Vol.1 Iss.2 pp. 14-17 **Journal of Economy & International Finance (EIF)**

The Relationship between Cognitive Capacity and Innovation

Empirical Evidence from the Algerian Food Sector

Amine M. Benmehaia [*1], Fatima Brabez [*2] ; Amina Omrane [#3],

* *Department of Rural Economy, Higher National School of Agronomy, Algeria*

[1] amine_benmehaia@yahoo.fr

* *Department of Rural Economy, Higher National School of Agronomy, Algeria*

[2] fbrabez@yahoo.fr

[#] *Department of Economics and Management, IHEC, Carthage, Tunis*

[3] amina.omrane@yahoo.fr

***Abstract*— This study tested a model that attempts to describe the influence of cognitive capacity on willingness to innovate differences between firms. We empirically examine the cognitive capacity – innovation relationship across firms. Results based on data from a set of 130 food manufacturing firms suggested that cognitive capacity affects positively the firm's willingness to innovate. Essentially, we argue that the correlation between cognitive capacity and firm willingness to innovate is determined ex-ante by the corporate governance system. We find that cognitive capacity have a positive effects on the probability that firms introduce product-line innovations. Results indicate that important and statistically significant differences do in fact exist across the studied firms.**

Keywords—Cognitive capacity, skill, firm experience, innovation, food sector, Algeria

I. INTRODUCTION

The objective of this paper is to shed light on the effects of cognitive capacity on willingness of firms to innovate exploiting a rich survey of over 130 Algerian food manufacturing firms. The dataset provides thorough information on firm's innovation willingness which is based directly on firm's responses to survey questions. It also contains precise measures of firm's cognitive capacity.

After accounting for the possible endogeneity of the cognitive capacity and scheming for a variety of factors that may also affect innovation, we find that cognitive capacity affects positively the probability that firms introduce product innovations.

The paper proceeds as follows: Section 2 by briefly describing existing theories that relate to cognitive capacity in firms and innovativeness invoking our hypotheses. Section 3 gives a description of the model used in the underlying study, while section 4 shows the empirical results. Section 5 concludes.

II. LITERATURE REVIEW

We focus in this paper on the determinants of product-line innovation in food sector by examining a special dimension of production. Production usually involves two processes, product development and the organization of production. Product development is concerned with the imagining and designing of a product. It is followed by the actual process of production, the transformation of inputs into outputs by economic organizations (Coase and Wang [1]).

Authors argue currently the inseparability of the cognitive dimension despite its influence on the learning process. However, the innovation process is assisted by a variety of sources of information: internal sources (within the firm), external market sources, educational and research institutions, and generally available information (OCDE [2]).

We advance here the hypothesis that the cognitive capacity has a positive effect on the firm's willingness to innovate. In a cognitive perspective, we take a part of the cognitive theories of corporate governance. Cognitive ability is referred to the experience of the shareholders and firm managers. Generally, it is the role of cognitive ability of decision-makers influencing the learning process and innovative activity of the firms.

The cumulative and collective characteristics of knowledge are made paramount in the firm's capital. Foray [3] emphasizes the important role played by knowledge and learning in the creation and development of innovation activities. On this point, Charreaux [4] argues that the cognitive role of the shareholder has been obscured in the classical theories of corporate governance.

Therefore, the dynamic vision lie with relating past innovations of firms and their current ability to innovate is also necessary because of the cumulative nature of knowledge (Cohen and Levinthal [5]).

From our perspective, the role of the governance system is to increase skills gains while reducing agency costs, knowing that the two dimensions can be nested. Reducing agency costs skills by removing incompatibilities between stakeholders can deprive the firm of the needed variety for innovation and adaptation (Charreaux [6]; Benmehaia *et al.* [7]).

The attribution of corporate social capital may amplify the value of market-specific reputation, because it may enhance the beliefs of potential buyers of products regarding their user-cost-efficiency, durability, and the like, as well as its symbol-

ISSN: 2961-6638

ic-values to them. In other words, corporate social capital In other words, market-specific reputation capital and corporate social capital can be mutually complementary. When de facto property rights in global commons are shifting from the corporate sector to the public in general, it becomes further essential for individual corporations to cope with this substantive institutional change by own technological potential and social capital accumulation (Aoki [8]).

The introduction of cognitive switch based, in turn, on the idea that corporate governance systems - rules governing the decisions of managers - also influence strategic choices, especially in terms of innovation (Charreaux [4]). Noting, in the end, all work claimed difficulties measures empirically.

III. MODEL AND METHOD

The model used to estimate the effect of firm cognitive capacity on the willingness of the firm to innovate with a non-linear regression model. The logistic regression seems to be appropriate in this case, followed by different statistical tests.

A. Data and Sample

The starting point of our data collection was the sample of 130 heterogeneous manufacturing firms publicly-traded in Algeria. The sample represents manufacturing firms operating in beverage sector, dairy sector and other industrial food products. The source of data is a personal collection dataset administered by a questionnaire on the Algerian food sector in 2012-2014. The focus is on innovation and the internal structure characteristics.

