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COGNITIVE ROLE OF ENGINEERS AND ITS IMPLICATIONS ON FINANCIAL PERFORMANCE: AN EMPIRICAL ANALYSIS ON THE FRENCHMARKET

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Abstract

The aim of the current paper is to show the effect of the involvement of engineers in the channels of both decision and control on the financial performance of the company. The theoretical framework of this study is based on the contributions of cognitive governance theories. The study which was conducted on a sample of French companies belonging to the 250 SBF index over the period 2003-2007 shows that the presence of an administrator who has a share in the capital and has training in the field of engineering promotes the company's financial performance.

Keywords: Cognitive Governance; Engineers; Financial Performance

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INTRODUCTION

The study of cognitive contribution of engineers in corporate financial performance is among the most eminent concerns of innovative companies. Being based on the creation of value, the cognitive approach of governance is the result of learning and innovation [1]. Indeed, the cognitive model rests upon a vision that is radically different from the disciplinary model relating to the process of value creation, to the extent that it gives central importance to the development of skills and enterprise capabilities that produce knowledge. It basically revolves around the concept of knowledge that is less reducing than that of information on which the disciplinary model is based. This model attributes governance responsibility to avoid wastage of value (waste that is due to problems of asymmetry and incompleteness of information) through control mechanisms. According to Fransman [2], in the cognitive model, the firm is considered as "a knowledge processor." This model is based on a vision centered on the influence of learning mechanisms and emphasizes the specificity of personnel whose skills are the determinants of value creation and the key to business performance [1]. Thus, the company's success is a reflection the competence of company's stakeholders.

In this context, the role of the shareholder is not limited to being simply a capital provider. Rather, he is perceived as a source of variety of information and knowledge. Similarly the role of the board is not reduced to the leaders' control and discipline, but it also presents a cognitive dimension known as a repertoire of knowledge.

Thus, we can admit that the involvement of engineers in the company's governance allows them to participate in the formulation of the strategy so as to improve understanding, creativity and innovation within the enterprise.

The relevance of the current study stems from two main reasons. First, it focuses on the identification of governance mechanisms in a cognitive perspective. Second, it will present an extensive research in so far few studies have been conducted to explain financial performance through cognitive governance and specifically the cognitive role of engineers in the French context. Indeed, most studies conducted on the relationship between the cognitive mechanisms of governance and financial performances are of American origin [3].

Through this scope of literature and the existing work carried out in this field, our aim is to understand the cognitive role of engineers and its impact on company's financial performance. To reach this end, in the first section, we will develop the conceptual framework of the study. In the second section, we will discuss the research methodology. Finally, in the third section, we will present and discuss the results of the study.

THE SPECIFIC CAPITAL OF ENGINEERS AND THE COGNITIVE GOVERNANCE

The Cognitive Role of the Shareholding of Engineers Leaders on Financial Performance

By registering in a cognitive perspective, the financial performance of the company depends on the formation of the leader [1]. Relating to leadership qualities, we can note that the presence of an engineer officer could foster financial performance of the company. Indeed, the engineer's leaders represent specific human resources. They help provide cognitive contributions in the company's strategic decisions. They often animate engagement in more profitable and risky ventures such as innovative projects in accordance with the interests of other stakeholders. According to Porter [4], the existence of an engineer holding an executive experience and knowledge is an obvious advantage in mastering creative projects value. This idea is still justified as long as the leader is involved in the company's capital.

Thus, in positions of power and knowledge, the owner's engineer's leaders are able to control the risk associated to the environment [5]. They are able to participate in various stages of the decision making process, using their specific knowledge and disciplinary powers, facilitating mutual understanding between the company and its partners, and improving the financial performance of the company [6,7]. On this basis, we can issue the following hypothesis:

H1: Participation of engineer's leaders in the capital has a positive effect on financial performance of the company.

The Cognitive Effect of the Involvement of Engineers in the Board of Directors on Financial Performance

In a cognitive perspective, a board must be primarily composed of qualified members that can contribute to creating dynamic capabilities and to the development of organizational learning.

