

**DOES BOARD DIVERSITY MATTER FOR INNOVATION PERFORMANCE?
EVIDENCE FROM THE WORLD'S MOST INNOVATIVE FIRMS.**

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ABSTRACT

In this paper, we study the impact of board diversity, considering both surface-level (gender and ethnic) and deep-level (educational and functional) diversity, on innovation performance. To empirically assess this impact, we collect data on the world's 100 most innovative companies according to Forbes 2018's ranking. The results suggest that gender diversity and ethnic diversity do not influence innovation performance. We also find that moderating gender and ethnic diversities by knowledge (educational and functional diversity) do not impact innovation performance. However, the results show that board size, as well as firms' sector and region, have a significant influence on innovation performance.

Keyword: Innovation performance, performance innovation, surface-level (gender and ethnic), deep-level (educational and functional).

1. INTRODUCTION

Over the last decades, innovation has become a major concern of both practitioners and academics (Drazin and Schoonhoven, 1996; Hoang and al., 2006). Innovation can be defined as the application of new ideas to the products, processes or any other aspect of a firm's activities (Rogers, 1998). It can also be defined as an idea, practice or material artefact perceived to be new by the relevant unit of adoption (Zaltman et al., 1973). The importance of innovation is widely recognized in the literature since the pioneering studies of Schumpeter. Innovation allows firms to achieve and extend a competitive advantage (Hitt et al., 1996, Ferreira, 2010), expand market share, and increase their performance (Franko, 1989, Miller and Triana, 2009, Torchia et al. 2011). In order to understand the ability of a firm to innovate, many empirical studies have examined the determinants of innovation (Hoang and al. 2006; Frenz and Ietto-Gillies, 2009; Miller and Triana, 2009; Wincent and al, 2010; De Cleyn and Braet, 2012; Galia and Zenou, 2012; Zona et al. 2012; Díaz-García et al. 2013; Honoré et al. 2015; Midavaine et al. 2016;

Helmets and al. 2017; Kang et al. 2018; Torchia et al. 2018). The empirical link between board diversity and innovation has taken much more attention in the literature than other types of relationships. Previous research traditionally has focused on observable diversity (such as gender, age, race, and ethnicity), called “surface-level” diversity (Torchia et al. 2015) probably due to the non-availability of data (Carter et al. 2010). However, an emerging stream of the literature is emphasizing the importance of investigation characteristics that are less visible, labeled “deep-level” diversity attributes (Jehn, Chadwick, and Thatcher 1997; Harrison et al., 1998; Harrison et al. 2002).

Deep-level diversity includes technological and educational abilities, socioeconomic background, knowledge, skills, values, attitudes, beliefs, and personality (Kilduff et al., 2000; Petersen, 2000; Timmerman, 2000; Milliken and Martins 1996; Harrison et al. 2002).

According to Torchia et al. (2015), it is interesting to focus on deep-level diversity. Their study supports the need to go beyond "surface level diversity" and to explore "deep-level diversity." Investigating less visible characteristics of directors is indeed an interesting angle of analysis for the research on corporate boards.

Following the growing literature on the deep-level diversity of corporate boards (Torchia et al. 2015; Midavaine et al. 2016), we consider the impact of board diversity on innovativeness intensity taking into account surface-level as well as deep-level of diversity.

To our knowledge, in the existing literature focusing on the relationship between board diversity and innovation, the study conducted by Midavaine et al. (2016) is the only one to investigate the effect of visible and less visible characteristics of directors on innovation, measured by R&D investment. Midavaine et al. (2016) measure the diversity of corporate boards in four different ways, two of which are person related (age and gender) and the two others are information based (education and tenure). They find that tenure diversity has a negative effect on innovativeness, while education diversity and gender diversity lead to firms being more innovative. They also find that gender diversity positively moderates education diversity, making the effect found stronger.

The aim of this paper is to extend this literature by exploring other characteristics of board directors and using a new proxy for innovativeness: the premium of innovation. Our research is unique because we consider both surface-level (gender and ethnic) and deep-level (knowledge) diversity in our study. The rest of the paper is organized as follows. Section 2 discusses the theoretical background of the paper and presents the main hypotheses. Section 3 presents the data and methodology. Section 4 discusses the main empirical findings. Finally, section 5 concludes the article.

2. THEORETICAL BACKGROUND AND HYPOTHESIS

The theoretical arguments explaining the relationship between the diversity of the board and innovation are drawn from the disciplinary and cognitive approaches of governance and the resource dependency theory.

