational size manageable. Classically groups are seen as influencing member satisfaction, performance (e.g., facilitation, risky shift), perception (e.g., Asch), and development of norms and attitudes.

Many authors (e.g., Poole & Real, 2003) have suggested that ideally teams increase: the many different types of expertise and points of view that are brought to the table; access to a wider range of resources outside of the team; share risks and outcomes; learning and potential growth among team members; consensus concerning a course of action; buy in and involvement; commitment to achievement of overall goal; and improve quality by having more than one set of eyes to look at a problem. On the other hand there are many potentially dysfunctional aspects of teams: concertative control; social loafing; groupthink; diffused responsibility; and waiting for someone else to take charge.

Teams are essentially groups on steroids. "Teams have a well-defined focus and a sense of purpose and unity that members of other groups do not share" (Poole & Real, 2003, pp. 370). Ideally team members share leadership roles, are accountable, encourage open-ended discussion, encourage listening, and measure their performance (Katzenbach & Smith, 2013). Teams are most appropriate when the organizational problem to be addressed is complex requiring a high degree of interdependence among team members (Sheard & Kakabadse, 2004).

Higgs reviewed 52 authors definition of teams and identified seven common elements: common purpose; interdependence; clarity of roles and contribution; satisfaction from mutual working; mutual and individual accountability; realization of synergies; and empowerment (Sheard & Kakabadse, 2004). Salas and his colleagues have suggested there is a 'big five' in teamwork: team leadership, mutual performance monitoring, backup behavior, adaptability, and team orientation (Salas, Sims, & Burke, 2005). Backup behavior refers to the willingness of other team members to provide assistance when needed. Many of these elements are included in the following definition: *A team is a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach which they hold themselves mutually accountable* (Katzenbach & Smith, 2013, pp. 39, italics in original). We might add to this definition shared decision making with some understanding of each other's roles, contributions to team, and that members interact adaptively and dynamically in pursuit of team goals.

Leadership

Most managerial discussion of leadership focus on headship. However, it is important to distinguish leadership from headship. Managers can be leaders, but they are not always leaders. They can influence people to get things done because of their positions. This headship is maintained through an organized system and it doesn't emerge from spontaneous recognition of group members. Headship situations are often characterized by external group goals set by a larger organization; as a result there is a lack of a sense of shared feelings and joint action. There can be clear status and other differences between the head and their followers which contribute to problems in communication. A managers influence depends on the organized system of which they are part (Gibb, 1969). On the other hand, leadership can be viewed as the influential increment, the ability to get others to do more (or different things) than they would normally do. For the moment, since the tensions are more pronounced, we will focus on managerial leadership associated with positions.

Tensions

Tensions are a ubiquitous feature of social life. They are manifested in a number of particular forms which are often discussed interchangeably: contradictory logics, competing demands, clashes of ideas, contradictions, dialectics, irony, paradoxes, dilemmas, dualisms, and so on (Cooren, Matte, Benoit-Barne, & Brummans, 2013). These tensions reveal contradictory and/or inconsistent qualities, statements that seem absurd but which may be true in fact. They stimulate us to deeper thought and a desire for resolution that needs to be approached deliberately. Dilemmas often represent a choice between equally balanced alternatives, each with associated costs and benefits, predicaments that seemingly defy a satisfactory resolution, often presented in either/or terms (Westenholz, 1993). Paradoxes are statements contradictory to received opinion; seemingly contradictory statements that may nevertheless be true. "Paradox is the simultaneous existence of two inconsistent states, such as that between innovation and efficiency, collaboration and competition, or new and old" (Eisenhardt, 2000, pp. 703).

The existence of paradox has been a pervasive theme in the management literature (Eisenhardt, 2000). While paradoxes reveal seemingly contradictory elements, dilemmas often reveal contrasting forces that may represent opposite, orthogonal ends of an underlying continuum. (e.g., participation, involvement, autonomy at one end, the need for direction at the other). They often entail either/or situations where one alternative must be selected (Cameron & Quinn, 1988), but they can also be paradoxical when options are contradictory and linked in such a way that any choice will only be a temporary one since tensions will resurface (Smith & Lewis, 2011). Here we will explore six specific domains where paradoxes arise: at team boundaries; culture; who is in charge, rationality/cognition; diversity, and collaborations (See Table 1).

Tensions	Teamwork	Leadership
Boundaries	Basis for Identity	Representative to/of Outside World
Culture	Common Ground; Basis for Action	Constrains; Developing a Vision; Founding Fathers (sic)
Who is in Charge?	Autonomy; Concer- tative Control	Syntality; Idiosyncracy Credits
Rationality/Cognition	Group Mind; Shared Cognition	Certainty; Best Synthe- sizer; High Cognitive Complexity
Diversity	Dualism; Represen- tative Role	High Status Professions; Assigned vs. Emergent; Managing Pluralism
Collaboration	Generalist vs. Spe- cialist; Individual vs. Collective	Monitor; SEC for Relationships

Managing Boundaries

Whether one is considered to be in a team or not becomes a basis for individual identity. Identification with team becomes an important source of self-esteem for team members. In effect individuals know who they are (and are known to others) by what groups they belong to.

A major function of assigned leaders is to serve at the boundaries representing a team to larger organization while also insuring that the team's efforts fit with the larger organization. One of the classic sources of satisfaction with a supervisor is their ability to obtain needed resources from the organization (Pelz, 1952), but this often involves accepting some constraints on the operation of the team. Referring back to the lead quote of this article often management expects heads to impose a direction for the team. Imposing solutions while simultaneously involving the team to get buy-in undermines developing an optimal solution based on the participation of team members. It is difficult to maintain a balance between leadership and teamwork in many organizational contexts, especially if one is trying to develop a truly participatory climate.

Culture

One critical element of boundaries is that the larger organization of which teams are the constituent parts, often have a supraculture which raises the questions of which culture is operative - the teams or the larger organizations. Internal, idiosyncratic cultures become a basis for team identity – competing with other teams, buffering the larger organization (often us vs. them is a powerful motivator). Interestingly one critical source of success is a willingness to fail. Creative teams need be given space to fail, to be failure tolerant (Sheard & Kakabadse, 2004).

Broadly speaking culture enriches our understanding of any information we gather while it restricts the range of answers we can seek (March, 1994). It also can improve efficiency by clearly delineating roles, relationships, and contexts within which individuals act, but it impedes the flow of information and the development of novel solutions to problems. This also leads to perhaps the ultimate paradox, the more people communicate, the more they converge on a common attitude, the less creative (different) they are. Processes of self-censorship, especially when one does not hold strong views, are often coupled with false consensus effects, the projection on to others of similar perspectives to one's own (Huckfeldt, Johnson, & Sprague, 2004).

One of the key functions of leadership is providing direction often through developing a vision. For entrepreneurs and founding fathers (sic) their personality and how they meet challenges may become embedded in the DNA of the organization (Schein, 1983).

Who is in charge?

In maintaining discipline, the leader will be less concerned with inflicting punishment than with creating the conditions in which the group will discipline itself (Homans, 1950, pp. 435).

Fundamentally teams need some direction, especially to act in concert with the larger context of the organization. The leader needs to counterbalance the powerful internal forces that teams can use to encourage conformity. However, substituting concertative control for leadership without the checks and balances, safeguards inherent in formal supervisor-subordinate relationships can often be more damaging to the development of creative problem solving. A Community of Practice can act as knowledge police in the same impeding way that medieval guilds often operated in a value preserving manner (Wenger, McDermott, & Snyder, 2002).

It may be much more difficult for a leader, especially an assigned one, to change than for a group to come to the conclusion that change is necessary. Emergent, as opposed to appointed leaders, are most likely to embody the norms of their groups and only can depart from them at some risk of losing their standing (Katz & Lazersfeld, 1955). But if the leader is really only a figurehead for group/team sentiment – who is leading then? Hollander's (1978) idiosycrancy credit notion suggests leaders are often selected and retained because they best represent group norms, but they often enhance their status by using their credits to get their groups to adopt different directions. So, while emergent leaders are often chosen because they best represent group norms, once the group has given them power they must use it or lose it (Katz & Lazersfeld, 1955). So you have the paradoxical statement that the initial conformity of the leader eventually results in change.

Rationality/Cognition

There is a commonly held belief that teamwork requires members to have similar cognitive structures. Meta-analysis have revealed that there is a cognitive foundation to teamwork with strong positive relationships to behavioral processes, motivational states, and team performance (DeChurch & Mesmer-Magnus, 2010). Shared cognitions, represented in shared mental models, result in more effective communication and are a critical driver of team performance (Salas & Cooke, 2008).

They promote receptivity to some messages, while making some others more difficult to understand. Often members operating in different frames need to come together to accomplish larger, collective purposes. These issues are critical to the operation of interprofessional teams. Decision making often rests on the cooperative judgments of organizational members immersed in different frameworks

Given traditional problems individuals have in developing certainty related to their roles, it is perhaps understandable that they have difficulties reintroducing uncertainty into their lives, partly from working directly in team settings with those who operate in different frames. This has been referred to as the "curse of knowledge" reflecting the difficulty people have in abandoning prior knowledge (Carlile, 2004). The bounded rationality they have developed with much prior effort. Often paradoxes result in even more intense use of existing strengths (Lewis, 2000), a failure to drop one's tools and more rigidity in organizational structures (Staw, Sandelands, & Dutton, 1981). When confronted with crisis situations, a failure to adopt appropriate, sometimes creative responses is related to an unwillingness to 'drop one's tools' in the face of external threats (Weick, 1996) or to expand one's role. They also can produce 'competency traps' where, because of initial success, teams quickly converge on limited courses of action and are unwilling to consider new approaches (Leonard, 2006; Rosenkopf & Nerkar, 2001; Taylor & Greve, 2006). Disastrous consequences often arise from situations where group ideas become accepted as truth, discouraging even the possibility of seeking discordant information. How long do we hold on to an answer we struggled so hard to attain?

But creating the illusion of certainty in one's vision is essential to leadership. Certainty is much desired, but the only certainty is that more certain we are the less likely we may be able to survive in today's world. The dark side of the quest for uncertainty reduction, is that once an answer is arrived at and a decision made, blockage from future information seeking may occur (Smithson, 1989).

Diversity

The composition of the team provides the initial starting point for all the rest of its activities. Organizational demography can have pervasive impacts. First, demographic factors may affect recruitment practices and the degree to which an organization will defer to members once recruited. Second, it may affect modes of control and the types of leadership that can be exercised. High status professions create problems for teams, in many ways paralleling issues of assigned leadership. For example, physicians are central to communication networks since they must authorize medical treatments reinforcing their status advantage. A third issue related to demography is intercohort conflict. If a supervisor is a member of a different demographic grouping, as well as in a privileged position, this might further impede the development of relational qualities such as openness in his/her relationships with subordinates. Finally, the relative homogeneity of teams and their organizational context also has implications for their exposure to new ideas and level of conflict (Joshi, 2006).

People need to be part of something, but they also needs to stand out (Peters & Waterman, 1982), balancing independence (personal identity, self-esteem) against a need for belonging and affiliation (Sheard & Kakabadse, 2004). Teams are often the place where operationally the U.S. cultural concern for diversity and inclusion must be resolved. But beyond surface diversity, teams must also confront deeper levels of diversity based on professional training and functional specialization. Functional heterogeneity is a critical issue in the operation of interprofessional teams and Communities of Practice. Another critical issue for teams is whether or not their members come from different status levels in the organization. Internal team leaders who are of considerably different status than the other members of the team can dampen the willingness of team members to engage in open communication. In short, then, the composition of the team provides the initial conditions for team success.

While diversity is directly related to creativity, it also is inversely related to the implementation of new ideas (Agrell & Gustafson, 1996). It has almost become a cliché to observe that the heterogeneity of team members contributes greatly to the creativity of team outcomes, but can cause difficulties in the internalities of group performance (e.g., communication difficulties). It decreases cohesiveness and increases the potential for conflict making implementation more difficult (Gargiulo & Benassi, 2000). All this leads also to a fundamental paradox, the more people communicate, the more they converge on a common attitude, the less creative (different) the organization is, but a common ground is critical for communication and implementation.

Collaboration

The capacity of an organization to maintain a complex, highly interdependent pattern of activity is limited in part by its capacity to handle the communication required for coordination. The greater the *efficiency of communication* within the organization, the greater the tolerance for interdependence (March & Simon, 1958, pp. 162, italics in original).

