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ABSTRACT

This article sought to investigate which dimensions of the management excellence model influence the innovative performance of micro- and small enterprises (MSEs) in the Federal District (DF) of Brazil. This study empirically tests the predictive relationship between innovation and business performance in a sample of 940 MSEs through Multiple Regression and, in addition, the Qualitative Comparative Analysis (QCA) method is used in 20 of the MSEs in the sample to verify the influence of these established dimensions on company performance, through Boolean algebra and formal logic. The results of the multiple regression revealed that only three of the seven dimensions of the Management Excellence Model (MEM) are associated with innovation performance, namely: i) customers, ii) information and knowledge, and iii) personnel. Furthermore, the logical equation resulting from the QCA indicates that the "people" dimension is a necessary and sufficient condition for innovation performance. The relevance of this study is the identification of the MEM dimensions that catalyze innovation and their influence on the performance of MSEs in the DF.

Keywords: Innovation. Entrepreneurship. Micro and Small Businesses.

RESUMO

Este artigo buscou analisar as dimensões do modelo de excelência gerencial que influenciam o desempenho inovador de micro e pequenas empresas (MPEs) no Distrito Federal (DF). A região territorial foi de Águas Claras e Vicente Pires no DF. Este estudo testa empiricamente a relação preditiva entre inovação e desempenho empresarial em uma amostra de 940 MPEs por meio de Regressão Múltipla e, além disso, a QCA - Qualitative Comparative Analysis QCA é usada em 20 das MPEs da amostra para verificar a influência dessas dimensões estabelecidas no desempenho das empresas, através da álgebra booleana e da lógica formal. Constatou-se com os resultados da regressão múltipla que apenas três das sete dimensões do Modelo de Excelência em Gestão (MEG) estão associadas com o desempenho da inovação, a saber: i) clientes; ii) informação e conhecimento; e; iii) pessoas. E, além disso, a equação lógica resultante da QCA indica a dimensão pessoas como condição suficiente e necessária para o desempenho da inovação. O estudo é relevante pois identifica as dimensões do MEG que catalisam a inovação e sua influência no desempenho das MPEs do DF.

Palavras-chave: Inovação. Empreendedorismo. Micro e Pequenas Empresas.

INTRODUCTION

Innovation has become a factor for survival and sustainable growth in an increasingly dynamic and competitive market. Finding new methods for executing processes, developing new products and services, maximizing results and improving organizational performance are goals that companies are setting daily**,** in order to remain in the market (Silva; Dacorso, 2014).

Thus, the Brazilian Micro and Small Business Support Service (Sebrae), through the Local Innovation Agents (ALI) program, won the 2016 Projects and Project Management Office (PMO) of the Year award from Mundo Project Management magazine, which aims to promote the continued practice of innovation initiatives in small companies, through proactive, free and personalized guidance, which began as a cooperation agreement signed between Sebrae and National Council for Scientific and Technological Development (CNPq)**,** (SEBRAE, 2016). The main tool used in this program is the Innovation Radar, which is based on the original work of Sawhney, Wolcott and Arroniz (2006), which elucidates which variables are drivers of innovation.

In addition, the National Quality Foundation (FNQ) seeks to generate value for organizations and other interest groups by supporting the ongoing search for excellence in management. To this

end, it disseminates the Management Excellence Model (MEM) as a fundamental instrument for the development of competitivity, sustainability, ethics and innovation in Brazilian organizations, that is, for business performance. It also promotes the National Quality Award® (PNQ), the most important recognition of the quality of management practices and the performance of organizations in the country (FNQ, 2016).

Thus, the MEM recognizes the management dimensions for excellence in the performance of organizations in Brazil (Oliveira et al., 2023), the strategic dimensions of which influence innovative performance (Dias; Hoffmann; Martínez-Fernández, 2019) and perform better in certain regions with regional agglomeration of the production sector, as elucidated by a study carried out by Hoffmann, Nascimento and Molina-Morales (2008), on the strategic dimensions contained in three territorially agglomerated industrial networks (clothing, footwear and furniture) which demonstrated, as an example of one of its main results, the existence of a high availability of knowledge, which is local, in the three networks analyzed. The Administrative Regions (ARs) Águas Claras and Vicente Pires, of the Federal District (DF), are known for the predominance of micro and small companies with high socioeconomic dynamism, as they are some of the newest ARs in the Federal District, which have grown rapidly with several small businesses generated, and are adjacent areas of the DF, the specific territory, of which, brings together these two administrative regions, This can be considered an interesting space for the application of the MEM in association with the innovation performance of small local businesses, with a view to promoting regional development.

The present study raises the following central question: Which dimensions of the management excellence model influence the innovative performance of micro and small enterprises (MSEs) in the Federal District (DF)? The territorial scope includes the Administrative Regions (ARs) of Águas Claras and Vicente Pires, adjacent areas that are among the newest in the Federal District, which justifies the choice of this territory that is still in the structuring phase. The territory encompasses society, its economy, its physical space and new communication technologies. Hence, the organization of cities, which is carried out by the individuals who inhabit them, with their ways of living and relating to the physical space (Santos, 2000; Mostagi; Mansano, 2019).