Agency theory (Jensen and Meckling, 1976) states that there is a divergence of interests between shareholders and managers. It is then necessary to establish control mechanisms to align the behavior of managers in the aim of maximizing the wealth of the shareholder.

From an agency perspective, the board of directors plays a disciplinary role. The presence of independent members contributes to protecting shareholder interests. Independent directors are

better able to control managers compared to dependent ones (Fama and Jensen, 1983; Baysinger and Butler, 1985). The cognitive approach associates this fact to the cognitive contributions of the different board members. According to Charreaux (2000), the qualities required of directors are no longer conceived regarding a dependent or an independent board, but to the cognitive contributions that can be integrated into a collective project. In this case, board diversity thus dominates the criterion of director independence.

Carter et al. (2003), Hermalin (2005), and Adams and Ferreira (2007) emphasize the importance of the two criteria, the independence of the board and its diversity. According to them, monitoring and control are more effective when the corporate boards are diversified, and the directors are independent. Carter et al. (2003) point out that diversity increases board independence.

In a similar vein, Goodstein et al. (1994) show that the diversity of board members has a significant effect on strategy changes in turbulent environments. Board diversity leads to an improvement of the control role in the corporate boards and promotes strategic decision-making in the shareholders' interest. Among several strategic decisions, investment in innovation is affected by board diversity.

From a resource approach, a firm's survival depends on its ability to reduce its dependence on the external environment. Organizational survival is the ability to ensure the acquisition and maintenance of resources (Jaskyte, 2012). A firm must establish interorganizational links that allow it to control certain indispensable resources to address environmental dependencies.

Boards serve to link the corporation to other external organizations (Pfeffer and Salancik, 1978). Corporate boards are not limited to their role of control. Boards are meant to gather critical resources. Their composition makes up a crucial portfolio of resources (Hillman et al., 2002).

2.1. Gender Diversity

From an agency approach, gender diversity involves more control in corporate boards (Daily et al., 1999) and consequently a reduction in agency costs (Jurkuset al. 2010). Martini et al. (2012) set out that an excess of control and great attention on the wealth protection for shareholders may hamper investments in innovation that are characterized by uncertainty.

From a resource approach, board diversity helps firms to gain critical resources (Hillman and Dalziel, 2003; Miller and Triana, 2009; Hillman et al., 2009; Dalziel et al., 2011).

Previous research (Hillman et al., 2007; Sharder et al., 1997) argues that women directors have a positive contribution to boards in terms the use of resources, the development of talent and competencies. Women directors help the firm to acquire and allocate resources. Huse (2008) suggests that women and men directors differ regarding experiences which may lead to differing opinions on corporate strategies. Robinson and Dechant (1997) and Pathan and Faff (2013) stress the role of females in boards, maintaining that they tend to work hard, have good communication and cooperation skills which improve decision-making.

Several studies have investigated the link between the board's contribution women directors and innovation. Some authors provide a positive relationship between gender diversity and innovation performance (Campbell and Miguez-Vera, 2008; Chen et al., 2015; Daily and Dalton, 2003; Gordini and Rancati, 2017; Midavaine et al., 2016; Miller and Triana, 2009; Torchia et al., 2011). Gender diversity has been associated with greater creativity, a higher intake of new ideas, and a better decision-making capacity (Adams and Ferreira, 2009; Bear et

al., 2010; Erhardt et al., 2003; Díaz-García et al., 2013; Huse and Solberg, 2006; Miller and Triana, 2009). Women directors have wider social networks which could increase innovation (Miller and Triana, 2009). In the same way, Ferreira (2010) highlight that board feminization provides firms with a competitive advantage which could be extended through innovation. In this article, we assume that gender diversity influences innovation.

2.2. Ethnic diversity

Some studies put forward arguments in favor of a negative influence of ethnic diversity on innovation. Carter et al. (2003) argued that ethnic minorities are often marginalized. Also, Westphal and Milton (2000) suggest that minority group members favorize divergent thinking decisions. Consequently, reaching a consensus about a decision, in particular, innovation which needs crucial discussions, may be exacerbated. Midavaine et al. (2016) note that person-related differences, including ethnic diversity, tend to pit groups against another. Hence, ethnic diversity may hamper innovation.

