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**Information:**

Tel: 021.313.63.35; 0731.300.120

Fax: 021.313.23.80

E-mail: [tudor.maruntelu@srac.ro](mailto:tudor.maruntelu@srac.ro)

Website: [www.calitatea.srac.ro](http://www.calitatea.srac.ro)

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# The Determinants of Innovation in Micro and Small Enterprises in the Northeast of Brazil

Cicero Eduardo WALTER<sup>1</sup>, Cláudia Miranda VELOSO<sup>2\*</sup>, Paula Odete FERNANDES<sup>3</sup>

<sup>1</sup> Professor, Federal Institute of Education, Science and Technology of Piauí, LAGEN, Brazil; E-mail: eduardowalter@ifpi.edu.br

<sup>2</sup> Corresponding author, Professor, GOVCOPP; UNIAG; University of Aveiro; Instituto Politécnico de Bragança, Portugal; E-mail: cmv@ua.pt

<sup>3</sup> Professor, UNIAG; NECE; Instituto Politécnico de Bragança, Portugal; E-mail: pof@ipb.pt

## Abstract

*Given the increasing complexity of the business environment, which has a considerable impact on Micro and Small Enterprises (MSE), innovation becomes the key to creating and maintaining competitive advantages, generating positive results for both companies involved in the process of innovation, and for the economy as a whole. The present research had as objectives to verify how the innovation presents itself in the MSE of the State of Piauí, to identify the determinants of innovation for the MSE of the interior and of the capital. In addition, it was intended to verify if there was an association between the geographical location and the innovation. For this, the study was based on a sample of 617 MSE distributed in six cities of the State of Piauí. The data were collected through the application of the Innovation Radar conducted by the Brazilian Micro and Small Business Support Service's Local Innovation Agents program. Statistical techniques of descriptive, exploratory and multivariate nature were applied. The results showed that the MSE under studied has a capacity for innovation between "Little Innovative" and "Occasional Innovative", and that the found innovation factors suggest the innovation is market driven rather than geographically as is commonly found in the literature on the subject.*

**Keywords:** *innovation; micro and small companies; GAI; management; Brazil.*

## 1. Introduction

A joint research project between the Brazilian Micro and Small Business Support Service (BMSBSS) and the Getúlio Vargas Foundation (GVF), released in an Executive Report by BMSBSS in February 2015, brought up the strategic importance of MSE for growth and economic development of Brazil. According to this survey, whose data cover the period 2001-2011, the share of Gross Domestic Product (GDP) by MSE in 2001 was 23.2%, rising to 27% in 2011, indicating that more than a quarter of GDP Brazilian company came from small businesses, is the main responsible for generating employment and income in the country.

Even considering the strategic importance of MSE for the economic growth and development of Brazil, there is a high mortality rate among MSE with less than two years of existence. Pereira, Grapeggia, Emmendoerfer and Três (2009), pointed to the lack of entrepreneurial behaviour, deficiencies in planning before opening the companies, deficiencies in management after opening the business, lack of support policies in the sector and depressed economic environment such as main factors explaining the high mortality rate, adding that the companies that were successful were those that used their innovative capabilities in the processes of management and use of new technologies.

Accordingly, innovation becomes the key to creating and maintaining competitive advantages, generating positive results for both the companies involved in the innovation process and the economy as a whole. In the words of Anthony and Chris-

tensen (2007, p.19), "innovation is imperative to maintain the health of the company. In fact, the creation of new products, services, processes and operational models contribute to the growth not only of the company but also of the national and global economy". Innovation is the specific instrument of business activity. It is the action that endows the resources of a new capacity to create wealth. Innovation actually creates the resource. A "resource" is something that does not exist until man discovers a use for something existing in nature and thus endows with an economic value (Drucker, 1987).

Knowing the importance attributed to innovation in the current business context, the main objective of this research is to identify the explanatory factors of innovation for MSE in the interior and capital, as well as the relationship between identified factors and innovation in their global context. In addition, it is expected to find evidence that the degree of innovation of the MSE under study is associated with Geographic Location.