The objective of this research is to analyze the dimensions of the management excellence model that influence the innovative performance of micro and small enterprises (MSEs) in the Federal District (DF). This research is justified by the need to improve the management process of micro and small enterprises, and by a study of the work that Sebrae carries out, through the ALI Program; to verify its effectiveness in the practice of innovation and the identification of business opportunities.

Of these nine hundred and forty MSEs in the Federal District, various of them were investigated through multiple regression, and twenty of them were selected for verification using QCA - Qualitative Comparative Analysis.

Thus, in the structure of this article, following this initial introductory topic, the theoretical foundation will be presented, in which the aspects of innovation, the innovation radar and the management excellence model are discussed. Next, the methodology used in the work is elaborated on; analysis and discussion of the results, referring to the companies studied and, finally, the conclusion, acknowledgement of supporters and references.

THEORETICAL BASIS

This section presents the central topics that underpin this study: understanding what innovation is, the innovation radar in micro and small businesses and the management excellence model.

AFTER ALL, WHAT IS INNOVATION?

Innovation consists of a dynamic and interactive process between different actors, often appearing in the form of an innovation network, which speeds up and amplifies its development and exerts influence on changes in the economy, shaping its mechanisms and structures and providing economic development (Faccin; Balestrin; Bortolaso, 2016; Nelson; Nelson, 2002; Ribeiro et al., 2023).

In Brazil, the conceptual and methodological framework of the Industrial Research on Technological Innovation (PINTEC), carried out by the Brazilian Institute of Geography and Statistics (IBGE), with the support of the Financing Agency for Studies and Projects (FINEP) and the Ministry of Science, Technology and Innovation (MCTI), is based on the third edition of the Oslo Manual and, more specifically, on the model of the Community Innovation Survey - CIS, version 2008, proposed by the European

Commission (Eurostat), in which the 15 member countries of the European Union participated, at the Statistical Office of the European Communities (IBGE, 2010).

If undertaking innovation processes in isolation does not seem to be a promising option, then the context and relationships matter. Different regions have different levels of regional development, where less developed regions have a productive structure and dynamics that are more dependent on less innovative sectors (Cardozo; Martins, 2020; Pinheiro et al., 2022; Ribeiro et al., 2023).

According to Behling and Lenzi (2020), new ventures generate wealth, increase the dynamism of the economy and contribute to social well-being and regional development through innovation in products and services that satisfy human needs. These benefits denote the relevance of entrepreneurial activity as a driver of socioeconomic development. This recognition has led to entrepreneurship gaining importance in several spheres, where there is a diversity of research opportunities in entrepreneurial cognition, contributing to the field of studies.

The main activity of the innovation system is to stimulate the interactions of innovative companies with other actors in the system and in the approach to regional development; interactions from this perspective generate more benefits for MSEs in their interactions locally, integrating knowledge, in addition to establishing a support policy, which includes financing for innovation processes (Edquist, 2011; Li et al., 2018; Ribeiro et al., 2023).

Innovation is seen as an evolutionary system, because for innovation to occur it is necessary to change production methods, incorporate new functions and forms of work organization. The result of these changes are new products and/or improvements in existing processes and products. An innovation is only complete when there is a commercial transaction involving an invention and, thus, generating wealth. In general terms, innovation is conceived as anything done differently that has an effect on economic life (Schumpeter, 2005; Deponti, 2023).

Innovation drives organizational performance due to the possibility of improving products and services and developing new products, according to market needs, positively impacting commercial results, in addition to allowing the optimization of organizational processes, consequently minimizing costs. Furthermore, it facilitates the improvement of organizational management and its resources (Sousa; Reyes Junior; Lora, 2021). Behling and Lenzi (2019) add that entrepreneurial

skills can have an impact on the adoption of more consistent business strategies, contributing to actions in response to unstable social and economic scenarios. Entrepreneurship is one of the main promoters of regional development, as it increases the dynamism of the economy and contributes to social well-being; meeting customer demands. In this sense, promoting a culture of fostering entrepreneurship is essential, especially for developing nations.

According to the OECD (2006, p. 56), "a general aspect of an innovation is that it must have been implemented. A new or improved product is implemented when it is introduced to the market". This statement is corroborated by Figueiredo (2009), for whom innovation is not restricted to creativity, as it refers to the implementation of new products, services, processes or organizational arrangements. This means that creative ideas need to be put into practice and launched on the market, because, after all, innovation "is uniting different types of knowledge and transforming them into new products and services that are useful for the market or the company" (Figueiredo, 2009, p. 31).

Therefore, the concept of innovation adopted in this research is that of Law No. 13,243/2016, which provides incentives for scientific development, research, scientific and technological training and innovation, and which defines innovation as: the introduction of novelty or improvement in an environment that is productive and social that culminates in new products, processes or services or that involves the addition of new functions or features to an existing service, product or process that may result in improvements and effective gains in quality or performance (Brasil, 2016).