Hillman et al. (2002) examine the possible difference between female and racial minority directors and white male directors. Their study identifies differences in occupational background, education level, and patterns of board affiliation. Authors find that female and African American directors are more likely to come from non-business backgrounds, are more likely to hold advanced degrees, and join multiple boards at a faster rate than white male directors.

Carter et al. (2010) study the relationship between both ethnic diversity and gender diversity of the board and firm financial performance. They do not find a significant relationship. Authors explain this based on social psychological theory. They suggest that having women and ethnic minority directors could be at the origin of group conflict and might nullify innovation and creativity in decisions.

Based on previous research, we expect that ethnic diversity may berelated to innovation.

2.3. Knowledge diversity

From a cognitive approach, Rindova (1999), Forbes and Milliken (1999) argue that cognitive input from the board is needed for strategic decision-making. Some authors highlight the effect of diversity of knowledge on innovation strategy. Ramadani et al. (2017) emphasize that knowledge is positively related to innovation activities. The ability of companies to innovate depends on the diversity of cognitive contributions of the board's directors. The last can stimulate creativity and faster innovation process (Carter et al. 2003, Ghaya and Lambert, 2016).

Literature research reveals that the diversity of knowledge allows companies to acquire critical resources and fosters a spirit of innovation. Xie and O'Neill (2014) point out that board diversity provides two types of resources, specific knowledge and the ability to link firm to other wider network of organizations. They also emphasize that these resources increase spending on R&D, and consequently innovation.

The diversity of knowledge refers to experience, tenure and educational qualifications such as the level of graduate studies. Indeed, some studies (Kor, 2006, Ujunwa, 2012) highlight the need to analyze the effect of directors with postgraduate doctorates on innovation. Chen (2014) mentioned that directors having completed graduate studies have more knowledge and positive influence on R&D investment typically. These directors are likely to be more involved in the innovation process (Bantel and Jackson, 1989). Graduate studies allow then managers to develop

skills and knowledge that constitute innovative assets.

Midavaine et al. (2016) emphasize that individuals with higher education may be more likely to take risks and tend to invest in R&D. Camelo et al., (2010) find a positive relationship between educational diversity in top management and innovation performance.

Midavaine et al. (2006) are also interested in diversity tenure. The authors find that board members with higher tenure are less likely to invest in R&D.

Hoang and al (2006) analyze the influence of education and training on the level of innovation, measured by the level of newness and the number of new products and services. They show that education and training positively influence the number of new products and services, while they negatively influence the level of newness. The results are not clear, especially since the two measures of innovation are strongly correlated. The authors emphasize that it is necessary to explore this relationship and to identify the existence of potential mediating variables.

Considering the interaction between the different facet of board demography seems then necessary.

Knowledge diversity may thus moderate the effect of gender and ethnic diversity on innovation.

3. DATA AND METHODOLOGY

3.1 Sample selection

To empirically assess the impact of board diversity on innovation, we collect data concerning the world's 100 most innovative companies given by Forbes 2018 ranking. The data has been drawn from two main sources: Forbes 2018 ranking, which provides the list of the world's most innovative companies as well as the innovation premium of each firm and Bloomberg, Boardex and Morningstar, which we use to obtain firm's specific data as well as data concerning director's profiles. Data for all the independent and control variables in the study were taken from 2017 while the dependent variable was taken from the Forbes 2018 ranking. The independent variables were lagged under the assumption that board members must be in their roles for some time to have an impact on company innovation. Out of the 100 companies, 4 were dropped due to missing information.

3.2. Variables

Dependent variable

Literature has measured innovation in several ways. Previous studies used scales based on criteria such as, the number of patents, total research and development (R&D) expenditure, the number of new products introduced to the market, the speed to market, being the "first" in the market, the newness of the new product (Hoang et al., 2006). In particular, R&D expenditure and the number of patents have been widely used as a measure of the innovativeness intensity (Honoré et al., 2015; Midavaine et al., 2016; Helmers et al, 2017; Miller and Triana, 2009; Brem et al., 2016; Xie and O'Neil, 2013; Ashwin et al. 2016; Zona et al., 2013). However, several researchers (Zahra and al., 1996; Kleinknecht et al. 2002; Kor, 2006; Midavaine et al., 2016) have criticized these frequently used proxies of innovation. Amongst others, Kleinknecht et al. (2002) argue that the most widely used innovation measures (R&D expenditure and the number of patents) suffer severe weaknesses as a proxy for innovation. In line with this idea, Kor (2006) argues that R&D expenditure is different from innovation, which is a consequence of this expenditure.