The present work is structured in four points, besides this introduction. The theoretical framework of the study is presented below, where the main concepts that guided the investigation are explained. Subsequently, the research methodology is presented, referring to the research objectives and hypotheses, the instrument for data collection, population characterization, sample definition and data processing technique. The third point is based on the analysis and presentation of the results, being the core of the present work. The present research is concluded with the presentation of the main conclusions of the study and suggested lines of future research on the subject in question.

## 2. Theoretical Framework

### 2.1. Innovation in Developing Countries

The companies do not operate in total isolation from the environment in which they are inserted. The environment at the same time as it is influenced by the organizations influences the conduct and performance of the same, especially, with respect to the practice of innovation. Small and medium-sized enterprises are the engine of economic development, especially in Developing Countries (DC). In order to respond to changing market circumstances, companies need to develop their organizational capacities, defined as the execution of coordinated tasks and the use of resources in order to reach a predetermined goal (Inan and Bititci, 2015).

According to the Oslo Manual (OCDE and FINEP, 2005), several exogenous factors make up the innovation scenario in the Developing Countries, such as macroeconomic uncertainty, instability, institutional fragility, lack of social awareness about innovation, entrepreneurial nature of risk aversion, lack entrepreneurs, barriers to nascent businesses, lack of public policy instruments to support business and managerial training, which act as an obstacle to innovation activity in these countries, a fact also pointed out by Rojas and Carrillo (2014) that shows that the exposure of Latin American countries with weak administrative, commercial and productive structures to market failures has led to defensive innovation strategies that take precedence over production initiatives and technological dominance with a more strategic focus.

Innovation in DC is characterized by the acquisition of third-party embedded technology to aid in the innovation of existing products and processes, which in turn are only minor or incremental changes that in some DC are the most frequent technological activities (Demonel and Marx, 2015; OCDE and FINEP, 2005). Tidd, Bessant and Pavitt (2008) define this type of relationship as "supplier-dominated" since most innovations in these circumstances refer to processes or innovations conducted by third parties.

Reichert, Camboim and Zawislak (2015) argue that the traditional view of the relationship between firms, innovation and development essentially relies on Research and Development (R&D) investments, patent grants and higher education personnel employed in these activities as the main responsibility for generating breakthroughs which lead to business development. However, as the same authors suggest, the fact that in emerging economies such as Developing Countries such a relationship is not necessarily positive, it doesn't remove the role of development agents from them, which is perfectly applicable to MSE, since in the Brazilian case the same has a 99,1% share in the country's economy and are responsible for 52.30% of all jobs generated (Paula, 2014).

### 2.2. Innovation in Micro and Small Enterprises

In Brazil, it is Decree No. 5,028, dated March 31, 2004, which gives the guidelines for the conceptualization of what has become an MSE. The decree establishes the gross annual revenue to determine and classify MSE, so that annual gross revenue equal to or less than \$ 110,350.60 (One hundred and ten thousand, three hundred and fifty dollars and sixty cents) characterizes micro, companies or individual firms; and gross annual revenue exceeding \$ 110,350.60 (One hundred and ten thousand, three hundred and fifty dollars and sixty cents) and equal to or less than \$ 542.818,40 (Five hundred and forty-two thousand, eight hundred and eighteen dollars and forty cents) characterizes as a small business.

MSE have characteristics such as the involvement of leaders in operational activities, focus on short-term and survival plans, low standardization and formalization, limited client base, low level of employee training, limited knowledge of operational activities improvement and, especially, innovation based on the needs of improvement and technological clients (Inan and Bititci,

2015).

For Sibirskaia, Stroeve and Simonova (2015, p.510) "the advantages of small innovative enterprises are flexibility, the ability to adapt to the new demands that have been made by scientific and technical progress". Ornek and Ayas (2015) point to a positive relationship between intellectual capital and corporate performance, a relationship that is embodied in the transfer of intellectual capital to innovation. Therefore, the importance of the detention of qualified individuals is evidenced, as well as the existence of mechanisms that help in the development of innovations through the identification, use and sharing of knowledge, and since the MSE have the low degree of training of the collaborators, innovation in these ventures may be undermined.

