

## **Key Determinants of Innovation in the Algerian SMEs**

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### **Abstract:**

Innovation has been considered as a key element for the growth of small and medium sized enterprises (SMEs) for a long time. Though this field of research has been subject to numerous studies, the links between the factors that affect innovation within SMEs still need to be clarified and investigated (Leghima, 2014). Several studies have suggested that there are many factors that lead to innovation, including individual, organizational and environmental factors as well as those related to—or are considered to be—innovation attributes (Saunière et al. 2012). They have, moreover, underlined the importance of recognizing that most of these factors can influence unevenly the process of innovation, in that they are not of equal strength nor all act in the same direction (Ducaux, 2013). In Algeria, however, very few researches have dealt with this subject (Metaiche M. & Benhabib A. 2013). The aim of this paper is to understand the entrepreneur, its human skills, financial capacity and collaboration with the external environment, the competition as well as R&D on capacity innovation of the SMEs. The choice of variables is based on a study that has regrouped several researches undertaken in 23 countries. For the purpose of this study, we have developed a conceptual model that has been tested empirically using data from 118 Algerians SMEs. After an exploratory analysis followed by a confirmatory analysis and using structural equation modeling, we have come to the following results: the capacity of innovation of the Algerian SMEs depends mainly upon entrepreneur's attributes as well as his/her financial capacity

**Keywords:** Innovation; Entrepreneurship; SMEs; Algeria.

**JEL Classification:** O33, C31, D22

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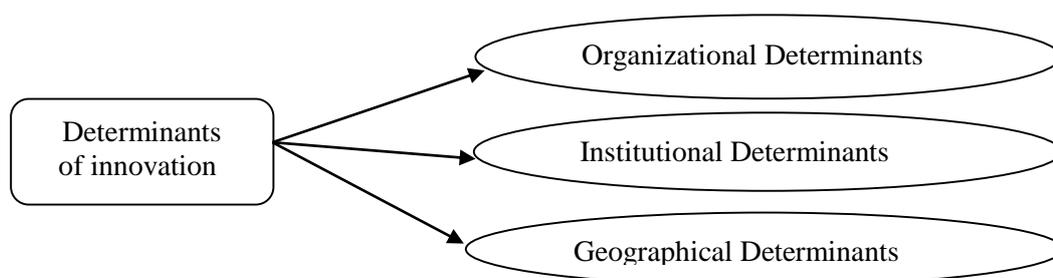
## Introduction

Nowadays, the activity of innovation in any firm goes far beyond its simple technological component as it concerns the manufacturing processes, the working organization as well as the types of management of human skills. De Woot P(2003) asserts that *“The fundamental logic of the company is the change. It is the innovation that brings ceaseless modification of an order existing with penalty, i.e the objective and the reward of the break of the status quo, that concerns the domain of product, the process, the marketing, the forms of organization, and the management.”* In the current economic environment where knowledge is an active element of performance, we notice that the relationships between enterprises and the quality of their institutional environment are of foremost importance. From this angle, innovation systems help establish the place within which occurs the main part of innovation dynamics. Therefore, the notion of National System of Innovation (NSI), Remoe (2002) describes the phenomenon of innovation within the framework of social and economic institutions. Literature on innovation also confers a territorial dimension to innovation through the integration of local structures, the setting up of interenterprise relationships and the implementation of scientific institutions.

Based on the literature, we have chosen to split the determinants of innovation into three main categories (see Figure 1):

- The Organizational Determinants that cover the responsibility to undertake an activity coupled with managerial culture and practice of innovation,
- The Institutional Determinants that allow to highlight the role of institutions in the dynamics of innovation and particularly the public policy of innovation,
- In addition, the Geographical Determinants that draw on the role of territorial systems of innovation as well as the forms of proximity to innovation.