Moreover, Trajtenberg (1990) highlights that (p.172) “patent counts cannot be informative about innovative output”. These previous concerns call for measuring the innovation differently. Hence, we choose to measure innovation using a new proxy: the innovation premium. To the best of our knowledge, this measure has not yet been considered to capture innovation in academic works. The innovation premium of a company is the difference between its market capitalization and the net present value of cash flows from existing businesses. It is calculated using a proprietary algorithm from Credit Suisse HOLT. The difference between them is the bonus given by equity investors on the educated hunch that the company will continue to come up with profitable new growth (Forbes, 2018).

Independent variables

A large strand within the literature reviewed has measured diversity using the number (or percentage) of persons who have a certain characteristic. Midavaine et al. (2016) argue that doing so assumes that the presence of more individuals who have such characteristic will lead to the expected impact on team output. Midavaine et al. (2016) highlight that this assumption does not fit the diversity argument put forward in this paper.

Hence, we operationalize board diversity using a more elaborated measure, which is the Blau's index (1977). Blau's index was recognized as the optimal method to measure diversity within a team (Harrison and Klein, 2007). This index is calculated as follows: $D = 1 - \sum_{i=1}^N p_i^2$

Where p is the proportion of members in a category and N is the number of categories (Blau, 1977). A high Blau's index value denotes great board diversity. However, in order to have standardized values of the index, ranging from 0 to 1, for all the diversity attributes, we follow Agresti and Agresti (1978) in computing a modified Blau's index. The modified Blau's index is obtained by multiplying by $N/(N-1)$ the initial Blau's index.

Hence, for each diversity attribute (gender, ethnic, educational and functional), we calculate a modified Blau's index.

Control variables

Following previous literature that has studied firm's innovation performance (Frenz and Ietto-Gillies, 2009 ; Miller and Triana, 2009; De Cleyn and Braet, 2012 ; Galia and Zenou, 2012; Díaz-García et al., 2013; Midavaine et al., 2016; Kang et al., 2018), we include several control variables to better isolate the effect board diversity on firm's innovation. These control variables facilitate comparability with previous studies and reduce the possibility that omitted variables influence innovation performance.

Hence, we control for the firm's characteristics as well as the firm's environment. The control variables considered in our study are board size, board independence, firm size, industry sector.

We finally include an additional variable that controls for the geographical location.

Table 1 describes the variables of our study as well as the proxies used.

Table1- Variables of the study

Variables		Proxy used
<i>Dependent variable</i>		
Inov_Prem	Innovation	The innovation premium
<i>Independent variables</i>		
Gender-Div	Gender diversity	Modified Blau's index with a classification of male and female
Ethnic-Div	Ethnic diversity	Modified Blau's index with a classification of 4 ethnic groups: Caucasian, Asian, Black, and Hispanic
<i>Moderating variables</i>		
Knowledge diversity	Educational diversity	Modified Blau's index with a classification of five subgroupings: business administration, Healthcare, Engineering, Legal, and Others.
	Functional diversity	Modified Blau's index with a classification of six subgroupings: General Management, Finance & Accounting, Technology, Law, Health and Others.
<i>Control variables</i>		
BoD_Size	Board size	Ln (number of directors)
Firm_Size	Firm size	Ln (number of employees)
BoD_Ind	Board independence	Proportion of outside directors
Sector	Industry sector	3 industry dummies: high technology sector, Manufacturing sector, and service sector.
Region	Geographical location	3 regions: America, Europe and Asia

3.3.Methodology

In order to empirically assess to what extent board diversity has an impact on firm's innovation, we suggest estimating regressions in which the innovation premium is explained by surface-level as well as deep- level board diversity plus a set of control variables. To apply linear OLS, there are two main assumptions: that we include all the important variables that could have an effect on innovation premium, and that the sample is randomly drawn. However, our study is conducted on the world's 100 most innovative companies, leading to a selection bias. To

consider this issue, we follow Frenz and Ietto-Gillies (2009) that have studied the firm's innovation performance, to estimate a truncated OLS regression. Indeed, this model is used when observations with values in the dependent variable below or above certain thresholds are systematically excluded from the sample. In our study, firms having an innovation premium below 34,92% are not part of the world's most innovative companies.

Empirical results

Table 2 below gives descriptive statistics and cross-correlations of the variables included in our model.