Given the specific circumstances of small and medium-sized enterprises, which are also valid for micro-enterprises, and because they are the potential key to economic growth, with greater adaptability to changes in the environment, the government must undertake efforts to sustain and create new enterprises collaborative focus on research and development and easy access to the results of collaborative research (Popescu, 2014).

## 3. Methodology and Methods

The main objective of the present investigation is to identify the explanatory factors of innovation for MSE in the interior and capital, as well as the relationship between identified factors and innovation in their global context. In addition, it is expected to find evidence that the degree of innovation of the MSE under study is associated with the geographical location.

In this context, and in order to determine the innovation factors in the MSE of the State of Piauí, Brazil, and how it relates to innovation in general, the following research hypothesis is established:

□ Research Hypothesis: Innovation in Micro and Small Enterprises in the State of Piauí is associated with its business environment (Geographic Location).

Research Hypothesis is based on the conceptual framework of Skibinski and Sipa (2015) and Aarstad, Kvitastein and Jakobsen (2016), who assert that MSE because they have limited internal resources, should use external sources of knowledge. In this way, the ability to explore and use the knowledge that comes from the outside becomes a key element for a successful innovation, which makes the environment in which it is located and the development of appropriate tools to exploit it. They further affirm that the geographic environment in which companies are inserted can have important effects on growth, profits and development, including survival and innovative performance.

The data collection instrument used was a questionnaire composed of 32 items that evaluate 13 (Thirteen) innovation dimensions, resulting from an adaptation made by Bachmann (2011) for MSE application of the Innovation Radar by Sawhney, Wolcott and Arroniz (2006), originally constituted of 12 (Twelve) dimensions. The innovation dimensions assessed by the Innovation Radar are: (1) Supply; (2) Platform; (3) Brand; (4) Customers; (5) Solutions; (6) Relationship; (7) Value Aggregation; (8) Processes; (9) Organization; (10) Supply Chain; (11) Presence; (12) Network and (13) Innovative Ambience.

In order to evaluate the reliability or internal consistency of the scale referring to the 13 (thirteen) dimensions of the Innovation Radar, the Cronbach's Alpha was calculated, as a measure of the proportion of variability in responses (Maroco and Marques, 2006). It was obtained a Cronbach's Alpha of 0.771, which can be considered as a reasonable reliability, being between 0.7 and 0.8.

The questionnaires were applied through the follow-up cycle of the program called Local Innovation Agents (LIA) of the

Brazilian Micro and Small Business Support Service from Piauí (BMSBSS-PI), which was conducted by 18 agents, resulting in a database with 617 cases, made available for the present investigation.

For the treatment of the data it was used the software SPSS Statistics in its version 22 and Numbers in its version 3.1. The statistical techniques used were descriptive, exploratory, inferential and multivariate in order to describe, analyse and interpret the behaviour of the attributes under study. Thus, in the first phase we chose to calculate the Global Average Innovation Index (GAIL), obtained by means of the simple arithmetic mean of the above mentioned 13 (Thirteen) dimensions of Innovation Radar (Equation 1).

$$GAIL = \frac{1}{n} \sum_{i=1}^n X_i \quad (1)$$

Where,

$n$ , corresponds to the number of independent variables of the Innovation Radar;

$X_i$ , corresponds to the independent variables of the Innovation Radar ( $i = 1, \dots, 13$ )

$$GAIL = 1/3(X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + X_8 + X_9 + X_{10} + X_{11} + X_{12} + X_{13}) \quad (2)$$

At where,

$X_1$ , Supply;  $X_2$ , Platform;  $X_3$ , Brand;  $X_4$ , Customers;  $X_5$ , Solutions;  $X_6$ , Relationship;  $X_7$ , Value Aggregation;  $X_8$ , Processes;  $X_9$ , Organization;  $X_{10}$ , Supply Chain;  $X_{11}$ , Presence;  $X_{12}$ , Network;  $X_{13}$ , Innovative Ambience.