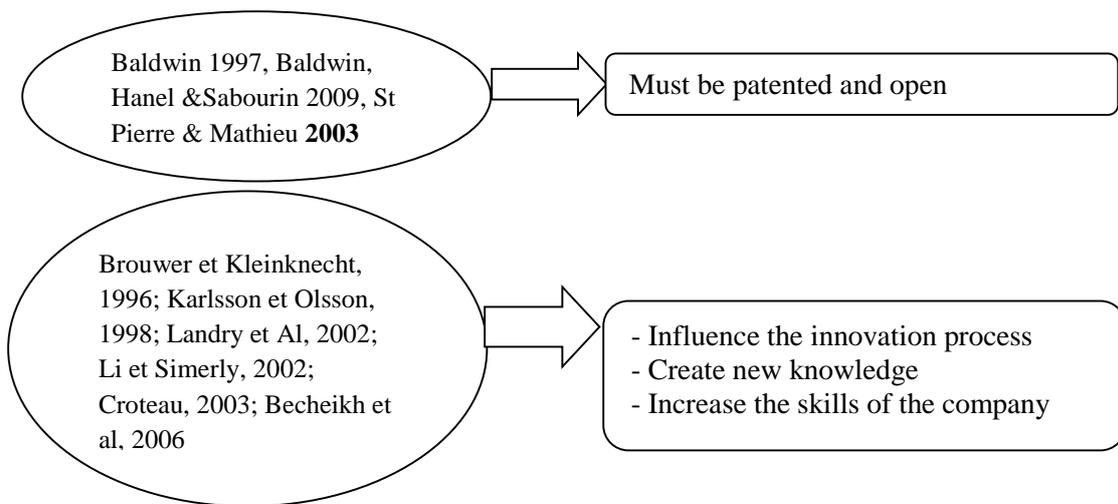
**Figure 1: Factors that stimulate innovation**



We shall list hereafter factors that stimulate innovation:

Factor 1-R&D and Patent: For a long time R&D has been considered as an essential indicator of innovation. The presence of R&D activities helps create a convenient climate to systematic questionings by triggering off companies flexibility, their capacity to integrate new concepts and their adaptability to any change in market conditions. Results of some studies (Figure 2) show that R&D is bound to the level of protection of the intellectual property (Baldwin, Hanel and Sabourin, 2009, SESSI, 2001). By studying the relationship between protection of the intellectual property and innovation, these authors showed that the innovative companies establish more patent for their inventions.

**Figure 2: Importance of R&D**



However, companies that develop protection strategies for their intellectual property tend to be less innovative. Other studies have shown that R&D influence the innovative process and increase the skills of the firm.

Factor 2-The characteristics of the SME's

- a. The size and the age of the company
- b. The business sector

Factor 3- The organizational skills

- c. The entrepreneur
- d. The human resources management
- e. The organizational shape
- f. The flexibility of the SME's
- g. The work atmosphere
- h. The strategic orientation

Factor 4-The resources of the company

- i. The financial resources
- j. The human resources
- k. The technological resources

Factor 5- The external environment of the SME's

- l. The environment
- m. The customers and the suppliers
- n. The technological opportunity
- o. The competitive pressure

Factor 6- Internal and external collaboration

- p. Internal collaboration
- q. Networking
- r. Partnership
- s. The technological alliances

Factor 7- Information source

Factor 8- Exports

Based on these determinants, we chose the variables that stem from a study that grouped several researches in 23 countries (see Table 1). From these studies, we highlighted the key factors that favor innovation by attributing 10 points to the first variable considered by the authors as most important. We have pursued our classification decreasingly according to the scale from 10 to 1. We proceeded afterward to the aggregation of the points that gave us the first six variables that are the entrepreneur, financial capacity, human skills, partnerships, competitive pressure and R&D.