Table 2- Descriptive statistics and correlations

Variables	Mean	Std.Dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable												
(1) Inov_Prem	48,37%	12,35%	1									
Independent variables												
(2) Gender_Div	0,62	0,30	-0,107	1								
(3) Ethnic_Div	0,29	0,29	-0,015	,285**	1							
Moderating variables												
(4) Educational_Div	0,59	0,26	0,065	0,037	-0,028	1						
(5) Functional_Div	0,71	0,14	0,082	-0,063	-0,160	0,144	1					
Control variables												
(6) BoD_Size	2,36	0,26	-,317**	,290**	0,178	0,091	-0,082	1				
(7) Firm_Size	9,95	1,36	-,299**	,296**	0,169	0,049	-0,026	,338**	1			
(8) Bod_Ind	0,69	0,22	-0,008	,432**	,266**	0,048	0,030	0,010	0,088	1		
(9) Sector	1,81	0,74	-,371**	0,058	0,179	-,218*	-0,114	0,168	,308**	0,028	1	
(10) Region	1,66	0,82	-0,122	-,479**	-,412**	-0,005	0,054	-0,184	-0,045	-,543**	0,014	1

Notes :*,**Denote significance at the 10% and 5%levels, respectively.

Our sample consisted of 96 companies. Of these firms, 41% are manufacturing firms, 39% are high technology companies, and 20 % are in the service sector. According to the geographical location of the companies, 56% of the firms are from America, 22% of them are from Europe, and 22% others are from Asia.

According to the gender, ethnic, educational and functional diversities, the mean values of the modified blau indexes are 0,62, 0,29, 0,59 and 0,71 respectively. On average, boards appear to be more diverse in terms of function than other attributes of diversities. This indicates that the directors of the firms in our sample have experiences in various sectors of activity. 47% of directors have an experience in general management, 24% in finance and accounting, 13% in technology, 5% in law, 4% in health and 7% in other sectors.

The mean values also indicate that ethnic diversity is quite low. The majority of directors are Caucasian (63%).

Related to the control variables, the mean of firm size is 9,95. The boards of the world’s most innovative companies have, on average, 10,92 members, among whom 69% are independent directors

We find that the simple correlation between the innovation premium and variables related to board diversity is not statistically significant. Furthermore, we do not find high correlation coefficients between all the variables from our study providing insurance that there are no multi-collinearity problems.

We then investigate the relationship between board diversity and the innovation premium more rigorously in a multivariate regression approach. We apply truncated OLS regression, as explained above. We estimate 5 different specifications. Table 3 reports the estimation results of the regressions. Model 1 comprises only control variables: Board size, Firm size, Board independence, Industry sector, and Geographical location. Then, in Model 2, we add gender diversity and ethnic diversity to the baseline model. Then, in Models 3 and 4, we test the effect of the moderating variables (educational diversity and functional diversity) on innovation premium. In these two models, the moderating variables are added individually. Finally, in Model 5, we include the moderators simultaneously.

Table 3- The effect of board diversity on the innovation performance

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Gender_Div		0,1043 (0,1355)	-0,1957 (0,3023)	-0,106 (0,1303)	0,1984 (0,3950)
Ethnic_Div		0,0851 (0,1281)	0,0891 (0,1275)	-0,4149 (0,5311)	-0,8907 (0,8014)
BoD_Size	-0,4507** (0,2030)	-0,4427** (0,2037)	-0,4423** (0,2011)	-0,4252** (0,1947)	-0,3901** (0,1831)
Firm_Size	-0,0305 (0,0301)	-0,02585 (0,3019)	-0,0263 (0,0300)	-0,0207 (0,0292)	-0,0181 (0,0281)
Bod_Ind	-0,2427 (0,1991)	-0,2261 (0,1989)	-0,2181 (0,1973)	-0,2322 (0,1932)	-0,2276 (0,1874)
Sector	-0,1595** (0,0710)	-0,1690** (0,07314)	-0,1621** (0,0720)	-0,1646** (0,0704)	-0,1581 (0,0667)
Region	-0,1226** (0,0621)	-0,1252*** (0,0657)	-0,1225*** (0,0650)	-0,1260** (0,0632)	-0,1212** (0,0609)
Gender-Div x Educational-Div			0,1008 (0,2146)		0,2917 (0,2941)
Gender-Div x Functional-Div			0,0442 (0,3652)		-0,6725 (0,5671)
Ethnic-Div x Educational-Div				-0,084 (0,3834)	-0,5350 (0,5591)
Ethnic-Div x Functional-Div				-0,4149 (0,5311)	1,7611 (1,1453)
Constant	2,269819*** (0,6088)	2,2543*** (0,6086)	2,2369*** (0,6016)	2,1793*** (0,5727)	2,0701*** (0,5421)
Wald X²	9,61**	9,57	9,73	10,43	11,20
-2 Log likelihood	-223,81	-224,82	-225,12	-226,07	-228,238
Observations	96	96	96	96	96

Notes: *, **, *** Denote significance at the 10%, 5% and 1% levels, respectively.
Standard errors in parentheses.