As we proceed along the different types of interdependence and associated coordination modes the costs of communication and the burdens of decision making increase (Thompson, 1967). This implies that under norms of rationality and efficiency organizations will try to minimize the need for more complicated modes of coordination and interdependence such as teams. Interestingly the balance needed between cohesion within groups associated with high levels of work interdependence and associated cooperation, and the structural holes that need to be bridged by managers through weak ties, often determine the relative adaptability of organizations to change

Interdependence is a necessary consequence of the division of labor in an organization (Victor & Blackburn, 1987). Members of teams may be in competition with each other for scarce resources such as promotions leading to the coinage coopetition which reflects that members in such situations must find a balance between competition and cooperation.

As we have seen a focus on interdependence has its roots in system theory approaches which classically placed paramount importance on interdependent relationships (Gulati, 2007). Generally it has been argued that increased needs for interdependence associated with differentiation will result in more lateral communication (Victor & Blackburn, 1987) best represented in detail operationally by network analysis since it can reveal how each individual job is embedded in a larger organizational structure (Brass, 1981). The failure to match network relationships (e.g., strong ties with reciprocal interdependence) to particular types of interdependence is likely to result in coordination failures (Gargiulo & Benassi, 2000).

Dialectics in relationships refer to the copresence of forces that are interdependent but negating. So, relationship bonding not only implies fusion and closeness, but also separation, distance and independence. Relationships are characterized by pulls as well as the need to differentiate each other (Fairhurst, 2001). Here is one area where leaders can make a critical difference; in effect, acting as a regulator of relationships much as the Security and Exchange Commission does in markets to insure a certain level of trust is maintained.

In the 1950's and 1960's there was a considerable body of work focused on the issue of how small group communication structures impacted performance and member satisfaction (Shaw, 1971), after a long fallow period, work on group networks within organizations has focused on the balance between internal and external information ties, needed to achieve optimal work performance (Katz, Lazer, Arrow, & Contractor, 2004). While traditionally communication has been recognized as the functional means by which groups accomplish goals, increasingly groups are seen as constituted by the communication their members have with each other. Communication structure, a fom of constraint, becomes an enabler. It is often the key factor in determining whether or not teams deliver consistently high performance. It effects the energy levels of team members, their engagement, and the extent to which they explore relevant sources of information (Pentland, 2013).

Resolving Tensions

In this section we will focus on approaches to managing tensions. Paradoxically, the first step to resolving them may be to accept the necessity for them: they are inevitable features of life (Cameron & Quinn, 1988). Indeed, specifying resolutions in and of itself may be paradoxical, since a focus on dilemmas involves a recognition that there really may not be any hope of resolving them. Instead of either-or thinking we need a'both-and' orientation (Fairhurst, 2001). The point may not be some grand synthesis, resolution, but mindful recognition of the tensions and contradictions that can then create possibilities for organizational transformation (Mumby, 2005) and, in some situations, where both elements can be simultaneously pursued (Cameron & Quinn, 1988).

In this section we focus on some approaches that have been made in the past to confronting the dilemmas in the categories discussed in the prior section specified by Poole and Van de Ven (1989): clarifying different levels of analysis, temporal factors, and overarching concepts.

Table 2: Resolving Tensions

Dimension			
Tensions	Levels	Temporal	Concepts
Boundaries	Ingroup, Outgroup	Ad Hoc vs. Permanent	Structural Hole Brokers; Bound- ary Spanners
Culture	Team or Organi- zation	Need Time to Develop Elabo- rated One	Charismatic; Transformational
Who is in Charge?	External, As- signed Leadership	Rotating Leader- ship; Emergent Leadership	Leaderless, Self-managing Teams; Unleaders; Humble Leader- ship
Rationality/ Cognition	Imprint of Larger Organization, Profession	Tacit Knowledge	Groupthink; Bounded Ratio- nality
Diversity	Deep, Functional: Surface, Demo- graphic	Common Ground	Melting Pot or Salad; Status Differen- tials
Collabora- tion	Network Structure	Cyclical	Density vs. Cen- trality

Levels

Poole and Van de Ven (1989) in their classic article suggest clarifying differing levels of analysis can serve to resolve paradox. Levels of analysis has been one of the most popular topics in management theory over the last couple of decades. The issue of levels is intimately associated with that of boundaries and the concept of an in-group and out-group.

Fundamental to the discussion of in-group and out-group is whether teams form a different, and in the worst case, oppositional culture to that of the larger organization in which it is embedded. Cultivating an us vs. them attitude is a classic motivational tool of leaders and is one way assigned leaders can strengthen their identity with a team. External leadership of self-managing teams is inherently paradoxical, but also suggests ways of synthesizing these dilemmas. An external leader, the manager to whom they report, is often the one who sets broad goals for a team (e.g., developing a marketing campaign; generating a new product, developing recommendations for coping with a particular organizational problem, meeting productivity targets). Research on effective external leaders suggest that they move back forth across boundaries, seek information, persuade in and out group members to support one another, and empower their teams (Druskat & Wheeler, 2003). They serve a critical linkage between the operational goals of a team and the larger goals and political environment of the organization in which they are embedded.

Often the impact of diversity is determined by the demographics of the larger organization. The functional specialization of team members is often critical to the operation of interprofessional teams in health-care settings with the status of physicians often critical to how team activities will be evaluated by the larger organization of which they are a part.

The logic or schema that team members apply to problems is often based on the imprint of the larger organization and/or their professions. Whether or not a team departs from these starting points is often based on the temporal factors we will discuss in the next section. It takes time for a unique way of approaching problems to develop.

Organizational demography can also play a critical role. So a team of young engineers charged with developing a solution to a technical problem in a hidebound conservative organization dominated by old hands may have difficulty selling their solution and reaching the implementation stage.

An inherent benefit of a network approach to collaboration is its capturing of multiple levels when a census approach is used (Johnson, 2009). Starting with the basic building block of dyadic relationships clique membership in dense relationships can be revealed. These cliques and their interconnections in turn can reveal the overall structure of an organization.

Temporal Factors

Poole and Van de Ven (1989) also recommended examining underlying temporal dynamics. The time orientation and temporal patterning of a team is often determined by outside forces. For teams one critical issue is whether they are temporary or permanent, the most basic form of temporal boundary. Ad hoc teams have difficulty developing an unique, idiosyncratic culture and an approach to problems that has its own rationality embodied in tacit knowledge. They also may truncate the natural processes needed for leadership emergence. Rotating leadership may be one way of resolving these issues. So, Davis and Eisenhardt (2011) found that in consortia, rotating leadership was ultimately more effective in producing innovation than either dominating or consensus leadership. Time is also critical in the development of shared experiences that can overcome initially heterophilous groups by developing common grounds for approaching problems. These issues can impact the commitment level of team members.

Coopetition has been suggested as the sort of overarching concept we will discuss in the next section which encompasses the basic tension between team members need to cooperate at the same time they may be pursuing relatively scarce individual rewards such as promotion. This may reflect cyclical dynamics within a group with cooperation high at certain points, such as the presence of an external threat or deadline, followed by periods of internal competition.

Overarching Concepts

Yet another approach to resolving dilemmas is to coin new terms (Poole & Van de Ven, 1989), such as structural hole brokers, which may include both underlying dimensions of the paradox; with structural holes often representing underlying differentiation processes, while brokers represent one approach to integration, spanning different teams (Burt, 1992; Johnson, 2004). Boundary spanning is often a critical function of leaders and part of the assigned role of appointed leaders.

Developing a culture and/or changing one have been associated with different types of leadership with terms like transformational and charismatic intimately involved with the development of particular cultures. Vision and culture often go hand-in-hand and communicating a clear vision is often seen as a major function of leadership. A focus on the functions served by leadership allows for a broader vision of so called 'leaderless' self-managing teams were many individuals can step to the fore to act in a distributed leadership fashion across the many functions successful teams need to focus on. Self-managing teams pose a number of puzzling paradoxes: "How does one lead those that are supposed to lead themselves? (Manz & Sims, 1984, pp. 409) and the 'unleader' – 'one who leads others to lead themselves' (Manz & Sims, 1984, pp. 411)

Somewhat similarly, the concept of humble leadership has been advanced for someone who dominates through humility focusing on accomplishment rather than personal recognition. These leaders are self-confident enough to do good, but their efforts are never truly recognized nor should they be.

The term groupthink has come to symbolize the very human, group processes (e.g., cohesiveness, conformity) that conspire against 'good', rational decision making. Groupthink refers to the deterioration in mental efficiency, reality testing, and moral judgment that result from group pressures (Janis, 1971). It is associated with high group cohesiveness, insulation of the group, powerful leaders who use sanctions, and lack of decision-making norms.

Bounded rationality reflects the development of a common ground for understanding within which groups can make decisions reflecting their own internal logic (March, 1994). Traditionally, dating back to small group communication network studies (Shaw, 1971), leadership has been associated with centrality in communication networks. While centralization describes the degree to which we are focused on particular nodes, density, on the other hand, has been proposed as an operationalization of shared leadership (Carson, Tesluk, & Marrone, 2007) and is commonly used as a measure of the internal network structure of teams (Henttonen, 2010). Density has been positively related to team performance and member satisfaction (Henttonen, 2010). It has also been described as the sort of bonding of a ... "trusted community where interactions are familiar and efficient" (Hoppe & Reinelt, 2010, pp. 601). So, on the one hand a highly centralized group, which implies low density, implies a strong leader, but also suggests a poorly functioning team.

Conclusion

One way of resolving tensions between leadership and teamwork is to approach conceptions of leadership in a different way. Emergent leadership, which is particularly important for self-managing teams, can be a result of many factors. Emergent leaders may be very capable of influencing, persuading other people to perform a certain tasks. They could have superior emotional intelligence and resulting social skills. They could be recognized for their superior performance. In Cattell's (1948) classic formulation regarding syntality, they could also best represent the group mind, personality, or the culture of a particular group. A critical factor relating to emergent leadership is that it stems, or flows, from the consent of team members. For our purposes perhaps a better approach to a definition of leadership is to reveal the more contemporary emphasis on coaching and advice. So a leader is a person who is able to mobilize team efforts on behalf of the accomplishment of mutual goals. There is also a recognition that a team can have multiple goals and different individuals may come to the fore as representing the people most likely to aid the group in their accomplishment. It has been suggested then that our focus should be on the process, functions of leadership rather than individual leaders (Morgerson, DeRue, & Karam, 2010).

One can mindfully accept paradox and use it constructively (Poole & Van de Ven, 1989). Indeed, our incomplete understanding can lead us to suggest resolutions that actually may be more troublesome than acceptance of the necessity of some dilemmas, which in turn leads us to a recognition that some tensions are inherently paradoxical. Increasingly dealing with dilemmas and paradoxes and their resulting tensions is a central concern of management (Luscher & Lewis, 2008) and the most effective leaders often exhibit paradoxical styles (Cameron & Quinn, 1988). It has been argued that 'masters of management' are those who can transcend their immediate work environment, viewing many different perspectives or sides of a dilemma simultaneously, developing seemingly paradoxical approaches to problems (Westenholz, 1993). Perhaps the worst thing a manager can do is let one side of the dilemma dominate (McLaren, 1982). Excellent companies have one striking feature - their ability to manage ambiguity and paradox (Peters & Waterman, 1982).

So, for example, while managers may design an organization to maximize one key concern (e.g., customers, products, functional specialties), they must through their own actions try to ameliorate the effects of their designs on other key organizational values. It has become commonplace to suggest that since organizations have multiple, often conflicting goals, that awareness of them is salutary for organizational learning and performance (Rice, 2008). As in design, managers need to be conscious of implications of choices; if the system supports one value, management can act to offset its harmful effect on another. So long term sustainability requires attention to multiple, competing demands (Smith & Lewis, 2011).

Being forced to choose between unpleasant, disagreeable, unfavorable dilemmas is often very difficult, but the important thing is that we be conscious of them so that we are clear as to their costs and benefits, since there are often unintended consequences or tradeoffs in choosing one over the other. Sometimes, as in Eastern religion's concepts of yin/yang, it is perhaps better to accept the presence of a two-sided coin and relish the interplay between them (Gupta, Smith, & Shalley, 2006), rather than maximize one at the expense of the other. Do Asian cultures, who have an appreciation of duality and for collectivistic approaches have a clear strategic advantage when it comes to managing paradox? Confucianism and Daoism teach leaders to be self-deprecating and to lead without appearing to lead (Ou et al., 2014).