The identification of innovation factors for MSE in the interior and capital was by means of Factorial Analysis, followed as well as an analysis of correlation to show the relationship between the factors of MSE innovation and the GAIL to determine what is the most important factors of innovation.

A final sampling error of 3.94% and a significance level of 5% were assumed to calculate the sample size. In order to make the decisions regarding the research hypothesis, a level of significance of 5% was assumed throughout the analysis.

## 4. Analysis and Presentation of Results

### 4.1. Descriptive and Exploratory Analysis

The study sample consisted of 617 MSE distributed among six cities of the State of Piauí, as follows: Teresina 425 (68.9%); Bom Jesus 47 (7.6%); Floriano 40 (6.5%); Piri-piri 40 (6.5%); Picos 33 (5.3%) and Parnaíba 32 (5.2%). Regarding the distribution of MSE by activity sectors, 54.6%, 34.5% and 10.9% represent the Service, Trade and Industry segments, respectively. Regarding location, 68.9% of the MSE in the sample are located in the state capital, while 31.1% are located in the interior of the State. The Global Average Innovation Index (GAIL) obtained through the average of the 13 dimensions of the Innovation Radar, whose overall mean value was 2.01 points (standard deviation 0.92), denotes globally that the MSE of the study sample have innovative capacity between 'Little Innovative' and 'Occasional Innovative', according to the adopted classification of Neto and Teixeira (2011).

The mean standard deviation of 0.92 indicates that the firms analysed responded to questions related to the Innovation Radar in the same sense, that is, there was little variability around them.

In order to answer the Research Hypothesis, the GAIL variable, measured on a metric scale, was transformed into a new variable measured on an ordinal scale. This new scale was called GAIL-Classification, which classifies the degree of innovation in 'Low', 'Medium' and 'High', so that it is possible to use the analysis of independence (Chi-Square) to check if there

is an association between the degree of innovation and the Geographic Location. For the values obtained by the Chi-Square independence test, given the value of evidence obtained that was 0.818, higher than the significance level of 5%, it is concluded that there is enough statistical evidence to affirm, at a level of significance of 5%, that GAIL-Classification and Location variables are independent.

### 4.2. Identification of the factors that contribute to innovation in the Micro and Small Enterprises of the interior and the capital

For the capital MSE, the Kaiser-Meyer-Olkin (KMO) and Bartlett test values are found to be 0.800 and less than 0.001, respectively. With these results it is possible to conclude that the result of the Factorial Analysis is good, allowing also to reject the hypothesis of identity of the correlation matrix, that is, that the variables are correlated to the level of significance of 5%, reason why it is possible to proceed with the Factorial Analysis.

Table 1 presents the results of the Factorial Analysis for the MSE of the Capital. The factors were renamed as Factor (1) Innovation for the development of new market spaces; Factor (2) Innovation for the development of intelligent interactions with customers; Factor (3) Innovation for value creation; Factor (4) Innovation for the development of intelligent supply channels.

Through the analysis of the internal consistency of the variables that support the latent variable of the degree of innovation, the Cronbach's Alpha was calculated, which suggested the elimination of the Presence variable for the MSE of the interior. In this sense, the variable was removed for the production of the Exploratory Factorial Analysis, since it is not translated as significant for the degree of innovation in the interior. In the Factorial Analysis for indoor MSE, the values obtained from the KMO and the Bartlett test were 0.794 and inferior to 0.001, respectively, in which it was concluded that the result of the Factorial Analysis remains average (KMO between 0.7 and 0.8) so that we can proceed with the Factorial Analysis.

Table 2 presents the results of the Factor Analysis for indoor MSE. The factors were renamed as Factor (1) Innovation for the development of new forms of Management; Factor (2) Innovation for the identification of niche markets; Factor (3) Innovation for value creation; Factor (4) Innovation for intelligent brand positioning.