The results are remarkable in several respects. We observe that the gender diversity board does not have a significant effect on innovation performance. Moderating the effect of gender diversity by function and education does not modify our results. This result is contrary to our expectations. It appears that gender diversity is unimportant for innovation intensity. This result is in line with previous studies that demonstrate that gender diversity does not influence firm value (Campbell and Minguez-Vera, 2008). We can explain this result by “glass ceiling” which is a set of artificial barriers created by certain prejudices and stereotypes that would prevent qualified women from advancing in the organization (Toé, 2014). Indeed, according to Grégoire et al. (2013), women are less present than men in specialized committees where decisions are being prepared.

Our results also show that ethnic diversity on the board has an insignificant effect on innovation intensity. Considering the interaction between this variable and knowledge does not affect this relation. This finding is not surprising considering that ethnic diversity is very weak in the boards of the world’s most innovative companies. On average, 63% of directors are Caucasian, 26% are Asian, 4% are Black, and 7% are Hispanic.

Concerning the control variables, we find that board size, sector, and region are determining factors in innovative performance. Our results show a negative and significant relationship between the firm sector and innovation performance. Belonging to high technology sector influences negatively the innovation performance. Firms located in America are also negatively related to innovation performance.

Our results highlight a negative and significant link between board size and innovation performance. This finding is consistent with the negative impact of board size on the ability to initiate strategic actions, and on the board’s internal dynamics to face complex environments (Goodstein et al., 1994; Galia and Zenou, 2012).

Finally, firm size and board independence do not have a significant impact on Firm innovation.

We checked whether our results are robust to the model used. The results remain unchanged when we run the same tests using a Tobin model. We also checked the robustness of our findings to alternative proxies of board diversity; we carry out the same tests using Blau indexes and proportions of different categories. The coefficients obtained are in harmony with our first results.

4. CONCLUSION

The objective of this paper was to assess the extent to which board diversity of the world’s most innovative companies may affect their innovation performance.

Our study offers new insights by exploring several characteristics of administrators (gender, ethnic and knowledge) and using a new proxy for innovation: the premium of innovation. Our research is unique because we consider both surface-level (gender and ethnic) and deep-level of diversity (knowledge).

The empirical findings suggest that gender diversity and ethnic diversity do not influence innovation performance. Furthermore, we find that moderating gender and ethnic diversities by knowledge do not impact innovation performance. Board size has a negative and significant effect on innovation performance. The results indicate also a negative and significant

relationship between both the sector and region and the performance innovation.

Our study contributes to the literature on board diversity and innovation performance, but it presents certain limits related to the size and selection of the sample. These limits offer avenues for future research. First, an interesting extension of this work could be to investigate the determinants of the innovation performance of the world's most innovative companies. Second, a possible extension of this study is to analyze the impact of board diversity on innovation performance on multi-country dataset and in a dynamic econometric framework. In this way, we could focus on more detailed variables that measure specific aspects of the institutional context and consider the potential impact of time on innovation performance.

