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Diversity and IT competence of Board of directors and executive management and innovation-based business strategy

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Abstract

As compared to the United States, Canada shows a weak performance in terms of innovation, resulting in lagging productivity growth. In 2009, the Expert Panel on Business Innovation of the Council of Canadian Academies concluded that this is because relatively few Canadian firms emphasize innovation when adopting their business strategy. A recent survey among CEOs around the world suggests that the most important ingredients for successful innovation at a company are having the right culture to foster and support innovation and a strong visionary business leadership while weak governance/leadership, inadequate technology, lack of talent and existing organization culture are stopping them from being more innovative (PwC, 2013). Prior literature stresses the importance of Board of directors, executive management leadership and information technology (IT) in the support and growth of the business. This research examines the influence of diversity and IT competence of the Board of directors and executive management on innovation-based business strategy. Results suggest that diversity on boards in terms of industry background and tenure influence positively overall innovation. More specifically, diversity of board tenure and executive tenure, as well as IT competence of executive management is positively associated with product innovation. In addition, size of the organization has an impact on overall innovation, and on product innovation.

Keywords: Board of directors; executive management; diversity; IT competence; innovation-based business strategy.

Résumé

Comparativement aux États-Unis, le Canada montre une faible performance en termes d'innovation, ce qui entraîne un retard dans la croissance de la productivité. En 2009, le Comité d'experts sur l'innovation dans les entreprises du Conseil des académies canadiennes conclut que c'est en raison du fait que peu d'entreprises canadiennes mettent l'emphase sur l'innovation lorsqu'elles adoptent leur stratégie d'affaires. Un récent sondage réalisé auprès de chefs de direction à travers le monde suggère que les plus importants éléments pour assurer le succès de l'innovation dans une entreprise sont une culture favorisant et supportant l'innovation et un leadership fort et visionnaire, alors qu'un faible leadership/une faible gouvernance, une technologie inadéquate, le manque de talent et la culture organisationnelle existante les empêchent d'être plus innovateurs (PwC, 2013). La littérature antérieure souligne l'importance du conseil d'administration, du leadership de la haute direction et des technologies de l'information (TI) dans le support et la croissance des affaires. Cette étude examine l'influence de la diversité et de la compétence en TI du conseil d'administration et de la haute direction sur l'adoption d'une stratégie basée sur l'innovation. Les résultats suggèrent que la diversité au sein du conseil d'administration en termes d'industries et d'années d'expérience sur le conseil influence positivement l'innovation dans son ensemble. Plus spécifiquement, la diversité du nombre d'années d'expérience au sein du conseil ou de la haute direction, ainsi que la compétence en TI de la haute direction, sont positivement associées à l'innovation en termes de produits. De plus, la taille de l'organisation a un impact sur l'innovation dans son ensemble, et sur l'innovation en termes de produits.

Mots clés: conseil d'administration; haute direction; diversité; compétence en TI; stratégie basée sur l'innovation.

INTRODUCTION

In 2009, the Expert Panel on Business Innovation of the Council of Canadian Academies (CCA) concluded that there is an innovation performance gap between Canada and the United States. The Expert Panel of the CCA concludes that Canada's weak innovation performance "is due to the fact that relatively few Canadian companies adopt innovation-based business strategies" (CCA, 2009, p. 209). Drawing on data collected from chief decision makers from 884 firms across Canada, Deloitte (2013) suggests that about one third of Canadian firms believe they are making competitive levels of investment when they are not.

A 2013 survey of 246 Chief Executive Officers (CEOs) from around the world reported that "CEOs are now taking personal responsibility for directing and inspiring innovation as it becomes an even more vital element of business survival and success" (PwC, 2013, p. 3). Moreover, about half of the 246 CEOs think that the most important ingredients for successful innovation at a company are having the right culture to foster and support innovation (57%) and a strong visionary business leadership (44%) (PwC, 2013, p. 9), while some believe that weak governance/leadership (9%), inadequate technology (18%), lack of talent (30%) and existing organization culture (41%) are stopping them from being more innovative (PwC, 2013, p. 11). In that spirit, an innovation-based business strategy can be influenced by an ambitious and expansionist Board of directors and executive management in large firms, as well as entrepreneurs that are pioneers and builders in smaller ones (CCA, 2009).