Often our larger, normative cultural understanding prevents us from comprehending the true balance needed and the costs and benefits of potential resolutions. The psychological focus of leadership studies in the US, which is deeply embedded in our culture, has led to a neglect of macro-issues (Fairhurst, 2001). Understanding these tensions provides another way of moving away from transformational charismatic views of leadership and a more critical view that of power and agency, compliance and conformity, resistance and dissent (Collinson & Tourish, 2015).

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Academic Spin-off as Triple Helix Element: Case-Study of Russian Regions

Konstantin Grasmik

Abstract: The innovation process is becoming more open. According to the concept of the Triple Helix, this requires the creation of institutions capable of mediating the interaction of agents, primarily related to the different elements of the innovation system. The academic spin-off is not only a form of technology transfer, set up at the university but also the institution that provides the interaction of scientists and entrepreneurs. This article gives an analysis of the implementation of the program of creating academic spin-offs in Russia. The main focus of the study is to analyze the affiliation of university spin-off with other companies, including personal links of founders. Research reveals that linkages are substantially personal: University staff member at the same time could be an entrepreneur. This finding allows not only clarifying the concept of the Triple Helix but also increasing the effectiveness of innovation policy, focusing on employees who can combine science and entrepreneurship.

Keywords: academic spin-off; innovation; networks; knowledge; region; Triple Helix; regional innovation system; Russia.

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Introduction

Academic spin-off became much more important form of technology transfer than a few decades ago. So the quantity of scientific papers devoted to its development continues to rise sharply. But in the first place study of university spin-offs is primarily aimed at the analysis of the factors stimulating their creation (Di Gregorio and Shane, 2003; Landry et al., 2006; Baldini, 2010). Evaluation of their impact on the economic development of the country is mixed. Vincett P.S. (2010) on the example of Canada shows that some spin-offs steadily grow for decades. Expenditures of the state budget allocated for their support are less than subsequent tax revenue. However, in Italy and Japan, the majority of the spin-off is created by young employees and engaged in the provision of consultancy services, rather than the commercialization of technology. These enterprises have low capital stock, volume of sales and number of employees (Etzkowitz et al., 2008; Ramaciotti and Rizzo, 2015). The main function of the spin-off is to ensure technology transfer to the market. With rare exception, they do not have enough resources to compete with incumbents, so cooperation with a larger company is of great importance for them. Some studies describe the positive effect of interaction with existing companies on the development of academic spin-offs (Shane, 2001; Shane and Stuart, 2002). Nevertheless, there is a lack of empirical publications (especially on developing countries) that address the problem of job combination by university researchers: simultaneous work in education, research, and business.

It follows from Triple Helix concept that institutions mediate interaction of subsystems of the innovation system, on the one hand, and ensure communication with the agents that are outside the community, on the other. In our opinion, an academic spin-off is one of such institutions, not just the form of technology transfer. On the one hand, such a company receives support from alma mater, being, in essence, an extension of university laboratories (Etzkowitz, 2003). On the other hand, the key task of the company is the realization of an innovative project that requires developing the technology of product manufacturing, attracting investors, conducting market research, etc. Consequently, the University becomes a part of the business environment, and employees of the university who created this company act as an agent, a link between educational, scientific and entrepreneurial sectors. As the experience of Silicon Valley confirms, in future such personnel increase its importance as a bridge by becoming venture capitalists (Bresnahan et al., 2001; Adams, 2005). Thus, the concept of Triple Helix should be somewhat supplemented: not only institutions but also individuals act as a link between the elements of the innovation system. And the worse the development of supportive organizations, the higher the role of individual agents' networking. Accordingly, the purpose of this article is to analyze the development of the academic spin-off as Triple Helix Institute on the example of Russian university spin-offs. The evaluation of the actual number of spin-offs is carried out because universities could create spin-offs for accountability purpose under the administrative pressure. The emphasis of the research is on spin-off viability by identifying their relationships with entrepreneurial organizations and differences between universities of the same region.

The paper is organized as follows. Sections two and three deal with the theoretical basis of the study. Part four analyzes the legislation governing the creation of academic spin-offs, as well as the results of the implementation in this state program. Section five discloses a technique of identifying and evaluating the links between spin-offs and other companies. The next part contains the comparative analysis of characteristics of knowledge generation and exploitation subsystems of regional innovation systems. Section seven describes the results of analysis of the spin-off sectors in four regions of Russia. At the end of the paper, findings are discussed.



Triple Helix as a tool of economic development

The concept of Triple Helix is a networking mechanism for the development and implementation of innovation policy within the Triangle University-Business-State. The participants of the innovation process carry out constant coordination, develop the vision of the prospects for the development of industries and technologies. Triple Helix institutes are aimed not only at promoting the development and implementation of innovative projects but also at the creation of communities, networking among economic agents.

The emergence of the Triple Helix is the response to the increase in the scale and pace of technological change and the resulting uncertainty of economic development. The innovation process is becoming more open and nonlinear (Chesbrough, 2011). The company could collaborate with other organizations in R&D; be engaged in technology exchange; acquire knowledge and ideas from the outside; create a market for its products by providing open access to some patents, etc. The determining factor of success becomes championship in entering the market with a new product and the exploitation of innovation under the framework of a better business model, which requires close agents interaction.

The scope of cooperation and its effectiveness depends on many factors. The important role belongs to geographical proximity of potential participants (Boschma and Ter Wal, 2007). Aside from the substantial reduction of material costs territorial proximity makes it easier to transfer implicit knowledge (Singh, 2005), stimulates the growth of trust due to the increased frequency of interaction and effect of reputation. However, geographical proximity is neither a necessary nor a sufficient condition for the generation and sharing of knowledge (Giuliani and Bell, 2005). Also organizational proximity of agents (work in the same company, the cross-membership in the board of directors, etc.) stimulates the establishment and maintenance of contacts. The next significant factor of cooperation is the social proximity of the participants (Breschi and Lissoni, 2009). Cognitive proximity implies similarity of agents' competencies, which allows them better understand each other (Nooteboom, 1999). It is appropriate to give the following practical example: venture investors often lack the knowledge to understand the meaning and evaluate the perspectives of inventions. Inventors do not have enough market competencies to properly develop business plan (Wright et al., 2007).

Overcoming the lack of proximity is carried out both through the creation of institutions that promote cooperation of economic agents and by the universalization of their activities. For example, in higher education transition of universities to the entrepreneurial university model takes place in many countries. It differs from a research university by integration of entrepreneurship in organizational purposes. In other words, the development of training courses, conducting R&D and publication of its results in top-ranked journals are not an absolute priority for the entrepreneurial organization (Perkmann et al., 2013). The university creates institutions that govern the process

of commercialization of innovation (technology transfer offices), stimulate the creation of new businesses (business incubators) and cooperation with existing companies (science parks). The entrepreneurial organization offers seed funding for student projects, university rules on intellectual property do not prevent the commercialization of scientific research results (Moray and Clarysse, 2005). In the process of creating and managing academic spin-off university staff build up a network of contacts in the business community. Thus, not only the formal institutions but also the experienced staff could act as the channel of the university integration into the business environment.

Entrepreneurial experience and its role in spin-off development

The steady growth of a university spin-off depends on the company's founders, their knowledge, perseverance. Setting up a firm requires a combination of behaviorist models of scientist, engineer, and entrepreneur. The aim of the scientist is to show the new effect, the engineer must develop production technology, the entrepreneur must ensure the availability of necessary resources to develop the effective business model, and organize the process of its implementation. Accordingly, the inventor should possess entrepreneurial characteristics: the presence of organizational skills, leadership skills, willingness to take risks, learning ability, negotiation skills, etc. Gottschalk et al. (2010) confirmed that if founders of spin-off have entrepreneurial or managerial experience, the size of the university spin-off is usually bigger. The coincidence of areas of activity is not a significant factor. Learning curve of entrepreneur affects the probability of conducting research, patenting, innovation exploitation (Cefis, 2003). The experience gained provides insight into consumer needs, technological features of production, characteristics of the labor market, the channels of obtaining financial resources, etc., thus allows focusing of research in commercially attractive areas (Fritsch and Krabel, 2012).

Attraction of investors requires dense and extensive contacts in financial and industrial communities. Some empirical studies (Walter et al., 2006; Miller et al., 2016) show that the ability of researchers to establish strategical relations with industry and end-users increases the chances of successful implementation of the innovative project. The dense network of contacts allows easier estimating of the market potential, developing a strategy for the protection of intellectual property rights, prototyping. An external company could possess a share in the capital of the academic spin-off. As a result, the university spin-off could get from the affiliate company not only knowledge and technology but also material and financial resources (Klepper and Sleeper, 2005). The study by Aggarwal et al. (2004) demonstrated that the acquisition of knowledge through interaction with an industrial partner is more efficient than by hiring of specialists. However, the study by Balderi and Piccaluga (2010) showed that there was an impact of link with another company on the growth rate of spin-off employment, but not on the volume of assets or revenues. A possible explanation could be as follows: academic spin-off just performs the function of the developer of the innovative project for the portfolio of a large company.

Institutional conditions and academic spin-off sector development in Russia

In 1996, federal regulations prohibited universities and research institutes to carry out activities not mentioned in the founding documents. Without the consent of the founder (as a rule, the Ministry of Education) University could not transfer the property, including IP, in the capital of the spin-off. Accordingly, the emerging process of cooperation with business slowed down significantly. The process of technology transfer became informal. Because of the low average wage in higher education sector scientists and engineers were forced to do business on their own, but more often interacting with entrepreneurs. As a result, employees of universities used state property to work for affiliated companies. In the context of the unfriendly business environment, the regulative pressure, the high cost of resources, the lack of development of innovation infrastructure in the majority of universities cooperation with other company remains a determining factor for the spin-off development. One of the key reasons for the high importance of the network of contacts with other companies is the lack of state support for spin-offs. The amount of capital required to implement high-tech projects is many times higher than state subsidies. And program to support medium high-tech enterprises is missing.

Practice confirmed that even in such circumstances, university - business cooperation could lead to the creation of medium-sized companies competitive on the global market. The crisis of 2009 provoked a change of policy about the academic spin-off. Right to transfer IP in the capital of the company without the consent of the founder, and, respectively, to create a spin-off Russian universities and research organizations received after the adoption of the Federal Law №217¹. However, a sharp rise in the number of academic spin-offs did not occur in the first year. The reasons were the discrepancy of the Federal Law №217 to provisions of other legal acts and the absence of sub legislative acts, which would enable academic spin-off to use state benefits. For example, universities did not have right to dispose of its share of spin-off revenues; spin-off could not participate in tenders; spin-off could not get premises and equipment without public procurement procedure, etc.

After resolving of the legal issues there was the sharp increase in the number of academic spin-offs in the second half of 2010. However, for the next years, there is the downward trend in the spin-off creation for the following reasons. At first, before the adoption of the Federal Law, universities could not dispose of income from intellectual property licensing. According to the norms of fiscal legislation, higher education organization had to transfer entire revenue from licensing to the federal budget. Thus, the incentives for registration and maintenance of patents, to the creation of innovative infrastructure, establishment and maintenance of contacts with companies, didn't exist. Employees registered patents for themselves and created firms to commercialize them. Strictly speaking, some of the academic spin-off represents the formalization of relations between universities and companies of their employees. Secondly, the stock of competitive intellectual property is exhausted. The new spin-offs require R&D and registration of patents, which is quite a long process. Thirdly, the university could

not invest a patent or exclusive license in spin-off capital. But the creation of spin-off based on the know-how requires a relationship of trust between the university, inventors, and entrepreneurs. Lastly, the Law $N^{0}217$ requires that the university share in spin-off capital is always at least 34% (for the joint-stock company - 25%). It does not allow the higher education organization to attract venture capital investments by reducing its stake, therefore, reduces the incentive for inventors to create spin-off too.

The dense social networks, the availability of entrepreneurial experience significantly affects the development of academic spin-off. Shane S. (2001) showed that the higher the number of business projects implemented by the university researcher, the higher the probability of commercialization of the following patents: 2-3 times compared with the inventors who have no business experience. It is noteworthy that the patent specifications: radicalism, patent scope and scale of the potential use - increases the likelihood of the commercialization of only 3-16%. In Russia, more than 2,900 academic spin-offs were created. An investor has a share in the capital of about 25% of spin-offs. However, the conclusion about the potential results of such cooperation is difficult to do because spin-off could be affiliated with other companies through personal links of inventors or director as they could be founders in other firms.