Considering that the present research also aims identifying the relationship between the innovation factors of the MSE in the interior and of the capital with the Global Average Innovation Index (GAIL), to complement the analysis, an analysis of Spearman's correlation ( $\rho$ ) between the newly created factors for the interior and capital MSE and the GAIL, in view of the violation of the normality assumption of the variables.

Table 3 presents the results of the Spearman correlation between the innovation factors of capital MSE and GAIL, in which it is observed that the factors Innovation for the development of new market spaces and Innovation for the development of intelligent interactions with the customers have the highest correlations, 0.635 and 0.506, respectively, with GAIL. For the MSE located in the capital, this relationship is strong and positive ( $\rho > 0.5$ ) for the first two factors and weak and positive for the other factors ( $\rho < 0.5$ ).

Table 4 presents the results of the Spearman correlation between the innovation factors of the interior MSE and the GAIL. For the MSE located in the interior, the factors that have the highest correlations with the GAIL are Innovation for the development of new forms of Management and Innovation to identify market niches, with correlations in the values of 0.574 and 0.516, respectively, indicating a relation strong and positive ( $\rho > 0.5$ ) with GAIL, while the other factors, Innovation for value creation and Innovation for intelligent brand positioning, although presenting positive correlations with GAIL, are significantly weak ( $\rho < 0.5$ ).

**Table 1.**  
Summary of the Factorial  
Exploratory Analysis for the  
MSE in the Capital

Factors	% Variance explained	Eigenvalues	
	25.592	3.327	
	<b>Variables</b>		
Factor 1 – New Market Spaces	Supply (0.663a; 0.441b)	Customers (0.606a; 0.494b)	Organization (0.571a; 0.477b) Innovative Ambience (0.545a; 0.423b)
	Processes (0.548a; 0.391b)	Presence (0.548a; 0.404b)	
	Brand (0.407a; 0.323b)		
	<b>% Variance explained</b>	<b>Eigenvalues</b>	
Factor 2 – Smart Interactions	10.352	1.346	
	<b>Variables</b>		
	Relationship (0.789a; 0.699b)	Network (0.770a; 0.690b)	
	<b>% Variance explained</b>	<b>Eigenvalues</b>	
Factor 3 – Value Creation	8.452	1.099	
	<b>Variables</b>		
	Solutions (0.797a; 0.646b)	Value Aggregation (0.740a; 0.585b)	
	<b>% Variance explained</b>	<b>Eigenvalues</b>	
Factor 4 – Smart Supply Chains	8.040	1.045	
	<b>Variables</b>		
	Platform (0.803a; 0.693b)	Supply Chain (0.558a; 0.552b)	

\*\*a: Factor Load; b: Communalities after extraction.

**Table 2.**  
Summary of the Factorial  
Exploratory Analysis for the  
MSE in the Interior

Factors	% Variance explained	Eigenvalues	
	31.605	3.793	
	<b>Variables</b>		
Factor 1 – Innovation (Management)	Organization (0.739a; 0.635b)	Supply Chain (0.687a; 0.616b)	Supply (0.417a; 0.325b)
	Processes (0.683a; 0.554b)	Innovative Ambience (0.545a; 0.423b)	
	<b>% Variance explained</b>	<b>Eigenvalues</b>	
Factor 2 – Innovation (Niches)	11.571	1.389	
	<b>Variables</b>		
	Relationship (0.764a; 0.647b)	Network (0.740a; 0.706b)	Customers (0.422a; 0.421b)
	<b>% Variance explained</b>	<b>Eigenvalues</b>	
Factor 3 – Value Creation	9.382	1.126	
	<b>Variables</b>		
	Solutions (0.794a; 0.692b)	Value Aggregation (0.779a; 0.653b)	
	<b>% Variance explained</b>	<b>Eigenvalues</b>	
Factor 4 – Innovation (Positioning/Brand)	8.798	1.056	
	<b>Variables</b>		
	Platform (0.818a; 0.726b)	Brand (0.595a; 0.741b)	

\*\*a: Factor Load; b: Communalities after extraction.