REFERENCES

- Adams, R.B. and Ferreira, D. (2009) 'Women in the boardroom and their impact on governance and performance', *Journal of Financial Economics*, Vol. 94, No. 2, pp.291–309.
- Baysinger, B.D. and H.N. Butler, 1985. Corporate governance and the board of directors: Value effects of changes in board composition, *Journal of Law, Economics and Organization* 1, 101–124.
- Blau, P. M. 1977. *Inequality and heterogeneity*. New York, Free Press.
- Campbell, K., & Mínguez-Vera, A. (2008). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, 83(3), 435–451. <http://doi.org/10.1007/s10551-007-9630-y>
- Carter, D. A., Simkins, B. J., & Simpson, W. G. 2003. Corporate governance, board diversity, and firm value. *Financial Review*, 38: 33–53.
- Carter, D. A., D'Souza, F., Simkins, B. J., & Simpson, W. G. (2010). The gender and ethnic diversity of US boards and board committees and firm financial performance. *Corporate Governance: An International Review*, 18(5), 396–414. <http://doi.org/10.1111/j.1467-8683.2010.00809.x>
- Charreaux, G. (2000). Le conseil d'administration dans les théories de la gouvernance. *Revue Du Financier*, 127(0), 6–17. Retrieved from <http://leg.u-bourgogne.fr/images/stories/wp/001201.pdf%5Cnhttp://leg2.u-bourgogne.fr/wp/001201.PDF>
- Daily, C.M. and Dalton, D.R. (2003) 'Women in the boardroom: a business imperative', *Journal of Business Strategy*, Vol. 24, No. 5, pp.8–10.
- Daily, C., Certo, S. and Dalton, D. (1999) A Decade of Corporate Women: Some Progress in the Boardroom, None in the Executive Suite, *Strategic Management Journal*, 20, 93–99.
- De Cleyn, S. H., & Braet, J. (2012). Do board composition and investor type influence innovativeness in SMEs? *International Entrepreneurship and Management Journal*, 8(3), 285–308. <http://doi.org/10.1007/s11365-010-0168-6>
- Díaz-García, C., González-Moreno, A., & Sáez-Martínez, F. J. (2013). Gender diversity within R & D teams: Its impact on radicalness of innovation. *Innovation: Management, Policy and Practice*, 15(2), 149–160. <http://doi.org/10.5172/impp.2013.15.2.149>
- Drazin, R. and Schoonhoven, C.B. (1996), "Community, population, and organization effects on innovation: a multilevel perspective", *Academy of Management Journal*, Vol. 39 No. 5, pp. 1065-83.
- Erhardt, N. L., Werbel, J. D., & Shrader, C. B. (2003). Erhardt_et_al-2003-Corporate_Governance%3A_An_International_Review, 11(2), 102–111.

<http://doi.org/10.1111/1467-8683.00011>

Ferreira, J.J.M. (2010) 'Corporate entrepreneurship and small firms growth', *International Journal of Entrepreneurship and Small Business*, Vol. 10 No. 3, pp.386–409.

Forbes (2018), How We Rank The Most Innovative Companies 2018, <https://www.forbes.com/sites/innovatorsdna/2018/05/29/how-we-rank-the-most-innovative-companies-2018/>

Forbes, D. P., & Milliken, F. J. (1999). Cognition and corporate governance: Understanding boards of directors as strategic decision-making groups. *Academy of Management Review*, 24(3), 489–505.

Franko, L.G. (1989) 'Global corporate competition: who's winning, who's losing and the R&D factor as one reason why', *Strategic Management Journal*, Vol. 10, No. 5, pp.449–474

Frenz, M., & Ietto-Gillies, G. (2009). The impact on innovation performance of different sources of knowledge: Evidence from the UK Community Innovation Survey. *Research Policy*, 38(7), 1125–1135. <http://doi.org/10.1016/j.respol.2009.05.002>

Galia, F., & Zenou, E. (2012). Board composition and forms of innovation: does diversity make a difference? *European J. of International Management*, 6(6), 630. <https://doi.org/10.1504/EJIM.2012.050425>

Ghaya, H. & Lambert, G. (2016). « L'implication du conseil d'administration dans le processus stratégique des entreprises : le particularisme français », *Management international*, Vol. 20, N°4, p. 176-187.

Goodstein, J., Gautam, K., & Boeker, W. 1994. The effects of board size and diversity on strategic change. *Strategic Management Journal*, 15: 241-250.

Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. 2002. Time, teams, and task performance: Changing effects of surface- and deep-level diversity on group functioning. *Academy of Management Journal*, 45: 1029–1045.

Harrison, D. A., Price, K. H., & Bell, M. P. 1998. Beyond relational demography: Time and the effects of surface- and deep-level diversity on work group cohesion. *Academy of Management Journal*, 41: 96–107.

Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review*, 32(4), 1199–1228.

Helmets, C., Patnam, M., & Rau, P. R. (2017). Do board interlocks increase innovation? Evidence from a corporate governance reform in India. *Journal of Banking and Finance*, 80, 51–70. <http://doi.org/10.1016/j.jbankfin.2017.04.001>

Hitt, M. A., Hoskisson, R. E., Johnson, R. A., & Moesel, D. D. (1996). The market for corporate control and firm innovation. *Academy of Management Journal*, 39(5), 1084–1119.