THE INNOVATION RADAR IN MICRO AND SMALL ENTERPRISES

The importance of MSEs for the global, national and regional development economies is relevant and it is pertinent to consider and understand their innovation process from the perspective of creating new value. This corroborates the structure, learning, organizational commitment and behavioral advantages attributed to small companies due to their ability to transform limited resources into new value (De Carvalho et al., 2020; D' Anjour, et al., 2023).

The frontiers of knowledge are always "advanced", and new technologies are characterized by a greater density of scientific knowledge and qualified personnel. As a result, in the coming decades, there will be an increase in the complexity of the Brazilian Science, Technology and

Innovation (ST&I) market" (Pronapa, 2011, p. 14). Thus, innovation is related to the commercial introduction of a new product**,** or the combination of something already existing, through a new or updated production process, marketed or used, created from an invention, which in turn belongs to the domain of Science and Technology (Mccraw, 2012; Zhang; Li; Li, 2021).

Companies, regardless of size and/or sector, seek to innovate to gain a competitive advantage and survive in an increasingly globalized and constantly changing market. Innovation is, therefore, a competitive differential that allows companies to develop innovative products, services and processes with added value, in addition to positioning themselves in the sector in which they operate (Carvalho; Reis; Cavalcante, 2011; Burgelman; Christensen; Wheelwright, 2012; Lara; Guimarães, 2014).

Large companies, because they have a superior management structure, have access to greater business opportunities and an ease of innovation. Micro and small companies, on the other hand, because they have fewer resources and more restricted capabilities, have difficulty accessing technological resources, restricting their capacity for innovation (Vasconcelos; Oliveira, 2018). However, studies indicate that innovations in micro and small companies do not occur through significant investments in research and development, but rather through daily practices with customers**,** or improvement of processes, which is why these companies develop through experimentation, learning and adaptation of technologies (Silva; Dacorso, 2014).

One of the ways to assess process innovation is the Innovation Radar, which has been used in several academic studies in Brazil, as demonstrated by the research of Bichueti et al. (2013); Capeleiro and Araújo (2013); Paredes, Santana and Fell (2014); Silva and Araújo (2014); Carvalho et al. (2015); Cunha, Carvalho and Bartone (2015), and which differs from the well-known Innovation Rate adopted by PINTEC. While the Innovation Index corresponds to the percentage of companies that implemented product or process innovation in relation to the total number of companies that responded, the Innovation Radar has a more limited focus and assesses innovation internally within the organization, being a measure of the maturity of the innovation process in small and medium-sized businesses (SMBs), based on their processes, results and the importance given to knowledge

as a tool aimed at competitiveness (Sebrae, 2016). In this context, the lack of resources has been associated with the failure of innovation in small and medium-sized companies (Hewitt-Dundas, 2006). According to Sawhney, Wolcott and Arroniz (2011 apud Carvalho et al., 2016), each of the twelve dimensions indicates different ways in which companies can innovate, based on the main characteristics involved in each dimension demonstrated in the Innovation Radar. According to research by Carvalho et al. (2016, p. 7), the Innovation Radar used by Sebrae and that

> was developed in 2008 by Bachmann & Associates (BACHMANN, 2009) and is based on the radar developed by Sawhney, Wolcott and Arroniz in 2006 (2011, p. 30). The inclusion of the Innovative Environment dimension is the main difference in the radar developed by Bachmann. The dimension estimates whether the company's environment is conducive to innovation through evidence such as the execution of technology transfer agreements and the use of resources from development agencies.

Thus, innovation analysis can be measured through 13 dimensions contained in the Innovation Radar: Offer, Platform, Brand, Customers, Solutions, Relationship, Added Value, Processes, Organization, Supply Chain, Presence, Network and Innovative Environment (Sawhney; Wolcott; Arroniz, 2006; Bachman; Desfani, 2008).

MANAGEMENT EXCELLENCE MODEL® (MEM)

The Management Excellence Model – MEM emerged in 1991, created by the National Quality Foundation – FNQ in conjunction with the foundation´s mission of disseminating the fundamentals of excellence in management to increase the competitiveness of Brazilian companies (Silva et al., 2014). The MEM served as the basis for the development of the National Quality Award – PNQ, a competitiveness award for MSEs in Brazil, and for the current 'Best in Management' award, the highest recognition for management excellence among Brazilian organizations (Silva et al., 2014; Fnq, 2016; Oliveira et al., 2023).

The MEM is a management model focused on customers, aiming to meet their needs, identify and use this understanding to create the capacity to retain them, in addition to being concerned with the motivation and training of employees, so that work can be carried out with excellence, ensuring adequate management of processes, based on this set of excellence work standards

(Marshall Júnior et al., 2008; Filgueiras; Damorim, 2019).

