REGEPE ENTREPRENEURSHIP AND SMALL BUSINESS JOURNAL

PUBLISHER ANEGEPE Associação Nacional de Estudos em Empreendedorismo e Gestão de Pequenas Empresas

ISSN: 2965-1506 v.13, n.2, May / Aug., 2024 https://regepe.org.br/

Research Article

Organizational innovation: Validation of a multidimensional scale for micro and small businesses

Miler Franco D'anjour[a]*, Bruno Campelo Medeiros[a], and Miguel Eduardo Moreno Añez[b]

[a] *Instituto Federal do Rio Grande do Norte (IFRN), Natal, RN, Brazil*

[b] *Universidade Federal do Rio Grande do Norte (UFRN), Natal, RN, Brazil*

Editorial Details

Sistema double-blind review

Article History

Received : *Mar. 03, 2023*
Accepted : *Aug. 06, 2023*
Available online : *May 25, 2024*

Article ID: *2502*

JEL classification: *L26, M10, O36*

Editor-in-Chef[1] or Adjunct[2]:
[1] Dr. Edmundo Inácio Júnior
Univ. Estadual de Campinas, UNICAMP

Associate Editor:
Dr. Julio Araújo Carneiro Cunha
Universidade Nove de Julho, UNINOVE

Executive[1] or Assistant[2] Editor:
[1] M. Eng. Patrícia Trindade de Araújo
[2] Camille Guedes Melo

Translation / Proofreading:
American Journal Experts (AJE)

How to cite:
D'anjour, M. F., Medeiros, B. C., & Añez, M. E. M. Organizational innovation: Validation of a multidimensional scale for micro and small businesses. *REGEPE Entrepreneurship and Small Business Journal*. 13(2), e2502. https://doi.org/10.14211/regepe.esbj.e2502

Related item (isTranslationOf**):**
https://doi.org/10.14211/regepe.esbj.e2361

Article verify by: Crossref Similarity Check

***Corresponding author:**

Miler Franco D'anjour
milerdanjour@gmail.com

Abstract

Objective: Validate a scale for measuring the multiple possibilities for innovation in Micro and Small Enterprises (MPEs) operating in the Metropolitan Region of Natal/RN. **Methodology/ approach:** The research is exploratory, with a survey of 542 companies in Natal/RN. Data were analyzed using descriptive statistics, exploratory factor analysis technique and confirmatory factor analysis using the technique based on partial least squares. Main results: The Exploratory Factor Analysis (EFA) resulted in the formation of 5 innovation constructs. The Confirmatory Factor Analysis was modeled by applying the PLS-SEM, which evaluated the confirmatory measurement model, based on the results identified in the EFA. **Theoretical/ methodological contributions:** The inclusion of the construct called Innovation in Knowledge Channels was validated, contributing with a broad and multidimensional proposal, being able to capture the complexity of innovation, reducing conceptual ambiguity and proving to be theoretically viable for future research. **Relevance/originality:** The study is relevant, approaching innovation from the perspective of Micro and Small companies, considering a multidimensional measurement scale, as empirical research so far has shown little evidence of innovation from the perspective of creating value for organizations and customers. **Social/Management Contributions:** As managerial implications, unlike the one-dimensional perspective, supported by concepts of technological innovation developed with large Research and Development (ReD) structures in large companies, this research considered the innovative role of small companies, which are capable of generating multiple innovations.

Keywords: Organizational Innovation. Multidimensional Scale. Micro and Small Business.

Inovação organizacional: Validação de uma escala multidimensional para micro e pequenas empresas

Resumo

Objetivo: Validar uma escala de mensuração das múltiplas possibilidades de inovação em Micro e Pequenas Empresas (MPEs) que atuam na Região Metropolitana de Natal/RN. **Metodologia/ abordagem:** A pesquisa é do tipo exploratória, com um levantamento de dados junto a 542 empresas de Natal/RN. Os dados foram analisados por meio de estatísticas descritivas, da técnica de análise fatorial exploratória e análise fatorial confirmatória com a técnica baseada em mínimos quadrados parciais. **Principais resultados:** A Análise Fatorial Exploratória (AFE) resultou na formação de 5 construtos de inovação. A Análise Fatorial Confirmatória foi modelada por meio da aplicação da PLS-SEM, o qual avaliou o modelo de mensuração confirmatório, a partir dos resultados identificados na AFE. **Contribuições teóricas/metodológicas**: Foi validada a inclusão do construto denominado Inovação em Canais de Conhecimento, contribuindo com uma proposta ampla e multidimensional, sendo capaz de captar a complexidade da inovação, reduzindo a ambiguidade conceitual e se mostrando teoricamente viável para futuras pesquisas. **Relevância/originalidade:** O estudo mostra-se relevante ao abordar a inovação sob o ponto de vista das Micro e Pequenas empresas, considerando uma escala de mensuração multidimensional, pois as pesquisas empíricas até então pouco evidenciaram a inovação sob a perspectiva de criação de valor para organizações e clientes. **Contribuições sociais/para a gestão**: Enquanto implicações gerenciais, diferentemente da ótica unidimensional, apoiada em conceitos de inovação tecnológica desenvolvida com grandes estruturas de Pesquisa e Desenvolvimento (P&D) em grandes empresas, a presente pesquisa considerou o papel inovador das pequenas empresas, capazes de gerar múltiplos aperfeiçoamentos.

Palavras-chave: Inovação Organizacional. Escala Multidimensional. Micro e Pequenas Empresas.

INTRODUCTION

The literature on innovation indicates an increase in the number of studies carried out in this field (Gao et al., 2020; Medeiros, 2021; Carneiro et al., 2021). Nonetheless, few systematic efforts have been made to conceptualize and develop analysis models that aim to understand the dynamics of innovation at the organizational level (Zeng et al., 2017).

Thus, in the literature, there are gaps in the practical understanding of the innovation process, which indicate inconsistencies and controversies in the formulation of theory and measurement scales, leading to imprecise conclusions (Silva & Di Serio, 2017). Thus, some works limit analysis to the dimensions of innovation, such as products and/or processes (Zeng et al., 2017), with typologies that rarely consider management innovation (Silva & Di Serio, 2017).