Methodological framework

Objective assessment of the interaction between universities and companies requires an analysis of the largest possible kinds of linkages, as well as taking into account the institutional features of SME. Interorganisational linkages could be formal or informal. An example of a formal cooperation agreement is R&D contract. However, contracts with spinoff are to a great extent informal in nature since compliance with all formalities (e.g. registration of the tender documents) entails significant transaction costs. Such contracts could be implemented between, say, relatives, former colleagues, etc. They could be difficult in detectability because of the desire to save trade secrets, so the focus of the research is on detectable relations. When institutions are imperfect, transaction costs to protect contractual rights are high, patent commercialization significantly depends on the efforts of management team, participation of key personnel in the company's capital is valuable incentive. Therefore, the object of analysis is the ownership structure of academic spin-off and their affiliated companies. Property rights in Russia are highly personified. It means that the connection between formally independent firms could nevertheless exist through the same founders. It is necessary to separate the cases when the person controls the company or just can participate in management. As well it is important to take into account the total turnover of all the affiliated companies. The source of information about companies is FIRA-PRO database. Accordingly, the algorithm of the research is as follows:

1. To collect the following information on spin-offs: value and structure of capital, industry affiliation of external investors, their turnover (if present), the presence of entrepreneurship experience until 2009 for founders, personal links of spin-off's owners with other companies. 2. To carry out the search for information on the Internet for each spin-off and its affiliated companies to get a better idea on the scope and scale of its activities.

3. Since the proper quantification of the intensity of contacts has methodological difficulties the next step is to distinguish several types of networking:

• WC (weak connection) —connection exists; however, financial information is absent, or the total annual turnover of affiliated companies is less than ten million RUB or there is no information about affiliated companies on the Internet. The last means that information about the firm with sizable turnover usually is presented mass media.

• MC (medium intensive connection)—the total annual turnover is more than ten million RUB, but the spin-off's founders play a subordinate role in this external company (or they are just affiliated with founders of large firms on other projects).

• PC (powerful connection) —if the owners of an academic spinoff at the same time play a dominant role in the management of companies with a total turnover more than ten million RUB.

To distinguish the weak link from other types threshold value of 10 mln. RUB. (approximately \$ 0.15 mln.) is used. Of course, the minimum level of turnover sufficient to co-finance innovative project is individual and depends on many factors. For example there are sectoral affiliation of the innovation project, amount of investment required, project implementation period, availability of state support, presence of co-investors, guaranteed orders, accumulated wealth of entrepreneurs, real rate of return, etc. As it follows from publications

in Russian business press, dedicated to the description of the practice of the implementation of innovative projects, many projects (especially IT) require much less than ten mln. RUB as the initial investment. Also if the project of an academic spin-off requires a significant investment, the prominence of investor clearly indicates on it.

General characteristics of regions

Despite the fact that according to the Constitution Russia is a federal state, in reality, it is closer to unitary one. Several reasons explaining it are the concentration of tax revenues in the federal budget, the lack of development of tax base in many regions and, as a result, dependence on federal transfers, the exaggerated role of the capital city (Moscow) in the scientific, business, cultural, sports, social and all other spheres. The result of this uneven development is that academic spin-offs are absent in fifteen regions, in twenty four there are less than ten firms. As a rule, these territories have depressed economies, a small number of researchers (less than 300) and in fact absence of regional innovation system.

Regional innovation system consists of two subsystems: the generation and dissemination of knowledge and exploitation of knowledge (Autio, 1998). But as noted by Etzcowitz (2008) the effectiveness of the functioning of the system is increased by the presence of institutions that mediate the interaction of the subjects of the two subsystems. Cooke et al. (1997) argue that the system of norms, rules, and values, organizational structures is formed evolutionary, and its main function is to increase the degree of confidence. For the analysis four regions of Russia were chosen, which are characterized by the presence of a stable and diversified economy and developed knowledge generation sector, namely, St. Petersburg, Krasnodar, Novosibirsk region and Belgorod region (See some indicators in Table 1).

Indicator	St. Pete	ersburg	Novosibii	rsk region	Belgoro	d region	Krasnod	ar region	Rus	ssia
	2010	2014	2010	2014	2010	2014	2010	2014	2010	2014
GRP, trl. RUB, in prices of 2010	1.70	1.91	0.48	0.64	0.40	0.45	1.03	1.29	37.7	42.2
GRP per capita, mln. RUB, in prices of 2010	0.35	0.37	0.18	0.23	0.26	0.29	0.2	0.24	0.26	0.29
Population, mln. pers.*	4.86	5.08	2.66	2.72	1.53	1.54	5.22	5.37	142.8	143.5
Unemployment, %	2.6	1.4	7.7	5.1	5.2	4	6.7	5.7	7.3	5.2
Share of mining, quarrying, and oil and gas extraction in GRP, %	0	0.4	2.5	1.8	16.8	12.4	0.8	0.6	10.4	10.6
Share of manufacturing in GRP, %	23.8	19.9	16.4	12.4	19.4	17.3	10.0	12.4	17.7	17.4
Share of investment in fixed assets in GRP, %	23.6	19.0	23.8	22.4	24.2	22.7	57.3	59.0	24.3	23.7

Table 1 - Descriptive statistics of regions

* - data was taken on 2010 and 2013.

Source: Statistical Agency of Russia

Regions are situated in different parts of Russia: St. Petersburg – in the north west (on the border with Finland), Belgorod region - in central Russia, Novosibirsk – in Siberia, finally, Krasnodar region – in the south. All territories are large, self-sufficient and industrialized. Even in agriculture-oriented Belgorod and Krasnodar share of manufac-

turing in the gross regional product is quite high. The mining sector is almost always absent, except Belgorod region. In all regions, the growth rate of GRP per capita exceeds the level in Russia as a whole. The rate of population growth which is higher than in Russia as a whole, also confirms its economic and social competitiveness.

See knowledge-generation subsystem indicators in Table 2.

Indicator	St. Pete	ersburg	Novosibiı	rsk region	Belgoro	d region	Krasnod	ar region	Rus	ssia
	2010	2014	2010	2014	2010	2014	2010	2014	2010	2014
Share of R&D expenditures in GRP, %	3.48	3.85	2.53	2.16	0.22	0.29	0.32	0.31	1.39	1.44
Number of researchers with scientific degree, thousand persons	11.29	11.15	5.14	5.29	0.31	0.39	1.04	1.71	105.1	109.6
The average age of researchers	48.5	47.0	47.9	48	44.5	43	46.6	44	47.4	46.0
Share of nongovernmental funds in R&D expenditures, %	31.5	37.1	23.9	24.8	46.8	64	37.2	48.5	31.2	32.9
Number of patent applications (inventions and utility models), thousand units	2.58	2.96	0.79	0.82	0.22	0.31	0.4	0.74	40.56	37.07
Number of patent applications for inventions per 10 000 persons of population*	3.41	3.16	1.99	1.93	0.76	1.29	0.96	0.90	2.00	1.65

Table 2 - Knowledge-generation subsystem indicators

* - data for 2012 and 2014.

Source: Statistical Agency of Russia

A high proportion of R&D expenditures in GRP in St. Petersburg and Novosibirsk is due to the role of these regions as leading research centers in Russia. However, much of the work performed is fundamental. The share of non-governmental funding is lower than in the other two regions. In all territories except the Novosibirsk region this proportion increased significantly, indicating the growth of interaction between local research institutions and companies. The number of patent applications per researcher is several times higher in Belgorod region and Krasnodar region in comparison with other two territories. As the share of the research sector in Belgorod region and Krasnodar Territory is much less, the number of patents on the invention per 10 000 inhabitants is below than in Russia as a whole. Higher migration influences this indicator, but in St. Petersburg in 2014 number of patent applications for inventions was by only 41 more than in 2010. The explosive growth in the number of researchers with scientific degrees in Krasnodar and the stagnation of this indicator in St. Petersburg suggest that scientific activity begins to shift in the more southern regions followed by internal migration. It should be noted the backlog of Novosibirsk region. By all accounts, including the average age of researchers, the region loses. If current trend maintains, the territories will swap in the nearest future. Indicators of innovation activity of regional economies, reflecting the use of knowledge, are presented in Table 3.

Indicator	St. Pet	ersburg	Novosib	irsk region	Belgore	od region	Krasnoc	lar region	Rı	issia
	2010	2014	2010	2014	2010	2014	2010	2014	2010	2014
Share of high-tech industries in GRP, %*	29,6	31,7	25,4	23,5	9,2	10,4	12,8	14,0	19,1	19,3
Innovation performance of organizations, %	13.0	18.9	5.5	9.7	10.9	11.5	6.2	6.2	9.5	9.9
Share of innovation expenditures in volume of shipped products, %	1.23	2.93	1.78	1.76	0.94	0.86	0.46	0.89	1.56	3.00
Share of innovation products in volume of shipped products, %	8	12	5.1	10	2.6	4.4	1.2	1.4	4.8	8.7
Share of small enterprises, executing technological innovations, %**	7.04	9.07	6.07	8.01	1.08	6.43	2.38	0.67	4.08	4.75
Labor productivity index, 2010=100***		110.24		108.60		119.73		113.21		110.33

|--|

* - data was taken for 2011 and 2014.

** - data was taken for 2009 and 2013.

*** - data taken: 2011-2013.

Source: Statistical Agency of Russia

In the regions with a strong research sector (St. Petersburg and Novosibirsk) the share of high-tech industries in GRP is higher too. However, this is due to the establishment of defense enterprises in the Soviet era. While in St. Petersburg there is substantial progress: increasing the relative share of innovation expenditures, the share of high-tech industries in GRP, in Novosibirsk region indicators do not grow or are on the national average. The level of innovation activity in Novosibirsk is lower, as indicated by a lower rate of productivity growth over 2010-13, compared with other territories.

So given set of parameters leads to the next conclusions. St. Petersburg is a region with a large-scale research sector. Regional high-tech companies are on the growth trajectory and receptive to innovation. In Novosibirsk economic growth is accompanied by a decrease of the role of high-tech industries; innovative activity corresponds to average figure; patent activity is very low. Belgorod region is a potential region-leader in the development of high-tech industries. The scale is small, but almost all indicators discussed change (some significantly) in a favorable direction. Particularly impressive is the growth of labor productivity. For Krasnodar region the driving force was the large volume of public investment in the process of preparation for the Olympic Games 2014. Of course, it stimulated the dynamics of economic indicators. Sector of knowledge generation in the region is developing rapidly, but technology use in the economy has an episodic character. The indicators reflecting it are the low share of innovative products in the volume of goods shipped, the low level of innovation activity, weak involvement of small enterprises in the exploitation of knowledge, etc. The affiliation of academic spin-off with business is less in Novosibirsk and Krasnodar region compared to other territories.

The results of the study

a. Krasnodar: results below expectations

There are nine universities and eighteen research institutions, located in different parts of the region. Perhaps their specialization in the disciplines related to agriculture stipulates lagging behind, because there are only 29 academic spin-offs in Krasnodar. But five companies are not technology-intensive, concerning OKVED (Russian analog of NAICS). The authorized capital of the regional academic spin-off, as a rule, is more than the minimum size; however, large firms are absent. The size of the authorized capital depends on the university. Also different is its policy about the share in the spin-off capital. Typically, universities prefer to control (51% and above), except for the Agricultural University and partially Kuban State University. University policy has the impact on the relationship of academic spin-offs with the business community (see Table 4).

 Table 4 - Distribution of Krasnodar spin-off on the types of relationships with business

Name of university	Powerful	Medium	Weak	Absent
Kuban State Agricultural University	1	1	3	2
Kuban State Technical University	0	1	4	2
Kuban State University	1	1	3	3
Sochi State University	0	0	0	2

More than half of the academic spin-offs is in close relations with other companies. However, only in five cases, it is a strong or medium link. In three of the five cases, a person affiliated with the company at the same time works at the university on a regular basis. In other words, the relationship between the components of the double helix (university-business) is of personal nature. Three academic spin-offs have strategic investors (pharmaceuticals, engineering, fodder production). In other cases, there are trade companies, which could help to the development of spin-off but mainly financially.

