

CHARACTERISTICS OF THE BOARD OF DIRECTORS AND INVOLVEMENT IN INNOVATION ACTIVITIES: A COGNITIVE PERSPECTIVE

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Abstract

This article focuses on the relationship between the characteristics of the board of directors and the innovation policies in the Tunisian context from a cognitive perspective of corporate governance. The method used in this study is based on the regression analysis. We directly regress the board of directors' characteristics with the firm level of innovation. Our model includes some control variables such as the firm's size, the firm's sector of activity and even whether firm is listed or not. We empirically demonstrate that only the inside directors and the duality of the CEO are positively and significantly associated with the firm's level of innovation. Moreover, the empirical results show that the big size of the board has a negative impact on the development of innovative firms. In the same way, we demonstrate that the compensation system which is based on long-term objectives has no influence on the determination of the innovation policies in Tunisian firms.

Keywords: Board of directors, innovation policies, cognitive approach of corporate governance, inside directors

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1. Introduction

The role of the board of directors of a firm in the innovation strategies has for long time been the subject of much debate. However, the research efforts suffered from several deficiencies especially the lack of an overarching theoretical perspective to examine its role in the innovation development. Thus, we need a theoretical framework that helps to explain the role of the board in the innovation development based on cognitive theories of corporate governance.

In the cognitive model of corporate governance, the board of directors can be evaluated by its capacity to promote organizational learning (Lazonick and O'Sullivan, 1998). Therefore the criterion of its efficiency is its capacity to create and protect an organizational value. Nevertheless, considering its disciplinary and strategic role, the board deserves a special attention. Beyond the legal or regulatory requirements, the board members should have specific knowledge and technological skills to help the leaders determinet the investment in innovation. More specifically, Lazonick and O'Sullivan (1998) recommend the existence in the board of the representatives of all the entities: employees, firms, financial institutions. The latter can show have a direct interest in the firm investment to develop organizational learning.

In contractual and strategic theories of corporate governance, the board is a tool of reducing the losses in value due to the conflicts of interest between the various partners, or creating the growth opportunities. It contributes, in this way, to the development of innovation.

The theoretical and empirical literature is interested specifically in the demographic characteristics of the board (Hermalin and Weisbach, 2003). Some studies have found that the outside directors are more

or less interested in all the innovation activities. Chung et al (2003) and Boone et al (2007) found that the proportion of the outside directors was negatively interested with the intensity of R&D. However, a study by Hill and Snell (1988) shows that the presence of the inside directors in the board is positively and significantly correlated in the intensity of the R&D. On the other hand, David et al (2001) did not find any significant correlation. The outside members of the board are considered as an important source of valuable information and undoubtedly they facilitate the access to critical resources.

Similarly, the pioneers of the agency theory suggest that the separation between the functions of the CEO and those of the chairman of the board is considered the best practice. However, this separation may also lead to a failure of communication and information asymmetry between the CEO and the chairman. In addition, and from a cognitive perspective, the board is regarded not only as a mechanism to minimize the agency costs, but a mechanism that facilitates the organizational learning and innovation (Lazonick and O'Sullivan, 2000; Boone et al, 2007).

In this context the firms which like to encourage innovation, the asymmetry of information and knowledge could be considered as an additional cost caused by the separation between the functions of the CEO and those of the chairman of the board (Zahra, 1996; Markman et al, 2001).

Besides, a large size of the board could be seen as a necessary condition to enhance investments in the R&D of the firm and consequently all the innovation activities, since it has a wide diversity of expertise that helps executives make better strategic and financial decisions. The heterogeneity of the board implies a high probability of obtaining skilled managers with necessary scientific expertise, and provides new opportunities for growth. However, Boone et al. (2007) show that a large board is negatively correlated with investment in the R&D. Zahra et al (2000) suggest that the board's average size is better to encourage innovation. In addition, the agency theory assumes that the critical efficiencies that boards generate derive from reducing the agency costs rather than from deploying relevant knowledge.

Similarly, firms which adopt a policy of innovation should include a compensation system that encourages managers to take decisions relates to the promotion of the innovation activities. In this respect, Guay (1999) and Coles et al (2006) suggest that a higher sensitivity of the leader's wealth induces more investment in the R&D. In addition, the use of managerial stock options is positively associated with innovation (the number of patents) and intensity in the R&D (Johnson et al, 2009).

On the basis of these considerations, this article will try to answer the following question: What is the effect of the characteristics of the board of directors on the development of the innovation activities?

The principal purpose of this study is to investigate the impact of the board of directors on the firms' innovation activities. Our research field is Tunisia which represents an example of developing countries being engaged, since 1997, in an important national program whose aim is to help the Tunisian firms face worldwide competition. This national program aims to restructure the Tunisian firms by encouraging them to invest in material as well as in immaterial areas in order to stimulate innovation that leads to competitive advantage.