The present study addresses the aforementioned gaps through a theoretical framework, providing a new conceptualization and an interdisciplinary measurement instrument for innovation and empirically validating them (Silva & Di Serio, 2017; De Carvalho et al., 2017). In this way, we propose a multidimensional innovation construct that is developed under a rigorous measurement approach (Sawhney et al., 2006; Chen & Sawhney, 2010; Silva & Di Serio, 2017). The proposed operationalization meets the twofold challenge of limiting the number of items used while maintaining the complexity and multidimensionality of the construct (Sawhney et al., 2006; Chen & Sawhney, 2010; De Carvalho et al., 2017; Santos et al., 2018).

The object of study of this research is micro and small enterprises (MSEs). Thus, this study tackles the challenge of studying innovation in MSEs that operate in traditional sectors of the economy, diverging from the literature, which has suggested that innovation originates in the research and development (ReD) activities and the technological and financial resources of large corporations (Fernández-Esquinas et al., 2017). However, current research refutes this presumption, which masks those truly responsible for innovation and competitiveness (Berends et al., 2014; Baumann & Kritikos, 2016; Fernández-Esquinas et al., 2017; Oliva et al., 2019; De Carvalho et al., 2020; Gao et al., 2020; Medeiros, 2021; Carneiro et al., 2021).

Considering the importance of MSEs for global and national economies and disregarding economic and managerial data, which tend to indicate a greater fragility of these organizations in terms of structure and financial resources, it is useful to understand their innovation process in terms of the creation of new value, which is not necessarily financial, both for customers and for these companies (Sawhney et al., 2006), especially in the context of increasing competition. For example, to consider a local scenario, even during the COVID-19 pandemic, the growth of companies based in Rio Grande do Norte was 17.3% higher in 2021 than in the previous year (Tribuna do Norte, 2022). This increase corroborates the structure, learning, organizational commitment and behavioural advantages attributed to small companies as a result of their innovation process (van de Vrande et al., 2009; Parida et al., 2012; McGuirk et al., 2015; Silva et al., 2016; Popa et al., 2017; Lima & Müller, 2017; Gao et al., 2020; Medeiros, 2021; Carneiro et al., 2021).

Based on the above, within the scope of MSEs, the literature highlights the pursuit of problem solving a path to innovation with a view to meeting the needs of the organization and its customers. However, this research direction lacks new empirical evidence (Sawhney et al., 2006; Chen & Sawhney, 2010; McGuirk et al., 2015; Oliva et al., 2019). Recent studies in Brazil consider innovation from a restricted perspective, focusing on specific cases (Ceolin et al., 2023), or an exclusive segment (Cabral da Silva & Correia, 2021). Therefore, there is a need to broaden research to include the validation of a scale, considering multiple aspects.

Accordingly, this study poses the following question: what is the level of adherence to a scale to measure the multiple possibilities of innovation in micro and small enterprises (MSEs) operating in the metropolitan region of Natal/RN? To answer this question, the present work conducts a quantitative study to explore the possibility of generating multiple innovations in MSEs (Sawhney et al., 2006; Bachmann & Destefani, 2008; Chen & Sawhney, 2010), especially in terms of adherence to traditional innovation practices, along with the benefits related to the management of these organizations. Thus, the general objective of the study is to validate a scale for measuring the multiple possibilities for innovation in micro and small enterprises (MSEs) operating in the metropolitan region of Natal/RN.

INNOVATION IN MICRO AND SMALL COMPANIES: A CONCEPTUAL UNDERSTANDING

Before discussing the conceptual bases of innovation in micro and small enterprises (MSEs), which underpin this study, it is necessary to build an understanding of the process of disseminating innovation concepts. In this way, this study is based on the inquiry carried out by Silva and Di Serio (2017), which indicates weaknesses in the conceptualization of organizational innovation criteria, resulting in a heterogeneous and dispersed conceptual basis (Forsman, 2011; Berends et al., 2014).

Silva and Di Serio (2017), present the main weaknesses of innovation theory as follows: i) a lack of conceptual convergence, leading to an inaccurate understanding within and between theoretical fields regarding what innovation truly is (Sawhney et al., 2006); ii) the existence of a high number of innovation typologies, which do not clearly present the unit of analysis, making comparisons between research results unfeasible (Gao et al., 2020; Medeiros, 2021; Carneiro et al., 2021); iii) the lack of a common understanding about the innovation process (Berends et al., 2014; Ferreira et al., 2015); and iv) the popularization of the fallacy that innovation is only technological, which is moreover dependent on R&D activities and is an exclusive privilege of large corporations (Berends et al., 2014; Silva et al., 2016; Silva & Di Serio, 2017), disregarding the innovative role of small companies (McGuirk et al., 2015; De Carvalho et al., 2020).

The lack of conceptual convergence on what innovation is demonstrates the multiple possibilities of innovation in the organizational field and the need to establish a conceptual framework for this research (Schumpeter, 1934; 1939; 1942; Sawhney et al., 2006; Chen & Sawhney, 2010; Silva & Di Serio, 2017). In this respect, the literature indicates that the innovation process within the scope of MSEs is related to the search for problem solving, with a view to simultaneously meeting needs and generating substantial new value for the organization and its customers (Sawhney et al., 2006; Chen & Sawhney, 2010; McGuirk et al., 2015). From this perspective, the present study uses the understanding proposed by Sawhney et al. (2006, p. 76), who define innovation at the organizational level as "the creation of substantial new value for customers and the company, creatively altering one or more dimensions of the organizational system".

This definition is in line with the results of studies examining innovation in MSEs, as it highlights the possibility of capturing the complexity of organizational innovation from a broad and multidimensional perspective (Gonçalves et al., 2017). Thus, it deconstructs the notion popularized in the literature that the major determinants of innovation are R&D activities and that technological and financial resources are held exclusively by large corporations. In contrast, current studies present this notion as fallacious, even masking those truly responsible for the innovation and competitiveness of organizations (Berends et al., 2014; Baumann & Kritikos, 2016; Fernández-Esquinas et al., 2017; Santos et al., 2018). Another important aspect of the concept is the vision of "creating new value", not necessarily financial, for both customers

and companies, attesting to behavioural advantages attributed to small companies' innovation process, such as a culture of innovation, climate, leadership, learning and organizational commitment (van de Vrande et al., 2009; Parida et al., 2012; McGuirk et al., 2015; Silva et al., 2016; Popa et al., 2017; Lima & Müller, 2017; Gao et al., 2020; Medeiros, 2021; Carneiro et al., 2021).