According to Charreaux [1], the board is a cognitive instrument that assists in the creation of skills and knowledge. It includes representatives of all entities such as business representatives, financial and formation institutions, engineers, etc. that can help the company build strategies to create value in a sustainable way [8,9].

Thus, the effectiveness of the board of directors is no longer simply viewed by internal and external distinction, but by the quality and nature of cognitive skills of the administrator. The legal (power, freedom), organizational (learning) and strategic (process management) levers of the board are not only binding as assumed by the traditional theory, but also enablers. They can lead the leader to develop strategies of growth. The nature of the directors' skills is also important. Indeed, a competent

engineer administrator can guide the leader to other strategic choices more than a financial administrator can do.

In this context, the criterion of the cognitive diversity of the board is centered on the internal/external criterion. Research has investigated the impact of the cognitive diversity of the Board on the creation of value. Cognitive diversity includes many dimensions: knowledge, education, values, perceptions and characteristics of personalities [10,11]. In this sense, Salancik and Pfeffer [12] showed that cognitive diversity is beneficial to the company. It ensures better quality control and promotes more creativity. According to Watson et al. [13], diversity leads to better knowledge that guarantees the company's competitiveness. The variety of skills in the board is likely to lead to greater innovation and collective dynamics.

In this perspective, Milliken and Vollrath [14] postulate that engineers play a cognitive role thanks to skills and specific knowledge that they hold. These help develop and encourage the strategies of growth. Their participation in counseling is a good signal to the market. They increase the company's ability to make strategic and risky decisions in the interests of a broader set of stakeholders and participate in different stages of decision making by using both their expertise and their disciplinary powers [7].

According to Miller [15], engineering or techno-structure is the basis of the specific amplification and profitable long-term investments such as R & D. Thanks to its particular expertise in the field of engineering, administrators tend to focus on profitable investments and increase the knowledge base of the board.

Following the same reasoning, we assume that financial performance increases with the presence of engineers in the board. Indeed, they are holders of specific knowledge that allow them to improve the ability of the company to make strategic decisions and to facilitate mutual understanding between the company and its partners. Based on the cited developments, we can issue the following hypothesis:

H2: The participation of engineers as members of the Board has a positive effect on financial performance of the company.

The Effect of the Participation of Engineers Administrators in the Capital on Financial Performance

Cognitive skills that administrator's engineers have also strengthened the detention of these for a proportion of the company's capital. Indeed, as part of the disciplinary approach, involving an engineer administrator in the capital gives him more encouragement to engage in cognitive tasks related to the decision making process, such as the analysis of the environment and the formulation and interpretation of the strategy [14]. Thus, we can issue the following hypothesis:

H3: Participation of Engineers administrators in the capital has a positive effect on

company performance.

RESEARCH METHODOLOGY

This section presents the main characteristics of the sample selected as well as the sources and data collection methods. From a literature review, we will identify the measures of the research variables. Finally, we display the statistical methodology used, the results and their interpretations.

Sources and data collection modes

To test our hypothesis, we collected data from the annual reports of French companies, reference documents and information circular "proxy statements". The sample includes 45 French firms over the period 2003-2007. Companies belonging to the financial sector such as banks and insurance companies are excluded from the sample because of their atypical behavior regarding the chosen mode of financing and investment.

After having selected the sample and the analysis period, we can move to the stage of variable operationalization and then to results interpretation.

MEASUREMENTS OF VARIABLES

Measurement of the Dependent Variable: The Company's Financial Performance (Perff)

The dependent variable in our study is financial performance. There are multitude indicators such as EVA, Tobin's Q ratio Marris, Treynor index. In this study, we will use the average equity performance (ROE) and the average returns on assets (ROA).

MEASUREMENT OF THE EXPLANATORY VARIABLES

Shareholding Engineers Leaders (ACTDING)

The participation of the engineer leader in the capital allows him to hold both the power and knowledge that are necessary for decision-making and improving financial performance. In this sense, Hill and Jones [7] postulate that engineer's leaders represent critical resources through their specific knowledge and cognitive skills. They improve strategic business decisions and engage in investments in R & D in accordance with the interests of other stakeholders. This variable is called dichotomous. It takes the value 1 if the shareholder has a leader in the field of training or technology engineering and 0 otherwise. This measure is used by Jarboui et al. [16].

