

# Incremental and Radical Innovations that Contribute to the Survival of Small Businesses in Environments of Crisis

Marcos Roberto Gois de Oliveira Macedo

Dept. of Business Administration, Federal University of Pernambuco (UFPE)

Av Prof Moraes Rego 1235, Recife PE Brazil - 50670901

Charles Ulises De Montreuil Carmona

Dept. of Business Administration, Federal University of Pernambuco (UFPE)

Av Prof Moraes Rego 1235, Recife PE Brazil - 50670901

Denilson Bezerra Marques

Dept. of Business Administration, Federal University of Pernambuco (UFPE)

Av Prof Moraes Rego 1235, Recife PE Brazil - 50670901

Received: Jan. 8, 2024    Accepted: Sep. 1, 2024    Online published: Nov. 1, 2024

doi:10.5296/jpag.v14i2.22369

URL: <https://doi.org/10.5296/jpag.v14i2.22369>

## Abstract

This paper examines the influence of incremental and radical innovations on the survival capacity of micro and small companies (MSE) in contexts of economic crisis.

State of the art on innovation points to a lack of a specific methodology to segregate incremental and radical innovation in MSEs. Identifying such a method allows for action to promote innovation in such more assertive companies, contributing to the survival of companies in the most adverse moments, such as crises.

In this sense, a methodology was developed to identify the type and degree of innovation based on the level of innovation in the sector of activity and was applied to a sample of 60 companies in the textile retail sector. The dependent variable was business survival, measured by the continuity or cessation of activity in 2020. The estimate of the probability of survival

was carried out using a binary logistic regression model.

The dimensions of incremental innovation, which are the most common in the business environment, did not significantly affect survival. The dimensions of radical innovation, which imply deeper and more disruptive changes in the business model, had a positive impact. Significant impact on survival in all cases. The most complex actions in the Solutions dimension increased the chances of survival by 42%; improving Processes by 39%; and innovation in the Square by 38%. These findings suggest that small businesses that adopt radical innovations have greater adaptability and resilience to adverse situations.

**Keywords:** Radical innovation, Incremental innovation, Degree of sectoral innovation, Small business, Crisis Environments

## 1. Introduction

Innovation is perceived by companies and researchers in the field as a fundamental instrument for survival in the competitive environment and with increasingly demanding customers (Santos, 2020; Raghuvanshi et al., 2017; Rajapathirana & Hui, 2018). This perception permeates companies of all sizes, according to Santos (2020) even small companies seek innovative results in an even intuitive way. Rajapathirana and Hui (2018) highlighted the prominent role of innovation in building competitive advantage.

The literature on organizational innovation has advanced from the unitary concept of innovation to dichotomous innovation formed from the segregation between incremental and radical innovation (Esma & Amine, 2024; Lennerts et al., 2020; Johnson, 2020; Dewar & Dutton, 1986); by realizing that the two possibilities of innovation sustain the competitive advantage of companies.

In times of crisis, companies' adaptability becomes vital to survive the hostile environment, and innovative companies naturally have this ability to seek creative solutions, whether endogenous or exogenous (Martins, 2020). However, according to Martins (2020), the outbreak of a crisis turns public policies to support innovation, especially in countries with modest innovation such as Brazil, Portugal, Argentina, and Russia, as the main supplier of exogenous sources for innovation.

The work of the Center for Research in Science, Technology and Society (2021) highlights the importance of policies to encourage innovation in Brazil as fundamental to increasing competitiveness. The work highlights a crucial element for the development of innovative policies: a precise diagnosis and clear objectives based on such diagnosis.

The question is how to obtain support from public policies or explore new opportunities or exogenous sources of innovation when resources are scarce and rationed, especially for small companies. The scarcity of resources makes it imperative to use the structure and solutions already available in the company to innovate and overcome the crisis. It is up to the company to use existing resources and seek primarily incremental innovation, or to be proactive and develop radical innovations before crises erupt when resources become scarce.