The Expert Panel of the CCA (2009) reported that: "Information and communications technologies (ICT) are vitally important for innovation because (i) the producers of ICT are themselves key innovation-intensive sectors of the economy; and (ii) the use of ICT in other

sectors contributes increasingly to productivity growth in the entire economy, and particularly in service industries" (CCA, 2009, p. 198). Moreover, "the ICT-producing sector was the principal driver of the productivity revival in the United States" and, since the 1990's, "the influence of ICT has been primarily due to productivity growth in sectors that use ICT intensively" (CCA, 2009, p. 68).

In fact, information technology (IT) is increasingly central to business performance (Wilkin and Chenhall, 2010) and is a key driver of much technological innovation and organizational change (Liang et al., 2010). For instance, as one of the innovative ways to do business, the Internet adoption mode characterized by online transactions is associated with proactive business strategy focusing on business transactions and integration of Internet strategy with the firm's business strategy (Teo, 2007).

Hence, strong IT leadership is expected from business managers (Basselier et al., 2003). In the same way, enhanced business knowledge is required from Chief Information Officers (CIOs) (Armstrong and Sambamurthy, 1999) who have become IT executive-level innovation leaders (Chun and Mooney, 2009). In an E-government innovation context where IT helps governments to provide information and services to citizens through web sites, typical leaders provide a direction, encourage knowledge sharing and rally resources (Prybutok et al., 2008). In addition, more emphasis on IT innovation through shared IT-business understanding is fundamental to IT-based value and competitive advantage (Ray et al., 2007). More specifically, CIO and CEO mutual understanding of the role of IT leads to a strategic alignment of IT with business, and thereby enhances the IT contribution to business performance (Johnson and Lederer, 2010).

Based on the above studies, knowledge sharing is an asset to increase business performance, IT is a key driver of innovation, and Board of directors and executive management can promote a culture of innovation and lead organizations to develop an innovation-based business strategy. In that sense, diversity and IT competence across the board and the executive team appear to be group characteristics that may favour such a leadership.

To our knowledge, no study has considered together these "collective" characteristics of Board of directors and executive management as potential determinants of innovation-based business strategies. The objective of this research is to examine the influence of diversity and IT competence of Board of directors and executive management on innovation-based business strategy.

This study is motivated by the following considerations. First, in practice, there is a need to document if, and to what extent, some group characteristics of Board of directors and executive management are related to innovation-based strategies in organizations. Second, there is a need to complement governance and innovation, as well as IT literature by questioning the influence of IT competence, as it appears to be crucial to innovate. Third, there is a need to identify significant determinants and get empirical insights for further research aiming at providing an in-depth understanding of factors enhancing innovation-based business strategy.

In the following sections, we present the conceptual framework and the research method. Results are then described, followed by a discussion and conclusion including limitations and research avenues.

CONCEPTUAL FRAMEWORK

In this research, we draw on insights from governance, innovation and IT studies to develop the conceptual framework. The diversity and IT competence of Board of directors and executive management taken as groups are expected to be associated with innovation-based business strategy.

Innovation-based business strategy

Innovation refers to "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD, 2005, p. 46)" (CCA, 2009, p. 26), and includes, among others, web-based commerce (CCA, 2009). An *innovation-based business strategy* refers to the extent to which an organization emphasizes product, process or management innovation to distinguish the firm from the others and achieve a competitive advantage. For instance, as reported by PwC (2013), a large proportion of surveyed companies will look to innovate in products (48%), technology (45%), customer experience (44%), systems and processes (43%) and business model (41%) over the next three years.