This study can provide explanations and managerial solutions for the Tunisian firms which have problems with the development of innovation. In other words, it identifies the mechanisms of governance that have the greatest impact on the development of innovation. Our research can help managers, bankers, different types of shareholders and stakeholders holding seats in the board of directors to take the necessary measures related to the governance structure (increased ownership of industry leaders) in order to mitigate the problems of underinvestment in the innovation activities and to make their business among the most competitive companies.

The remaining part of the paper is organised as follows. In the next section we present the theoretical background of the relationship between the board characteristics and the innovation activities based on the approach of cognitive governance (the resource-based view of the firm, evolutionary theory, and the knowledge-based view of the firm). In section 3 we discuss the methodological aspects of this study. The empirical results are presented and discussed in section 4. Finally, section 5 is a conclusion.

2. Effects of the board of directors on innovative activities

Based on a meta-analysis study in corporate governance, it was found that the classical model of corporate governance suffers from several limitations (Dalton et al, 1999; Rhoades et al, 2000). For example, the agency theory, based on a very simplistic assumption, supposed that the shareholders take up only to financial capital and the assumption of the financial risk. This design has a low explanatory power regarding the actual shareholding structures, and requires the cognitive role of the shareholders in order to provide a more satisfactory explanatory model of these structures. Similarly, it blames the classical theories of corporate governance for not being interested in the origin of investment opportunities which are considered by most research as a set of exogenous data. The integration of cognitive dimensions in the skills and knowledge of the various providers of resources could influence the

strategic decisions of the firm by supporting innovation and competitive advantages being the principal vectors of the value creation (Lazonick and O'Sullivan, 2000; Boone et al, 2007).

Using a cognitive approach of corporate governance, we examine, in this section, the effect of the board of directors on the innovation development.

2.1. Insides directors and innovation activities

Xue et al. (2007) showed that the external directors of the board would be more efficient in boards that deal with problems of information asymmetry. In contrast, the inside directors of the board could more effectively support the advice that focuses as on specific issues concerning the strategic orientation of the firm.

In the same way, a criticism of the traditional theories of corporate governance shows that several claims limit the realism of the agency theory to a model of understanding the effectiveness of these governance mechanisms (Hendry, 2002). In this respect, the agency theory assumes that the criticism directed to the effectiveness of the board in reducing the agency costs, fails to deploy the appropriate knowledge. Besides, some evolutionary economists, however, have argued that the choice of investment may depend more on the availability of knowledge (Teece, 1990), rather than on the calculation of agents. The involvement of the leaders in the formulation of the strategy and particularly in the preparation phase of strategic decision making enables them to protect the interest of the shareholders by identifying the problems and defining the appropriate decisions. Therefore, to understand the effectiveness of the board, we need a theoretical framework that explains how the expertise of leaders allows them to contribute the quality of strategic corporate decisions.

In firms that follow a policy of innovation, where a substantial amount of information is produced and analyzed, the outside directors are not able to manage this kind of volume of specific information. After a review of the literature cited in several studies, Kose et Lemma (1998) does not confirm that the presence of the outside directors enhances the performance of the firm. Furthermore, Agrawal and Knoeber (1996) show that the outside directors have a negative effect on the performance of the firm. This can be justified by the fact that they are integrated within the board because the firm in question displays a poor performance or it is simply a political process. Hoskisson et al (2002) state that a board dominated by outside directors will promote the external acquisition rather than the internal innovation projects. In this way, the outside directors, given their time constraints and their access to information, appear to be incapable of controlling the internal operations and by then are interested principally in listed financial and strategic component remains second order. These authors indicate that the inside directors will be more efficient compared to the outside directors. Thus, they have specific information that allows them a direct access to the critical resources, the uncertainty control and the risk of innovation projects.

Similarly, firms with a board dominated by inside directors tend to focus on innovation rather than on external acquisitions. Westphal (1999) suggested that the internal members are beneficial and can improve the social interaction and trust. Therefore, the participation of inside directors in determining the innovation policy by providing knowledge resources and expertise allows the firm to improve its financial performance. For these reasons, we can say that boards dominated by insider directors have a positive impact on the innovation activities involvement.

H₁: The board dominated by inside directors has a significant and positive impact on the innovation level of the firm.

2.2. CEO Duality and innovation activities

The two main roles in a corporation are those of the chief executive officer (CEO), who is legally responsible for ensuring the management of the firm, and of the chairman of the board who represents the interests of the shareholders. The pioneers of the agency theory suggest that the separation between the functions of the CEO and those of the chairman is considered as the best practice of corporate governance.

Although the separation of management and control functions is recommended by theorists of the agency theory, it could also bring about a failure of communication and information asymmetry between the CEO and the chair board. Firms that want to encourage innovation, asymmetry of information and knowledge could be considered as an additional cost due to the separation between these two roles (Zahra, 1996; Markman et al, 2001).