Used to measure business performance in SMEs, the Management Excellence Model® (MEM), from the National Quality Foundation (FNQ), is based on eight Fundamentals of Excellence, broken down into themes that, in turn, are opened in processes that indicate the most appropriate tool. The FNPQ uses the MEM to fulfill its mission, which is to encourage and support Brazilian organizations in their development and evolution of their management so that they become sustainable, cooperative and generate value for society and other stakeholders (FNQ, 2016).

The main characteristic of MEM is integration, mainly due to its systemic nature. Thus, MEM is considered a reference model in organizational management, the main characteristic of which, is to be an integrative model for improving the management of Brazilian organizations (FNQ, 2016).

MEM is a methodology composed of tools and practices that help companies reach the level of excellence in management (Sebrae, 2016). In addition, there is the MPE Brasil Award - Micro and Small Business Competitiveness Award, which aims to promote MEM, which utilizes the analysis tool of the management self-assessment questionnaire for MSEs (FNQ, 2016).

Sebrae, within the scope of the Local Innovation Agents Program (ALI), has as a premise of applying diagnoses that aim to assess the degree of maturity in the management of MSEs, through a consolidated instrument that is the *MPE Brasil questionnaire* and which also subsidizes the MSE Award (Sebrae, 2016). The dimensions adopted by Sebrae and FNQ for management excellence are present in the theoretical and empirical evidence of several national and international studies (Rothwell, 1994; Oecd, 2005; Andreassi, 2007; Dias; Hoffmann; Martínez-Fernández, 2019).

Any organization that adopts the MEM can plan its management practices based on the model's requirements; evaluating and improving them systematically, and continuously disseminating them among all processes, products and stakeholders. As it is a systemic model, it considers the structuring and alignment of the organization's management components from the perspective of a system. Thus, it allows the various elements of an organization to be implemented and evaluated together, in an interdependent and complementary manner, aligning management systems and increasing the total number of results. The model can be used in assessments, diagnoses and guidelines for any type of organization, of different sizes, whether public or private, for-profit or not-for-profit (Sartori; Sluk, 2011).

METHODOLOGICAL ASPECTS

This study adopts a descriptive type of research regarding its purpose. Furthermore, regarding the means, bibliographic and field research is carried out, with primary data collection (VERGARA, 2016). In order to fulfill the general objective of analyzing the dimensions of the management excellence model that influence the innovative performance of micro and small businesses, a sample of 940 (nine hundred and forty) MSEs was selected.

The selected sample set is from the perspective of regional development, since the territorial division was deliberately made into the Administrative Regions (ARs) of Águas Claras and Vicente Pires, which are contiguous locations within the Federal District (DF). The justification for this selection is the fact that they are two of the newest administrative regions in the DF, with a growing number of small businesses and a high degree of socioeconomic dynamism.

Innovation measures were collected through the application, within the scope of the Sebrae ALI Program, of a questionnaire that measures the catalysts of innovation in companies (Innovation Radar Questionnaire), which is structured in 42 (forty-two) questions that make up the 13 (thirteen) dimensions. Each question is scored on a scale of 1 (low), 3 (medium) or 5 (high).

Individual service level scores were calculated, on a case-by-case basis, for each of the dimensions that make up the Innovation Radar. These individual scores were arranged in descending order. For the Performance measures, primary data from the entire sample of MSEs using the Management Excellence Model (MEM) questionnaire from the National Quality Foundation (FNQ), in which each question is evaluated from 0 to 100 and the measurement of variables is given different weights, preserving the original weight structure of the instrument.

For the analyses, different procedures are adopted in two stages. In the first stage, the explanation of each dimension of the Innovation Radar on the performance in the sample data is tested through Multiple Regression in the 940 (nine hundred and forty) cases. Multiple Regression describes the relationship between variables, allowing us to analyze how the result is predicted from several predictor variables (Field, 2009), indicating the existence of a cause and effect relationship between the variables (Stevenson, 1981).

Attention was paid to collecting sufficient data to obtain a reliable regression model, with at least 10 (ten) data cases for each predictor in the model, with 15 (fifteen) cases recommended per predictor variable (FIELD, 2009). In this sense, to test the effects of the 7 (seven) predictors studied in this research, the sample was composed of 940 (nine hundred and forty) MSEs from the Federal District.

To measure the degree of innovation and business performance, two questionnaires were applied to 940 (nine hundred and forty) MSEs from the Federal District and the statistical program SPSS (Statistical Package for the Social Sciences) was used to operationalize the multiple regression calculations.

The instruments used by Sebrae/CNPq, within the scope of the ALI Program, were two questionnaires: i) for innovation catalysts, the Innovation Radar questionnaire was used, which is structured in 42 (forty-two) questions that make up the 13 (thirteen) dimensions, each question is evaluated as 1 (low), 3 (medium) or 5 (high); and ii) the business performance questionnaire, the Management Excellence Model (MEM), from the National Quality Foundation (FNQ), in which each question is evaluated between 0 and 100 and the measurement variables have different weights.