**Table 1: Research variables (points 10 for the best, 1 minimum)**

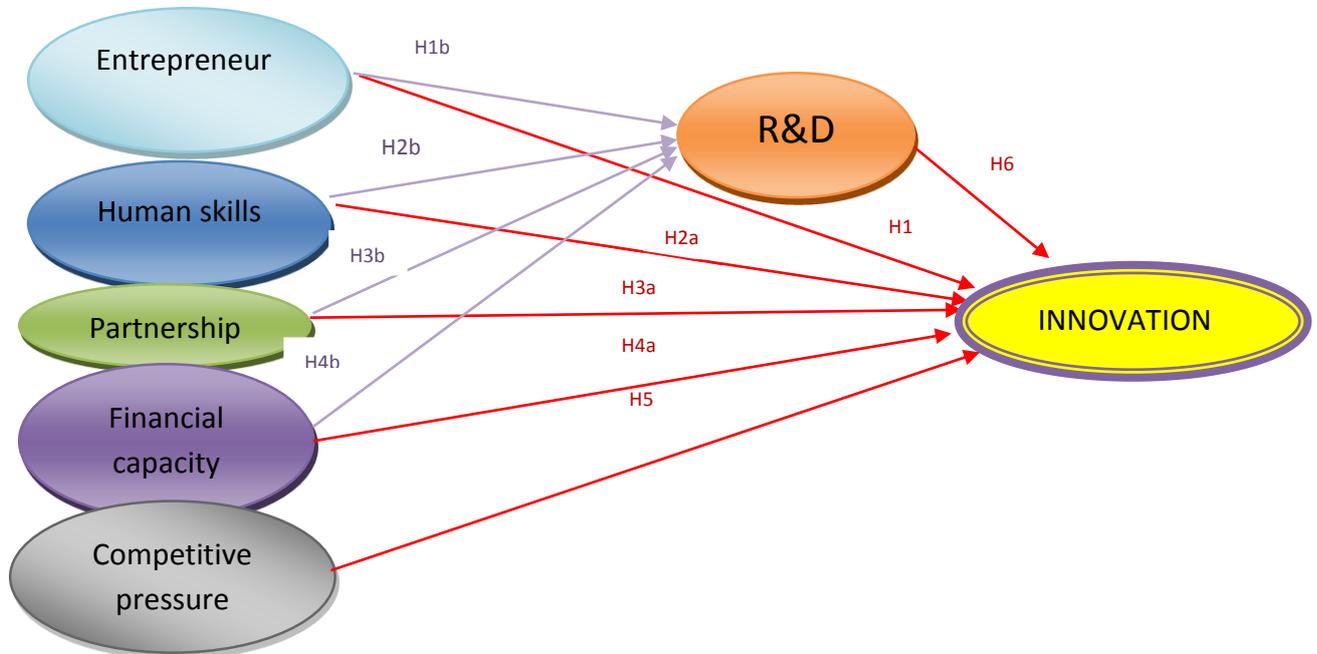
Authors\ Variables	Human skills	Entrepreneur	IC TS	Financial capacity	Size	Business sector	Age	R & D	Culture	Cocurrentiel pressure	Structure	Strategy	Partnership	Export	Information system
Jong & Brouwer 1999	10	10	4	6	1			3	8	2	7	9	5		
Le Bars Anne 2001														4	
Romijn H. & Albaladejo M 2002	9			7	10			8		10	6		9 8		
Julien P.A & C. Carrier 2002					10	9						8			7
Galende J. & De la Fuente J.M 2003	9			7				8		10	6		9 8		
Amara N. & Landry R. 2005	7	9		8									10		
Bouacida Y & Haudeville B. 2007			9	8	10										
Becheikh et al. 2006	7				10	4	8	9					5	6	
Freel M.S & Harrison R.T 2006				9						8			10		
St pierre & Trépanier 2003	9	10 8	9	9					7		7		6		
Soparnot R. and Stevens E. 2007	8											9	10		
Vega Jurado et al. 2008	9			7				8		10	6		9 8		
Girard P. 2008	10	9						7		6			8		