However, this separation of roles could enrich the diversity of opinions among the leaders and the board's chairman and thus can improve the quality of taken the decisions. Markman et al (2001) argue that the diversity of a management team can add value to the firm by bringing "a broader knowledge base

that allows innovation projects to draw on more information sources". In contrast, Dutta et al (2004) found that the separation of these two functions does not affect the R&D intensity of firms.

Based on these mitigated results, we adopt the idea that the separation of functions negatively influences the level of firm's innovation activities. This idea generated from the cognitive arguments that we have adopted in this paper. The additional information that leaders can make available for the management team reduces uncertainty substantively. Similarly, the knowledge that the managers use to interpret information reduces the procedural uncertainty. However, in the case of function separation, the chairman of the board, who is not involved in the operations of the corporation, is unable to manage the risk of uncertainty that relates to the development of innovation projects. Similarly, the specificity of these projects makes the possession of knowledge an asset to improve the quality of decisions. In this sense, the leader who assumes the two functions can enhance growth prospects of the firms by employing information and knowledge; elements which are based on innovation strategies. Therefore, the success of the firm becomes a reflection of the competence of the CEO (Davis and Donaldson, 1997). This leads us to the logical proofs of the resource dependence theory (Pfeffer, 1981). According to this last theory, the power is allocated to the actors who bring resources essential to the operation of the organization and which are not easily replaceable. Thus, the firm will be defined as an entity of accumulation of knowledge and a specific nexus of investment guided by the leaders' vision. The concept of managerial discretion, however, exceeds the single opportunistic dimension which is an essential component of transaction costs theory. Davis and Donaldson (1997) argue that especially leaders need to have a margin of freedom to bring in all their intrinsic motivation that allows them to make effective decisions especially in innovation.

In the same way, the specific investments are not considered as tools to entrenchment, but as means of preserving the specific managerial capital to align the interests of executives with those of the shareholders (Castanier and Helfat, 1992). The CEO could thus develop a network of relations favorable to enhance their prestige and reputation (Geletanycz et al, 2001). The combination of functions is not a source of danger and mistrust, but it is a way to align the cognitive and mental schema to solve problems projects of investment in innovation since the leader is seen as a potential contributor of knowledge and cognitive resources. Thus, the separation of functions is a source of conflict of interests which takes mental and cognitive dimensions. Based on these developments, we can suppose the following hypothesis.

Hypothesis 2 (H2): The duality of the functions of CEO and chairman of the board influences the innovation level of the firm positively.

2.3. Board of directors' size and innovation activities

From a cognitive perspective, the board is regarded not only as a mechanism which minimizes the agency costs but also a mechanism for learning and increasing the allocation of resources of the firm (Lazonick and O'Sullivan, 2000 ; Boone et al, 2007).

In this context, firms need to pursue innovation strategies which are brought to involve the holders of knowledge in the process of decision making. Hence, a large board is a necessary factor to support investments in the R&D and consequently all the innovation activities, since it is more difficult for a CEO to dominate and have a wide diversity of expertise which helps him to make better decisions (Zahra and Stanton, 1988). However, Boone et al. (2007) show that a large board of directors is negatively correlated with investment in the R&D. While Zahra et al. (2000) suggest that the average size of the board is better to support innovation. Therefore a limited size of the board seems inadequate to control the strategic leaders in investment in R & D.

Accordingly, a limited size of the board seems inadequate to control the strategic leadership in investment in the R&D. A large board of directors requires a high probability to obtain skilled managers having specialized scientific knowledge and providing new opportunities for growth (Carter et al, 2003). Daellenbach et al (1999) show that the top management team is positively related to a higher level of intensity in the R&D. Besides, Letendre (2004) specifies that the knowledge and experience of directors are key attributors to good boards.

The board of directors usually acts according to the knowledge and experience of its members. Westphal and Fredrickson (2001) suggest that the board members can use their personal experience as reference marks when they formulate and evaluate strategic solutions. By observing many boards involving members with a little expertise in industry or finance, Pound (1995) concluded that they can not support strategic decisions effectively.

Therefore a large board allows the corporation to have the necessary skills to help it find new growth opportunities and consequently promote investment in innovation.

Wu (2008) shows that firms which are efficient in their R&D efforts, have a large size board of directors. In the Tunisia context, Omri and Mehri (2003) concluded, in a study while covered 43 listed companies over a period of six years (1995 – 2000), that a large number of administrators can benefit to the firm knowledge, specific expertise, and an expanded network of contacts which may be responsible for identifying profitable investment for the firm. Thus, many administrators possessing specific knowledge are the cause of the diversity required to support complex and risky strategies. This allows the firm to have an easier access to the expertise needed in developing the innovation strategies. Based on these developments we can seek the following hypothesis.

Hypothesis 3 (H3): A large size of the board of directors influences the innovation level of firm positively.

2.4. Managerial compensation system and innovation activities

From a cognitive perspective, the role of the board directors is expanding with the construction of the strategic vision and its implementation. It can help the leader identify or build opportunities for growth, expand his strategic vision by comparing the cognitive pattern. A good compensation system is that allows a correct valuation of the expertise brought by the leader in building opportunities for long term growth for the future of the firm.