To verify the influence of business management dimensions on the innovation performance of small businesses, Qualitative Comparative Analysis (QCA) was used. QCA is a qualitative research technique developed to solve problems caused by the need to make causal inferences based on a small sample of cases. The method is used in social sciences based on the binary logic of Boolean Algebra and seeks to maximize the number of comparisons that can be made through the cases investigated (Ragin, 1987). Several studies that describe and teach the use of QCA have been published in several languages in recent years, having gained relevance in recent decades for being used as a data analysis tool in various fields of science in the United States and Europe. In Latin America, however, this methodology has been little used (Ariza; Gandini, 2012; Wagemann, 2012).

Thus, the 20 (twenty) companies, among the 940 (nine hundred and forty) studied, the 10 (ten) with the best business performance and the 10 (ten) with the worst results, were selected by the TOSMANA program (Tool for Small N Analysis), a free comparative analysis program, available at: www.tosmana.net, for Qualitative Comparative Analysis of Dichotomous Data (Crisp-Set Qualitative Comparative Analysis – csQCA). This analysis method is used in binary data sets, with the help of Boolean algebra, since the use of QCA is generally defined in an intermediate N, in which most applications are in the wide range of 10

(ten) to 50 (fifty) cases, although there are several studies with applications for a large number of cases (Rihoux; Ragin, 2009).

Multiple regression was chosen because this statistical method makes it possible to measure the association through regressions between several variables, which establishes whether the dependent variable of innovation performance increases or decreases in relation to how much the value of the independent variables varies (Field, 2009), that is, the dimensions of the Management Excellence Model (MEM). The QCA method cannot provide information on these aspects, however, with this analysis it is possible to model the logical relationships between the variables regarding sufficiency, necessity or specific conditions, such as when the variable (condition) is necessary, but is insufficient on its own to explain the result**,** or vice versa (it is sufficient for the result, but is not necessary). Therefore, QCA can provide information on the aspects of sufficiency and necessity, statements that are not easy to verify using statistical methods alone (Wagemann, 2012).

Therefore, QCA was chosen as a complementary method to better understand the phenomenon under investigation, in which the cases analyzed were the 20 micro and small companies that were at the extremes, that is, the 10 with the best innovative performance versus the 10 worst, for a comparative analysis in the regions of Águas Claras and Vicente Pires, contained in the territory of the Federal District of Brazil. From Ragin's (1987) perspective, the number of cases is not a limitation, but a deliberate choice of the researcher, since a central objective of comparative research is to achieve familiarity with the cases, since knowledge of the cases is an end in itself, that cannot be achieved when the cases are very numerous, but beyond any other end that is pursued (Ragin, 2007).

ANALYSIS OF RESULTS

To test the explanation of each dimension of the Performance Innovation Radar in the sample data, the Multiple Regression test was performed using the following equation for innovation performance:

i = b 0 + b 1 Leadership **i + b 2** Strategies and Plans **i + b 3** Customers **i + b 4** Society **i + b 5** Information and Knowledge **i + b 6** People **i + b 7** Processes **i**

The analysis of the correlation matrix provides an approximate idea of the relationship between the predictors and the output variable and an initial perception of multicollinearity. Analyzing the R (Pearson correlation coefficient) for the predictors only, ignoring innovation performance, the two largest correlations are, respectively, between Leadership and Strategies and Plans with R = 0.725 ($p < 0.001$) and between People and Information and Knowledge with R = 0.582 ($p < 0.001$). Despite the importance of correlations, the coefficient is low and therefore indicates that the predictors are measuring different issues (collinearity does not exist). According to Field (2009), if there is no multicollinearity in the data, there should not be substantial correlation values (R > 0.90) between the predictors.

Table 1 presents the R value of the multiple correlation coefficient between the predictors and the output, i.e., 0.620. The R2 value of 0.384, a measure of how much variability in the dependent variable can be accounted for in the predictors, means that the predictors (independent variables) are responsible for 38.4% of the variation in innovation performance (dependent variable).

The adjusted R2 gives an idea of how well our model generalizes, i.e., the difference with the final model is small, 0.384 – 0.379 = 0.005 or about 0.5%. This means that if the model were derived from the population rather than a sample, it would explain approximately 0.5% less of the variance in the output.

The change in variance that can be explained, gives an F-ratio of 82.99, which is significant ($p < 0.001$). The Durbin-Watson statistic is 1.57, which indicates that the assumption of independence of error is satisfied, since the value is between 1 and 3 (Field, 2009).

Table 1 | Summary of the regression model[a]

Model	R.	R squared	R squared ajustaded	Standard error estimate	alterar estatísticas					Durbin-Watson
					R squared change	F change	df1	df2	Sig. F change	
1	0,620[b]	.384	.379	,433469	.384	82.994	7	932	,000	1.572

a. Dependent variable: Innovation_performance
b. Predictors: (Constants), Processes, Society, Customers, Strategies and Plans, People, Information and Knowledge, Leadership

Source: Prepared by the authors (2022)

In addition, as can be seen in Table 2, the result of the ANOVA analysis of variance, which tests whether the model is better at predicting the output, was significant ($p < 0.001$). Therefore, the model significantly adheres to the data.