Do companies participating in an innovation stimulus program have a different chance of survival when choosing incremental innovations or radical innovations? Therefore, this work aims to objectively segregate incremental innovation actions from radical innovations by adapting the sectoral innovation degree method developed by Oliveira et al. (2011) and verify the effect of radical and incremental innovation on the survival capacity of small Brazilian companies. To test the method, it was evaluated how 60 companies in the textile trade sector innovated and the impact of innovation on their survival from 2015 to 2020, including during this period the crisis caused by the Covid-19 pandemic.

## 2. Theoretical Background

### 2.1 Defining Innovative Capacity

According to Dewett et al. (2007) the literature presented concepts such as innovation, innovative capacity, skills for innovation, as synonyms. Another confusion arises when considering innovation as the development of new technologies and products, which the literature has already tried to adjust and separate the term technological innovation to designate this form of innovation. Avelar et al. (2024), Ettlie and Rosenthal (2011) and Den Hertog et al. (2010), also add that technological innovation has a way to go to be understood in the environment of micro and small companies.

Despite this movement of conceptual exchange that revolves around innovation, it is essential to present a concept of innovation suited to the reality of micro and small companies in order to add competitive advantage to them. According to Saboia et al. (2022) and Teece (2007) firms can obtain competitive advantage through developing the ability to build and reconfigure competencies, whether internal or external, to respond to environmental changes.

According to Borgers, Burcharth and Chesbrougt (2021), the use of open innovation is not a typical source of knowledge for Brazilian companies. According to these authors, 72% of executives from Brazilian companies surveyed seek growth through the development of internal projects, while in India this number is 36%.

Innovation can be understood as the connection between the ability to create and transform concepts into competitive advantage. According to Schumpeter (1988), innovation is the result of the abilities to build and reconfigure competitive advantages. This concept of innovation was presented in the 2018 Oslo Manual (Organization for Economic Cooperation and Development and Statistical Office of the European Union, 2018). In light of the manual, it is possible to innovate in the marketing of products, development of distribution channels, creation of new products and/or processes, development of new marketing actions, and other actions that impact the company's value in a sustainable and permanent way.

Therefore, an innovation is understood as an action capable of generating value for the company by producing something new, that is, innovation implies a change in the company's internal organizational paradigm, but not necessarily a change in the business paradigm, this change having an organic source within the company. company, that is, created with intrinsic resources, or even as in external sources and resources.

Innovative capacity is related to the potential to innovate. According to Guan and Ma (2003), the company's innovative capacity concerns internal experiences and experimental acquisition. Lawson and Samson (2001) define innovative capacity as an ability to continuously transform knowledge into new products, processes, and systems for the benefit of the company and its stakeholders. In other words, innovative capacity arises from the company's competence and ability to efficiently use available resources.

Zawislak et al. (2012) consider innovative capacity as the result of a set of capabilities, guided by technology and business.

In the scope of technology, it is the knowledge used to transform resources into products through routines, referring to the capacity for technological development and productive capacity.

Within the scope of business, there is the ability of companies to take developed solutions to the market with low transaction costs, which implies the development of managerial (or administrative) capacity and commercial capacity.

Even though companies have the four capabilities, which permeate the areas of technology and business, it is expected that one of them will predominate for a certain period (Zawislak et al., 2012).

When it comes to the innovative capacity of micro and small companies, it is natural that the expectation of mastering the four capabilities is frustrated, even if there is innovation. Which leads to a paradox: is it necessary to have innovative capacity to innovate? According to Laforet and Tann (2006), managerial and commercial capacity can be decisive for the company to innovate, even without the knowledge to develop a new technology.

Raghuvanshi et al. (2017) showed that micro and small companies in India developed innovative capacity based on relationship networks, with special emphasis on the search for external complementarity of skills and involving the innovation ecosystem and assuming the role of risk taker.