Measurement of the shareholding of directors engineers (ACTADING)

The company could benefit from cognitive skills of its members in order to increase its value [17]. This brings us to reflect whether the engineer shareholder is playing an active role in the Board of Directors.

Therefore, we talk about the activism of engineers and its impact on financial performance. Jarboui et al. [16] have constructed an indicator measuring the property of industry leaders. This indicator is dichotomous. It takes the value 1 if the leader owner has training in the field of engineering in its various branches or in technology, and 0 otherwise.

Following the same logic of these authors, the operationalization of the variable shareholding of engineer's directors will be considered as a dichotomous variable. It takes the value 1 if the administrator holder of equity has training in the field of engineering and 0 in the opposite case.

The involvement of engineers in the Board of Directors (ADING)

In a disciplinary perspective, the effectiveness of the board depends on its composition which is conceived according to internal or external distinction. However, the cognitive approach to governance gives more attention to cognitive skills and specific knowledge of the board members. Therefore, we seek to show the importance of the participation of engineers in the Board's financial performance. We propose the percentage of engineers in the board as a measure.

Choice and measurement of control variables

Regarding company size (SIZE), there are different measurement indicators. We will opt for the natural logarithm of total assets.

As for the debt ratio (Debts), we use the ratio of total debt / total assets [18,19].

DATA ANALYSIS

Statistical treatments were carried out in two stages: the principal component analysis and analysis of the linear regression. The technique of factor analysis (ACP) enables us to make the number of smaller variables while retaining the essence of the information contained in the data.

This technique applies to variable considered as continuous or interval variables. It simplifies the number of variables measuring the same variable, and calculates a synthetic score (Table 1). Similarly, it allows the construction of variables called factors explaining most of the observed variance.

Table 1: Definition and variable measures.

Variables	Abbreviated	Measure
Financial performance	PERFF	*Return on assets (ROA) = Operating profit before tax / total assets. *Return on equity (ROE) = Net profit for the year / equity.
Shareholding engineer leader	ACTDING	ACTADING = 1 if the leader having a share capital has a scientific background in the field of engineering. ACTADING = 0 otherwise.
The involvement of engineers in the Board of Directors	ADING	% Of engineers in the Board of Directors
The shareholding directors engineers (engineers activism)	ACTIVING	Activing = 1 if the administrator having a share capital has a scientific background in the field of engineering. Activing = 0 otherwise.
company size	SIZE	natural logarithm of total assets
indebtedness	ENDETT	Debt ratio = medium and long- term debt / total assets.

As part of the study and based on the technique of main components analysis (ACP), we can obtain the financial performance factor (PERFF), which includes both variables ROA and ROE. It can recover up to 68% of the information with a KMO value equal to 0.5. Finally, linear regression will help to explain the effect of the involvement of engineers in the supervisory bodies and decisions on financial performance of the company.

The choice of this method is verified by checking the conditions of its application (metric variable and explanatory study, linear, absence of multicollinearity) (Table 2). An

examination of the correlation matrix shows that the correlation coefficients are less than 0.8 which is the limit from which the problems of multi collinearity begins [20].

Table 2: Pearson correlation matrix.

	ACTDING	ADING	ACTIVING	SIZE	ENDETT	VIF
ACTDING	1	0.170*	0.379**	0.026	-0.115	1.180
ADING		1	0.356**	0.117	-0.084	1.153
ACTIVING			1	0.154*	-0.106	1.321
SIZE				1	-0.239*	1.087
ENDETT					1	1.076
*The correlation is significant at 0.05 level (bilateral).						
**Correlation is significant at 0.01 level (bilateral).						