The concept also highlights the role of creativity, which refers to the skills, competencies and capabilities for generating ideas in the development and/or improvement in services, products and processes. In this sense, the entrepreneur is seen as the central figure in innovation management, which takes on more tacit characteristics in small companies, with the innovation process depending on the objectives and motivations of the entrepreneur (Sawhney et al., 2006; Fernández-Esquinas et al., 2017).

The concept of innovation proposed by Sawhney et al. (2006) is also aligned with the distinct characteristics of MSEs: it reduces the conceptual ambiguity for the operationalization of research in this field, clarifies what an innovation is, and presents the unit of analysis and the dimensions of innovation that should be considered in research (Gao et al., 2020; Medeiros, 2021; Carneiro et al., 2021). A point of convergence in the historical and epistemological trajectory of this concept of innovation is that Sawhney et al. (2006) use the concept of innovation proposed by Schumpeter (1934; 1942), showing the central role of the entrepreneur in the innovation process and the possibility of generating innovation beyond the technological context, that is, in the administrative context, namely, the organization's relational view and customer orientation (Chen & Sawhney, 2010; Damanpour & Aravind, 2012; Simões et al., 2015; Gonçalves et al., 2017).

Structure of an innovation assessment model in micro and small companies

Considering the need to build a model capable of representing the innovation process in the technical–administrative dimension, i.e., the organization's relational vision and customer orientation, Chen and Sawhney (2010) classify innovation by its "focus" (i.e., what will innovate and how it will innovate) and "locus"/place of development and application of innovation (internal and external). Thus, their classification ranges from a technical–administrative dimension, with internal application to the organization, to a more external dimension, based on open innovation, seeking new knowledge and generating value for both the organization and its customers (Chen & Sawhney, 2010).

Based on these relationships between "focus" and "locus", Chen and Sawhney (2010) propose a model that covers dimensions that generate organizational innovations. The original model developed by Sawhney et al. (2006) and Chen and Sawhney (2010) was called innovation radar. By revealing the theoretical and empirical characteristics of the 4 (four) innovation anchoring dimensions, the formation of 12 (twelve) new dimensions capable of systematically capturing the effect of innovation was identified, based on the technical–administrative context in terms of relational vision and customer orientation.

Notably, the application of the innovation radar model in studies on the development of innovation in MSEs in the national context has also indicated a fifth dimension (Néto & Teixeira, 2014; Paredes et al., 2015; De Carvalho et al., 2015; Simões et al., 2015; Gonçalves et al., 2017; De Carvalho et al., 2020), originally called "innovative ambience" (Bachmann & Destefani, 2008), which, in this study, based on the international literature, is renamed "innovation in knowledge channels" (van de Vrande et al., 2009; Parida et al., 2012; Silva et al., 2016). The redefinition of this new approach to innovation is theoretically supported since the literature considers "innovation in knowledge channels" as a form of open innovation (van de Vrande et al., 2009; Parida et al., 2012; Silva et al., 2016).

Related studies

Recent research has focused on studying the use of innovation scales without delving into their validation. Bezerra, Martins and Nishi (2021) sought to analyse the degree of innovation of MSEs in the tourism sector based on the innovation radar model. They used four case studies, identifying only how far the participating companies are in relation to the radar dimensions. Their main finding was that these companies are slightly innovative or occasionally innovative due to the lack of knowledge of their managers and the lack of technical support.

Cabral da Silva and Correia (2021) also replicated this model, considering 8 companies in the red ceramic industry segment. The results showed that these companies also show little innovative behaviour, which is similarly driven by the lack of employees with technical management knowledge to develop innovative practices.

Barbosa, Sousa, Nacife and Novak (2022) provided a different perspective, focusing on validating a scale of technological innovation in the Courts of Justice in Brazil with other innovation approaches. A factor analysis revealed other aspects relevant to promoting organizational learning and innovative practices, such as people's innovative behaviour and organizational resources.

Another important study was a theoretical review of the use of organizational innovation scales in empirical research between 2002 and 2020 (Costa & Reis Neto, 2022). The results suggest the use of other innovation factors that need to be observed, such as innovations in organizational processes and innovations in marketing strategies, in line with the model proposed in the present study.

METHODOLOGY

This objectives of this research are exploratory. Regarding the procedures, this study conducts a quantitative survey, which allows researchers to make inferences about their sample and determine whether there is a relationship between the variables studied (Sampieri et al., 2013). In this case, the research examines the context of micro and small companies, with the objective of analysing the phenomenon of innovation in these types of organizations (Sampieri et al., 2013).

The study population was defined as MSEs participating in the SEBRAE/CNPq Local Innovation Agents Program (ALI). The ALI is an extension program developed through technical cooperation agreement No. 55/2014 signed between CNPq and SEBRAE that seeks to encourage innovation among participating MSEs (De Carvalho et al., 2020). Thus, the population of this study consisted of 2931 MSEs that operate in traditional sectors of the economy and participated in the ALI program from 2014 to 2018 with physical headquarters in the metropolitan region of Natal/RN.

As it was not possible to cover the entire population universe, a simple random sample was used, which was defined by drawing lots among the 2931 MSEs that constituted the population universe delimited for the study (Sampieri et al., 2013). Thus, the study sample consisted of 542 MPEs, determined with the sampling technique for finite populations and the model proposed by Fonseca and Martins (2011). The following equation was therefore used: $n = (Z2 \cdot \sigma \cdot N)/(d^2 (N -1) + Z^2 \sigma^2)$. A sample of 542 (five hundred forty-two) participants was determined to guarantee a reliability index of 95% and a sampling error of 4%.

The data were collected through a questionnaire based on the innovation radar model proposed by Sawhney et al. (2006) and Chen and Sawhney (2010). Importantly, these data were collected before the pandemic, so their effects did not influence the results of the present study. Thus, the final instrument used to measure the multiple possibilities of innovations existing in MSEs was composed of 34 variables, scored on a 7-point Likert scale ranging

from 1 to 7, where 1 means "does not apply to my company" and 7 means "applies systematically to my company" (Hair Jr. et al., 2009), according to the variables presented in Table 1.

The choice of the innovation radar model was based on previous research, which demonstrated the suitability of this model for the present study. However, no validated scale for measuring multiple innovations has been proposed in the literature. Articles in the literature are limited to presenting a measurement carried out using descriptive statistics techniques associated with the theoretical categories proposed by Sawhney et al. (2006) (Néto & Teixeira, 2014; Paredes et al., 2015; De Carvalho et al., 2015; De Paula et al., 2015; Simões et al., 2015; Gonçalves et al., 2017; Silva et al., 2016; De Carvalho et al., 2020).