Baowendsomde Eliane Olga 2009		10 8	9	9							7		6		
P. Morand &M.Delphin 2009													10 10		
Frenz, M. and Letto- GilliesG.2009	9			7				8		10	6		9 8		
Bouzi Ines 2011	10	10		8	7					9					
Tlili Adel et Chriri Ali 2011								9					9 10		
J.C. Saunière et al. 2012	8							9	10			7	8 8		
T Koivisto 2013													10 10		
J.C.Boldrini 2013	9	10		9											
L.N.Safoulanito u et al. 2013		10	8							9					
A. Leghima 2013 and 14		10										08	09		
<b>TOTAL</b>	114	104	39	94	48	13	5	69	25	74	45	41	212	10	7

## Materials and Method

### The Theoretical Model and Research Hypotheses

**Figure 3: The conceptual model**



This model (Figure 3), which corresponds to the synthesis of our understanding of the state of the theoretical and empirical knowledge of the process of innovation in the context of the SME, summarizes all the dimensions which will be deepened in the present study on their capacity to stimulate the innovation. Then, we formulate our hypotheses as far as innovative research in the Algerian SME is concerned.

**H1a:** The entrepreneur is the initiator or the central point of the process of innovation in the SME.

**H1b:** The more the entrepreneur is directed to e R&D, the more the probability of innovation is important.

**H2a:** The more the company is endowed with skilled staff, the more it has capacities to innovate.

**H2b:** Human Resources oriented to R&D will favor innovation in the SME.

**H3a:** The availability of financial resources increases the capacity of the SME to innovate.

**H3b:** The firm that allocates a specific budget to R&D has more probability to innovate.

**H4a:** The firm working within an integrated partnership has a major impact on its capacity of innovation.

**H4b:** Collaboration with external R&D bodies increases the propensity of the SME to innovate.

**H5:** The competitive pressure has a positive effect on the capacity of innovation in the SME.

**H6:** R&D impact positively on the propensity to innovate in the SME.

To confirm or disconfirm these hypotheses, we apply the following three steps: data collection, scale measurement and exploratory analysis through a PCA (principal component analysis) and finally the analysis through the structural equation modeling.

### **Data collection**

At first, our investigation through a questionnaire has been sent to a sample of 30 industrial companies in the region of Tlemcen (West Algeria) in order to pretest the overall questionnaire for clarity and comprehension. Then, we widened the size of our sample, first on a national level and second through a diversified business sector. We have developed a conceptual model that has been tested empirically using data from 118 Algerian SME

We choose the 47<sup>th</sup> Edition of the International Fair of Algiers that took place between May 28 and June 2, 2014 at the Exhibition Center in Algiers. More than 1000 state-owned and foreign companies coming from about forty countries participated in his summer fair that is considered as one of the biggest economic demonstration in the African continent with 600 foreign companies representing 38 countries such as: Algeria, Belgium, Burkina Faso, Cameroon, China, Cuba, Czech Republic, Egypt, France, Germany, United Kingdom, India, Indonesia, Iran, Iraq, Italy, Japan, Jordan, Kuwait, Libya, Malaysia, Mali, Palestine, Poland, Portugal, Russia, Senegal, South Africa, Spain, Sudan, Tunisia, Turkey, Ukraine, United States, Argentina, Venezuela, Vietnam and Yemen. The United States was a guest of honor of the 47<sup>th</sup> FIA. As for Algerian participation, were present 453 PME activating particularly within sectors of food-processing industry, services, energy and petro-chemistry, electronic industry, textile, mechanics, steel industry, metal industry, construction and building materials. Data collection was performed through self-administered questionnaires.

At this point of our research, we may note the existence of several constraints linked to the organizational environment. Actually, the environment of the company (the executive staff) is less inclined to answer questionnaires than the individual consumers. Indeed, the corporate policy and the confidentiality level of tackled issues may explain the caution of companies to give clear answer but we assured anonymous involvement.

### **Scale Measurement and Exploratory Analysis through PCA**

The questionnaire consists of two parts. The first covers the nominal variables (MSDS). The second consists of 116 items measuring our research variables.