Miller et al (2002) recommend that firms operating in an uncertain environment should design a compensation system for the leader based on performance. The empirical literature in corporate governance devoted to innovation through the remuneration policy and the incentive managers have some differences. In this respect, the alignment of interests is done to promote the projects of investment in innovation. Holthausen et al. (1995) find that the relationship between innovation and compensation system based on long term is significantly positive. A strong relationship can be observed between the performance of the firm and the leadership remuneration (Hall and Liebman, 1998), but it isn't significant, according to the results found by Eng and Shackell (2001).

Thus, the leader who has the ability and experience required is able to maintain the growth and the survival of the firm to increase its value. Zahra (1996) stipulates that the remuneration systems based on the short term could discourage managers from pursuing the innovation strategies. The question is to know what the motivation for owners to index executive compensation based on achievement of long term objectives. In this sense, the leaders are seen as a source of value creation under the terms of its expertise and its knowledge in the development of specific projects. It would be advantageous for the firm to protect its human capital by the compensation system based on long term goals. Hence, the remuneration system based on specific skills that the leader could bring to the firm could develop these skills. He is a provider of skills and knowledge. This could be reflected positively in the development of the innovation activities conducted by the firm. The value of the contribution of cognitive leadership is, then determined by the type of the compensation system ratified by the board of directors.

A related hypothesis can therefore be formulated as follows:

Hypothesis 4 (H4): The compensation system of the firm based on long term goals influences the innovation level of the firm positively.

2.5. Control Variables

The size of the firm, the sector and the listing of the firms on the stock exchange have been included to control the relationship between the board of directors and innovation. A number of authors have suggested that these variables might influence the innovation level of the firm (e.g., Wu, 2008).

3. Research design

3.1. Model and variables measurements

To test our hypotheses about the relationship between the board characteristics and the innovation level of firm, we propose the following model:

$$\text{INVTIND}_i = \beta_0 + \beta_1 \text{BDINSID}_i + \beta_2 \text{DUAL}_i + \beta_3 \text{BDSIZE}_i + \beta_4 \text{MCSYT}_i + \beta_5 \text{LOGTA}_i + \beta_6 \text{SECT}_i + \beta_7 \text{LIST}_i + \varepsilon_i$$

Where:

INVTIND: Dependent variable.

BDINSID, DUAL, BDSIZE and MCSYT : Independent variables.

LOGTA, SECT, and LIST: Control variables.

$\beta_0, \beta_1, \dots, \beta_7$: parameters to be estimated.

ε_i : the random error.

i: 1.....95 firms

The following table 1 summarizes variables measurements of this study.

Table 1. Summarizes variables measurements

Variables	Code	Definition
Innovation index	INVTIND	The Innov-index refers to all the innovations in the firm: the leaders were requested to determine the influence of the board of directors in the implementation of the innovation activities.
Percent Inside Directors	BDINSID	Percent Inside Directors shows the percentage of the board members who are employees in the firm.
Duality of CEO and board chair	DUAL	Duality is a dummy variable equal to one if the CEO is also the current chairman of the board of directors, and "0" otherwise.
Board size	BDSIZE	Log (Number Directors) is the number of directors in the board in the previous period.
Managerial compensation system	MCSYT	Binary variable that takes 1 if the compensation system is based on long term goals and 0 otherwise.
Firm size	LOGTA	Firm size is measured as the natural log of the total assets.
Sector	SECT	Binary variable that takes value 1 if the firm belongs to a high-tech sector and 0 if the firm belongs to a traditional sector.
Listed firms	LIST	Binary variable that takes value 1 if the firm is listed on the stock exchange of Tunis and 0 otherwise.

3.2. Sample and Data Collection

Our attention was focused on the problem of the corporate governance system in the promotion of the innovation activities. The popular choice was guided by a criterion essential to know that the legal criterion. It follows that the first criterion of our choice of the population is the limited firm.

Taking into account the diversity of the variables we need in our research, we collected our variables from several sources. Certain information is obtained through a survey administered to the companies in question. Additional information about our sample was collected manually from the following sources of information:

- The financial statements published in the official bulletins of the Stock Exchange of Tunis (SET).
- Reports of companies available to the council of the financial market.

Our sample contains a total of 95, non financial Tunisian anonymous firms, among of which 17 are listed on the Stock Exchange of Tunis while 78 are not. The firms in question were interviewed over a period of three years from 2004 to 2006. The choice of this period is based on the recommendations of the Oslo manual of the OECD (1997) and the empirical studies on the subject in different contexts (Flor and Oltra, 2004; Wu, 2008).

In our study we are interested only in the manufacturing firms. Table 2 presents the firms of the sample and their sectoral affiliations.