This potential is natural for micro and small companies given the central role that the entrepreneur assumes in the company. Panayides (2006) already defined innovative capacity as a result mainly arising from the individual's ability, rather than from the organizational innovative capacity.

The management structure of micro and small companies naturally allows for greater flexibility and reinforces the entrepreneurial stance as a fundamental element for maintaining the company in the market. According to Musetti et al. (2024) the possibility of reconfiguring the use of resources in response to external fluctuations in demand creates a competitive advantage through innovative strategies.

Just as there is confusion in the literature between the concepts of innovation and innovative capacity, there are also conceptual difficulties in the ways of measuring innovation or how to measure innovative capacity. The literature is scarce in works dedicated to presenting tools to measure innovative capacity, in this field Sawhney et al. (2006) and Oliveira et al. (2014), even

though these authors use the term evaluate innovation.

The assessment of innovation itself is carried out using criteria such as number of patents, investment in research and development. The first authors to address the topic of measuring innovation were Villers (1964), Roman (1974) and Balderston (1984).

Villers (1964) relates innovation to the number of patents obtained or requested by the company; technical works presented at conferences and magazines; the use of tools to obtain cost reduction; useful technology and market position of companies.

Roman (1974) inserts research and development into the proposition of Villers (1964) in addition to evaluating the unit cost, or its variation when applying the research result. This author raises the hypothesis about the importance of the manager being able to attract and retain talent.

Balderston (1984), evaluates innovation from an efficiency perspective. It checks, for example, the rate of investment in research and development on profits or additional sales, on the reach of new products on the market, on the ratio of R&D cost per employee and the impact on the return period on investments.

The work of Sawhney et al. (2006) evaluates innovation as a process. It treats innovation because of factors, or rather, evaluates innovative capacity. The basis of the above work is the Oslo Manual, which was first published in 1995. The manual is in its 4th edition (OECD/Eurostat, 2018).

## *2.2 Incremental and Radical Innovation*

The concept of innovation in the contexts of business organizations has moved from the unitary logic of innovation to the dichotomous discussion of incremental and radical innovation. Such expansion is not a phenomenon discussed recently, research since the 1980s such as that by Dewar and Dutton (1986) and Ettlé et al. (1984) discussed the dichotomy and application in organizations.

Lennerts et al. (2020) present applications of radical and incremental innovation defined in Chandy and Tellis (1998) contemplating technological changes linked to innovation. For these authors, radical innovation is related to the development of new products or processes for new customers, while incremental innovation is related to changing products or processes in an adaptive way, that is, based on something existing, an adaptation is made with small technological changes.

Balder, Hagedorn and Stark (2024) corroborate the authors above by pointing out that incremental innovation does not produce more effective results than radical innovation in the creation of new products.

The concepts of Lennerts et al. (2020) of radical and incremental innovation refer to radical and incremental technological innovation.

Radical innovation for work, addressed here, is understood as the incorporation of new knowledge, technologies or resources applied to products, processes, markets, or any end or

means activity of the organization. Such innovation can originate external to the company or be developed internally.

Incremental innovation, for this work, is generally developed internally from the observation of internal processes or by observing the company's business environment, and appears as an improvement of products, processes, markets already existing in the company or easily accessible. In order not to build a significant competitive advantage over competitors, but with the power to bring the company closer to the market's frontier of innovation possibilities.

Such concepts are aligned with the concept of Sheng and Chien (2016) who define radical innovation as the acquisition of new technologies or knowledge, or the concept of incremental innovation as a new use of technologies or knowledge already existing in the company.

Some authors such as Lennerts et al. (2020), Dunlap et al. (2016) bring ambidextrous innovation, that is, radical and incremental simultaneously. This aspect is presented by Oliveira et al. (2014) when stating that the innovation actions developed by companies have the power to influence different aspects of the company's business. Example: the radical innovation of creating a new product has an impact with incremental innovation through the adaptation of processes already existing in the company.