The questionnaire is primarily intended to measure the capacity of SME to innovate. More measures were taken into account: General information about SME (9 items), place of

innovation in the SME (15 items), entrepreneur (16 items), human skills (18 items), financial capacity (10 items), partnership (15 items), competitive pressure (3 items), R&D (5 items), innovation inhibitors in SME (25 items). Some items are taken from literature; others are specifically elaborated for the analysis. Through these components, respondents were asked to give their views of capacity of innovation and specify their degree of agreement or disagreement on a 5 Likert scale.

**Table 2: Results of PCA (Principal Component Analysis)**

	<b>Alpha of Cronbach</b>	<b>KMO</b>	<b>Bartlett</b>
INNOV : 1	0.804	0.591	0.000
2	0.799	0.634	0.000
ENTR	0.522	0.630	0.000
HS	0.505	0.561	0.000
CF	0.767	0.670	0.000
PAR	0.797	0.625	0.000
PC	0.663	0.518	0.000
R&D	0.764	0.743	0.000

Initial exploratory analysis was conducted through a factor analysis in several common and specific factors. This allowed us to eliminate several items that were ‘defective’, i.e. those poorly correlated factors whose presence may deteriorate the internal consistency of scales construction by using Cronbach's alpha as well as the results of factor analysis with varimax orthogonal rotation. Exploratory analyzes were performed on all the scales used in the IBM SPSS 20 software. Several ACP with varimax rotation were conducted on the scales.

The results shown in Table 2 indicate:

- For all scales, the data are adequate to the factorization (all KMO are greater or near to 0.6 and Bartlett's test of sphericity is significant).
- The scores are satisfactory with Cronbach's  $\alpha$  indicating good internal consistency of the scales.
- The results of this analysis that are satisfactory in terms of tests of internal consistency (commonality, KMO and Bartlett's test, and the alpha of Cronbach), remain for the selected dimensions (see Table 2, for the selected scales of Principal Component Analysis, PCA).

The confirmatory factorial analysis allows to confirm the structure of scales and to study the reliability and the validity of the variables. A factorial structure is specified in order to appreciate the adequacy of the results of the data collected in this measurement model defined a priori. The appreciation of the quality of adjustment of our measurement model is evaluated on the basis of the absolute, incremental and parsimonious model fitting. The overall absolute fit index shown in Table 3 is about 0.08, with some values superior to 0.5 which can be considered as good, whether with classical statistics calculated on the values of the sample (GFI, AGFI,) or with model fit index of population estimates (Population Gamma Index (PGI), Gamma Adjustment Population Index (GAPI)). The same evaluation can be formulated as parsimonious and incremental, which fit with values exceeding 0.5.

**Table 3: The measurement and structural absolute model fitting**

Index	INOV	ENTR	HS	FC, PAR, CP, R&D
Chi <sub>2</sub>	3875.879	358.068	59.283	1802.703
DF	435.000	55.000	10.000	230.000
p Level	0000	0000	0000	0000
RMC Standardised Residuals	0.075	0.037	0.0797	0.006
(GFI). Joreskog	0.734	0.967	0.959	0.729
(AGFI). Joreskog	0.650	0.850	0.876	0.635
No centrality Population Parameter	4.852	0.958	0.006	3.377
Index RMSEA Steiger-Lind	0.091	0.048	0.035	0.079
Index Gamma Population	0.663	0.964	0.930	0.655
Index Gamma Ajusted Population	0.583	0.846	0.789	0.566

Thus we can say that the constructs used to examine the measurement and the structural models are acceptable and justify our evaluation of the structural model. Therefore, it is possible to perform the model analysis.