The data were processed and analysed using descriptive statistics, the exploratory factor analysis technique (AFE) and confirmatory factor analysis (CFA) and modelled using partial least squares (PLS-SEM). Initially, the data were checked for asymmetry and kurtosis to determine whether they were normal, as explained in Table 2.

Statistical techniques were modelled and calculated for descriptive statistics and exploratory factor analysis using Stata® statistical analysis software, version 16. To model the confirmatory factor model (PLS-SEM), the statistical analysis software SmartPLS® was used.

ANALYSIS AND DISCUSSION OF RESULTS

The 542 micro and small companies (MPEs) studied are headquartered in the metropolitan region of Natal/RN and meet the criteria established by Complementary Law No. 123/2006, which classifies an MPE in Brazil according to its annual gross revenue, which should be less than or equal to R$360 thousand (Simões et al., 2015). The majority of these MSEs, approximately 71%, have been operating for more than 5 years and are relatively established companies, as they have surpassed the 2-year period, which is considered critical for the mortality of MSEs in Brazil (Brazilian Support Service to Micro and Small Companies [SEBRAE], 2016).

Table 1

Innovation radar scale

Inov01	The company has successfully launched new products and/or services in the market in the last 3 years.
Inov02	The company has one or more registered trademarks.
Inov03	The company has a system for adopting new ways of generating revenue using existing facilities and resources.
Inov04	The company systematically adopts new solutions to reduce the cost of transporting or storing raw materials and products.
Inov05	The company routinely uses consultancies or support from entities such as SEBRAE, SENAI, SESI, universities, junior companies, etc.
Inov06	In the last 3 years, the company has changed the characteristics of its products and/or services for ecological reasons.
Inov07	The company uses its brand in advertising or is associated with other products, services, or businesses that may bring prestige.
Inov08	Over the last 3 years, the company has adopted new ways of generating revenue, facilitating relationships between partners and their customers.
Inov09	In the last 3 years, the company has created points or sales channels different from those already existing.
Inov10	The company systematically seeks new information and technologies at events (seminars, congresses, etc.) and from technical or business associations.
Inov11	Physical and knowledge resources for production or services serve more than one family of products and/or services.
Inov12	The company has a system for collecting information about customer needs.
Inov13	The company modifies its processes (execution, control, marketing, etc.) or facilities to obtain greater efficiency, quality, flexibility or speed in service and/or the production cycle.
Inov14	In the last 3 years, the company has established new relationships with distributors or representatives to sell its products and/or services.
Inov15	The company's practice is to seek knowledge or technologies from suppliers, competitors or customers.
Inov16	The same product and/or service is offered in more than two versions to reach new markets or consumer groups.
Inov17	The company has a system for identifying new markets for its products and/or services.
Inov18	Over the last 3 years, the company has adopted new management practices.
Inov19	Over the last 3 years, the company has adopted new ways of exchanging information with customers, with or without information technology, to improve the efficiency of its processes.
Inov21	The company systematically acquires information, technical or otherwise, paying fees or royalties for patented inventions, or integrates new know-how and skills.
Inov22	Over the last 3 years, the company has offered new complementary solutions to its customers, creating revenue opportunities.
Inov22	The company has launched new products and/or services, or versions, in the last 3 years, as a result of information about customer needs.
Inov23	In the last 3 years, the company has received more than one new process, product or service certification.
Inov24	The company has already used some of the subsidized financial and technological support programs for innovative activities.
Inov25	Over the last 3 years, the company has offered new solutions to its customers, based on the integration of resources/products/services.
Inov26	In the last 3 years, the company has adopted new facilities, interfaces or resources to improve customer relationships.
Inov27	In the last 3 years, the company has adopted new software for administrative or production management with the specific aim of gaining differentiation.
Inov28	In the last 3 years, the company has modified inputs, facilities, or processes for ecological reasons.
Inov29	The company has a formal system for collecting suggestions from employees.
Inov30	Over the last 3 years, the company has transformed part of its waste into an opportunity to generate revenue.
Inov31	The company systematically reorganizes its activities or changes the way employees work to improve its results.
Inov32	In the last 3 years, the company has adopted new IT resources to interact with customers.
Inov33	Over the last 3 years, the company has entered into partnerships with other organizations to provide better products and/or services or to increase its competitiveness.
Inov34	Over the past 3 years, the company has made radical changes to its competitive strategy.

Note: Adapted from the theoretical categories proposed by Sawhney et al. (2006); Chen and Sawhney, (2010).

Table 2

Multivariate Analysis Techniques

Analysis Methods	Validation Techniques and Tests	Objective	Methodological basis
Exploratory Factor Analysis	Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO)	Measure the degree of partial correlation between variables	Corrar et al. (2011)
	Bartlett's test of sphericity	Indicate the existence of sufficient relationships between indicators to apply factor analysis	Corrar et al. (2011)
	Varimax Rotation	Minimize the occurrence of a variable having high factor loadings for different factors	Corrar et al. (2011)
	Cronbach's Alpha Test	Identify whether the scale produces consistent results between repeated or equivalent measurements of the same object or person, revealing the absence of random error	Corrar et al. (2011)
Confirmatory Factor Analysis with Partial Least Squares (PLS-SEM)	Reliability Values (CC)	Indicate the degree of internal consistency of the latent constructs	Hair Jr. et al. (2014); Ringle et al. (2014)
	Convergent Validity (AVE)	Check how much, on average, the variables positively correlate with their respective constructs	Fornell and Larcker (1981); Hair Jr. et al. (2014)
	Discriminant Validity (DV)	Indicate whether the constructs or latent variables are independent of each other	Fornell and Larcker (1981); Hair Jr. et al. (2014)

Note: Elaborated by the authors.

Regarding the sectors in which MPEs operate, 44% of the companies carry out their activities in the commerce sector, 40% in the services sector and 16% in the industrial sector. Thus, although the MSEs were chosen randomly from the database of the ALI program monitoring system (SistemALI®), these companies present a distribution similar to that of MSEs in the national market, in which 45.3% operate in the service sector, 44.6% in the commerce sector, 8.2% in the industry sector and 1.9% in the agribusiness sector (De Carvalho et al., 2020). Regarding the number of employees, 81% have up to 19 employees, and 19% have more than 19. The company classification criteria used by the IBGE considers micro companies to be those with up to 19 employees and small companies as those between 20 and 99 employees. These criteria correspond to the two groups of companies in our sample (SEBRAE, 2016).