### *2.3 Measuring Innovative Capacity*

Innovation is a decisive factor in establishing and maintaining a competitive advantage for both large companies and small organizations (Saab & Antonello, 2023). As highlighted by Valladares et al. (2014), the ability to innovate is recognized as one of the determining factors for the success and survival of organizations. According to the authors, the ability to innovate is directly linked to the factors that make up the organization.

Demircioglu et al. (2019) state that innovation research can be divided into two groups: the first group treats innovation as a dependent variable, thus examining elements or factors that facilitate or determine innovation. As an example, there is the work of Torugsa and Arundel (2016) and Demircioglu and Audretsch (2017).

In the second group of works for Demircioglu et al. (2019) are those who consider innovation as an independent variable and evaluate the results arising from the innovative process of companies such as increased performance, improved quality of products and services, among others. Works in this line are Brown and Osborne, (2012); Ballot et al. (2015).

The present work will follow the first line, specifically investigating organizational factors that affect the capacity to innovate. These factors can be internal or external. Machado and Fracasso (2012) propose that, when internal factors limit the ability to innovate, the organization must incorporate inputs from external sources into its innovative processes.

Sawhney et al. (2006) propose a tool called innovation radar, which lists a set of dimensions through which a company develops an innovative proposal. In the present work, an expanded version of this radar is considered, obtained from the survey of information relating to these

dimensions through questions formulated for this purpose. This way, measurements of each dimension of the innovation radar are obtained.

The relevance of innovation in the development of a nation, city or company is indisputable, therefore, the way of measuring innovation is also very important. However, as observed by Oliveira et al. (2014), a major difficulty is establishing a measurement procedure and defining an innovation process.

One way to generate innovation is through the holistic approach proposed by Schumpeter (1984) to define dimensions for innovation. According to the author, innovation can arise in the form of a new product, new process, the search for new markets, the development of new sources of raw materials or new market structures.

The reference document for contemporary innovation is the Oslo Manual (OECD/Eurostat, 2018) which presents the concept of innovation as new procedures that significantly modify the way products or processes are carried out. According to the Oslo manual (OECD/Eurostat, 2018): “An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)”.

This does not describe models for measuring innovation or innovative capacity, but presents some indicators that may be related to new products, new processes, investment in RD&I, revenue, operating margins, portion of sales affected by new pricing methods, etc.

Using the Oslo Manual as a reference and using the indicators proposed in the Oslo Manual and the dimensions of innovation proposed by Schumpeter (1984); Sawhney et al. (2006) created 12 dimensions of innovation that culminated in the innovation radar.

In addition to the four dimensions presented by Schumpeter (1984), namely: supply, processes, supply chain, presence; Sawhney et al. (2006) propose adding eight more dimensions: Platform, Brand, Solutions, Relationship, Value Adding, Organization, Supply Chain and Network – creating a tool called Innovation Radar that lists the dimensions through which a company can look for ways to innovate.

Measurement typologies date back to Schumpeter's (1984) holistic innovation. The figure below illustrates Schumpeter's innovation model and that of other authors and agents. It also presents them as a comparison with the model of Sawhney et al. (2006).

Measurement typologies go back to innovation in a holistic way by Schumpeter (1984). Over time, other methodologies incorporating new variables emerged.

Bachmann and Destefani (2008) added to the 12 dimensions of Sawhney et al. (2006) the concept of an environment conducive to innovation. Table 1 presents the dimensions of innovation proposed by Sawhney et al. (2006) and Bachmann and Destefani (2008).

Table 1. Definition of Innovation Dimensions (Innovation Radar)

Dimension	Definition
Offer	Development of products with innovative features.
Processes	Redesign of processes to allow increased operational efficiency.
Customers	Identify customer needs or new market niches.
Square	Identify new forms of marketing and/or distribution.
Platform	It is related to the adaptability of the production system to the diversity of products demanded.
Brand	Ways in which companies transmit their values to customers.
Solutions	Systems or mechanisms to simplify customer difficulties.
Relationship	It relates to the customer's experience with the company.
Adding value	Improve the way of capturing the value of products perceived by customers and suppliers.
Organization	Improve the company structure.
Supply chain	Improve logistics with suppliers and customers, whether internal or external.
Network	Communication between the links in the supply chain.
Innovative Ambience	It relates to the professionals who make up the company and who collaborate with the culture of innovation.