Table 2 | ANOVA[a]

Model		sum of squares	df	Mean of squares	F	Sig
1	Regression	109.160	7	15.594	82.994	,000[b]
	Residual	175.118	932	.188		
	Total	284.278	940			

a. Dependent variable: Innovation_performance
b. Predictors: (Constants), Processes, Society, Customers, Strategies and Plans, People, Information and Knowledge, Leadership

Source: Prepared by the authors (2022)

Among the seven dimensions admitted as catalysts of innovation, which are positioned as predictors in the Regression model for the dependent variable of Performance (Table 3), only three contribute significantly to the model: **i) customers; ii) information and knowledge; and iii) personnel.** Thus, it is understood that the empirical evidence partially supports the dimensions of the original model in micro and small companies in the Administrative Regions (ARs) Águas Claras and Vicente Pires, in the Federal District (DF), revealing the three dimensions of the Management Excellence Model (MEM) that impact the performance of innovation in companies in these spaces.

Table 3 | Multiple Regression of the dimensions of predictive management and its effects on Innovation Performance

Model		Non-Standardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B.	Standard Error	Beta			Tolerance	VIF
1	(Constant)	1.625	0,046		35.676	,000		
	Leadership	0,015	0,012	,055	1.272	,204	,358	2,797
	Strategies and Plans	0,016	0,010	,065	1.627	,104	,419	2,387
	Customers	0,065	0,010	,221	6.476	,000	,565	1,769
	Society	0,005	0,009	,017	,564	,573	,723	1,383
	Information and knowledge	0,076	0,011	,284	7.121	,000	,415	2,409
	Personnel	0,024	0,010	,087	2.388	,017	,500	1,999
	Processes	0,007	0,010	,022	,641	,521	,551	1,815

Source: Prepared by the authors (2022)

The emphasis on organizational and human resources is due to the peculiarities of micro and small businesses in the context of innovation promoting regional development. In the specific case of the Águas Claras and Vicente Pires regions in the Federal District (DF), human knowledge must be associated with other resources to achieve superior performance, which reinforces what Dierickx and Coll (1989) indicated about the combination of resources.

To complement the Multiple Regression analysis, it was decided to perform a Qualitative Comparative Analysis (QCA). Thus, following the theoretical recommendation of selecting typically successful and unsuccessful cases from the original sample (940 MSEs), two groups were selected consisting of the 10 (ten) best and 10 (ten) worst companies from the Águas Claras and Vicente Pires regions in the DF, in terms of Performance scores obtained in their measures in the Management Excellence Model (MEM). These 20 (twenty) companies formed a sub-sample for analysis via QCA. The scores of each company and their distribution in the MEM dimensions are presented in Table 4.

Table 4 | MSEs that obtained the best and worst performances in the Innovation Radar

Companies	Leadership	Strategies and Plans	Customers	Society	Information and Knowledge	Personnel	Legal demands	Innovation Radar
E150	8.42	7.01	10.00	9.17	8.77	9.00	10.00	4.13
E100	8.83	7.01	8.10	4.33	8.77	5.80	9.38	4.08
E105	8.83	7.01	8.10	4.33	8.77	5.80	9.38	4.08
E112	8.83	7.01	8.10	4.33	8.77	5.80	9.38	4.08
E115	8.83	7.01	8.10	4.33	8.77	5.80	9.38	4.08
E120	8.83	7.01	8.10	4.33	8.77	5.80	9.38	4.08
E119	8.83	5.27	10.00	6.67	9.38	10.00	8.25	4.00
E606	7.25	8.13	10.00	6.67	8.15	7.60	7.00	3.90
E135	6.00	6.39	6.70	6.83	8.77	7.20	4.75	3.89
E139	6.00	6.39	6.70	6.83	8.77	7.20	4.75	3.89
E74	2.25	0.76	1.20	3.33	2.63	2.40	2.63	1.28
E88	3.75	3.02	3.30	3.50	2.25	2.40	5.25	1.28
E467	2.25	0.76	2.40	2.00	0.75	3.20	2.63	1.28
E376	0.50	0.00	3.00	2.50	0.75	1.20	2.25	1.26
E260	1.50	0.00	2.40	4.33	1,50	1.20	2.25	1.25
E639	6.77	4.14	3.90	4.50	5.27	3.90	5.25	1.23
E96	1.75	0.76	1.80	2.00	1.50	1.20	3.38	1.21
E76	0.50	0.00	2.60	3.33	1.50	2.40	5.25	1.18
E58	0.00	0.00	0.60	1.00	0.75	1.20	2.25	1.15
E71	3.51	2.27	1.20	3.33	3.77	3.90	2.63	1.15

Source: Prepared by the authors (2022)

The analysis was performed using the Qualitative Comparative Analysis (QCA) method. As a dichotomization procedure, with the responses to the Innovation Radar questionnaire (between 0 and 5), through a slice considering the averages, the scores of the dimensions answered in the questionnaire that were equal to or greater than 3 were represented by the number 1, or that is, they are characterized as the presence or high degree of the dimension studied. A certain dimension with a score lower than 3 was represented by the number 0, that is, absence or low degree of scores in the dimension/variable studied. This criterion was adopted following the procedures of the "Good Practices" of Rioux and De Meur (2009, p. 42), on how to dichotomize the conditions in a meaningful way, in which one recommendation is the use of "mechanical cutoff points, such as the mean or median, (...) considering the distribution of cases".