Product innovation happens when a firm develops products that are new to the firm (Fitzgerald et al., 2008), and when it "declares it has introduced completely new products or products with important modifications, products with new functions resulting from innovations, or has made changes to the design, presentation, materials, or composition of the product" (Nieto and Santamaria, 2010, p. 50). New products are defined "as those either with unprecedented performance features or familiar features that offer significant improvements in performance or

cost that transform existing markets or create new ones" (Wu, 2008, p. 147). Indeed, new products may use new technology that permits quantum leap in performance or technologies that have an impact on (or cause) significant changes in the whole industry (Talke et al., 2010). Incremental product innovation such as line extensions (minor modification of an existing product) or "me-too" products (imitation of competitors' products that are already on the market), and radical product innovation, are indicators of innovation efforts (Radas and Bozic, 2009). Product testing/feasibility study/exploration and awards received for products can also be considered as indicators of innovation effort.

Process innovation refers to the introduction of some significant modification in the production process such as new machines or new methods of organization (Nieto and Santamaria, 2010). Similarly to new products (Talke et al., 2010), new processes may use new technology that permits quantum leap in performance or technologies that have an impact on (or cause) significant changes in the whole industry. Further, as for products, it is reasonable to consider that awards received for processes can also be considered as indicators of innovation effort.

Management innovation refers to major changes in areas of business structures and practices such as implementation of new (or significantly changed) corporate (e.g. mission statement) or marketing strategies, implementation of advanced management techniques (e.g. knowledge management), and implementation of new or significantly changed organizational structure (e.g. diversification activities) (Mol and Birkinshaw, 2009).

Diversity and IT competence

Board of directors and executive management diversity is defined by heterogeneity from a functional or industry standpoint, as well as tenure (Talke et al., 2010). In the light of Talke et al. (2010), the *functional background* describes which categories represent a board member or an executive functional specialization (finance/accounting, marketing, human resources, production/operations, research/development, information systems/IT, legal/general counsel and others such as management, politics, communications/investor relations, strategy/development) while the *industry background* indicates which categories represent their industry experience (financial services/insurance, manufacturing, mining, oil & gas, retail/wholesale, telecommunications/IT/media). Executive management *tenure* is defined as the number of year each executive has been assigned to the executive team (Talke et al., 2010) while Board of directors tenure refers to the number of years each board members has been assigned to the board.

IT competence is defined as a whole and refers to managerial or technical IT skills (Mata et al., 1995) and IT experience (Basselier et al., 2003). Managerial IT skills include ability to conceive of, develop and exploit IT applications to support and enhance other business functions while technical IT skills refers to the know-how needed to build IT applications using the available technology and to operate them to make products or provide services (Mata et al., 1995). IT experience includes experience in IT projects and experience in management of IT (Basselier et al., 2003).

Influence of diversity and IT competence on innovation-based business strategy

The strategic role of Board of directors requires rich knowledge and experience to ensure that management is proactive in finding appropriate alternatives and being creative when opportunities emerge (Shimizu and Hitt, 2004). According to Wu (2008), the collective competence (knowledge, experience, and commitment) of board members is positively associated with product innovation. Indeed, when board members have more industry-wide and company-specific knowledge and experience, when they invest more time and energy in their role, there is more innovation in terms of new product introduction (Wu, 2008).

In addition, considering the increasing and crucial importance of IT to innovation and growth, the Board of directors' commitment to IT is expected to be related to an innovation-based business strategy. On the contrary, a lack of IT knowledge on the part of board members can limit their assessment of IT-based competitive advantage (CEFRIO, 2009).

Dahlin et al. (2005) indicated that diversity among innovation team members can lead to more innovation outcomes because of its positive impact on creativity, task reflexivity and information sharing. Building on these results, Talke et al. (2010) found that top management team diversity has a significant positive impact on the strategic choice of organizations to place emphasis on innovation. Indeed, taken as a whole, greater differences (heterogeneity) in educational, functional, industry, organizational background, and executive tenure, lead to greater focus on innovation fields (Talke et al., 2010).

Enhanced IT competence on the part of business managers leads to stronger IT leadership from business people (Basselier et al., 2003), and IT skills are correlated with a commitment to

technological innovation (Hulland et al., 2007). Furthermore, lack of formal IT training gives rise to a lack of knowledge to take advantage of IT (CCA, 2009). In that spirit, if executives have considerable IT knowledge and experience, it is reasonable to expect that they will be more qualified to lead the IT strategy by articulating and communicating a vision about the role of IT in the innovation-based strategy.