The low quantity of the academic spin-off in Krasnodar region is due to two main reasons. At first, it is the dominance of the agricultural sector in the regional economy. As a result, about half of the spinoff's innovations focuses on this industry. Secondly, it is the lack of development of innovation infrastructure in the province. For example, both business incubators were created recently: in 2009 and 2011 respectively; Technopark was registered only in 2006. Analysis of the regional legislation confirmed the absence of institutions that promote the development of high-tech firms.

b. Belgorod: territory of growth

In this region academic spin-offs were created by only two local universities: Belgorod State University of Technology (BSTU) and Belgorod State University (BSU). Most BSTU projects focuses on the construction sector, primarily production of building materials. Another part of the projects concentrates on energy saving. The main areas of BSU spin-off activity are medicine, energy, and telecommunications. It is important to note that almost all spin-off projects coincide with the content of intellectual property, the university invested in capital. So, the share of "false" firms is extremely low.

The creation of academic spin-offs in BSTU presumes preserving control. As a rule, the university share is 51%, at least - 50%. BSU has no control over its spin-offs. Authorized capital of all BSTU spin-offs is close to or equal to the minimum, while in Belgorod State University it is above the minimum of 6-12 times. It indicates on the higher evaluation of BSU's assets, transferred to the capital. The differences are significant in spin-off networking too (see Table 5).

 Table 5 - Distribution of Belgorod spin-off on the types of relationships with business

		_		
Name of university	Powerful	Medium	Weak	Absent
Belgorod State Technical University	1	3	13	35
Belgorod State University	9	4	5	6

Only 17 BSTU spin-offs have close networking relations with other firms. In three cases innovative projects were started long before spinoff creation. Therefore, the spin-off is just a legal shell, a means of enhancing growth through participation in federal grants. Six BSU spinoffs have a strategic investor, which is a medium or a big company in the same area of activity. Three spin-offs are under control of the big holding companies, which supply products for ministries and stateowned companies. In five cases of strong and medium networking cofounder combines employment at the university and entrepreneurship.

The higher efficiency of BSU is caused not only by the cutting-edge scientific research or special status of research university status. Uni-

versity is very active in cooperation with local companies, federal and regional authorities to obtain co-financing for the implementation of innovative projects, the creation of innovative infrastructure objects. As a result, investments in BSU over the past decade amounted to over 5.5 billion RUB. University made seed investments in three spinoffs and also in attraction research teams in nanotechnology center.

c. Novosibirsk: science or business?

In Novosibirsk region, the role of state research organizations in the creation and commercialization of research results is higher than anywhere. There are four academic spin-offs in which research institutions are founders. But only Novosibirsk State University (NSU), situated closely to a lot of scientific organizations is inclined to cooperate. As in Belgorod spin-off, networking types vary considerably depending on the institution (see Table 6).

 Table 6 - Distribution of Novosibirsk spin-off on the types of relationships with business

Name of university	Powerful	Medium	Weak	Absent
Novosibirsk State Architectural and Constructional University (NSACU)	1	1	0	1
Novosibirsk State Agricultural University (NSAU)	1	2	0	1
Novosibirsk State Technical University (NSTU)	2	1	6	15
Novosibirsk State University (NSU)	3	2	3	1
Others	1	0	2	1

The interrelation between university share in the capital and its size is confirmed again. For example, in NSTU and NSACU half of spinoffs are controlled by the University. NSU adheres to the sufficiency of "blocking stake" policy - only in the case of one spin-off share is equal to 50%. As a result, the size of NSU spin-off capital exceeds the minimum. In two cases, it is more than 1 million RUB.

Perhaps control of the university is due to the fear that in other case the spin-off founders will independently manage grants and other investments on the realization of R&D projects. As a result, many of the projects on creation of spin-off are developed economically poorly. Universities make little effort regarding attraction financial resources for the development of companies.

Twenty-five spin-offs are in networking relations with other firms. In six cases another company is spin-off's founder. However, this is always a local company. Often spin-off director (cofounder) performs a similar role in the company-cofounder. It means that often employees of universities create academic spin-offs. And the revenue of these companies is rather small. In Belgorod region initiative to create an academic spin-off proceeds from the business, so there are a lot of affiliated medium and even big firms. In Novosibirsk region initiators are higher education organizations through their most active employees. In Novosibirsk region founders of nine out of fourteen spin-offs with powerful and medium types of networking simultaneously work in the university, in Belgorod region these indicators are seven and seventeen, respectively. The development of spin-off in Novosibirsk has a closed, local oriented nature, largely due to the almost complete lack of regional and municipal support. The analysis of the recipients of subsidies to small businesses showed that university companies are absent among them. Among the residents of the Technopark and business incubator only one spin-off and four firms affiliated with them.

d. Saint-Petersburg: great potential, but episodic success

In St. Petersburg universities 137 spin-offs were created. This result is insufficient compared to Belgorod region, given that the number of people employed by the higher education organizations of St. Petersburg, as well as the number of universities itself, is higher nine times. Four organizations created seventy spin-offs. The each other university didn't create more than ten companies. See the distribution of spin-offs on networking types in Table 7.

 Table 7 - Distribution of St. Petersburg spin-off on the types

 of relationships with business

Name of university	Powerful	Medium	Weak	Absent
Saint-Petersburg	7	5	9	10
State University of				
IT, Mechanics and				
Optics (SSUIMO)				
Saint-Petersburg	3	5	4	2
State Electrotechnical				
University (SSEU)				
Saint-Petersburg	7	1	4	1
State Polytechnic				
University (SSPU)				
Saint-Petersburg	0	2	1	8
State Forestry				
University (SSFU)				
Others	17	15	19	17

Interestingly, the distribution of the spin-off on types of networking is the same in a group of leading universities and others; the proportion of spin-off without connections is less than a third in both groups. Therefore, innovation policy in the region doesn't aim at increasing of spin-off quantity just for reporting, or to receive benefits in the future. In many universities spin-offs are absent. Spin-off market potential and the likelihood of the commercialization of the product considerably depend on the scale of the business, affiliated with an academic enterprise. In cases where data were available revenue of affiliated companies are summarized. In twelve cases they exceed one bn. Rub. (15 mln. USD), which is a feature of St. Petersburg as a "northern Russian capital."

More than in half cases (35 of 62 firms) inter-company cooperation is built with the mediation of one of the co-founders, who is at the same time a teacher (employee) of the University. Plus in ten cases this person is a former employee or graduate student. In some cases, the cumulative revenue of such affiliated companies exceeds 100 million RUB. An employee of the university, as a rule, is the junior partner: his (her) share in the authorized capital rarely exceeds 25%. The dominant owner is often a local entrepreneur with business interests in several areas. For example, one of the spin-offs is linked personally with the subsidiary of JSC "LANIT." This company is the largest Russian system integrator and partner of more than two hundred major world manufacturers of equipment and software. Suffice it to say that the total number of employees is 5,400 people, and its turnover in 2012 exceeded 73 billion RUB².

As in other regions, the leaders in networking are the universities, which possess objects of innovation infrastructure (technoparks, business incubators, TTO) and have a special status (for example, research university), which provides additional financial resources. But the importance of status should not be overestimated: SSPU is not a research university, but almost all the spin-offs closely cooperate with business. These higher education organizations develop the entrepreneurial competence for a long time. For example, SSEU Technopark was established in 2000; first employee's companies appeared in the 1990th and were placed (informally) in the university premises.

Conclusions

The aim of this article was to characterize the academic spin-off as the institution of the Triple Helix. By creating spin-offs, the university becomes able to obtain the competence for commercialization its patents, to establish useful contacts, to understand the rules of business. The latter is especially important, because as shown by Shane (2001) if inventors possess entrepreneurial experience, it significantly increases the probability of creating a spin-off in the future. In turn, the external company gains access to new knowledge, talented graduates, etc. Under the conditions of underdeveloped state innovation institutions, such networking becomes personified: employee, graduate student (current or former) at the same time performs the role of entrepreneur.

The spin-off from four regions of Russia with a stable, diversified economy is the research sample. The results reveal that the presence of a developed research sector does not guarantee the active involvement of the local universities in the commercialization of knowledge, as well as the affiliation of academic spin-off with business. On the contrary, it may even interfere. Scientists may prefer a relatively independent existence, as the creation of a successful company requires a tremendous amount of time and effort. If there is the possibility of large-scale research at public expense, the grant requires the preparation of articles in peer-reviewed journals. The combination of activities is possible but requires the very efficient team.

If the spin-off is networked with other company, in more than half of the cases the relationship between the university and the business world is personified: the entrepreneur at the same time is an employee of the University (teacher, dean, provost, etc.) or has work experience (graduate student) at the University. Triple Helix concept focuses mainly on institutions as formal structures designed to reduce friction between the sectors. Meanwhile, the prevalence of personification indicates on the dominant role of informal relationships in the Triple Helix system. And only over time, they could be replaced by formal institutions. The prevalence of this type of personalization is dependent on the region and the local economy. In a region with more advanced research sector personification is more pronounced. The higher the total turnover of the affiliated companies, the less significant role an inventor plays.

The analysis confirms that even within the same region universities differ in the intensity of networking with business and involvement of scientists in cooperation with companies. Typically, these universities have a special status and included in the government program to improve international competitiveness. Of course, this brings additional state subsidies, which makes them mobilize efforts to improve management efficiency. However, there are universities without the special status, however, effectively creating spin-offs. The more important factor is the experience in the commercialization of university inventions in cooperation with business. Before the adoption of the Federal Law №217 in 2009 some higher education organizations encouraged the creation of academic spin-off by employees, supporting them with university resources. It was a walk on thin ice for the rector but helped retain employees. Therefore, some of the spin-offs could be a reflection of long-standing cooperation, but it is hardly possible to identify it with certainty.

The research has some limitations. There were analyzed only formal relationships of spin-off's cofounders, i.e. through participation in the capital. However, the academic spin-off can be in close cooperative relations with other firm through the cofounder's relative who holds a high position in the company. Relations with firms can exist on an informal basis. In this case, an employee of the university conducts research informally in the interests of the firm. Therefore, the research results indicate the lowest level of the spin-off networking.

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Footnotes:

- 1. Federal Law №217-FZ, 02.08.2009. "On amendments to certain legislative acts of the Russian Federation on the establishment of business entities by budgetary and educational institutions with a purpose of practical application (implementation) of intellectual property".
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An Up-to-date Survey in Barriers to Open Innovation

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Abstract: Open Innovation (OI) is recently recognized as a key factor in the competitiveness of companies. Firms that are not engaged in OI practice risk of becoming uncompetitive. However, innovating firms are likely to face several challenges often illustrated by barriers. Many researchers studied OI barriers without giving importance to their category. The main objective of this survey is to identify and categorize some barriers to OI practice by analysing how the literature on this topic has evolved for the last seven years (2009-2015). Our understanding of OI barriers can be insightful for future research on OI and it can assist managers, in fostering an innovative culture by supporting new ideas and avoiding an attitude that creates resistance towards these ideas.

Keywords: Innovation; open innovation; barriers; categorization.

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Introduction

In the past century innovation was increasingly seen as the most important success factor of the companies' organizational performance, regardless their size and the industry they belongs to (Bigliardi et al. 2013). Many companies have been able to reinvent themselves with successful innovation projects (Pontiskoski and Asakawa, 2009). Results of the American Management Association Survey revealed the main importance of the innovation in the success of businesses (Jamrog, 2006). Innovation is considered extremely important for the company's long-term survival.

However, innovation has been defined in different ways. Booz, Allen and Hamilton (1983) considered innovation as a linear process of sequential events from research and idea generation to commercialization. Otherwise, it is as a process through which ideas are transformed into new products, services or processes (Baregheh et al., 2009). Besides, Damanpour (1991) defined innovation as *"an idea or behaviour, whether a system, policy, program, device, process, product or service, that is new to the adopting organization"*. For Weerawardena (2003), innovation is the capacity of a firm to perform a range of coordination actions in order to deliver new products and new services to the market, in a way that surpasses competitors. Innovation is defined as a process through which ideas are transformed into new products, services or processes (Baregheh et al., 2009).