According to Table 1, from the perspective of the dimensions that drive innovation, within the scope of the 7 (seven) dimensions or variables of the Management Excellence Model (MEM), this analysis allowed us to glimpse situations that constitute sufficient and/or necessary conditions for success in the performance of innovation (based on the Innovation Radar), considering the presence and absence of these pro-innovation dimensions (based on the Innovation Radar) and explaining the minimized logical equation.

For Rioux and De Meur (2009), there are superfluous conditions that can be eliminated from the complete initial expression, generating a shorter expression, which is called the "primary implicant", that is, the minimized logical equation. Then, with the help of the Tosmana program, the option of excluding logical remainders was selected to, with parsimony sparingly, arrive at a reduced expression (see Table 3). With the logical remainders resource (reminders), it was possible to eliminate combinations not observed in empirical cases or that could be described by a much smaller logical expression (Boolean minimization). Therefore, these superfluous combinations were excluded with the minimization process. The result of Boolean algebra, as shown in Table 3, yielded the following logical equation:

Personnel {1}

This expression can be read as follows: the presence of the 'Personnel' dimension leads to the presence of successful innovative performance, that is, a result (output) dichotomized into 1 (one), which highlights the performance of innovation in micro and small companies contained in specific spaces in the regions of Águas Claras and Vicente Pires, in the Federal District (DF).

Frame 1 | Qualitative Comparative Analysis of Successful and Failed MSEs

Tosmana Report

Algorithm: Graph-based agent
Settings:

Minimizing: 1

including R

Truth Table:

v1: leadership v2: Strat_Plans

v3: Customers v4: Society

v5: Information. Knowledge. v6: Personnel

v7: Processes

O: Innovation_Performance id: Companies

v1	v2	v3	v4	v5	v6	v7	O	id
0	0	0	0	0	0	0	0	E74, E467, E376, E96, E58
0	0	0	0	0	0	1	0	E76
0	0	0	0	1	0	0	0	E71
0	0	0	1	0	0	0	0	E260, E77, E93
0	0	0	1	1	0	1	0	E69
0	1	0	0	0	0	0	0	E97
0	1	0	0	0	0	1	0	E88
0	1	0	1	0	0	1	0	E53
1	1	1	1	1	0	1	0	E639
1	1	1	1	1	1	1	1	E150, E100, E105, E112, E115, E120, E119, E606, E135, E139, E140, E144, E118, E653, E110

Result(s):

Personnel {1}

(E150, E100, E105, E112, E115,E120,E119,E606,E135,E139,E140,E144,E118,E653,E110)

Source: Created with Tosmana software (Version 1.61) using data from this research.

The results showed that the presence of the "Personnel" dimension of the MEM is sufficient and necessary in itself to influence the innovation performance of small businesses in these territorial areas in the Federal District.

It is important to distinguish between the results of Regression and the results of QCA. Wagemann (2012) points out that, in a regression line, for example, the independent variables are not alternatives, since they all contribute a certain percentage to the explanation of the phenomenon. If they were alternatives, the regression logic would imply that only one of them would win, which is not the case. On the other hand, in QCA equifinality, the causal conditions behave as "components" with which a complex causal relationship can be modeled.

The constitutive definitions of the MEM dimensions responsible for generating innovative performance in micro and small businesses in the regions of Águas Claras and Vicente Pires, with a view to promoting regional development in the Federal District, are retrieved below:

- Customers: i) Are customers categorized and their needs and expectations identified?; ii) Are products and services disclosed to customers?; iii) Are customer complaints recorded and handled?; iv) Is customer satisfaction assessed?; v) Is information obtained from customers analyzed and used to retain them and attract new customers? The customer dimension, especially with regard to identifying customer needs, their needs for product launches, and also customer feedback on customer service for adapting products or services, is in line with the empirical results of the study by Rothwell (1994).
- Information and knowledge: i) Does the company demonstrate its commitment to the community through social initiatives or projects?; ii) Is the information necessary for planning, executing and analyzing activities and for decision-making defined and made available to employees?; iii) Is knowledge exchange promoted?; iv) Are improvements promoted in management practices?; v) Is comparative information obtained and used in the analysis of performance and improvement of products/services and processes? Such characteristics are highlighted in the work of Andreassi (2007) and in the Oslo Manual (OECD, 2006). In addition to this scope for the set of organizational resources, Gonçalves, Coelho and Souza (2011) add "detailed information and knowledge about the market in which it operates" to the distinctive indicator of competitive advantage.