Source: Adapted from Bachmann and Destefani (2008).

However, as explained by Oliveira et al. (2014), when using the arithmetic mean of dimensions, the Innovation Radar does not consider the heterogeneity of each sector, which creates distortions and difficulties in comparisons. The solution suggested by the authors is to use the Sectoral Innovation Degree (GIS) for an intersectoral analysis applied to Micro and Small Enterprises (MPEs) and propose a model for identifying the potential for innovation dimensions of MPEs coming from different sectors.

For Oliveira et al. (2014) an innovative company should not necessarily have a good score in all dimensions of innovation, but rather, have scores in the dimensions that are most relevant in the company's competitive environment. Therefore, the authors used the model proposed by Oliveira et al. (2011) known as the degree of sectoral innovation (GIS). The result of the work indicates that between 3 and 5 dimensions of innovation are relevant for each sector of activity.

### 3. Method

#### 3.1 Population and Sample

The population of this study is made up of micro and small companies participating in the 2nd edition of the program – Local Innovation Agents (ALI), from Sebrae-PE (Brazilian Support Service for Micro and Small Businesses in the state of Pernambuco) that operate in the clothing segment. From the initial population, around 500 companies served by Local



Innovation Agents in the Central and Northern Agreste Region of Pernambuco were analyzed, whose data were made available by the Sebrae-PE project coordination.

Of the approximately 500 companies initially analyzed, approximately 150 were eligible to be part of the sample for this research. In other words, they had gone through initial consultancy with the Local Innovation Agent and then put into practice at least two groups of proposed actions divided into two stages or moments.

Of this, 108 micro and small companies remained, 60 in the Commerce sector and 48 in the industry sector. The Commerce sector was selected for the study because it has more companies. The innovation radar data used was collected by ALIs through interviews with owners, direct observation, and documentary analysis between 2014 and 2015.

Information on the survival of these companies was collected between 2020 and 2021 using the federal revenue website to check the companies' registration status [https://solucoes.receita.fazenda.gov.br/servicos/cnpjreva/cnpjreva\\_solicitacao.asp](https://solucoes.receita.fazenda.gov.br/servicos/cnpjreva/cnpjreva_solicitacao.asp). Among the companies that remained open, information was validated through research on social networks and telephone contact. Due to the difficulty of accessing companies in the industry sector and also considering the higher number of companies in the commerce sector, the latter was used in the study, which resulted in the analysis of innovation and impact on the survival of 60 companies in the commerce sector.

### *3.2 Procedure for Measuring Incremental and Disruptive Innovative Capacity*

The model presented makes it possible to improve the analysis of the innovation radar according to the 13 dimensions of Bachmann and Destefani (2008). Each dimension is made up of a set of questions, whose average value reflects the company's characteristic in terms of innovation in this specific dimension (Bachmann & Destefani, 2008). Table 2 below presents such questions in a synthetic way. The innovative capacity in each dimension was calculated by the simple arithmetic average of the questions that make up each construct (dimension). This information was collected in 2015.

Table 2. Definition of research themes

<b>Dimension</b>	<b>Themes assessed</b>
Offer	Do companies successfully launch new products? Are you bold?
Processes	Looking to improve processes? Do you have management systems? Certifications? Focus on environmental management?
Customers	Identifies customer needs? Looking for new markets? How do you use needs for new markets?
Square	Create sales channels?
Platform	Are there different versions for the products?
Brand	Does the company have brand protection? Does it leverage the brand?
Solutions	Integrates solutions for customers. Are you looking for complementary solutions for clients?
Relationship	Are you looking for new ways of relating? Do you have

	computerization as a relationship tool? Do you use social networks?
Adding value	Add value using all available resources? Are you looking for a way to optimize value through partnerships with customers and suppliers?
Organization	Do you make adjustments to the company's strategy? Reorganize activities? Looking for organizations to partner with?
Supply chain	How does the supply chain operate?
Network	How is communication with customers? And with suppliers?
Innovative Ambience	Are you looking for external sources of knowledge? Are you looking for a source of financing for innovation?