**Table 4: Measurement and incremental model fitting**

Measure	INOV	ENTR	HS	FC, PAR, CP, R&D
(NFI). Index Ajust.Normed Bentler-Bonett	0.524	0.726	0.774	0.673
(NNFI).Index Ajust.Non Normed Bentler-Bonett	0.567	0.734	0.759	0.623
(RFI).Rho Bollen	0.660	0.783	0.849	0.701

The NFI of Bentler-Bonnett represents the proportion of total covariance of the tested model compared with the basic model. Result are satisfactory by considering that they exceed 0.5 for INNO, almost 0.7 for FC, PAR, CP and R&D, and a very satisfactory result for ENTR and HS.

NNFI of Bentler-Bonnett or TLI tests the improvement brought by the model tested compared with the basic model taking into account the parsimonious aspect of the model. The results register a NNFI that exceeds 0.550 which gets closer to 0.9 for HS, explaining that the adjustment of our measurement model is good.

Rho of Bollen represent the reduction of the function of distance step of freedom when we go away from the basic model; it is an adjustment of the NFI that remains sensitive to the size of the sample. A figure between zero and one, of 0.660 for INNOV and 0.849 for HS is a good result.

**Table 5: Measurement and parsimonious model fitting**

Measure	INOV	ENTR	HS
James-Mulaik Brett Parsimonious Fit Index PNFI	0.516	0.741	0.887

The aim is to avoid the overestimation of the model by having too many parameters, and then to detect if the bad adjustment of the model results from lack of parameters. The model should be preferred according to the criterion of the razor of Occam. The test PNFI of James-Mulaik and Brett help adjust the NFI with regard to the degrees of freedom of the tested model. A result of 0.887 for HS and 0.741 for ENTR is considered a good result, and figures for the rest of the variables exceed 0.5 and can be accepted as satisfactory.

We can summarize to say that our model measures the absolute indications (Chi<sup>2</sup>, RMSEA, GFI, RMR, Gamma and Adjusted Gamma), the incremental indications (CFI, NNFI, and NFI) as well as the parsimonious indications (PNFI) as satisfactory.

## Hypotheses Testing

Having estimated the measurement quality of instruments, we can then proceed to the research hypotheses tests by using structural equations modeling.