THE RESEARCH MODEL

At this level and through a test of the three hypotheses, we will try to explain financial performance (PERFF) from government cognitive variables of the firm (shareholding of the executive engineer ACTDING, participation of engineers in the board of administration ADING, and activism of engineers ACTIVING) and in the presence of the control variables (firm size SIZE and debt ratio ENDETT).

Our model is displayed as follows:

$$PERFF = \beta_0 + \beta_1 ACTDING + \beta_2 ADING + \beta_3 ACTIVING + \beta_4 SIZE + \beta_5 ENDETT + E_i$$

The model was selected after several iterations and after eliminating some outlier observations in order to present the best results of the general validity test of the model to improve its forecasting ability and its explanatory power.

Hypothesis (H1) seeks to test the effect of the involvement of engineer’s leaders in the capital on the financial performance of the company. Statistical tests show that the variable of shareholding engineer’s leaders (ACTDING) has no significant effect (Table 3).

Table 3: Significant effects from statistical tests.

v. indépendantes	V. dependent		
	PERFF		
	B	t	Significance threshold
Constant		-1.993	0.048
ACTDING	0.37	0.540	0.589
ADING	-0.071	-1.030	0.304
ACTIVING	0.312	4.256	0.001
SIZE	0.072	1.079	0.282
ENDETT	0.012	-0.175	0.861
$R^2 = 0.108$; R^2 adjusted = 0.088; $F = 5.323$; $N = 225$			

In the French context, this finding is not compatible with the results of previous studies [1,5,21] which proved the existence of a positive and significant relationship between the formation of the owner-manager and financial performance of the company.

Hypothesis (H2) seeks to test the impact of the involvement of engineers in the board on the financial performance of the company. Statistical tests showed that the varying participation of engineers in the Board of administration (ADING) has no significant effect on financial performance.

This finding is not consistent with previous studies of Charreaux [1], Lazonick and O'Sullivan [22] that showed that a board of directors composed of specific knowledge holders is able to help the firm build strategies for creating value in a sustainable way.

Hypothesis (H3) seeks to test the effect of the involvement of engineer's administrators

in the capital and in the Board on the financial performance of the company. Statistical tests show that activism of engineers (participation in the capital and in the board) has a positive and significant effect on the financial performance of the company.

Indeed, the participation of engineers in the decision and the company's supervisory bodies is considered as an obvious asset in the mastery of knowledge. This participation helps build capacity to increase responsiveness, organizational learning and understanding. Therefore, this encourages the financial performance of the company.

This result highlights the cognitive contribution of the owner's administrators in improving the financial performance of the company. In this sense, by having power and knowledge, engineers who perform both functions (shareholder and director) helped to encourage investment in R & D which is a major factor in creating value. This could also be a synonymous to strong growth opportunities [23].

In order to strengthen our results, we also tested the influence of two control variables that may have an impact on the financial performance of the company. These variables are the size and debt policy of the company. The significance tests show that the variable "SIZE" and the debt variable "ENDETT" have no statistically significant effect on financial performance.

CONCLUSION

The objective of this study is to determine the cognitive effect of engineers on the financial performance of French companies. The theoretical framework of this study is based on the contributions of recent theories of cognitive corporate governance.

The results of statistical tests show that French companies that are characterized by the participation of active engineers in the capital and in the company's board of directors are more likely to achieve higher financial performance. Regarding the control variables, the results show that the size of the company and its debt ratio have no significant effect on financial performance. Integrated model of trust and TAM and concluded that trust is a significant factor in determining consumer's intention to purchase online. Moreover, Chen and Lan claim that the perceived usefulness only exists for those online retailers upon whom consumers have trust. However, earlier research also specifies that the trust is the driving force for perceived usefulness [24].

Like any research, our study presents some theoretical and methodological limitations.

Theoretically, financial performance could be refined by integrating other data [25]. Thus, the number of variables tested in our case remains reduced. Methodologically, that sample is small (45 firms over the period 2003-2007).

As a conclusion, we believe that this study could open interesting research perspectives. A first extension would integrate other variables of cognitive governance that may affect the financial performance such as the managerial discretion. The second extension would be to study the effect of engineer's activism on the relationship between spending on R & D and financial performance.

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