Table 2. Distribution of firms in the overall sample

Sector	Number of firms
Agro-alimentary	30
Chemicals	8

Mechanical and Metal	10
Textiles and clothing	12
Electrical and electronic material	15
Constructional material, pottery and glass industry	9
Information technology and communication	11
Total number of firms	95

4. Empirical results and discussion

Statistical Package for the Social Sciences (SPSS) version 11.0 was used to analyze the collected data. Multiple linear regressions were used to determine the important predictors. The relationship between the board characteristics and the innovation level of the firm is tested using the multiple linear regression model.

Table 1 presents the coefficients correlation between the various explanatory variables used in this model. The results presented in this table show that there is not any coefficient which exceeds the 0.7 level as the limit traced by Kervin (1992).

Table 3. Correlation Coefficient

<i>variables</i>	<i>BDINSD</i>	<i>DUAL</i>	<i>BDSIZE</i>	<i>INCSYT</i>	<i>LOGTA</i>	<i>SECT</i>	<i>LIST</i>
<i>BDINSD</i>	1						
<i>DUAL</i>	0.060	1					
<i>BDSIZE</i>	0.015	0.227	1				
<i>INCSYT</i>	-0.027	-0.049	0.006	1			
<i>LOGTA</i>	0.097	0.034	0.182	0.086	1		
<i>SECT</i>	-0.032	0.098	0.122	0.017	0.118	1	
<i>LIST</i>	0.033	0.026	0.092	0.477	0.179	-0.124	1

The intercorrelations for all the explanatory variables are examined using the Variance Inflation Factors (VIF). The VIF analysis reveals no sign of multicollinearity, and the VIF values of all the independent variables range between 1.037 and 1.436; far below the acceptable upper bound of 10. The variance inflation factor (VIF) is reported for each regression to demonstrate the stability of the model.

Both tests suggest that the regression estimates are not degraded by the presence of multicollinearity. Furthermore, the regression estimates consistently yield a Durbin-Watson statistic. This statistic is equal to 0.818, which indicates that the autocorrelation is not a problem.

The empirical results show that 32 % of variation in the innovation level is explained by variables related to the board characteristics and the control variables. Fisher's statistics (F) is equal to (5.979) and confirms the good quality of the model at a significance level less than 1%. Thus the explanatory power of the model is satisfactory since the value of F is significant at the 1%. In this sense, we reject the null hypothesis and state that the regression is significant as a whole.

We can conclude that the model is statistically significant and explains the studied phenomenon. Concerning the significance of the independent variables, we can see three variables statistically significant. Regarding the control variables introduced in the model, the results show that these variables are not statistically significant.

Table 4 below shows beta coefficients, t Student and significance, and a variance inflation factor of this model.

Table 4. Results of multiple linear regressions model

<i>Variables</i>	<i>Coefficients b</i>	<i>t- Student</i>	<i>Significance</i>	<i>VIF</i>
<i>C</i>	1.456	3.082	0.003***	
<i>BDINSD</i>	0.084	4.174	0.000***	1.037
<i>DUAL</i>	0.227	3.145	0.002***	1.091
<i>BDSIZE</i>	-0.996	-2.507	0.014**	1.111
<i>INCSYT</i>	0.027	1.471	0.145	1.436
<i>LOGTA</i>	0.040	0.547	0.586	1.163
<i>SECT</i>	0.080	1.123	0.265	1.058
<i>LIST</i>	-0.040	-0.044	0.658	1.253
<i>Model statistics</i>	<i>F</i> = 5.979 (<i>p</i> = 0.000) <i>R</i> ² = 0.325, <i>R</i> ² <i>adj</i> = 0.27 <i>D-W</i> = 0.818			

*** : Significant level 1%; ** : Significant level 5%; * : Significant level 10%

4.1. Analysis of the impact of the inside directors on the board on the level of innovation (H 1)

The results of the model show that the rate of the inside directors in board has a positive and significant effect on the level of innovation ($\beta = 0.084$, $t = 4.174$, $p = 0.000$).

Therefore the first hypothesis (H1) is confirmed in this study. This corroborates the results found by Wu (2008).

In this context, our empirical results show that the inside directors in the board contribute to the shareholders' interests by using information, expertise and other cognitive resources in developing innovation. The inside directors are interested in developing the innovation strategies by putting forward their technical and specific information. Besides, in this new economy, scientific knowledge plays a crucial role in business and emerges as a main force in developing the technological assets of the corporation.

Some studies have described practices, such as the proposed managerial stock options, as a means to integrate the providers of resources or expertise in the organization for a long period. From a cognitive perspective of corporate governance, a high percentage of inside directors in the board of directors is positively correlated with the level of innovation. Indeed, Zahra (1996) shows that directors are more oriented to projects that have a potential to generate positive returns in the long term. Similarly, Godard (1996) has found that more firms invest in the R&D unless the board is composed of outside directors.

Therefore, these results seem inconsistent with the postulates agency theory attributed to the role of the various outsider members of the board as guards of the interests of shareholders (Jensen and Meckling, 1976).