**Table 6: The structural equations modeling**

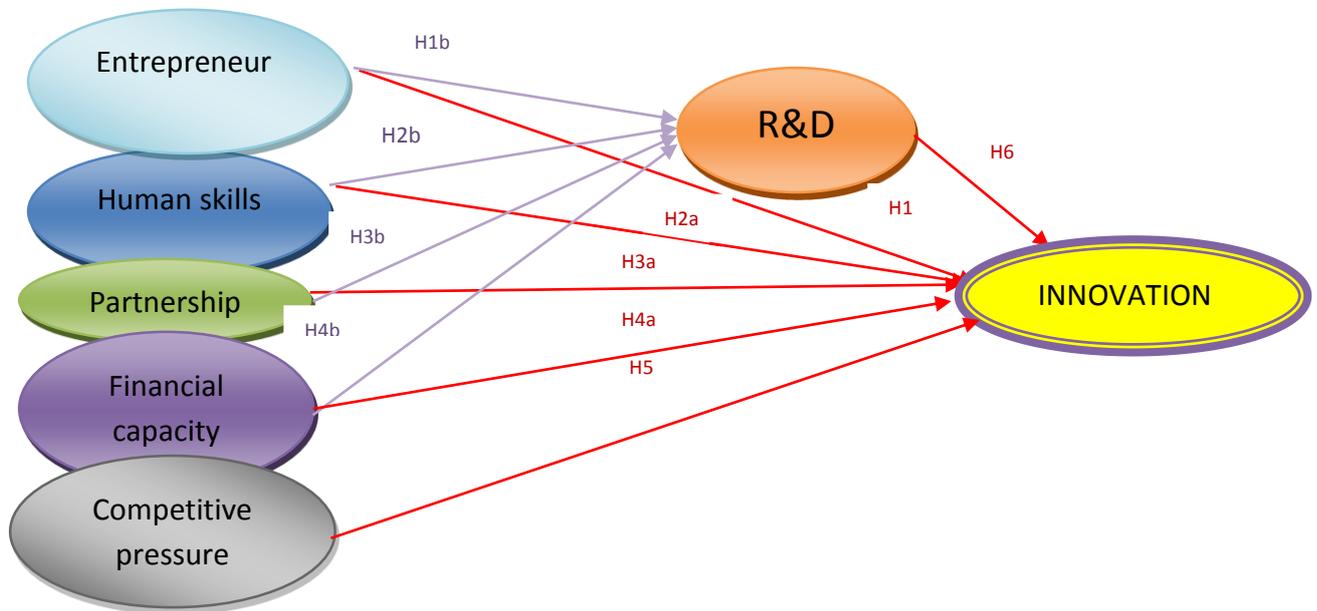
<b>Variables</b>	<b>Equation</b>
Entr → Innov	Innov = β1. Entr + ξ1. Innov = 0.618. Entr + 0.115.
HS → Innov	Innov = β1. HS + ξ1. Innov = 0.255. HS + 0.093.
FC → Innov	Innov = β1. FC + ξ1. Innov = 0.422. FC + 0.088.
PAR → Innov	Innov = β1. PAR + ξ1. Innov = 0.230. PAR + 0.017.
CP → Innov	Innov = β1. CP + ξ1. Innov = 0.501. CP + 0.094.
RD → Innov	Innov = β1. RD + ξ1. Innov = 0.238. RD + 0.013.
Entr → RD	RD = β1. Entr + ξ1. RD = 0.265. Entr + 0.094
HS → RD	RD = β1. HS + ξ1. RD = 0.418. HS + 0.080.
FC → RD	RD = β1. FC + ξ1. RD = -0.330 FC+ 0.085.
PAR → RD	RD = β1. PAR + ξ1. RD = - 0.294. PAR+ 0.085
Research & development	RD= 0.265 .ENTR +0.418.HS -0.294.PAR -0.330.CF + 0.652
Innovation	Innov= <b>0.618ENTR + 0.255HS + 0.422 FC -0.230 PAR + 0.501 CP + 0.238RD+ 0.928</b>

Results of our model allow supporting strongly the role of the entrepreneur in triggering off an innovation within an enterprise: the regression coefficient of 0.618 is statistically significant. These results consolidate the arguments of some authors that consider the entrepreneur as the initiator or the central point of the process of innovation in the context of the SME, Ghalbouni Asmaa (2010).

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**H3a:** The availability of financial resources increases the capacity of the SME to innovate.

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**H4a:** The firm working within an integrated partnership has a major impact on its capacity of innovation.

**H4b:** Collaboration with external R&D bodies increases the propensity of the SME to innovate.

**H5:** The competitive pressure has a positive effect on the capacity of innovation in the SME.

**H6:** R&D impact positively on the propensity to innovate in the SME.

To confirm or disconfirm these hypotheses, we apply the following three steps: data collection, scale measurement and exploratory analysis through a PCA (principal component analysis) and finally the analysis through the structural equation modeling.

We confirm that the entrepreneur is a very important factor in the probability of stimulating innovation within the Algerian company.

As regards the hypothesis H1b, results exhibit a statistically significant coefficient of 0.265 that goes along with Djeflat (2012) analysis in a way that the activity of R&D becomes valid when the entrepreneur is directed to the action and the need of the moment. Bencheikh & al. (2006), and Olga & al. (2008) confirm that the presence of a leadership regarding innovation directed to R&D increases the capacity of the SME's to be integrated and oriented for a successful innovation.

It is generally admitted that the quality of human resources has a significant impact on firms' innovative capacity. Results of our analysis confirm that staff competency, presenting a coefficient of 0.255, has a major impact on the propensity to innovate. Indeed, the first stages of the process of innovation require knowledge and particular skills that can be the key for subsequent developments. The skills, which the company possesses, with the aid of the staff, would allow her to use not only the internal but also the external information to be transformed into knowledge. In this case, we agree with the authors that consider the lack of qualified personnel is often one of the major obstacles to their activities of innovation.