Overall, if Board of directors and executive management are comprised of individuals who have different and complementary functional and industry backgrounds, it can be expected that they can lead an organization to innovate. Diversity in terms of years of experience on board or executive team can also favour innovation. Furthermore, if a Board of directors or executive management as a whole suffers from a lack of IT competence, there is a chance that it will not be actively involved in supporting the use of IT to innovate.

Based on the above discussion, Board of director and executive management diversity and their level of IT competence should influence positively firms' innovation-based business strategy. Since business size can influence innovation (Askarany and Smith, 2008), we control for its influence on the relationships under study.

RESEARCH METHOD

Sample

All firms comprising the S&P/TSX composite index on February 26, 2012 were selected because these large firms represent about 70% of market capitalization for all Canadian-based companies listed on the Toronto Stock Exchange. From the 253 target population, we have

withdrawn foreign-based companies, development stage companies, subsidiaries of a parent company that are already in the sample, firms without a web site and firms with missing data. Our final sample is comprised of 163 firms.

Approach and source of data

The archival approach which relies on the use of data available from databases or other sources was used to collect data. As a rich source of data, mass communication is appropriate to examine a variety of questions (Judd et al., 1991). In that spirit, using web sites as the main data source provided access to a large quantity of factual and public information on a large number of firms (including annual reports, proxy statements and annual information forms).

In the light of the conceptual framework, two data collection grids were developed and tested for innovation-based business strategy, and board members' and executives' characteristics respectively. Indeed, a first version of each data collection grid was developed by one of the researcher. This version was then tested by a research assistant on about 30 sample firms. After discussions with this research assistant, both researchers refined the grids and agreed on written instructions that were given to two other research assistants in charge of collecting data (one for each grid). Data were collected in summer-fall 2012 and are related to firms' 2011 year-end. Thereafter, the researchers did reliability checks on data collected for each of the main constructs and computed the diversity and IT competence measures as detailed below.

Measurement of constructs

To measure *innovation-based business strategy*, we used a list of 17 items from previous studies. These items are described in the Conceptual framework section. Each item was coded either according to the number of corresponding innovations described in the annual report or the annual information form, 0 if none, or attributed a value of 1 if present, 0 otherwise[1]. Eight items were used to measure product innovation (Fitzgerald et al., 2008; Wu, 2008; Radas et Bozic, 2009; Nieto and Santamaria, 2010; Talke et al., 2010); five items relate to process innovation (Nieto et Santamaria, 2010; Talke et al., 2010), and four items measure management innovation (Mol and Birkinshaw, 2009). A composite index was computed for total innovation (sum of 17 items). Subindexes were also computed for product innovation (sum of eight items), process innovation (sum of five items) and management innovation (sum of four items).

To measure *diversity* as described in the Conceptual framework, we first collected data on functional and industry backgrounds of board members and executives, as well as the number of years each individual has been appointed to the board or the executive team. To do so, we used the annual information form or the proxy statement. Then, similar to Talke et al. (2010), we computed heterogeneity in terms of i) functional and ii) industry backgrounds based on Blau's (1977) formula[2]. Finally, based on Allison (1977), board's heterogeneity related to tenure was calculated using the coefficient of variation (standard deviation/mean). We did the same to calculate diversity across executive management. Higher scores indicate greater diversity across the Board of directors or executive management.

[1] The measure obtained for each item is conservative since most organizations describe their innovations in qualitative rather than quantitative terms.

[2] Blau's (1977, p. 9) formula is 1 - $[\sum x_i^2/(\sum x_i)^2]$`where x_i is the number of persons in each group and the sum is taken over all groups. For functional backgrounds, a group corresponds to a function, for example an operations manager. For industry backgrounds, a group corresponds to an industry, for example manufacturing. The closer the result of the calculation is to 1, the greater the heterogeneity.

To measure *IT competence* across Board of directors, we first use a dichotomous variable for each board member (1 if the board member has managerial or technical IT skills, or IT experience; 0 otherwise). We then computed an IT competence score totalling the number of board member having IT competence, and divided this score by the total number of board members. This gives us the proportion of board members with IT competence within a firm. We applied the same steps to measure IT competence across executive management. Higher scores indicate a greater proportion of individuals with IT competence on the Board of directors or executive management.