Source: Adapted from Bachmann and Destefani (2008).

According to the authors, each question offers three answer options, as shown in Table 3 below:

Table 3. Criteria for classifying companies by level of innovation stage

DEGREE	DESCRIPTION
5	Innovative company for the item in question
3	Innovation at an intermediate stage
1	Non-innovative or little innovative company

Source: Adapted from Bachmann & Destefani (2008).

According to Ketokivi and Ali- Yrkk ö (2010), innovation actions have an impact on multiple dimensions of the radar, but differently for each company. These authors signaled that, regardless of the origin of the innovation, whether it be the launch of a new product or a sales strategy, there will be an increase in the other dimensions of innovation. However, the propagation of the impact between dimensions has different effects depending about each company, especially those coming from different sectors.

The overall innovative capacity was measured using GIS - Sectoral Innovation Degree (Oliveira et al., 2014). The GIS proposed by Oliveira et al. (2014), is calculated based on the dimensions of the Innovation Radar (Sawhney et al., 2006) plus the "Innovative Environment" dimension (Bachmann & Destefani, 2008).-

This work proposes the creation of the Incremental Innovation Degree for each company  $i$ , the  $G2I_i$ . and the sector's degree of incremental innovation,  $G2IS$ . To be calculated as below:

$$G2IS = \text{Max} \frac{\sum_{i=1}^n \sum_{k=1}^{13} p_k D_{ik}}{n} \quad (1)$$

$$\text{subject to: } \sum_{k=1}^{13} p_k = 1$$

in which  $D_{ik}$  is the value of the innovation dimension  $k$  for company  $i$ , and  $n$  is the number of companies in the sector. The weight of the dimensions of innovation  $p_k$  is obtained through optimization model 1. Equation 2 shows the achievement of the degree of incremental innovation for each company  $i$ .

$$G2I_i = \sum_{k=1}^{13} p_k D_{ik} \quad \text{For all } i = 1, \dots, n \quad (2)$$

G2I allows us to infer the dimensions of disruptive and incremental innovation. Dimensions with weights other than zero are incremental and common to the business environment of the participating companies, while dimensions with weights equal to zero constitute radical innovation and little used among companies in the segment and location.

Once the *scores are defined* of each dimension, the G2I was calculated, segregating the dimensions between incremental and innovative, the impact of these dimensions on the companies' survival capacity was structured and verified.

### 3.3 Procedure for Inferring the Impact of Incremental and Disruptive Innovation on Company Survival

Used the federal revenue website, telephone contact and *on-site visit* companies, it was identified which companies were functionally operational and which were closed (and year of closure). This survey was carried out between the months of May and September 2020. In other words, the survival of companies was observed within a 4-year horizon.

The companies were separated into two categories: survivors, that is, those that were still in operation in September 2020; and those that closed between 2015 and 2020. As this variable is considered dependent and the *scores* of each dimension the independent variable according to the logistic equation below:

$$\text{logit}(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 X_i + \varepsilon_i \quad (3)$$

Due to multicollinearity problems inherent to the dimensions of innovation, it was necessary to implement one equation per dimension of innovation. Issues of heteroscedasticity prevented the aggregation of two or more sectors, making it necessary to work with well-defined clusters (in this case textile retail).

From the equation above it is possible to infer the probability of survival of companies depending on the dimensions of innovation (independent term  $X_i$ ).