Having identified the characteristics of MSEs, we sought to evaluate, through exploratory factor analysis (AFE), the latent structure of each dataset through the formation of underlying directions, making it possible to explain the correlations between certain sets of data. Before performing the EFA, the univariate normality of the variables was verified by analysing the values of the univariate asymmetry (skew-sk) and its flattening, also called univariate kurtosis (kurtosis-ku). As indicated by Favero and Belfiore (2017), for study parameters, we considered the desirable values for measuring the shape of the distribution in terms of univariate asymmetry as sk < 3 and flatness as kurtosis ku < 5. Based on this analysis, the manifest variables presented acceptable values for asymmetry. However, in validating kurtosis, ku values greater than 5 were observed for the variables Inov 18 (ku = 16.156), Inov 21 (ku = 12.245), Inov 23 (ku = 31.463), Inov 24 (ku = 17.749), Inov 30 (ku = 6.823) and Inov 34 (ku = 8.916), indicating severe nonnormality in these variables. Therefore, they were excluded from the study since they might present problems regarding their formulations in the questionnaire or the adequacy of the corresponding statement for capturing the characteristics of the MSEs participating in this study.

Considering the results of the univariate normality check, EFA was conducted with 31 variables reflecting innovation. The first AFE check sought to assess the global adequacy of the model. For this purpose, the KMO statistic and Bartlett's test of sphericity were used. The results of the global adequacy of the factor analysis for the innovation model showed a KMO of 0.854, which, according to Corrar et al. (2011), indicates that the variables share a high percentage of variance. Bartlett's sphericity test is statistically significant at the 1% level, with a p value < 0.01, which indicates that there are sufficient correlations between the innovation variables to carry out EFA.

In Table 3, the factors extracted in the EFA are identified using the eigenvalue criterion Kaiser (eigenvalue ≥ 1), in which the presence of 5 factors was identified for the innovation model, which has eigenvalues varying between 6, 18231 for the first factor and 2.18235 for the last extracted component. The 5 factors make up 88.99% of the total variance of the original variables and represent a total loss of variance of 11.01%. These AFE results converged with the theoretical proposal of this research, which contains 5 constructs: innovation in operations (InovOperacoes - η1), innovation in knowledge channels (InovCConhec - η2), innovation in marketing (InovMkt - η3), innovation offers (OfertaInov - η4) and innovation in partnerships (InovParc - η5).

These results contribute to the advancement of the original innovation radar model proposed by Sawhney et al. (2006) and by Chen and Sawhney (2010), who identified 4 dimensions of innovation. However, the results indicate the existence of the fifth dimension, innovation in knowledge channels (InovCConhec - η2), which represents a theoretical contribution of this study and is conceived as a type of open innovation (van de Vrande et al., 2009; Parida et al., 2012; Silva et al., 2016).

This new dimension has the following main characteristics: the capture of knowledge channels available from external and internal sources of the organization; the participation of strategic individuals in the organization of business, technical and scientific events in MSE activities (Costa & Reis Neto, 2022),); the search for knowledge from suppliers, competitors and customers; the acquisition of new knowledge, technical or otherwise, with the payment of fees or royalties; and the development of a formal system within the organization for collecting information from employees (Bachmann & Destefani, 2008; Forsman, 2011; Parida et al., 2012; Skibiński & Sipa, 2015; Silva et al., 2016; De Carvalho et al., 2020). These results reinforce the importance of this dimension given the results reported by Bezerra, Martins and Nishi (2021), and Cabral da Silva and Correia (2022), in which this factor was found to be a cause for companies' difficulty in promoting innovation.

The magnitude of the Cronbach's alpha was verified to evaluate the reliability with which the factors were extracted from the original variables. The Cronbach's alpha value offers clues about the consistency of the entire scale and is measured through a reliability coefficient that individually assesses the influence of the construct with a variation from 0 to 1. In this study, values greater than 0.7 were considered to indicate internal consistency (2011).

Table 3

Final Model of Exploratory Factor Analysis (n = 542)

Variables	Operational innovation (InovOperations - η1)	Innovation in knowledge channels (InovCConhec - η2)	Marketing innovation (InovMkt - η3)	Innovation offers (OfertaInov - η4)	Partnership innovation (InovParc - η5)
Inov14	0.9113				
Inov15	0.8337				
Inov16	0.8916				
Inov17	0.8874				
Inov19	0.8627				
Inov20	0.8817				
Inov22	0.8714				
Inov29		0.9017			
Inov31		0.9348			
Inov32		0.8683			
Inov33		0.7963			
Inov05			0.4941		
Inov06			0.7705		
Inov07			0.7076		
Inov08			0.8936		
Inov09			0.7432		
Inov12			0.6775		
Inov13			0.9056		
Inov01				0.7671	
Inov02				0.5185	
Inov03				0.8045	
Inov04				0.7349	
Inov10				0.7923	
Inov11				0.8126	
Inov25					0.8350
Inov26					0.6307
Inov27					0.8561
Inov28					0.4436
Eigenvalue	6.18231	4.78739	4.21933	3.55760	2.18235
Variance Percentage (%)	26.29%	20.36%	17.94%	15.13%	9.28%
Accumulated Percentage (%)	26.29%	46.64%	64.59%	79.71%	88.99%

Note: n = 542. Varimax rotation with Kaiser normalization. Elaborated by the authors.

All the factors obtained had coefficients with Cronbach's alpha higher than the standard established in the literature, which is equal to 0.7, indicating internal consistency:

- the factor "innovation in operations", consisting of 7 variables, had a Cronbach's alpha equal to 0.9170;
- the factor "innovation in knowledge channels", consisting of 4 variables, had a Cronbach's alpha equal to 0.9503;
- the "marketing innovation" factor, consisting of 7 variables, had a Cronbach's alpha equal to 0.9107;
- the "innovation offer" factor, consisting of 6 variables, had a Cronbach's alpha equal to 0.8918; and
- the "partnership innovation" factor, consisting of 4 variables, had a Cronbach's alpha equal to 0.8164. These results confirm the consistency of the factors found (2011).

Confirmatory factor analysis (CFA) was carried out using the measurement model based on PLS-SEM, which characterizes the relationship between the latent variables and their observed measurements to indicate how the latent variables relate to the variables observed reflexes. SmartPLS® generates statistics that enabled the verification of each construct that makes up the proposed CFA model.