In addition, Baysinger and Hoskisson (1990) show that the inside directors engage in the strategies because they have better access to information and knowledge about the decision making process while the outside directors have a financial control. It appears that the cognitive logic is opposed to the financial one. Therefore, firms that have boards dominated by inside directors are more innovative. In these firms the value creation is no longer limited to the minimization of agency and transaction costs but rather based on the valuation of the innovation activities. Thus, the main effort for most innovation is to attach a great importance to the most qualified and most competent. As a result, the director is regarded as a provider of resources and skills rather than of concepts such as egoism and opportunism. The integration of inside members in the board allows the firm to derive benefits and advantages to continually launch the innovation projects.

In addition, the knowledge-based theory has challenged the agency theory assumption that the presence of outside directors on the board is a necessary condition for a sustainable value creation in the firm. Indeed, the agency theory was based on the control of leaders ignoring the ability of employees and the leader of the firm to innovate and create a cognitive capital (Charreaux, 2002).

The company's employees, especially those who have specific knowledge, are more informed regarding the issues and problems of the firm since their dependence on the leaders facilitates the acquisition of information. Thus, the participation of the inside members in the board allows it to receive information unfiltered by the leader.

The empirical results achieved validate this hypothesis and demonstrate the cognitive contribution of the inside members in the board. This could be interpreted by the importance of experience and

knowledge brought by the directors to conduct effective innovation policies in the firm. Similarly, experienced administrators could easily build relationships with highly skilled resource holders needing the requirements of innovation. These results corroborate the results found by Wu (2008). Many skills are needed in the functioning of the board while enables it to monitor and ensure a policy of innovation. Therefore, the human capital available to the board members could better address the complexity of innovation strategies (Wang et al, 2008).

4.2. Analysis of Duality of CEO and board chair on the level of innovation (H 2)

The results of this model show that the duality of the CEO and the board chair has a positive and a significant effect on the level of innovation ($\beta = 0.227$, $t = 3.145$, $p = 0.002$). Therefore the second hypothesis (H2) is confirmed in this study. This corroborates the results found by Dutta et al (2004) who found that the separation of functions of the CEO and the board chair does not facilitate the firm's commitment to the R&D activities and therefore innovation.

Similarly, this duality of functions allows the firm to benefit from time and the tacit knowledge acquired by the inside directors. Therefore, this duality is not considered dangerous in the Tunisian context. On the contrary it encourages innovation. In this way, an executive director who is also the chairman of the board has an easy access to information and therefore can better coordinate the innovation activities.

Based on the cognitive theory of corporate governance, several recent studies (Belkhir, 2004; Adams and Mehran, 2005) emphasize the benefits following the adoption of duality manifested in the increased knowledge of the environment of the greater firm and greater competence on the part of the leader regarding the development of the firms' internal projects.

Another explanation could be provided. Indeed, the combination of these two functions allows the firm to save time and resources particularly in the context of the innovation development. Similarly, the characteristics of innovation projects, which are translated into uncertain future value, require the convergence of visions and objectives. Separating these two functions could cause problems of coordination and vision and therefore a high probability of failure of these projects. This also allows us to convey the need for an alignment of the mental and cognitive patterns of the decision makers.

4.3. Analysis of the impact of the size of the board on the level of innovation (H 3)

A large size of the board has a negative and significant effect on the level of innovation ($\beta = - 0.996$, $t = - 2.507$, $p = 0.014$). Based on these results, this hypothesis (H3) is not confirmed. In the context of Tunisia, a large board size has a negative impact on the innovation activities.

The absence of a positive relationship between these two variables could be explained by the fact that the majority of the Tunisian firms in this sample have boards of medium size. Thus, the results found in this study comply, in some way, with those found by Boone et al (2007) suggesting that the board of director's size is negatively correlated with the level of the R&D and thus innovation.

Similarly our results do not support the conclusions of Mehri and Omri (2003), following a study of 43 firms listed on the stock of exchange over a period of six years between 1995 and 2000, who found that a high number of administrators could benefit the business knowledge and expertise and an expanded network of contacts which may be responsible for identifying profitable investment for the firm.

4.4. Analysis of the impact of managerial compensation system of the firm on the level of innovation (H 4)

The statistical results show that the managerial compensation system of the firm has a positive and non significant effect on the level of innovation ($\beta = 0.027$, $t = 1.471$, $p = 0.145$). However, the managerial compensation system of the firm is not significantly related to the innovation level. Consequently, hypothesis (H4) is not supported. This shows that the short term objectives to be reached dominate the long-term objectives.

Hence, the firms of the sample tend to focus on elements that affect short-term profitability to the detriment of long term goals. This goes against the assumptions of the current cognitive governance. In this sense, the functions of the board have a new evidence based on the human capital. The remuneration of the CEO by stock options is not necessarily explained by the objective of aligning its interests with those of the shareholders, as was postulated by the contractual approach to governance, but rather by the encouraging the competent members of the firm to bring new innovative sources of value to the corporation. However, the empirical results found that the Tunisian firms do not give great importance to the managerial compensation system for executives.