Indeed, innovation is performed on the basis of the knowledge of the people involved in its process. However, many authors stated that innovation is often driven from the contingency p eculiarities particularly related to firms' competition, deregulation, scarcity of resources, and customer demand (Damanpour and Schneider, 2009). In this sense, Rothwell (1992) includes internal interaction between departments and external interaction between the firm and its customers, partners, and suppliers. This is due to the hype of the knowledge society where information and knowledge are accessible and being a part of the competitiveness of organizations and also individuals (Coras and Tanatau, 2012). Moreover, companies cannot avoid the impact of the current environment variations such as: intensified competition, broad and fast knowledge diffusion, and rapid growth of R&D investments, amounts and shortness of the product and technologies life-cycles. Hence, companies should rethink about how to innovate their business and their processes.

Today companies are conscious of the constant flow of novel ideas for their innovation process. They continually pay close attention to users, as a source of valuable feedback and relevant use case experiences. They integrate outside knowledge and ideas, research projects, and concepts into their own offering. Furthermore, the ubiquitous of Information Technology advances has rendered organizational boundaries very porous; by the way they allow the facilitating knowledge transfers inward and outward (Whelan et al., 2010). Moreover, the traditional resource-based view into a firm would harm and hinder today's innovation practice. Accordingly, companies should find new ways to do things. Interestingly they could focus only on what they are good at and outsource what they cannot do themselves. They could also integrate outsides ideas, new knowledge into their own offering, and then migrate from the traditional to a modern practice of innovation called open innovation.

Open Innovation (OI) is considered as a new paradigm of innovation, where organizations innovate with partners to share risks and rewards. It is popularised by its initiator Chesbrough (2003), as an opposite to the traditional paradigm of innovation: 'closed innovation'. Unlike this later, where companies innovate relying on internal resources only, in OI, company boundaries become porous and allow resources integration between the company and external collaborators (Chesbrough, 2003). OI is a new practice regarding the manner in which firms conduct and commercialize innovation outputs (Liaocet al., 2014). It is defined as '*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the*



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markets for external use of innovation, respectively, (Chesbrough et al., 2006). Hence, OI invites actors outside the organization to pursue innovation driven either by non-profit (Kuk and Davies, 2011) or profit (Ceccagnoli et al., 2011) motivations. Rice et al. (2012) noted that OI acts as an innovation catalyser and will never overcome fundamental deficiencies or ineffective systems and capability configurations elsewhere in the company.

Moreover, OI has been catalysed through the ubiquitous of Information technology. This later allows access to a bulk quantity of data in a more open fashion, throughout the outside innovators (Boudreau and Lakhani, 2009). Moreover, regarding Chesbrough (2003) three main factors are behind the migration towards this practice: (1) the increasing availability and mobility of knowledge workers (2) the flourishing of the Internet and venture capital markets, and (3) the broadening scope of possible external suppliers. Mortara et al. (2008) added four other reasons behind this migration: (1) Reducing time to market for products (2) Availability of new technologies (3) Access to competencies (4) Exploitation of internally developed technologies.

Today, OI practice is perceived by companies as means to improve their innovation performance (Huang et al., 2015) and accelerate its rate (Lam et al., 2013). Indeed, it has been adopted first in the high-tech sectors (Chesbrough, 2003; Kirschbaum, 2005), and then emerged within low-tech sectors, such as the industry (Holmström and Westergren, 2012), small and medium-sized enterprises (SMEs) (Gassmann et al., 2010; Henkel, 2006; Lee et al., 2010; Parida et al., 2012; Rahman and Ramos, 2013), food industry (Fortuin et al., 2009), etc. The majority of extant research on OI is drawn from firms operating in North America and Europe (Chaston and Scott, 2012). Subsequently, OI practice is still limited and requires more application. For this issue, we research about OI barriers as drawbacks to foster its application.

The extensive literature written on open innovation subjects highlights the motivations and the benefits of the OI. Nevertheless, studies about OI barriers are still limited and none of these researches has gone over the classification of OI barriers. Given these limitations, we consider of high weight the need to stress on these barriers. Hence the aim of this survey is to fill this gap by reviewing and classifying by categories the main current barriers toward innovation practice. We referred to key concepts related to barriers or obstacles of OI cited in researches published since 2009. Moreover, by undertaking this paper, we purpose two main objectives: (1) to beef up the scarce literature on open innovation barriers by providing a basis on OI barriers, (2) to shed light on the factors that a firm needs to approach in order to foster a culture for open innovation.

We have structured this paper as follows. Section 2 provides the theoretical basis for OI paradigm. Section 3 reviewed recent researches related to OI barriers and present a meta-analysis of the OI barriers. In section 4 we conclude and highlights some managerial implications and paths for furthers researches.

Open Innovation Paradigm

Indicate Nowadays, organizations are faced to many challenges, varying from complex tasks to creation of the competitive advantage and surviving in the dynamic environment (Dess and Picken, 2001). Innovation is considered the main key to overcome these challenges. It is seen as the bloodline of any organisation aiming to succeed in such environment (Schulze et al., 2012). Lichtenthaler and Lichtenthaler (2010) stated that traditionally, innovation was sticked to Research & Development (R&D) departments, where importance was devoted to the internal knowledge only, so that off-the-wall ideas were less interesting. Afterwards, the abundant knowledge due to the massive usage of IT obliged companies to not entirely rely on their own ideas to innovation (OI).

In 2003, Henry Chesbrough introduced the concept of OI. His research works at Xerox PARC (Chesbrough & Rosenbloom, 2002), IBM, Intel and Proctor & Gamble, revealed the firm necessity to innovation strategies allowing innovation flows across firm boundaries and outlined the role of company-to-company partnerships. Furthermore, OI has become one of the critical topics in innovation management literature (Chesbrough, 2003; Christensen et al., 2005; Gassmann, 2006;Westergren and Holmström, 2012). It has quickly gained the interest of practitioners and researches from a wide range disciplines, including economics, psychology, sociology, and even cultural anthropology (Von Krogh and Spaeth, 2007).

Chesbrough (2006) defined OI as "The use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology" (Chesbrough et al, 2006, p.1). Otherwise, it explains the way of innovation when a company provides internally generated knowledge for the market and external knowledge flows in. For West et al. (2006, p.286), OI is described as "both a set of practices for profiting from innovation and a cognitive model for creating, interpreting and researching those practices". West and Gallagher (2006) added that OI is a wide range of internal and external sources for innovation opportunities consciously integrated with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels.

OI explains how firms would enhance their innovative performance by exploitation external knowledge, as well as how they would benefit financially by using external paths to market (Chesbrough, 2003; Gassmann and Enkel, 2004). It aims to accelerate internal innovation, and to expand the markets for external use of innovation respectively (Chesbrough et al., 2006). It incorporates accumulation of ideas, knowledge, licenses, intellectual properties, patents, and inventions (through licensing, joint ventures, spin-offs). In addition, internal inventions that are not being used in a company's business process should be taken outside the company (through licensing, joint ventures, spin-offs) (Chesbrough and Crowther, 2006). Hence, OI could be seen as a combination of two differently directed processes: inbound and outbound. From other side, Enkel et al. (2009) proposed to combine the inbound activities with outbound activities in order to co-develop, commercialise and co-capitalise on innovation. In the "open" innovation model, companies make use of external ideas and competence, to strengthen its own innovation capabilities (Chesbrough 2003; Gassman 2006; Mortara et al., 2009). Thus, open innovation is paradigm assuming that firms can and should use internal and external ideas, and internal and external paths to market, as the firms look to advance their technology (Chesbrough, 2003)

West and Gallagher (2006) identified three main inherent management challenges related to: (1) maximization that include outbound IP licensing and patent pooling (2) incorporation where firms should identify relevant knowledge through scanning, recognitions, absorption and political willingness to integrate external innovation and (3) motivation in witch firms have to assure continued supply of relevant external technologies and IP. Instead of relying on its own R&D department to enhance the company innovation abilities, the open innovation model mobilises the key organisational networks and players (suppliers, customers, public and private research centres, institutions, universities and even competitors) (Clausen and Pohjola, 2009; Piperopoulos, 2012)

Despite of being widely researched, there is no clear consensus upon what constitutes open innovation practices, however, it has been defined as an antithesis of its predecessor, "closed" innovation, (Bullinger et al 2012),where companies relied on internal channels for research, development and commercialization of their inventions (Chesbrough 2003; Gassman and Enkel, 2004). It figures out that firms should use external ideas and internal and external paths to market, as the firms look to advance their technology (Chesbrough, 2003).

Traditionally innovation takes an importance place within companies and has been the way several industries operated. It started closed where firms look beyond their internal environment and limited resources for knowledge, ideas, opportunities and partners, (Chesbrough, 2003; Spithoven et al., 2012). This way is called the vertical integration model or the closed innovation paradigm. This paradigm refers to an understanding that successful innovation requires also control processes (Pontiskoski and Asakawa, 2009). Moreover, research and development activities within organizations are considered strictly internal processes and should be guarded from external influences (Westergren and Holmström, 2012). In the sense of Chesbrough (2003), companies have to bring out their ideas and then to develop them, build them, market them, distribute them, service them, finance them and support them on their own in the closed paradigm. Otherwise, ideas should be generated in-house and the only way to market them is through the originating firm (Chesbrough, 2006 b). Besides, companies should be strongly self-reliant, because one cannot be sure of the quality, availability, and capability of others'

ideas (Chesbrough, 2003). Also, the closed paradigm supposes that innovation must be kept in-house and the intellectual property generated through R&D department is a trade secret.

Although the closed innovation paradigm worked well for quite some time and many, the current innovation landscape has changed (Vrande et al., 2009). Hence a many developments within and outside the innovation arena revealed the ineffectiveness of the traditional innovation system and engender the necessity to change the innovation process and migrate to the open one. These developments consist of knowledge workers and information technology breakthroughs, the increased mobility of workers, the growing presence of venture capital, the increasingly shortened product life cycles, the growing competition, the globalization of economy, the improved use of information technology, and the wide availability of knowledge from multiple sources engendered the outdate of the closed innovation and the migration the OI paradigm (Rahman and Ramos, 2010). Based on Chesbrough (2003) assumptions, the open paradigm is driven by four main factors: (1) The increased availability and mobility of skilled "knowledge-workers", (2) the new external options available for unused ideas, (3) the external suppliers increasing capability and finally, (4) the emerging venture capital markets that created new strategic opportunities for companies.

The OI paradigm assumes that firms should use external ideas as well as internal ones, internal and external paths to market, as the firms look to advance their technology (Chesbrough, 2006). Otherwise, it refers to a strategy and business philosophy where companies actively look for both internal and external ideas' sources to accelerate their innovation process. It is an emerging paradigm that is based on the fact that external ideas and internal paths are placed at the same level of importance. Referring to Chesbrough et al. (2006), OI paradigm can be understood as the antithesis of the traditional paradigm. It is seen as the use of purposive inflows and outflows of knowledge and ideas for both accelerating internal innovation and expanding the markets for external use of innovation.

The open innovation paradigm provides a new perspective towards external collaboration. It acknowledges that companies have a strong interest to partner and to integrate external sources of knowledge. Innovation becomes, then, a collective activity integrating a great number of stakeholders for production and R&D. in the same sense, Lichtenthaler (2011) suggested two main OI characteristics distinguish from the innovation collaborative approaches: (1) the integration of inward and outward knowledge transfer, and (2) the complementary character of internal and external innovation. By adopting an OI paradigm, firms can pursue it in three different ways: (1) engagement in enriching their own skills and knowledge through the integration of stakeholders (suppliers, customers,...) into the internal innovation process (Enkel et al. 2009), (2) carry out outbound OI activities by bringing ideas, patents, and any intellectual property rights form to the market (Lichtenthaler, 2008) and (3) co-creation with complementary partners (Enkel et al., 2009) that combine the outbound and inbound OI activities. Table 1 summarize peculiarities of open and closed innovation paradigms.

Open Innovation	Closed Innovation
Not all of the smart people work for us" so we must find and tap into the knowledge and expertise of bright individuals outside our company	The smart people in our field, work for us
External R&D can create significant value; internal R&D is needed to claim some portion of that value	To profit from R&D, we must discover, develop and ship it ourselves
We don't have to originate the research in order to profit from it	If we discover it ourselves, we will get it to market first
Building a better business model is better than getting to market first	If we are the first to commercialize an innovation, we will win
If we make the best use of internal and external ideas, we will win	If we create the most and best ideas in the Industry, we will win
We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model	We should control our intellectual property (IP) so that our competitors don't profit from our ideas.