Hoang, D. T., Igel, B., & Laosirihongthong, T. (2006). The impact of total quality management on innovation: Findings from a developing country. *International Journal of Quality and Reliability Management*, 23(9), 1092–1117. <http://doi.org/10.1108/02656710610704230>

Honoré, F., Munarib, F., Pottelsberghe de La Potterie, B. (2015). Corporate governance practices and companies' R&D intensity: Evidence from European countries, *Research Policy*, Volume 44, Issue 2, 533-543.

Hillman, A. and Dalziel, T. (2003). 'Board of directors and firm performance: integrating agency and resource dependence perspectives'. *Academy of Management Review*, 28, 383–96.

-
- Hillman, A., Cannella, A. A. and Harris, I. (2002). 'Women and racial minorities in the boardroom: how do they differ?'. *Journal of Management*, 28, 747–63.
- Jensen M.C. et Meckling W.H., 1976, "Theory of the firm: managerial behavior, agency costs and capital structure", *Journal of Financial Economics*, Octobre, 3 (4), 305–360.
- Kang, J. K., Liu, W. L., Low, A., & Zhang, L. (2018). Friendly boards and innovation. *Journal of Empirical Finance*, 45(February 2017), 1–25. <http://doi.org/10.1016/j.jempfin.2017.09.007>
- Kilduff, M., Angelmar, R., & Mehra, A. 2000. Top management–team diversity and firm performance: Examining the role of cognitions. *Organization Science*, 11: 21–34.
- Kor, Y. Y. (2006). 'Direct and Interaction effects of top management team and board compositions on R&D investments strategy', *Strategic Management Journal*, 27, pp. 1081–1099.
- Midavaine, J., Dolfsma, W., & Aalbers, R. (2016). Board diversity and R & D investment. *Management Decision*, 54(3), 558–569. <http://doi.org/10.1108/MD-09-2014-0574>
- Miller, T., & Triana, M. (2009). Demographic diversity in the boardroom: Mediators of the board diversity–firm performance relationship. *Journal of Management Studies*. *Journal of Management Studies*, 46(5), 755–786.
- Paper 10/98). Melbourne, VIC: Melbourne Institute of Applied Economic and Social Research.
- Pfeffer, J. and Salancik, G. (1978) *The External Control of Organizations: A Resource Dependence Perspective*, Harper & Row, New York.
- Ramadani V, Abazi-Alili H, Dana LP (2017), « The impact of knowledge spillovers and innovation on firm-performance: findings from the Balkans countries », *International Entrepreneurship and Management Journal*, Vol. 13, p. 299–325.
- Rindova, V. P. (1999). What corporate boards have to do with strategy: A cognitive perspective. *Journal of Management Studies*, 36(7), 953–975.
- Rogers, M. (1998). Definition and measurement of innovation (Melbourne Institute Working Paper 10/98).
- Torchia, M., Calabrò, A., & Huse, M. (2011). Women directors on corporate boards: From tokenism to critical mass. *Journal of Business Ethics*, 102(2), 299–317.
- Zaltman, G., Duncan, R., & Holbek, J. (1973). *Innovations and organizations*. New York, NY: Wiley.
- Torchia, M., Calabrò, A., Gabaldon, P., & Kanadli, S. B. (2018). Women directors contribution to organizational innovation: A behavioral approach. *Scandinavian Journal of Management*, 34(2), 215–224. <http://doi.org/10.1016/j.scaman.2018.02.001>
- Wincent, J., Anokhin, S., & Örtqvist, D. (2010). Does network board capital matter? A study of innovative performance in strategic SME networks. *Journal of Business Research*, 63(3), 265–275. <http://doi.org/10.1016/j.jbusres.2009.03.012>
- Zona, F., Zattoni, A., & Minichilli, A. (2013). A Contingency Model of Boards of Directors and Firm Innovation: The Moderating Role of Firm Size. *British Journal of Management*, 24(3), 299–315. <http://doi.org/10.1111/j.1467-8551.2011.00805.x>
- Timmerman, T. (2000) Racial Diversity, Age Diversity, Interdependence, and Team Performance, *Small Group Research*, 31, 592–606.
- Torchia, M., Calabrò, A., & Morner, M. (2015). Board of directors' diversity, creativity, and cognitive conflict. *International Studies of Management & Organization*, 45(1), 6–24.