5. Conclusion

In this article we have examined the impact of the characteristics of the board of directors in innovation activities. Taking a cognitive perspective, we argue that the board characteristics have an impact on corporate innovation activities in the Tunisian manufacturing firms. Specifically, the results show that the relationship between innovation activities and both variables (percent inside directors in the board and duality of the CEO and the board chair) is significantly positive. This result indicates the importance of the cognitive contribution of the inside administrator in the board in the development of innovation.

Concerning the size of the board, the statistical results show that a big size acts negatively on the development of innovation. This could be explained by the fact that the majority of the Tunisian firms have small sized board. In the same way the empirical results show that the compensation system, which is based on long term objectives, is non significant in the determination of innovation in the Tunisian firms. Finally, the statistical tests show that the variables of control retained in this study (size, sector and listing of the firm on the stock exchange) don't have any impact on the level of innovation. As a result, the potential of innovation of the firms is independent of these control variables.

This study has also some limitations. One limit is a try due to the size of a sample which is relatively reduced. More explicitly, the generalization of the results of this study is not possible. Moreover, because of the difficulty of measuring the capacity of innovation of the firms, we rely only on the declarations of the leaders.

References

1. Adams, R. B. and Mehran, H. (2005), "Corporate performance, board structure and its determinants in banking industry", *Working paper*, Federal Reserve Bank of New York.
2. Agrawal, A. and Knoeber, C. (1996), "Firm performance and mechanisms to control agency problems between managers and shareholders", *Journal of Financial and Quantitative Analysis*, Vol. 31, No. 03, pp. 377-397.
3. Baysinger, B. and Hoskisson, R. (1990), "The composition of boards of directors and strategic control: effects on corporate strategy", *Academy of Management Review*, Vol. 15, pp.72-87.
4. Belkhir, M. (2004), "Board of directors size and performance in banking", *Working papers*, University of Orleans (France).
5. Boone, A. L., Field, L. C., Karpoff, J. M. and Raheja, C. G. (2007), "The determinants of corporate board size and composition: An empirical analysis", *Journal of Financial Economics*, Vol. 85, pp. 66-101.
6. Carter, D.A, Simkins, B.J. and Simpson, W.G. (2003), "Corporate governance, board diversity, and firm value", *The Financial Review*, Vol. 38, pp. 35-53.
7. Castanias, R.P. and Helfat, C.E. (1991), "Managerial Resources and Rents", *Journal of Management*, Vol. 17, No. 1, pp.155-171.
8. Chung, K, Wright, P. and Kedia, B. (2003), "Corporate governance and market valuation of capital and R&D investments", *Review of Financial Economics*, Vol.12, pp. 161-172.
9. Coles, J.L., Naveen, D.D. and Lalitha, N. (2006), "Managerial Incentives and Risk-Taking", *Journal of Financial Economics*, Vol. 79, pp. 431-468.
10. Dalton, D. R., Daily, C. M., Johnson, J. L. and Ellstrand, A. E. (1999), "Number of directors and financial performance: a meta-analysis", *Academy of Management Journal*, Vol.42, No. 6, pp. 674-86.
11. Daellenbach, U.S., McCarthy, A.M., and Schoenecker, T.S. (1999), "Commitment to Innovation: The Impact of Top Management Team Characteristics", *R&D Management*, Vol. 29, No. 3, pp.199 - 208
12. Davis, J. and Donaldson, L. (1997), "Toward a Stewardship Theory of Management", *Academy of Management Review*, Vol. 22, No. 1, pp. 20-47.
13. Dutta, S., Kumar U., Kumar, D. and Zhu, P. (2004), "Determinants of corporate R&D intensity: Canadian evidence", *Proceedings of Management Science Division*, ASAC Quebec.
14. Eng, L.L. and Shackell, M. (2001) "The Implications of Long Term Performance Plans and Institutional Ownership for Firms' Research and Development Investments", *Journal of Accounting, Auditing and Finance*, Vol. 16, No. 2, pp. 117-139.
15. Fama, E. and Jensen, M. (1983), "Separation of ownership and control", *Journal of Law and Economics*, Vol. 26, pp. 301-325.
16. Flor, M.L. and Oltra, M.J. (2004), "Identification of innovating firms through technological innovation indicators: an application to the Spanish ceramic tile industry", *Research Policy*, Vol. 33, pp. 323-336.