## 4. Results and Discussion

The companies in the commerce sector used in this research are predominantly from Caruaru, 70% of the sample is from this Municipality, of these companies only 52% remain open, a

similar percentage when evaluating all companies. Table 1 illustrates the survival of companies.

Table 4. Distribution of companies by city, survival, and year of closure

City	Total	Open	Closed (year of closure)					
			2015	2016	2017	2018	2019	2020
Caruaru	42	22	1	2	7	4	4	2
Gravat á	6	4	0	0	0	1	1	0
Santa Cruz do Capibaribe	8	4	0	0	0	2	2	0
Surubim	1	0	1	0	0	0	0	0
Toritama	3	1	0	0	0	1	1	0
<b>Total</b>	<b>60</b>	<b>31</b>	<b>2</b>	<b>2</b>	<b>7</b>	<b>8</b>	<b>8</b>	<b>2</b>

Source: research based on social networks (Instagram and Facebook ) and telephone contact and research data and federal revenue website: ([http://servicos.receita.fazenda.gov.br/Servicos/cnpjreva/cnpjreva\\_solicitacao.asp](http://servicos.receita.fazenda.gov.br/Servicos/cnpjreva/cnpjreva_solicitacao.asp) ) Access between 08/10/2023 and 23/12/2023.

Approximately 75% of the companies that closed ended their activities between 2017 and 2019, with 2017 being the year in which only companies in Caruaru closed. The year 2019 has only 2 companies closed, but the period is incomplete as this year's data is related to the period from January to September.

It is noteworthy that the period of 2015 and 2016 is marked by the monitoring of companies by the local innovation agents' program, but also by economic recession. Apparently, the recession hits the Pernambuco textile sector (retail) in 2017.

The following table and graph (Figure 1) show a general overview of these companies in terms of innovation and propensity to innovate in the dimensions of innovation researched.

Dimensions	Scores
Offer	3.05
Customers	3.78
Brand	3.65
Network	2.87
Square	2.22
Platform	2.05
Solutions	1.52
Relationship	1.88
Adding value	1.83
Organization	2.30
Supply chain	2.50
Processes	1.17
Innovative Ambience	2.01



Figure 1. Innovation radar

Source: Own preparation based on the ALI project (2024).

The offer, customers, brand, and network dimensions have an average of more than 2.50 (on a scale of 1 to 5). Having the customer dimension and marks the focus of textile retail companies in the region. On the other hand, processes and solutions were little explored by companies until 2015 (data collection period). Note that an average of 3.78 means approximately 70% of the *score* maximum to be reached and a saturation of actions in this direction.

The application of  $G\ 2I_i$  (degree of incremental innovation) allows us to visualize the potential of the segment and companies. The table below shows the weight of the incremental innovation dimensions, the number of companies for each  $G\ 2I$  score and the average innovation dimensions of such companies (categorized by score).

Table 5. Degree of innovation by company category and weight

Company categories			Indexes												
GIS	Number of Companies	Number of Survivors	Offer	Processes	Customers	Square	Platform	Brand	Solutions	Relation ship	Adding Value	Organi- zation	Supply Chain	Network	Innovation Ambience
0.6	5	4	2.0	1.0	2.6	1.7	1.2	2.0	1.4	1.6	1.4	2.6	1.8	1.4	1.7
0.7	2	1	3.0	1.0	4.0	2.3	4.0	1.0	1.0	2.0	1.7	3.0	3.0	1.0	1.3
0.8	8	5	2.3	1.0	3.8	2.1	2.3	2.6	1.4	1.9	1.9	2.5	2.0	2.0	2.2
0.9	9	6	1.4	1.0	4.0	2.4	2.0	4.1	1.6	2.0	2.0	1.2	2.1	2.8	2.6
1.0	10	3	3.4	1.0	3.3	2.2	1.7	3.6	1.7	2.1	1.5	2.4	2.4	2.8	1.9
1.1	6	3	3.7	1.7	3.5	2.2	2.5	4.3	1.5	1.7	1.0	3.0	2.7	3.3	1.7
1.2	19	9	4.0	1.2	4.3	2.3	1.9	4.3	1.5	1.8	2.2	2.3	3.0	3.7	2.0
1.3	1	0	4.0	3.0	5.0	3.0	4.0	5.0	3.0	2.0	2.3	3.0	3.0	3.0	1.3
Average weight per dimension			0.33	0.00	0.26	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.13	0.00

Source: Own preparation (2024).