- Personnel: i) Are the roles and responsibilities of people (managers and employees) defined?; ii) Is the selection of employees made according to defined standards and does it consider the requirements of the role?; iii) Are employees trained in their roles?; iv) Are hazards and risks related to health and safety at work identified and addressed; v) Are employee well-being and satisfaction promoted? Human resources are fundamental factors for innovation, as corroborated by the research of Dias, Hoffmann and Martínez-Fernández (2019). The personnel variable was given special emphasis in both the multiple regression and the comparative qualitative analysis, since human capital represents the set of knowledge, skills and attitudes that favor the performance of work to produce economic value, especially in micro and small companies in the administrative regions of Águas Claras and Vicente Pires. These are the attributes acquired by professionals through studies and experiences.

Based on this concept, companies and institutions can analyze the capacity of their employees, regardless of their position, and can train them in a career path of bottom-up development to generate better results. Companies that value human capital have a series of positive aspects in their organizational structure, as execution errors are fewer, as refinement of skills and processes is incessant, and, consequently, productivity, motivation and commitment are also greater.

In a complex and interconnected environment, organizations seek strategies to improve their performance (Furrer; Thomas; Gouvessevskaia, 2008) in several dimensions (Bentes et al., 2012; Gonçalves et al., 2013). In this article, performance in the innovation dimension was measured through the Innovation Radar, performance being indicated by 13 (thirteen) dimensions evaluated within the scope of the Local Innovation Agents Program (ALI).

In this sense, for the best innovative performance, the complementary nature of technological resources (Gawer; Cusumano, 2002; Rosenberg, 2006) and knowledge are used strategically so that resource networks provide revolutionary performance (HUGGINS, 2010).

The use of the Management Excellence Model (MEM) indicated the dimensions that drive the achievement of innovations in the Administrative Regions of Águas Claras and Vicente Pires, which will permit initiatives to promote development in those regions.

The results of the analyses showed, through a statistical analysis with multiple regression, that the dimensions: Customers, People and Information and Knowledge influence the performance of micro and small companies in the RAs of Águas Claras and Vicente Pires. The Qualitative Comparative Analysis (QCA) also highlighted the "Personnel" dimension with its sufficient and necessary influence on the performance of innovation in the 20 companies surveyed in the two cities.

CONCLUSION

This research is based on theoretical approaches to innovation systems and networks, focusing on the Innovation Radar, based on Sawhney, Wolcott and Arroniz (2006), and the Management Excellence Model (MEM), derived from the National Quality Foundation (FNQ), with the objective of analyzing the dimensions of the management excellence model that influence the innovative performance of micro and small companies in the Federal District.

The theoretical proposal contributed to the consideration of catalysts or dimensions that drive the achievement of innovations and a set of principles and values, within the scope of a MEM, for a differentiated performance in Brazilian organizations. As a result, a study was conducted indicating the empirical evidence of a survey with 940 (nine hundred and forty) MSEs from the regions of Águas Claras and Vicente Pires, in the Federal District (DF), in which 20 (twenty) stood out for the best and worst results, regarding the model of excellence in management, and were carefully selected for analysis, discussion and achievement of the research objectives.

From this, it was evidenced, through a statistical analysis with multiple regression, that three of the seven dimensions that catalyze innovation are actually those that have an influence on the performance of micro and small companies in the Federal District, in the specific spaces of Águas Claras and Vicente Pires, namely: Customers, Personnel and Information, and Knowledge. The "Personnel" dimension stands out, which, in addition to the Qualitative Comparative Analysis (QCA), was the only dimension that sufficiently and necessarily influenced the innovation performance of the 20 (twenty) companies selected at the extremes (the 10 best and the 10 with the worst results) of the sample deliberately selected in the territories of Águas Claras and Vicente Pires in the Federal District.

Thus, the literature points to several factors that drive innovation, but there are few studies that empirically investigate which of these innovation attributes really influence the business performance of micro and small companies, which represent approximately 90% (ninety percent) of companies in the world. In this sense, this is the greatest contribution of this study to the area of innovation and applied social sciences.

One limitation of this research is the lack of methods that could conduct in-depth interviews to better understand the phenomenon studied, since QCA only allows for the evaluation of the association between variables, as well as statistical methods of correlations between two or more variables, in which it is possible to establish whether the dependent variable increases or decreases in relation to how much the value of the independent variable varies, by itself**,** or by how much it varies. Therefore, the influencing or significant variables are known, but triangulation with other qualitative methods would allow for a broader understanding of the determinants.

For future work, new research is suggested that focuses on comparative analysis with different sectors. Furthermore, the use of other qualitative methods for a better understanding of the reasons why certain predictors in the scope of business management affect the performance of innovation in small businesses should be employed.

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