Hypothesis H2b is confirmed with a correlation coefficient of 0.418 with regard to the link between the entrepreneur and R&D. This relationship has been confirmed by several authors about the presence of staff dedicated to R&D whose stimulating exchanges with the external environment increases the use of the rich information sources as well as the creativity of the company, Bencheikh & al. (2006), Rhaïem (2013), and Mairesse & Mohnen (2011).

Moreover, it would seem that SME's that possess financial resources have more probability to triggering innovation. Indeed, our results show that the availability of resources has an influence on the rate of innovation. This rate presents a statistically significant coefficient of 0.422 and confirm results of Frenza & al. (2009), Ross u., koschatzky k., stanovnik p., (1999)

Several authors confirmed that there is a very important relation between financial capacity and R&D by mentioning that the investment in activities of R&D influences positively innovation—Mairesse & Mohnen (2005), Griffith & al. (1997), INSEE (2013). Results of our analysis confirm that this relation is not significant, meaning that the coefficient of correlation of -0.330 can be explained by carelessness as far as the importance of R&D activities by Algerian firms is concerned. Our hypothesis is thus invalidated.

As regards collaborations with the external environment, we notice that the development of collaborations stimulates innovation in SME's. Results show that partnership with the external actors has a positive and significant effect on the rate of innovation with a statistically

significant coefficient of 0.23. The rate of innovation would thus increase the capacity of companies to collaborate. This goes in line with studies made by Idrissi (2012), Norrin & Etienne St Jean (2012).

Result of the correlation between partnership and R&D is negative with a coefficient of -0.294, invalidating our hypothesis that is nevertheless validated by several authors like Gersbach & Schmutzler (2003), Cassimam & Veugeler (2005), and Idrissi (2012). This result can be explained by the fact that Algerian companies are not interested in R&D.

For the impact of the competitive pressure on the probability of innovation, results exhibit a significant correlation of 0.501. This result explains the role of competition on the capacity of innovation, and validate previous studies like Gorin (2012), Rahmouni (2012), and Safoulanitou (2013).

The last hypothesis is also validated. Actually, R&D is the cornerstone of innovation by creating a convenient environment for its implementation. This may help comprehend that any company engaged in research and development activities has a probability to reach an innovation. We join then authors who confirm that R&D contribution remains important in the process of innovation of the SME's, Thechkedalh (2012), Christophe (2012), and Ramadan (2013).

In summary, on the basis of our results, among six factors retained in our model as having an influence on the capacity of innovation within Algerian SME's, only the entrepreneur, the competitive pressure and the financial capacity would really have an impact on the rate of innovation.

Indeed, we understand the limitation of a small sample. A bigger sample would give results that could be more convincing.

## **Conclusion**

Following the example of several previous empirical studies, our investigation shows that innovative capacity of the SME's depends generally on its intrinsic characteristics and the situation in which it operates. Indeed, on one hand, the more the company is managed by a qualified entrepreneur and possesses a financial capacity as well as human skills, the more it may innovate in product or service to take advantage of scale economies and maintain its market share, and on the other hand, the more it may facilitate internal and external communication by emphasizing organizational innovation. Furthermore, Results show that collaborations with the external environment, the competitive pressure and R&D exercise a positive influence on the probability to innovate. We can also say that Algerian firms have not internalized the importance of R&D within their organizations yet. Results confirm that in spite of the importance of innovation, SME enterprises do not invest and do not collaborate in the field of research and development. A tentative argument that could also be advanced is that most studies on Algerian SMEs have come to present the familial nature of the Algerian SMEs as a constraint to their growth Benhabib & al (2014). After all, innovation in the Algerian SME enterprises does not obey necessarily to the conventional determinants put forward in developed countries.

Their activities of innovation are much more centered upon the imitation of foreign technologies and generics development and often with the introduction of incremental improvements to the existing knowledge.

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