To address the limitations of the Cronbach's alpha test, which individually assesses the influence of constructs, the composite reliability of the factors was used to identify the influence of all constructs simultaneously (Ringle et al., 2014). A composite reliability (CC) greater than 0.7 and an average variance extracted (AVE) greater than 0.5 were used as acceptable values (Fornell & Larcker, 1981; Hair Jr. et al., 2014). Table 4 presents these values for all the latent variables of the innovation model. According to Fornell and Larcker (1981) and Hair Jr. et al. (2014), the values obtained for CC are higher than the minimum value indicated in the literature, with the lowest value identified (0.881) for the latent variable InovParc – η5.

In relation to convergent validity, the average variance extracted (AVE) was calculated, based on which the percentage of the total variance of the indicators explained by the latent variable was evaluated. Table 2 shows that the AVEs for the 5 innovation

constructs are higher than the minimum value indicated by Fornell and Larcker r (1981) and Hair Jr. et al. (2014). The lowest value identified was 0.652 for the OferInov- η4 construct. The others were higher, indicating convergent validity, as they were higher than the limits recommended by the literature (Fornell & Larcker, 1981; Hair Jr. et al., 2014).

The last criterion used to evaluate the validity of the construct was discriminant validity. This measure was used to evaluate whether the scales used measure different constructs or to confirm that differences are not identified between the measurements of the constructs, that is, whether the respondents understood the questions as constituting a homogeneous set (Hair Jr. et al., 2014). To assess discriminant validity, the Fornell–Larcker criterion (1981), was used, in which the square roots of the AVE values of each construct are compared with the correlations (Pearson) between the constructs. It was verified that the square roots of the AVEs were greater than the correlations between the constructs, indicating discriminant validity.

Based on the results obtained regarding the good adjustment of the measurement model, the consistency of the theoretical and empirical indications can be assessed, confirming their validity (Hair Jr. et al., 2014). Thus, the three dimensions evaluated for CFA through PLS-SEM indicated that the theoretical model of this research explains how the different variables observed for innovation represent the measures of their respective constructs under analysis, forming the basis of the theoretical model developed (Sawhney et al., 2006; Chen & Sawhney, 2010).

Confirming these factors allows for a greater understanding of the innovation phenomenon based on multiple approaches for application in MSEs in the context of the study. Thus, new variables can be analysed throughout the innovation evaluation process, which is a source of competitive advantages for MSEs that operate in traditional sectors of the economy (De Carvalho et al., 2015; Fernández-Esquinas et al., 2017; Santos et al., 2018; De Carvalho et al., 2020; Costa & Reis Neto, 2022).

CONCLUSION

Based on the results of exploratory factor analysis (EFA), this study identified 5 constructs, whose manifest variables were not excluded. The EFA model presented satisfactory global adequacy and indicated sufficient correlations between the variables to conduct EFA (KMO and Bartlett's test of sphericity). Based on the factors identified by EFA, the internal consistency of the respective constructs was verified using Cronbach's alpha, which was greater than 0.8 and therefore indicated the internal consistency of the innovation constructs.

The confirmatory factor analysis was modelled through the application of PLS-SEM, which evaluated the confirmatory measurement model based on the results of the EFA. The CFA attested to good adjustment indices for all innovation constructs: the composite reliability indices (CCs) were evaluated and found to be higher than 0.881; the average variance extracted (AVE) had indices higher than 0.652; and the discriminant validity attested that the constructs are independent of each other.

Regarding theoretical contributions, to create an instrument for measuring multiple innovations, we started with the innovation radar model, developed by Sawhney et al. (2006), seeking to construct a useful and applicable theoretical framework to analyse innovation in MSEs, which is the subject of this research. Based on the variables operationalized in this research instrument, the inclusion of a construct called innovation in knowledge channels was proposed and validated (Forsman, 2011). Thus, this study contributes to a broad and multidimensional conceptualization, which is capable of capturing the complexity of innovation and proved to be theoretically viable for carrying out future research on MSEs (van de Vrande et al., 2009; Parida et al., 2012; Silva et al., 2016).

In terms of the study's practical contribution, unlike the one-dimensional perspective supported by concepts of technological innovation developed with large research and development (ReD) structures that are the privilege of large corporations only (Berends et al., 2014; Silva et al., 2016; Silva & Di Serio, 2017), this study considered the innovative role of small companies, which are capable of generating multiple innovations (McGuirk et al., 2015).

Finally, some limitations should be acknowledged, which highlight future research opportunities. The first is that the study has regional characteristics, examining MSEs based in the metropolitan region of Natal that participated in the ALI extension program from 2014 to 2018. Other companies with intensive use of technology and innovation may have been excluded from this study. Collecting data from MSEs, which are associated with business incubators and technology parks, would be a promising way to replicate this research in future studies.

The second limitation concerns the use of cross-sectional data in the study. Although the study focused on innovation in various MSEs, it would be pertinent to conduct a longitudinal survey within organizations. A third and important limitation is that the study did not capture the effect of the pandemic and, consequently, any changes in technological mentality that may have been accelerated by companies. Future studies can explore this gap.

Table 4

EFA measurement model based on PLS-SEM

Constructs	Cronbach's alpha	Composite Reliability (CC)	Average Variance Extracted (AVE)
InovOperacoes - η1	0.960	0.966	0.782
InovCConhec - η2	0.955	0.964	0.818
InovMkt - η3	0.913	0.931	0.661
OfertaInov - η4	0.892	0.918	0.652
InovParc - η5	0.817	0.881	0.652

Discriminant validity of latent variables - innovation

	InovOperacoes - η1	InovCConhec - η2	InovMkt - η3	OfertaInov - η4	InovParc - η5
InovOperacoes - η1	0.884				
InovCConhec - η2	0.128	0.904			
InovMkt - η3	0.245	0.131	0.813		
OfertaInov - η4	0.242	0.025	0.191	0.808	
InovParc - η5	0.174	0.050	0.334	0.233	0.808

Note: Elaborated by the authors.

The fourth limitation concerns the fact that this study collected data based on the perceptual judgement of a single expert, in this case, an MSE entrepreneur. To remedy this limitation, it would be ideal to obtain a joint vision of managers in relation to the innovations generated.

Conflit of interest statement

The authors declare that there is no conflict of interest.