Data analysis

Detailed descriptive statistics for dependent and independent variables are presented in the Results section. As the dependent variables (i.e. total innovation and product, process and management innovation) showed large skewness and kurtosis, we created binary variables, coding 1 for values above the median and 0, otherwise. Binary logistic regression analyses were then used to assess the relationship between Board of directors and executive management characteristics and innovation-based business strategy.[3] Table 1 presents the correlation matrix. Board industry background and tenure, executive industry background and IT competence, as well as the organization size (ln assets) are significantly correlated with total innovation and product innovation.

[3] All the variance inflation factors are below 1.83. For condition indexes above 15, the regression coefficient decomposition matrix shows that no condition indexes account for variance proportions above 90 percent for two or more coefficients. According to Hair et al. (1998), this indicates that multicollinearity is not a problem.

Table 1

Pearson Correlations (n=163)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	**.68**	1.00											
3	**.30**	-.05	1.00										
4	**.30**	**.24**	-.02	1.00									
5	.03	.01	.10	-.01	1.00								
6	**.34**	**.20**	.13	**.19**	**.31**	1.00							
7	**.20**	**.26**	.03	.08	.06	.13	1.00						
8	.09	.10	-.04	**.19**	.03	**.16**	.01	1.00					
9	.03	.04	.00	.01	**.24**	.15	-.08	.05	1.00				
10	**.19**	**.17**	.06	.09	**.16**	**.35**	.09	.14	**.19**	1.00			
11	.02	-.05	.09	.06	**.17**	.07	**.42**	-.02	.12	.08	1.00		
12	**.21**	**.20**	-.03	**.18**	.02	**.23**	.07	**.62**	.14	**.21**	.02	1.00	
13	**.34**	**.30**	.15	**.25**	-.01	**.29**	**.22**	.06	-.08	.03	.13	.01	1.00

	Dependent variables		*Independent variables (cont.)*
1	Overall innovation (0, 1)	7	Board tenure
2	Product innovation (0, 1)	8	Board IT competence
3	Process innovation (0, 1)	9	Executive functional background
4	Management innovation (0, 1)	10	Executive industry background
	Independent variables	11	Executive tenure
5	Board functional background	12	Executive IT competence
6	Board industry background	13	Organization size (ln assets)

Note: Correlation greater than .19 is **significant** at the 0.01 level (two-tailed); Correlation greater than .15 is **significant** at the 0.05 level (two-tailed).

RESULTS

Descriptive data

Table 2 presents descriptive data on the sample firms. The firms show mean revenues of about 5 billions dollars, mean assets of about 35 billon dollars and mean market value above 7 billion dollars. Mean net income is 529 million dollars with some firms having a net loss as indicated by the negative minimum value. From the minimums, maximums and standard deviations, we can conclude that there is great variability among firms' revenues, assets, market value and net income. Board of directors and executive management are of similar size with a mean of 9.79 and 8.38 members respectively. The majority of firms are from the mining and oil

and gas industries (76/163, 46.6%). The next largest group is from the financial services/insurance sector (36/163, 22.1%). Firms from the services industry represent 13.5% (22/163) of the sample. Firms from the manufacturing, retail/wholesale, telecommunications/media/IT and utilities sectors represent each less than 10% of the sample.

Table 2

Sample firms' characteristics and research variables' descriptive data

Panel A: Organizations' size and performance, and board and executive size

Variables	N	Mean	Median	Std Dev.	Min.	Max.
Size						
Revenues[a]	163	5,241,226	1,387,293	9,103,349	0	49,679,000
Assets[a]	163	34,845,440	3,084,982	111,999,472	238,998	751,702,000
Market value[a]	163	7,758,034	2,766,304	12,387,743	391,111	69,940,940
Performance						
Net income[a]	163	529,075	148,445	1,050,873	-562,808	5,889,000
Board size	163	9.79	9.00	2.92	4	19
Executive size	163	8.38	8.00	3.77	2	26