B. Dependent variable: The innovativeness

The dependent variable we are attempting to predict is the willingness of the firms to innovate. We distinguish between product and process innovation because the two tend to respond to different factors can have very different impacts on them (Cohen and Klepper [9] ; Cohen [10]). To study product-line innovation, we use measure based on firm's responses to the following questions: How many product-lines did have the firm at the time of creation? We get P_0. Did the firm realize other product-line innovations? We get the actual $P_{(t)}$. The difference makes:

$$P = P_{(t)} - P_0$$

We consider the case where the response variable is binary, assuming only two values that for convenience we code as one or zero. We define binary variable Y that take the value of one if P is strictly positive value, zero when P takes the value of zero. In other words:

$$Y = \{1 \text{ if } P > 0, \quad 0 \text{ if } P = 0\}$$

The Logit regression model for dichotomous data is appropriate when the response takes one of only two possible values representing the presence or absence of an attribute of interest, the willingness to innovate in our case. The Logit model determines the impact of multiple independent variables presented simultaneously to predict membership of a dependent variable.

$$\text{Logit}(\pi_i) = \beta X_i$$

y_i as a realization of a random variable that can take the values one and zero with probabilities π_i and $1-\pi_i$ (Dummy variable that takes the value of one if the firm innovates, zero otherwise). X_i represents the measures of the cognitive capacity characteristics held by the firms.

C. Independent variables: The cognitive capacity

The strength of our dataset lies on the detailed information about cognitive capacity. A first key explanatory variable is the professional specialized skills of firm owner, which we proxy by a qualitative measure with binary variable. It take the value of 1 if the share holder have a specialized skills, 0 if isn't.

As other explanatory quantitative variables, we precede three measures to proxy the cognitive ability of the firms. First, the professional experience of personal who intervene in innovation decision in firm. We proxy as a quantitative variable from the total mounts of numbers of professional experience years. We measure also the number of persons personal who intervene in innovation decision in firm as a quantitative variable. Finally, our data allows us to detect if the firm's age determines its willingness to innovate.

IV. RESULTS AND ANALYSIS

Based on the descriptive statistics showing the correlation matrix of variables in Table I, from which we find no severe multi-colinearity issues among independent variables.

The resulting Logit model in Table II, with all independent dummies token together, we find that the coefficient on the dummy of firm age is statistically insignificant. In the Logit estimation, the coefficients of our measure of owners specialized skills and number of designers are respectively 1.619 and 0.533 for product innovation, the z-statistics are 2.454 and 2.459. The Logit estimates that they are likely correlated on the product innovation.

We also report the p–value for a test of exogeneity of our measure of owner's specialized skills and number of designers in the Logit model. Based on this test, we reject the null hypothesis that the owner's specialized skills and number of designers are exogenous with respect to the propensity to carry out product innovation.

We mention that the global Logit model, using 130 observations has a number of cases correctly predicted are significant (90.8%). The model presents a relatively strong correlation (Adjusted R-squared of 0.55) with a minimized log-likelihood ratio and other error criterions. The whole model for all independent variables presents at their mean a beta of 0.49.

Treated separately, we get some robust models that we can shed the light in the direction of our hypothesis. In Table III, we test the effect of owner's specialized skills. The resulting model shows a good prediction of 74.6% with a p-value statistically significant. The coefficient shows a positive high effect on the innovativeness This is with a sensibility of 0,68 and a specificity of 0.79. We find that the owners having specialized skills, the greater is the probability that the firm carries out product innovation.

Moreover, modelling with only the measures of firm age (Table IV), we have found that it has a statistically significant effect. The old firms have a great chance to have higher willingness to innovate more than others. With a number of cases correctly predicted are significant of 70%, his sensibility is 0,42 and a specificity of 0,91. We can assert here that old

ISSN: 2961-6638

firms present a higher willingness to innovate. Furthermore, in Table V, we model the effect of the designer's experience. It is shown that it has a statistically significant. The designer's experience do not affect significantly the willingness to innovate.. The model shows a sensibility of 0,78 and a specificity of 0,91. We can assume strongly that there is a neutral relationship designer's professional experience in the firm with the probability to have a higher level of willingness to innovate.

As discuss earlier, the estimated positive effect of cognitive capacity, in its some measures, on firms' innovation stands in sharp contrast with the predictions of the theoretical literature. Here we have provided a preliminary empirical evidence to suggest that there is a relationship between firm cognitive capacity and the ability of firms to innovate. These results seem to be more consistent with the stated approaches.

V. CONCLUDING REMARKS

This paper has been built on the hypothesis that the cognitive capacity of a firm impacts its willingness to innovate. We have found that, after accounting for its possible endogeneity, cognitive capacity has a large, positive and significant effect on product-line-innovation. This result is robust to using alternative instrument sets, and to controlling for a variety of firm attributes (as firm size and performances) and local conditions that may also influence innovation. We believe that the analysis represents a first step in a potentially fruitful line of research.