Table 1. Inspired from Closed Innovation Vs Open Innovation Chesbrough, H. W. (2003 b)

Barriers to Open Innovation (OI)

In 2009, Pontiskoski and Asakawa, described in a conceptual paper, how companies overcame barriers to use open innovation strategy in R&D and commercialization projects. The two authors studied three companies able to reinvent themselves and their business: Nokia nseries, Nintendo Wii, and Apple iPod. They compared three of their product development and commercialization projects. Their objective was about comparing and contrasting open innovation success factors and pitfalls from the three companies. To do this, they exploited secondary data related to the cited companies, and then they identified three levels of open innovation barriers: cognitive, behavioural, and institutional.

Mortara et al. (2009) tried to identify barriers and challenges related to implementation of OI in companies belonging to divers sectors (Fast moving consumer goods, Energy and oil, Aerospace and defence, Software and media, Electronics and telecommunication, Intermediaries such as knowledge and service brokers). Methodologically, they interviewed 26 managers of these companies and underlined the influence of several barriers ranging from internal cultural issues, lack of appropriate skills, lack of resources and appropriate structural change.

In the same intent, Fortuin and Omta (2009) attended to find out the main drivers and barriers to open innovation in the food processing industry in Netherlands. Also, they explored how far this industry can rely on the principles of innovation management developed in high-tech industries to improve its innovation performance. The two authors referred to the theoretical insights derived from the industrial organization theory and the resource-based view to develop their questionnaire. Results of the data collected from research director, CTO, or CEO of the nine companies participating in the study, light out the importance of the barriers related to the underutilization of open innovation in the food industry.

Vrande et al. (2009) explored barriers for open innovation in SMEs,

acting in manufacturing and service industries. They used a survey database collected by EIM, a Dutch institute for business and policy research, in December 2005. The authors suggested many OI innovation barriers ranging from, administration, finance, knowledge, marketing, organizational culture...

In 2010, Hernandez-Mogollón et al. studied the role of cultural barriers in the relationship between open-mindedness (OM) and organizational innovation towards SMEs. The study was conducted in a population of 57.000 firms of the Extremadura region, Spain. Authors adopted a simple aleatory sampling and mailed their questionnaire to the selected SMEs. Their finding exposed the impact of the cultural barriers on the relationship between OM and organizational innovation in these enterprises. In the same context of SMEs, Rahman and Ramos (2010) emphasized various open innovation strategies by focusing transformation of innovation process from closed boundary to networked paradigm. They tried to provide an overview on innovation strategies and to discuss about some challenges and barriers that SMEs are facing in implementing OI strategies. To identify these barriers, the two authors referred to the contributions of Hadjimanolis (1999) and Rush and Bessant (1992).

As for Savitskaya et al. (2010), they proposed to analyse the barriers to open innovation from three different aspects: (1) internal firms' environment, (2) institutional factors or innovation system and (3) cultural background. They targeted around 800 companies in the Yunnan province (China) and collected their data through email and a paper survey, and also by phone, in a few cases. The authors were limited on the following factors considered as the main barriers to manufacturing and service sectors OI companies: Not-invented here syndrome, no adequate technologies on offer, fear of losing own innovation ability, lack of marketplaces for technologies and not-sold here complexity of IP rigths and fear of infringements.

Lee et al. (2010) investigated three main problems: (1) to place the concept of open innovation in the context of SMEs (2) to suggest the input of an intermediary in facilitating innovation and (3) to report

accounts of Korean SMEs' success in working with an intermediary. They pointed up many barriers to OI in the SMEs Korean context: Difficulties in finding suitable manpower in a labour market, market uncertainty in innovative products, imitation possibilities of technology innovation, short of ability in R&D planning and management, lack of market information, frequent turnover human resources (usually for R&D),...

Holmström & Westergren (2012) studied indirectly barriers to OI by exploring its preconditions in iron ore mining sector and highlighted the critical influence of trust. Besides, Lüttgens et al. (2012) attempted to identify both critical incidents that may occur during the implementation of crowdsourcing in the innovation process and also to derive suggestions for organizational interventions to overcome these barriers. To do, they based on a design science approach and a longitudinal study of six companies engaged in piloting of open innovation.

In 2013, Lam et al. purposed to understand drivers and barriers to OI type called the Industry-University Collaboration (IUC) in Hong Kong. They hypothesised that these drivers and barriers ranged from unavailability of competent external partners to provide the necessary knowledge and technologies, fear of disclosing their own intellectual property to external partners, innovation too easy to copy, or lack of demands from clients/customers for generation of knowledge and technologies, existing legislation, norms and regulations,...

In their conceptual paper, Coras and Tantau (2014) stressed on the benefits, the barriers and the drawbacks entailed by open innovation projects. They explored the incentives of firms embarking in collaborative relationships, and the diversity of risks entailed. They revealed many barriers related to: Workforce, knowledge sharing, collaboration, market, clients finance technology and intellectual property. Furthermore, Hjalmarsson et al. (2014) proposed a framework of OI barriers to of digital services. This framework has been designed using a systematic research approach including a literature review of existing barriers related to cost, finance, innovation, knowledge, market, organization, strategy, regulation, society and technology.

Recently, McCormack et al. (2015) conducted a research to identify drivers and barriers to adopt OI in Galway MedTech cluster in Ireland. They firstly classified these barriers into many categories: Knowledge, marketing, organisation culture, property rights, quality of partners, competence of employees, commitment and idea Management, and secondly they administrated an online survey to a population of 43 companies. Moreover, Janevski et al. (2015) focussed on SMEs and studied level of awareness and constraints for adoption of open innovation strategies in the Republic of Macedonia. Authors conducted a survey among 63 firms and investigated barriers related to many category constraints of the Macedonian context: Recruiting constraints, general constraints, competition constraints, and policy constraints. With the similarly research subject, Nafi et al. (2015) examined the issues and challenges facing the implementation of OI among the SMEs in Malaysia. They inspected the issue of trust and its relation to the study of open innovation and collaborative networks.

Categorizing the Open Innovation Barriers

barriers. Selection was based on the following criteria. We primary conducted computerized keyword searches related to Barriers to OI, lacks of OI, and obstacles of OI. We limited the selection to articles that were related to the subject areas 'Management' or 'Business', 'Information Technology' and that were published in the following scientific databases: Ebscohost, Scopus, ISI Web of Knowledge, ABI Inform and Google scholar. Second, we manually searched abstracts from these databases. Then we examined the references from the articles identified in these previous steps to locate additional studies that the other searches were unable to capture. Third, we removed duplicates and articles that were deemed not applicable by the authors.

The final sample consisted of 19 articles published within the last seven years (2009-2015) that handled research questions related to OI barriers. Of these 19 articles, four were published respectively in 2009 and 2010, two in 2012, two in 2013, three in 2014 and four in 2015. Furthermore, we selected barriers used within these 19 articles and we conducted a lexical analysis in order to classify them by category. For this issue, we used two Project R software (R Core Team, 2014):

- a. Rstudio software for a lexical analysis order to identify the common themes between these barriers and the statistical analysis.
- b. RQDA software to classify the barriers by category

Choice of the Project R software is due to the fact that this environment provides a powerful and flexible system for statistical computations. It is considered powerful enough for performing analyses, comparable to other software, e.g. Nvivo, SAS, SPSS (Mangiafico, 2013). Wordcloud package is used to visualise the dominant words within the barriers sentences. Results revealed the dominance of the following words: Management, Market, Knowledge, partners, technology, trust, and extern, etc. are shown in Figure 1. From these words, we generated six general themes related theses dominant words:

- Environmental (Env)
- Managerial and Organizational (Mgm & Org)
- Individual (Ind)
- Cultural (Cult)
- Innovative (Inn)
- Processual (Pro)



After fixing up the general themes related to the dominant words, we performed a classification of the identified barriers. Table 1 (index) gathers all the barriers used within the 19 articles arranged by theme, by country and by sector. For example, Lüttgens et al. (2012) cited 13 barriers: (1) Negative Attitude, (2) Intellectual property management, (3) Workflow rigidity, (4) NIH (not-invented-here) syndrome, (5) Lack of internal commitment, (6) Bottom-up management, (7) Insufficient resources, (8) Allocating wrong task to pilot, (9) Insufficient top management support, (10) Unrealistic expectation, (11) Legal barriers, (12) Organizational / Administrative barriers and (13) Communication barriers. However, a direct exploitation of these barriers risks to be reductive, whence the reason behind the necessity to classify them. By the way, it becomes easy for managers, CEO and innovators to master the general level of barriers (that could be Individual, Organizational...) instead of analysing them directly. Thereby, for Lüttgens et al. (2012), we identified four main categories of barriers allocated as follow:

- Environmental Barriers: Legal barriers;
- Managerial and organizational Barriers: Intellectual property management, Bottom-up management, Insufficient resources, Allocating wrong task to pilot, Insufficient top management support, Unrealistic expectation, Organizational/ Administrative barriers, and Communication barriers;
- Individual Barriers: Negative Attitude, Workflow rigidity, Lack of internal commitment, and Insufficient top management support
- Cultural Barriers: NIH (Not-Invented-Here) syndrome

Classification in Figure 2 allows the comparison between categories of barriers. The managerial and organizational barriers (38.4%) are the most cited and exploited barriers, followed by the environmental (27.9%, then the individual (16.7%) and the cultural (10.9%). The last places are respectively occupied by the Innovative (5.4%) and the processual (0.8%) ones.





Moreover an intersection between the category of barriers and the activity sector expose the dominance of barriers tested in SMEs, followed by industry (Table 2). The digital services sector and IT came in the fourth position. This intersection proved the great intention given to open innovation and its barriers in SMEs. This is due to the fact that this category of firms could be the most concerned with the OI practice. Otherwise, the correlation test between OI barriers and sector pointed out a positive non-significant relationship between category of barriers and type of sector (r = 0.269). Hence, explication of OI barriers could not be limited on the characteristics of the activity sectors only. They could be related to the country peculiarities also.

Barriers Category * Sector Cross tabulation									
		Sector	Sector						
		SMEs	Mechanical engineering	Food processing companies	Digital Service and IT	Biotech & Pharmaceutical	General	Industry	Total
Barriers Category	Environmental	23	1	0	14	5	17	12	72
	Managerial and Organizational	33	8	0	10	6	17	25	99
	Individual	13	4	0	5	4	10	7	43
	Cultural	5	1	1	6	1	5	9	28
	Innovative	4	0	0	5	0	1	4	14
	Processual	0	0	0	0	0	1	1	2
Total		78	14	1	40	16	51	58	258

Table 2 Cross tabulation barriers category and Sector

Table 3 disclose the relationship between OI barriers and countries. Results revealed the dominance of Sweden followed by Germany in investigating the OI barriers. These results allowed concluding the attention given by these two countries to the OI practice and the desire of its dissemination. Moreover, managerial and organizational barriers marked high score for both of Sweden (27) and Germany (24). This explains the attentiveness that firms should devote to managerial and organizational barriers whenever they wish adopt an OI practice. Furthermore, a correlation test was performed to study the relationship between category of barriers and countries. Results indicated a very week correlation between the two variables (r= 0.015). Otherwise, dominance of OI barriers does not necessary implies the country commitment in OI practice.