GAI	Innovation (New market spaces)	Innovation (Smart interactions)	Innovation (Value Creation)	Innovation (Smart supply chains)
	0.635**	0.506**	0.252**	0.427**

\*\* The correlation is significant at the level of 0.05 (2-tailed).

**Table 3.** Spearman correlation between the GAI and the innovation factors of the capital

GAI	Innovation (Management)	Innovation (Niches)	Innovation (Value Creation)	Innovation (Positioning/Brand)
	0.574**	0.516**	0.270**	0.465**

\*\* The correlation is significant at the level of 0.05 (2-tailed).

**Table 4.** Spearman correlation between the GAI and the innovation factors of the Interior

Based on all analysis presented previously, it is concluded that the Research Hypothesis have not been validated, that there is no association between the degree of innovation of the MSE and the Geographic Location, and Research Hypotheses is refuted.

## 5. Conclusions, Limitations and Future Research

The results obtained differ from the studies conducted by Skibinski and Sipa (2015) and Aarstad, Kvitastein and Jakobsen (2016), considering that in the case in question, there is no association between the geographic environment and the innovative performance of the Micro and Small Enterprises studied.

Walter, Veloso, Fernandes and Ribeiro (2017) analysed 550 MSE from the State of Piauí using exploratory and inferential techniques, found statistical evidence that indicated a certain degree of homogeneity in the innovation capacity of these companies. These authors attributed this finding to the Regional Innovation System, which, although incipient, believed to exert influence in providing a level of innovation between 'Low' and 'Occasional'. However, the results obtained in the present research indicate that there is statistical evidence to affirm that innovation capacity and geographical location are not associated. In this sense, it can be concluded that it is not the geographic location that determines the innovation of Micro and Small Companies in the state of Piauí, but other factors. The analysis of the correlations between the factors that determine innovation in capital and interior MSE with GAI leads to

indications that it is the Market, not the location which plays an important role in the innovative performance of the companies analysed; since results obtained to a greater or lesser degree point to a concern to innovate with market orientation. In addition, the low GAI value of 2.01 points (standard deviation of 0.92), characterising MSE between 'Little Innovative' and 'Occasional Innovative' may be related to weaknesses in MSE innovation capacity. Bayarçelik, Tasel and Apak (2014) were postulate that innovation can only occur if there is capacity for innovation in the company, better understood as the availability of resources, collaborative structure and processes for problem solving.

In this sense, the results obtained provide an important practical contribution to the management and monitoring of innovation in MSE, presenting an indicator that reflects how much innovation is present, serving as a parameter for possible actions of improvements to be adopted by both companies and by the public policies in the form of public policies that foster innovation in these enterprises. Within this framework, the encouragement of the establishment of partnerships between MSE and local universities and research institutes, with a view to obtaining the necessary resources for innovation, networks between MSE, as well as the implementation of a policy of financial subsidies by join the innovation networks, can be of great importance for the gradual increase of the innovation capacity of the companies studied.

As theoretical contributions, the results obtained provide evidence that the Market itself exerts a considerable influence on the way Micro and Small Enterprises innovate, contrary to what is commonly seen in the literature on the subject, that the Regional Innovation System is the the main catalyst for innovative performance. As in any study, there are some limitations. One of the limitations is that the available database has information restricted to the results of the application of the Innovation Radar.

As future research, it is suggested to explore whether the bureaucratic barriers encountered by Doruk and Söylemezoglu (2014) as crucial impediments to innovation in developed countries are present in developing countries' MSE. To consider the connection between innovation and economic growth pointed out by Pece, Simona and Salisteanu (2015) in the case of MSE. And to check what obstacles and incentives are present in MSE for the development and exploitation of open innovation networks in developing countries, since McCormack, Fallon and Cormican (2015) and Solleiro and Gaona (2012) present open innovation as a possible solution to the resource limitations of MSE in order to become more innovative.

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