Authors' statement of individual contributions

Roles	Contributions		
	D'anjour M. F.	Medeiros B. C.	Añez M. E. M.
Conceptualization	■		■
Methodology	■	■	■
Software	■		
Validation	■	■	■
Formal analysis	■		
Investigation	■		■
Resources	■	■	■
Data Curation	■		
Writing - Original Draf	■		
Writing - Review & Editing	■	■	■
Visualization	■	■	■
Supervision			■
Project administration	■		
Funding acquisition	N. A.		

Note: Acc. CRediT (Contributor Roles Taxonomy): https://credit.niso.org/

REFERÊNCIAS

Bachmann, D. L., & Destefani, J. H. (2008). Metodologia para estimar o grau de inovação nas MPE. XVIII Seminário Nacional de Parques Tecnológicos e Incubadoras de Empresas. Aracaju.

Baumann, J., & Kritikos, A. S. (2016). The link between R&D, innovation and productivity: Are micro firms different? Research Policy, 45(6), 1263–1274. https://doi.org/10.1016/j.respol.2016.03.008

Barbosa, K. A., Sousa, M. M., Nacife, J. M., & Novak, S. S. (2022). Innovations in courts: Validation of a scale of technological innovation. *Revista de Gestão e Secretariado, 13*(4), 2314-2336. https://doi.org/10.7769/gesec.v13i4.1474

Berends, H., Jelinek, M., Reymen, I., & Stultiëns, R. (2014). Product innovation processes in small firms: Combining entrepreneurial effectuation and managerial causation. *Journal of Product Innovation Management, 31*(3), 616-635. http://dx.doi.org/10.1111/jpim.12117

Bezerra, J. S., Martins, P. C. S., & Nishi, J. M. (2021). Análise do grau de inovação nas MPEs do Turismo, em uma área de fronteira, à luz do radar de inovação. Revista Acadêmica Observatório de Inovação do Turismo, 15(3), 97-122. https://doi.org/10.17648/raoit.v15n3.7163

Cabral da Silva, W. B., & Magalhães Correia, A. M. (2022). Análise da inovação no segmento da indústria de cerâmica vermelha: Uma aplicação do radar da inovação. Gestão & Regionalidade, 38(115). https://doi.org/10.13037/gr.vol38n115.7568

Carneiro, V., da Rocha, A. B., Rangel, B., & Alves, J. L. (2021). Design Management and the SME Product Development Process: A Bibliometric Analysis and Review. *She Ji: The Journal of Design, Economics, and Innovation, 7*(2), 197-222. http://dx.doi.org/10.1016/j.sheji.2021.03.001

Ceolin, M. J. A., Damke, F., Da Silva, E., Bulhões, R., & Meneghatti, M. R. (2023). Innovation in times of a pandemic: the case of a construction industry. *International Journal of Innovation, 11*(1), 21862. https://doi.org/10.5585/2023.21862

Chen, J., & Sawhney, M. (2010). Defining and measuring business innovation: the innovation radar. In Proceedings of the American Marketing Association Conference. Boston MA. http://dx.doi.org/10.13140/RG.2.2.22863.07846

Corrar, L. J., Dias Filho, J. M., & Paulo, E. (2009). Análise multivariada para os cursos de administração, ciências contábeis e economia. Editora Atlas.

Costa, E. S., & Reis Neto, A. C. (2022). Escalas para mensurar inovação: identificação de elementos utilizados para mensurar a inovação no contexto empresarial entre o período de 2022 e 2020. *Revista de Administração, Sociedade e Inovação, 8*(2), 24-41. https://doi.org/10.20401/rasi.8.2.564

Damanpour, F., & Aravind, D. (2012). Managerial innovation: Conceptions, processes and antecedents. *Management and organization review, 8*(2), 423-454. https://doi.org/10.1111/j.1740-8784.2011.00233.x

De Carvalho, G. D. G., da Silva, W. V., Póvoa, Â. C. S., & de Carvalho, H. G. (2015). Radar da inovação como ferramenta para o alcance de vantagem competitiva para micro e pequenas empresas. *RAI Revista de Administração e Inovação, 12*(4), 162-186. https://www.revistas.usp.br/rai/article/view/101898

De Carvalho, G. D. G., Cruz, J. A. W., de Carvalho, H. G., Duclós, L. C., & de Fátima Stankowitz, R. (2017). Innovativeness measures: a bibliometric review and a classification proposal. *International Journal of Innovation Science, 9*(1), 81-101. http://dx.doi.org/10.1108/IJIS-10-2016-0038

De Carvalho, G. D. G., De Resende, L. M. M., De Carvalho, H. G., Pontes, J., & Correa, R. O. (2020). The local innovation agents program: a literature review on the largest Brazilian small business innovation support program. *International Journal of Innovation Science. http://dx.doi.org/10.1108/IJIS-03-2020-0022*

De Paula, L. P. D., Danjour, M. F., Medeiros, B. C., & Añez, M. E. M. (2015). Inovações em processos de tecnologia: Um estudo de caso em uma empresa de contabilidade da cidade do Natal/RN. *Holos, 6*, 196-209. https://doi.org/10.15628/holos.2015.3200

Fávero, L. P., & Belfiore, P. (2017). Manual de Análise de Dados: Estatística e Modelagem Multivariada com Excel®, SPSS® e Stata®.

Fernández-Esquinas, M., van Oostrom, M., & Pinto, H. (2017). Key issues on innovation, culture and institutions: implications for SMEs and micro firms. http://dx.doi.org/10.1080/09654313.2017.1364770

Ferreira, J. J., Fernandes, C. I., Alves, H., & Raposo, M. L. (2015). Drivers of innovation strategies: Testing the Tidd and Bessant (2009) model. *Journal of Business Research, 68*(7), 1395-1403. http://dx.doi.org/10.1016/j.jbusres.2015.01.021

Fonseca, J. S., & Martins, G. A. (2011). Curso de estatística. Atlas

Forsman, H. (2011). Innovation capacity and innovation development in small enterprises. A comparison between the manufacturing and service sectors. *Research policy, 40*(5), 739-750. https://doi.org/10.1016/j.respol.2011.02.003

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research, 18*(1), 39-50. https://doi.org/10.2307/3151312

Gao, H., Ding, X., & Wu, S. (2020). Exploring the domain of open innovation: bibliometric and content analyses. *Journal of Cleaner Production, 275*, 1-16. http://dx.doi.org/10.1016/j.jclepro.2020.122580

Gonçalves, A. D., Cardoso, H. H. R., de Carvalho, H. G., de Carvalho, G. D. G., & de Fátima Stankowitz, R. (2017). Panorama view of innovation in brazilian small businesses. *International Journal of Innovation, 5*(3), 325-334. https://doi.org/10.5585/iji.v5i3.239

Hair Jr, J., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2009). Análise Multivariada de Dados. (6a ed.). Bookman.