In this paper, we have provided some preliminary empirical evidence to suggest that there is a relationship between firm cognitive capacity and the ability of firms to innovate. These results seem to be more consistent with the stated approaches.

REFERENCES

[1] R. H. Coase, and N. Wang, "The Industrial Structure of Production: A Research Agenda for Innovation in an Entrepreneurial Economy," Entrepreneurship Research Journal, 1(1), 2011.

[2] OCDE, "Principes directeurs pour le recueil et l'interprétation des données sur l'innovation," Manuel d'OSLO, Éditions OCDE, 2005.

[3] D. Foray, "L'économie de la connaissance," Éditions La Découverte, Paris, 2000.

[4] G. Charreaux, "Variation sur le thème : A la recherche de nouvelles fondations pour la finance et la gouvernance d'entreprise," Finance Contrôle Stratégie, 5 (3), pp. 5-68, 2002.

[5] W. Cohen, and D. Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation," Administrative Science Quarterly, 35, pp. 128-152, 1990.

[6] G. Charreaux, "Pour une gouvernance d'entreprise comportementale : Une réflexion exploratoire," Cahier du FARGO, 1050601, 2005.

[7] M.A. Benmehaia, F. Brabez and S.B.E. Maliki, "Corporate Governance and Agri-Food Innovation: Empirical Study of Algeria's Beverage Sector," International Journal of and Economics and Strategic Management on Business Process, 2, pp. 86-92, 2014.

[8] M. Aoki, "Le capital social 'individuel', les réseaux 'sociaux' et leurs liens avec le jeu économique," Revue d'économie du développement, 24, pp. 97-119, 2010.

[9] W.M. Cohen, and S. Klepper, "The anatomy of industry R&D intensity distributions," The American Economic Review, 82(4), pp. 773-799, 1992.

[10] W.M. Cohen, "Fifty years of empirical studies of innovative activity and performance," Chapter 4, in : B.H. Hall, and N. Rosenberg, Handbook of the Economics of Innovation, Vol.I, Elsevier Science Publishers.pp. 129- 213, 2010.

APPENDIX

TABLE I. CORRELATION COEFFICIENTS MATRIX,
5% critical value (two-tailed) = 0.172 for n = 130

	(1)	(2)	(3)	(4)	(5)
(1) Innovativeness	1.00	0.482	0.648	0.682	0.425
(2) Specialized Skills Owners		1.00	0.415	0.400	0.354
(3) Experience of Designers			1.00	0.663	0.335
(4) Number of Designers				1.00	0.295
(5) Firm Age					1.00

TABLE II. Logit Model, using 130 observations, Dependent variable: Innovativeness, Standard errors based on Hessian

Explanatory Variables	Coefficient	Std. Error	z	
Const.	-6.241	1.101	-5.665	***
Owners Skills	1.619	0.660	2.454	**
Designers Experience	0.039	0.013	2.870	***
Number of Designers	0.533	0.216	2.459	**
Firm Age	0.048	0.032	1.510	
Log-likelihood	-34.259	Adjusted R-squared		0.559
Schwarz criterion	92.855	Akaike criterion		78.518

Number of cases 'correctly predicted' = 90.8%
Likelihood ratio test: Chi-square(4) = 109.726 (0.0000)
Contingency table include : a=51 ; b=6 ; c=6 ; d=67

TABLE III. Logit Model, using 130 observations, Dependent variable: Innovativeness, Standard errors based on Hessian.

Explanatory Variable	Coefficient	Std. Error	z	
Const.	-1.170	0.269	-4.336	***
Owners Skills	2.125	0.406	5.231	***

Number of cases 'correctly predicted' = 74.6%
Likelihood ratio test: Chi-square(1) = 31.22 (0.0000)
Contingency table include : a=39 ; b=18 ; c=15 ; d=58

TABLE IV. Logit Model, using observations 1-130, Dependent variable: Innovativeness, Standard errors based on Hessian

Explanatory Variable	Coefficient	Std. Error	z	
Const.	-2.017	0.441	-4.5715	***
Firm Age	0.143	0.038	3.7004	***

Number of cases 'correctly predicted' = 70.0%
Likelihood ratio test: Chi-square(1) = 45.76 (0.0000)
Contingency table include : a=24 ; b=33 ; c=6 ; d=67

TABLE V. Logit Model, using observations 1-130, Dependent variable: Innovativeness, Standard errors based on Hessian

Explanatory Variable	Coefficient	Std. Error	z	
Const.	-3.784	0.663	-5.700	***
Designers Experience	0.058	0.010	5.601	***

Number of cases 'correctly predicted' = 86.2%
Likelihood ratio test: Chi-square(1) = 78.20 (0.0000)
Contingency table include : a=45 ; b=12 ; c=6 ; d=6

ISSN: 2961-6638