Panel B: Organizations' main industry (n = 163)

Industry	N	Industry	N
Financial services/Insurance	36	Retail/Wholesale	7
Manufacturing	14	Services	22
Mining	28	Telecommunications/Media/IT	11
Oil & Gas	48	Utilities	8

Panel C: Dependent and independent variables (n = 163)

Variables	Mean	Median	Std Dev.	Min.	Max.
Dependent variables					
Overall innovation	6.42	4	13.01	0	144
Product innovation	4.01	2	6.74	0	70
Process innovation	2.11	1	11.00	0	140
Management innovation	0.31	0	0.62	0	3
Independent variables					
Board functional background[b]	0.720	0.746	0.098	0.235	0.844
Board industry background[b]	0.687	0.724	0.141	0.219	0.901
Board tenure[c]	0.634	0.650	0.258	0.000	1.339
Board IT competence[d]	0.054	0.000	0.123	0.000	0.900
Executive functional background[b]	0.784	0.802	0.091	0.278	1.000
Executive industry background[b]	0.466	0.500	0.234	0.000	0.853
Executive tenure[c]	0.682	0.677	0.372	0.000	1.890
Executive IT competence[d]	0.069	0.000	0.138	0.000	0.800
Organization size (ln assets)	15.338	14.942	1.748	12.38	20.44

[a] Numbers are in thousands of Canadian dollars.
[b] Heterogeneity according to Blau (1977).
[c] Coefficient of variation (Std Dev./Mean).
[d] Percentage of board members or executives with IT competence.

Total innovation is rather low (mean = 6.42) but shows great variability as evidenced by a standard deviation of 13.01 (12 firms have zero innovation, not tabulated). Product innovation represents the majority of innovations (mean = 4.01) followed by process innovation (mean = 2.11). However, process innovation has great variability (std dev. = 11.00) and a median of only 1. Management innovation is the type of innovation that is the least present.

Board of directors and executive management are quite heterogeneous in terms of functional backgrounds (mean = 0.720 and 0.784 respectively). However, boards are more heterogeneous than executive management in terms of industry backgrounds (mean = 0.687 and 0.466 respectively). Tenure is similar for boards and executive management with mean dispersions equal to 0.634 and 0.682 respectively. These numbers indicate great variability in terms of the number of years that members have been sitting on boards and executive management. IT competence is low for boards and executive management (5.4% and 6.9% respectively).

Logistic regressions

As shown in Table 3, the logistic regression on total innovation indicates that heterogeneity in board industry background and tenure are the variables that favor innovation ($p \leq 0.10$). Organization size is also a significant determinant of total innovation.

Table 3

Binary logistic regressions: Analysis of Overall Innovation

Part A: Overall Innovation[a]

$$Overall\ Innovation_i = \beta_0 + \beta_1\ (Functboard_i) + \beta_2\ (Indusboard_i) + \beta_3\ (Boardtenure_i) + \beta_4\ (ITboard_i) + \beta_5\ (Functexec_i) + \beta_6\ (Indusexec_i) + \beta_7\ (Exectenure_i) + \beta_8\ (ITexec_i) + \beta_9\ (Lnassets_i) + \varepsilon_i$$

Variable	Coefficient β	Likelihood (Expβ)	p[b]
β_0	-9.023	0.000	0.001
Functboard	-1.017	0.362	0.631
Indusboard	3.780	43.834	**0.025**
Boardtenure	1.365	3.916	**0.093**
ITboard	-0.819	0.441	0.651
Functexec	0.274	1.315	0.907
Indusexec	0.882	2.415	0.318
Exectenure	-0.642	0.526	0.247
ITexec	2.991	19.902	0.117
Lnassets	0.364	1.440	**0.003**

Test for β_1 to $\beta_9 = 0$ Chi-squared = 41.06 $p < 0.001$ Nagelkerke $R^2 = 0.299$

Part B: Classification by Model

Overall Innovation	Effective count	Accurate Classification by Model	Percentage of Accurate Classifications
Above median	70	45	64.3
Median and below	93	72	77.4
Total	163	117	71.8

[a] Overall innovation equal 1 if 5 or more innovations, 0 otherwise.