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). A primer on partial least squares structural equation modeling (PLS-SEM). Sage publications.

Hair, Jr. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. *Journal of the academy of marketing science, 45*(5), 616-632. http://dx.doi.org/10.1007/s11747-017-0517-x

Lima, V. A., e da Silva Müller, C. A. (2017). Why do small businesses innovate? Relevant factors of innovation in businesses participating in the Local Innovation Agents program in Rondônia (Amazon, Brazil). *RAI Revista de Administração e Inovação, 14*(4), 290-300. https://www.revistas.usp.br/rai/article/view/145366

McGuirk, H., Lenihan, H., & Hart, M. (2015). Measuring the impact of innovative human capital on small firms' propensity to innovate. *Research policy, 44*(4), 965-976. https://doi.org/10.1016/j.respol.2014.11.008

Medeiros, F. S. B. (2021). Inovação em serviços: um panorama da produção científica na base scopus (1967-2017). *Desafio Online, 9*(2), 302-327. https://doi.org/10.55028/don.v9i2.5630

Néto, A. T. da S., & Teixeira, R. M. (2014). Inovação de micro e pequenas empresas: mensuração do grau de inovação de empresas participantes do Projeto Agentes Locais de Inovação. Brazilian Business Review, 11(4), 1–27. https://doi.org/10.15728/bbr.2014.11.4.1

Oliva, F. L., Semensato, B. I., Prioste, D. B., Winandy, E. J. L., Bution, J. L., Couto, M. H. G., ... e Massaini, S. A. (2019). Innovation in the main Brazilian business sectors: characteristics, types and comparison of innovation. *Journal of Knowledge Management, 23*(1) 135-175. https://doi.org/10.1108/jkm-03-2018-0159

Paredes, B. J. B., de Santana, G. A., Cunha, T. N., & de Aquino, J. T. (2015). Uma análise intrassetorial e intersetorial do grau de inovação de empresas de pequeno porte do Estado de Pernambuco. *RAI Revista de Administração e Inovação, 12*(4), 140-161. https://www.revistas.usp.br/rai/article/view/101888

Parida, V., Westerberg, M., & Frishammar, J. (2012). Inbound open innovation activities in high-tech SMEs: the impact on innovation performance. *Journal of small business management, 50*(2), 283-309. https://doi.org/10.1111/j.1540-627X.2012.00354.x

Popa, S., Soto-Acosta, P., & Martinez-Conesa, I. (2017). Antecedents, moderators, and outcomes of innovation climate and open innovation: An empirical study in SMEs. *Technological Forecasting and Social Change, 118*, 134-142. https://doi.org/10.1016/j.techfore.2017.02.014

Ringle, C. M., Da Silva, D., & de Souza Bido, D. (2014). Modelagem de equações estruturais com utilização do SmartPLS. *Revista Brasileira de Marketing, 13*(2), 56-73. https://doi.org/10.5585/remark.v13i2.2717

Sampieri, R. H., Collado, C. F., e Lucio, M. P. B. (2013). Metodologia de pesquisa. Penso.

Santos, M. B., Monteiro, P. R. R., Gonçalves, M. A., & Camilo, R. D. (2018). Reference models and competitiveness: an empirical test of the management excellence model (MEG) in Brazilian companies. *Total Quality Management e Business Excellence, 29*(3-4), 346-364. http://dx.doi.org/10.1080/14783363.2016.1188656

Sawhney, M., Wolcott, R. C., e Arroniz, I. (2006). The 12 different ways for companies to innovate. *MIT Sloan management review, 47*(3), 75. http://dx.doi.org/10.1109/EMR.2007.329139

Schumpeter, J. A. (1934) The Theory of Economic Development. Harvard University Press, Cambridge Massachusetts.

Schumpeter, J. A. (1939). Business cycles (Vol. 1, pp. 161-174). New York: McGraw-Hill.

Schumpeter, J. A. (1942). Capitalism, socialism and democracy. Harper e Row.

Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (2016). Sobrevivência das Empresas no Brasil. SEBRAE. Recuperado de http://datasebrae.com.br/wp-content/uploads/2017/04/Sobreviv%C3%AAncia-de-Empresas-no-Brasil-2016-FINAL.pdf.

Silva, G., Dacorso, A. L. R., Costa, V. B., & Serio, L. C. Di. (2016). Relationships and Partnerships in Small Companies: Strengthening the Business through External Agents. BAR - Brazilian Administration Review, 13(1), 1–18. https://doi.org/10.1590/1807-7692barnaahead0116

Silva, G., e Di Serio-luiz, L. C. (2017). Revisitando os Pressupostos Básicos da Teoria de Inovação. In EnAnpad 41.

Simões, L. C., Oliveira, M. A. C. de, Mendes, D. R. F., & Pinheiro, A. A. (2015). Radar da inovação: um estudo de caso das prestadoras de serviço de Brasília/DF. REGEPE Entrepreneurship and Small Business Journal, 4(2), 133–152. https://doi.org/10.14211/regepe.v4i2.167

Skibiński, A., & Sipa, M. (2015). Sources of Innovation of Small Businesses: Polish Perspective. Procedia Economics and Finance, 27, 429–437. https://doi.org/10.1016/S2212-5671(15)01017

Tribuna do Norte (2022). No RN, número de micro e pequenas empresas cresceu 17,3% em 2021. Recuperado de http://www.tribunadonorte.com.br/noticia/no-rn-naomero-de-micro-e-pequenas-empresas-cresceu-17-3-em-2021/530733.

van de Vrande, V., de Jong, J. P. J., Vanhaverbeke, W., & de Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. Technovation, 29(6–7), 423–437. https://doi.org/10.1016/j.technovation.2008.10.001

Zeng, J., Zhang, W., Matsui, Y., & Zhao, X. (2017). The impact of organizational context on hard and soft quality management and innovation performance. International Journal of Production Economics, 185, 240–251. https://doi.org/10.1016/j.ijpe.2016.12.031