Table 3. Cross tabulation	barriers	category	and	countries
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Country * Barrier Category Cross tabulation								
		Barrier_Category						
		Environmental	Managerial Organizational	and Individual	Cultural	Innovative	Processual	Total
	Germany	8	24	10	4	1	0	47
	Italy	1	3	1	0	0	0	5
	Netherlands	0	0	0	1	0	0	1
	China	1	1	0	1	1	0	4
	Denmark	5	6	4	1	0	0	16
	Sweden	16	27	7	12	7	1	70
	Norway	0	0	1	0	0	0	1
Country	UK	0	4	4	4	0	1	13
	Malaysia	0	0	1	0	0	0	1
	Hong Kong	7	4	1	1	1	0	14
	Finland	2	1	2	2	1	0	8
	Korea	5	7	1	0	2	0	15
	Macedonia	3	3	3	0	0	0	9
	Portugal	7	6	2	1	0	0	16
	Romania	17	13	6	1	1	0	38
Total		72	99	43	28	14	2	258

Conclusions and further research

The objective of this paper is to broaden the scope of research about Open Innovation (OI) throughout a categorization of its barriers. It presents practically the barriers' approach toward OI practice. This approach could be seen as a powerful mean to better explain individual and organizational behaviours. It could help to foster OI adoption and even solve problems related to its applicability. Indeed, the barriers approach to OI could be considered a meaningful approach in explaining success factors of OI practice. Our work is an innovative in identifying obstacles and problems that organizations and managers have to advance innovative activities. However, further research is needed in finding efficient tool measurements for OI barriers and drawing effective and practical conclusions. We chose a sample descriptive meta-analysis to account for the limitation of researches studding barriers to OI. We aim for categorizing these barriers and subsequently building a standardized measurement tool for OI barriers. Further researches are probably required to explore and examine barriers by categories and in more detail. They could exploit results of this conceptual paper, especially barriers categorization, to build new constructs explaining OI innovation practice from one or both of the following approaches: organizational, individual, environmental, cultural, innovative or processual. This categorization enables to enrich the findings on barriers to OI and could provide answers to questions of strength and importance of these barriers quantitatively. Moreover, the present study revealed that the barriers to OI are not equal in sectors and even in countries, it could be necessary to develop specific barriers' tool that takes into consideration the differences between organization, activities and countries.
Indeed, OI affects companies' capacity to compete successfully in an increasingly global market. Hence, understanding its barriers can help in the company strategies and policies government development that contribute to economic growth and increased wealth. This paper shows the importance of understanding categories of OI barriers, especially when expressing innovation intention. More attention on OI barriers category can lead to an effective joint action for open innovation promotion. This approach is important especially when the firm is not highly innovative. Barriers assessment becomes a crucial step to its engagement in open innovation practice. Besides, understanding OI barriers can afford to managers tools to foster an open innovative culture within their firms by avoiding negative attitude. An alignment between OI culture and the firm's business strategies can engender great efficiency and efficiency and organizational success.

The insufficient number of researches studding OI innovation barriers (19 articles only) has been the major drawback performing our work. We are aware of the fact that this meta-analysis is a minor step on the road to gaining a better understanding of the open innovation barriers. Of course, there are still many uncharted categories. We hence, enumerate a number of them without having the ambition to be more exhaustive. The number of researches used in the meta-analysis is low. It could diminish the results power even when they are representative studies in the literature. We only considered six categories of barriers (environmental, managerial and organizational, individual, cultural, innovative and processual) but other typologies exist. But our effort may open a window for a future research to investigate deeply on OI barriers and generate new categories. Findings of this paper can be used in the development of companies' strategy or public policy that support and encourage open innovation practice.

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			Barrier	s category		-				
Author	Year	Barriers	Env	Mgm & Org	Ind	Cult	Inn	Pro	Country	Sector
Lüttgens et al	2012	Negative Attitude Intellectual property management Workflow rigidity NIH (not-invented-here) syndrome Lack of internal commitment Bottom-up management Insufficient resources Allocating wrong task to pilot Insufficient top management support Unrealistic expectation Legal barriers Organizational/ administrative barriers	X	X X X X X X X X X	X X X X	Х			Germany	Mechanical engineering
Hernandez- Mogollon et al	2010	Cultural barriers		Λ		Х			Spain	SMEs
Fortuin and Omta	2009	The underutilization of open Innovation				Х			Netherlands	food processing
Savitskaya et al	2010	The main barriers to inbound OI: Not Invented Here syndrome No adequate technologies on offer Takes too much time/resources Fear of losing own innovation ability The main barriers to outbound OI: Not Sold Here Complexity of IPR, fear of infringement The difficulty of finding buyers	x	X	Х	X X	Х		Finland	Manufacturing and service sectors
Pontiskoski and Asakawa	2009	Lack of marketplaces for technologies Levels of OI barriers: Cognitive, Behavioural and institutional Embracement of a more open culture Risk-taking activities Different value chain perceived by the food	X	X	X X					
Bigliardi and Galati	2013	supply chain Complexity in managing the numerous relationships	Х	Х					Italy	Industry
Lee et al	2010	Different focus of the different actors involved Difficulties in finding suitable manpower in a labour market Short of suitable manpower within the firm Market uncertainty in innovative products Imitation possibilities of technology innovation Short of ability in R&D planning and management Lack of technological information Funding difficulties Technological uncertainty Funding difficulties due to high innovation and commercialisation costs Lack of market information Frequent turnover human resources (usually for R&D) Difficulties in using external services R&D department without power Monopolistic or oligopolistic market structure Funding difficulties Delayed payment by customers Needlessness of additional innovation	x x x x x	X X X X X X X X X	х		x x		Korea	SMEs

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Table 1. OI barriers arranged by theme, by country and by sector for the period 2009-2015

		Administration: Bureaucracy, administrative burdens, conflicting rules Finance		X X		v			
		Finance: Obtaining financial resources Lack of technological knowledge	Х	Х		л			
		Competent personnel Legal/administrative knowledge		Х	Х				
		Insufficient market intelligence		X					
		Market affinity		X					
		Marketing problems of products		A V					
		Communication problems		X					
		Aligning partners		X					
		Costs of innovation		X					
17 1 4 1	2000	Time needed		Х				0	C) (F
Vrande et al	2009	Ownership of developed innovations		Х				Germany	SMEs
		User rights when different parties cooperate	Х						
		IPR		Х					
		Quality of partners	Х						
		Partner does not meet expectations	Х						
		Deadlines are not met	Х						
		Customer requirements misjudged Customer demand too specific	X X						
		Innovation appears not to fit the market			37		Х		
		Employees lack knowledge/competences			X				
		Not enough labour flexibility			A V				
		Resistance to change			A Y	v			
		Idea management		x	Α	Α			
		Employees have too many ideas.		21	х				
		No management support		Х					
		Administration		Х					
		Finance		Х					
		Organizational Knowledge		Х					
		Individual Knowledge			Х				
		Marketing		Х					
		Culture				Х			
		Organisation		Х					
McCormack et al	2015	Resources	X					Danmark	Biotech &
		Property Rights	X						Pharmaceutical
		Quality of Partners	A V						
		Customer Demand	л Х						
		Competent Employees	Λ		x				
		Commitment			X				
		Organizational Idea Management		Х					
		Individual Idea Management			Х				
		Supply (Technological information	Х						
		Raw material and finance	Х						
		Customer needs;	Х						
		Customers' perception of the risk of							
		innovation	Х						
		International market limitation	Х						
Rahman and		Government regulation	A	37					
Ramos	2010	Anti-trust measure	Х	X				Portugal	SMEs
		Policy actions		Х					
		Lack of Internal funds		Х					
		Technical expertise		Х					
		Management time		Х					
		Culture and human nature				Х			
		Attitude of top management to risk			Х				
		Employee resistance to innovation			Х				
		Out-of-date accounting system		Х					
		0 1							

Mortara et al		2009	Organizational Support from top management Individual Support from top management Create an OI Culture Appropriate structural change Knowledge of the company Knowledge of the company Obtaining the right blend of skills Motivation of operatives Internal cultural issues Lack of appropriate skills Operational difficulties Lack of resources External cultural issues		x x x x	X X X X	X X X	х	Х	UK	Genaral
Holmström Westergren	&	2012	Trust			Х	Х			Norway	Industry
Nafi et al		2015	Trust Unavailability of competent external partners to provide the necessary knowledge and technologies Fear of disclosing their own intellectual	X		Х	Х			Malaysia	SMEs
			property to external partners	24				v			
			Lack of demands from clients	Х				21			
			Customers for generation of knowledge and	Х							
			Higher uncertainty and unpredictability	37							
			concerning	Х							
Lam et al		2013	Strong internal competence The overall planning and implementation		x	Х				Hong Kong	Industry
			Absence of corporate policies to incorporate		x						
			external ideas	v	Λ						
			Lack of demands from clients and	л							
			customers for generation of knowledge and	Х							
			technologies Resistance to including external parties by								
			corporate management		Х		Х				
			Difficulty in integrating external knowledge		Х						
			Scarcity of skilled employees			Х					
			Wages of the skilled employees are too high			Х					
			Lack of knowledge in implementing new technology		Х						
Ianevski et al		2015	The labour market lacks skilled workers			Х				Macedonia	SMEs
Janevski et al		2015	Increase quality of product/service		X					Maccuoma	0101113
			Government policies	Х	л						
			Laws and regulations	Х							
			Unfavourable business climate	X V							
_			The domestic innovation system is	Λ							
Huang et al		2015	rudimentary and the indigenous					Х		China	SMEs
			Innovation capacity has not been well built		Х		Х				

		Workforce Employees resistance to			v	v			
		innovation and change			Λ	Λ			
		Poor understanding of their role,			Х				
		Safety mentality			Х				
		Insufficient technical expertise or training of employees			Х				
		Insufficient knowledge about partners		Х					
		High staff turnover		Х	Х				
		Difficulty in finding quality employees			Х				
		Low support for innovation		Х			Х		
		Insufficient expertise partners	Х						
		Ethical barriers		Х					
		Leaking critical internal resources and		37					
		disclosure of core competencies		Х					
		Conflicting interests of partners	Х						
		Developing dependency on partners,	v						
		relational risk	Λ						
		Lack of trust and communication	Х	Х					
		among partners							
		partner leaving	Х						
Coras and	2014	Poor quality of partners	Х					р .	C 1
Tantau	2014	Poor management of partnership	Х	Х				Romania	Genaral
		Volatile and ambiguous industry regulation	Х						
		Unethical behaviour of the partners	Х						
		Large volume of paperwork	Х						
		Administrative burdens	Х						
		Lack of market information and transparency	Х						
		Constantly changing needs of the	Х						
		Lack of financial capital		x					
		High commercialization cost		x					
		Higher management		X V					
		Coordination and control costs		л Х					
		Technology leakage to rival	v	Λ					
		Technological uncertainty	X X						
		Inability to adapt to technology	11						
		advances		Х					
		Knowledge spill over		Х					
		Core knowledge flow towards the competitors	Х						
		Inexistence of formal contracts	Х						

		High innovation costs		x						
		High cost of finance		X						
		Short-term economic monetary and		21						
		financial policies	Х							
		Lack of venture capital	x							
		Lack of vehicle capital	x							
		Easily imitable innovation	21				x			
		High risk-level of innovation					X			
		Lack of technical competence			x					
		Lack of technical competence and			11					
		information	Х							
		Lack of marketing competence			х					
		Market information	х							
		Lack of management competence			Х					
		Lack of innovation experience		Х		Х				
TT: 1 (1	2014	Uncertain product demand	Х							Digital Service and
Hjalmarssonet al	2014	Lack of innovation motivation		Х						IT
		Weak value offering					Х			
		Multifaceted market conditions	Х							
		High market competition and saturation	Х							
		Lack of partner co-operation	Х							
		Lack of time		Х						
		Unsupportive organizational culture				Х				
		Weak R&D environment	Х			Х				
		Lack of innovation champion				Х				
		Weak innovation strategy		Х						
		Lack of strategic fit		Х						
		Hindering government policies and	v							
		regulations	л							
		Inefficient intellectual property processes		Х						
		Lack of public acceptance for innovation"	Х			Х				
		Unavailable technology					Х			
		Regulatory requirements in industry	Х							
		Conservative approach to IP	Х	Х						
		Internal R&D is the principal source of new				x				
		knowledge				Λ			Sweden	
		Hard to find the right balance open vs.		v						
		closed		А						
		Traditional values				Х				
		NIH syndrome				Х				
		Strong sub-cultures				Х				
		Rivalry between internal functions		Х		Х				
		Low trust in external technologies			Х	Х				
		Low trust in external sources			Х	Х				
		Low trust internally			Х	Х				
		Unbalanced value distribution in		x						
		collaboration networks		Α						
		No top-down strategy for OI		Х						
		OI is not in line with corporate strategy		Х			Х			
		No corporate technology strategy		Х						
		No patent no talk IP policy		Х						
Steninger	2014	IP Medusa effect		Х						Industry
0		OI initiatives do not fit into current		x				x		1
		processes or organizational structures		21				21		
		OI leads to actions contra dictionary to					x			
		those that were done before					11			
		Lack of appropriate open innovation tools		x			x			
		and infrastructures		21			21			
		Not possessing the right blend of open		v	v					
		innovation skills		Λ	Α					
		Difficult to coordinate the broad variation		x						
		of skills,		21						
		External coordination of technology		v						
		management tasks		Λ						
		Loss of proprietary knowledge		Х						
		Limiting development of internal skill and		v						
		core technological competence		Λ						
		Increasing dependency on external	v	v						
		technology providers	л	Λ						
		Increasing complexity derived from	v	v						
		additional interfaces with external parties	Λ	л						

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