[b] Probability tests are two-sided.

Table 4 presents the logistic regression on product innovation. It indicates that heterogeneity in board and executive tenure and executive IT competence are the variables that favor innovation ($p \leq 0.10$). Similar to total innovation, organization size is also important for product innovation.

Table 4

Binary logistic regression: Analysis of Product Innovation

Part A: Product Innovation[a]

$$Product\ Innovation_i = \beta_0 + \beta_1\ (Functboard_i) + \beta_2\ (Indusboard_i) + \beta_3\ (Boardtenure_i) + \beta_4\ (ITboard_i) + \beta_5\ (Functexec_i) + \beta_6\ (Indusexec_i) + \beta_7\ (Exectenure_i) + \beta_8\ (ITexec_i) + \beta_9\ (Lnassets_i) + \varepsilon_i$$

Variable	Coefficient β	Likelihood (Expβ)	p[b]
β_0	-9.495	0.000	0.001
Functboard	-0.307	0.736	0.882
Indusboard	0.514	1.672	0.737
Boardtenure	2.756	15.730	**0.001**
ITboard	-1.504	0.222	0.412
Functexec	2.187	8.908	0.340
Indusexec	1.243	3.467	0.151
Exectenure	-1.530	0.217	**0.008**
ITexec	3.369	29.045	**0.078**
Lnassets	0.383	1.466	**0.002**

Test for β_1 to $\beta_9 = 0$ Chi-squared = 40.07 $p < 0.001$ Nagelkerke $R^2 = 0.293$

Part B: Classification by Model

Product Innovation	Effective count	Accurate Classification by Model	Percentage of Accurate Classifications
Above median	70	42	60.0
Median and below	93	76	81.7
Total	163	117	72.4

[a] Product innovation equal 1 if 3 or more innovations, 0 otherwise.

[b] Probability tests are two-sided.

Logistic regressions were also performed for process and management innovation (not tabulated). However, both regressions are not significant at $p \leq 0.05$.

DISCUSSION AND CONCLUSION

The objective of this study was to examine the influence of diversity and IT competence of

Board of directors and executive management on innovation-based business strategy. Similarly to Wu (2008) and Talke et al. (2010), we found that some Board of directors and executive management collective characteristics can influence innovation. Our results suggest that greater heterogeneity in Board of director industry background and tenure leads to more innovation overall, and that product innovation is driven by board and executive tenure as well as executive IT competence. Further, large organizations innovate to a greater extent.

These results have practical implications. If firms want to increase their performance in terms of innovation, they should consider recruiting board members with different industry background. Moreover, they should make sure they have a great variety in terms of years of experience on board and executive management. Furthermore, executive management should collectively have IT competence. Board and executive management functional background, board IT competence, and executive management industry background do not appear to be associated with innovation-based business strategy.

By focusing on the role of the Board of directors and executive management as leaders in innovation, the results can be helpful to board members and executives. By questioning the influence of IT competence on innovation-based business strategy, this study contributes to the governance, IT, and innovation literatures. By considering simultaneously diversity and IT competence as "collective" characteristics of Board of directors and executive management, this study brings a new perspective to the topic under study. By identifying significant characteristics of the Board of directors and executive management that influence the innovation-based business strategy, the results provide empirical insights to further research aiming at providing an in-depth understanding of factors enhancing innovation-based business strategy.

Indeed, further research could analyze enterprise governance of IT and its relationship with the individual and group characteristics of the Board and executive management, in order to provide an in-depth understanding of factors enhancing synergy between IT and business. This analysis could lead to building theory regarding the relationships between factors enhancing IT-business synergy, and their influence on innovation-based business strategy.

In spite of the above contributions, this study has limitations. The measure of the dependent and independent variables are based on the researchers' assessment of data disclosed in public documents. These data may not be exhaustive. In particular, firms' description of their innovations is often in qualitative terms. Further, since data were not available for certain variables for a number of firms on the S&P/TSX composite index, we had to exclude these firms, thereby decreasing the sample size.

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