17. Foss, N.J. and Laursen., K. (2005), "Performance pay, delegation and multitasking under uncertainty and innovativeness: An empirical investigation", *Journal of Economic Behavior & Organization*, Vol. 58, No.2, pp. 246-276.
18. Geletanycz, M.A., Boyd, B.K. and Finkelstein, S. (2001), "The Strategic Value of CEO External Directorate Networks: Implications for CEO Compensation", *Strategic Management Journal*, Vol. 22, No. 9, pp. 889-898.
19. Guay, W.R. (1999), "The sensitivity of CEO wealth to equity risk: an analysis of the magnitude and determinants", *Journal of Financial Economics*, Vol. 53, No 1, pp. 43-71.
20. Hall, B. and Liebman, J. (1998), "Are CEOs really paid like bureaucrats?", *Quarterly Journal of Economics*, Vol.113, No. 3, pp. 653-691.
21. Hendry, J. (2002), "The principal's other problems: Honest incompetence and the specification of objectives", *Academy of Management Review*, Vol. 27, No. 1, pp. 98-113.
22. Hermalin, B. and Weisbach, M. (2003), "Boards of directors as an endogenously determined institution: a survey of the economic literature", *Economic Policy Review*, Vol. 9, pp. 7- 26.
23. Holthausen, R.W., Larcker D.F. and Sloan, R.G. (1995), "Bus. Unit innovation and the structure of executive compensation", *Journal of Accounting and Economics*, Vol. 19, No. (2-3), pp. 279-313.
24. Hoskisson, R.E., Hitt, M.A., Johnson, R.A. and Grossman, W. (2002), "Conflicting voices: The effects of ownership heterogeneity and internal governance on corporate strategy", *Academy of Management Journal*, Vol. 45, No. 4, pp. 697-716.
25. Jensen, M.C. and Meckling, W. (1976), "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure", *Journal of Financial Economics*, Vol. 3, No. 4, pp. 305-360.
26. Johnson, S. A., Ryan, H. E. and Tian, Y. S. (2009), "Managerial Incentives and Corporate Fraud: The Sources of Incentives Matter", *Review of Finance*, Vol. 13, No. 1, pp. 115-145.
27. Kerwin, J. B. (1992), *Methods for Business Research*, New York: Harper Collins.
28. Kose, J. and Lemma, S.W. (1998), "Corporate governance and board effectiveness", *Journal of Banking and Finance*, Vol. 22 pp.371 - 403.
29. Lazonick, W. and O'Sullivan, M. (1998), "Corporate Governance and the Innovative Economy: Policy Implications", STEP Report ISSN 0804-8185, Oslo.
30. Markman, G., Balkin, D. and Schjoedt, L. (2001), "Governing the innovation process in entrepreneurial firms", *Journal of High Technology Management Research*, Vol. 12, pp. 273-293.
31. Miller, J. S., Wiseman, R. M., Gomez, M. and Luis, R. (2002), "The fit between CEO compensation design and firm risk", *Academy of Management Journal*, Vol. 45, No.4, pp. 745-756.
32. OECD, (1997), *Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*, 2nd Edition. (www.oecd.org)
33. Omri, A. and Mehri. B. (2003), "Performance des entreprises tunisiennes", *Working paper*.
34. Pound, J. (1995), "The promise of the governed corporation", *Harvard Bus Rev*, Vol. 73, No. 2, pp. 89-98.
35. Rhoades, D. L., Rechner, P. L. and Sundaramurthy, C. (2000), "Board Composition and Financial Performance: A Meta-analysis of the Influence of Outside Directors", *Journal of Managerial*, Vol. 12, pp. 76-91.
36. Wang, Q., Wong, T.J. and Xia, L. (2008), "State ownership, the institutional environment, and auditor choice: Evidence from China", *Journal of Accounting and Economics*, Vol. 46, pp.112- 134.
37. Westphal, J. (1999), "Collaboration in the boardroom: behavioral and performance consequences of CEO-board social ties", *Acad Manage Journal*, Vol. 42, No. 1, pp. 7-25.
38. Westphal, J.D. and Fredrickson, J.W. (2001), "Who directs strategic change? Director experience, the selection of new CEOs, and change in corporate strategy", *Strategic Management Journal*, Vol. 22, No. 12, pp. 1113-1137.
39. Wu, H.L. (2008), "When does internal governance make firms innovative?", *Journal of Business Research*, Vol. 61, No. 02, pp. 141-153.
40. Xue, Y. (2007), "Make or buy new technology: The role of CEO compensation contract in a firm's route to innovation", *Review of Accounting Studies*, Vol.12, No. 4, pp. 659-690.
41. Zahra, S.A. (1996), "Governance, ownership and corporate entrepreneurship: the moderating impact of industry technological opportunities", *Academy of Management Journal*, Vol. 39, pp. 1713-1735.
42. Zahra, S.A., Neubaum, D.O. and Huse, M. (2000), "Entrepreneurship in medium-size companies: exploring the effects of ownership and governance systems", *Journal of Management*, Vol. 26, No. 5, pp. 947-976.
43. Zahra, S.A. and Stanton, W.W. (1988), "The implications of board of directors composition for corporate strategy and performance", *International journal of management*, Vol. 5, No. 2, pp. 229-236.