According to table 2, companies with a higher or lower  $G2I$  do not indicate a greater chance of survival, although there is a slight advantage for those with a  $G2I$  lower than 1.0. The highlighted dimensions: offer, customer, brand and network are identified by the proposed method as incremental dimensions, while the others are listed as dimensions with radical innovation. Figure 2 illustrates these dimensions in the radar format.

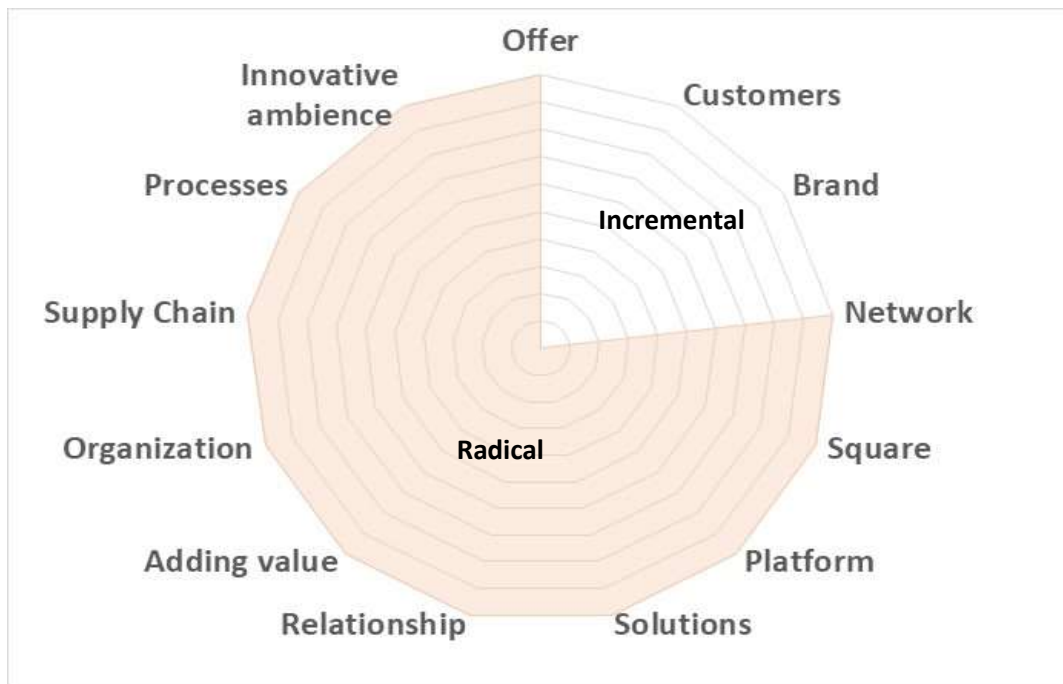


Figure 2. Incremental and radical dimensions

Source: Authors (2024).

Incremental dimensions tend to add marginal value to companies, except when such companies are deficient in such dimensions. The radical dimensions have significant aggregative potential, but also imply risk since the environment may not perceive the added difference to the customer.

In this aspect, the table below presents the application of the logit model (logistic regression) considering the profile of surviving and non-surviving companies in relation to the dimensions of incremental and radical innovation. Of the initial 60 companies, only 31 survived. In 2020, 2 companies were closed (in the Municipality of Caruaru) representing 6% of the previously surviving companies in activity, however the economic effects of the Covid-19 crisis apparently were not fully incorporated into textile retail companies in Caruaru and the region.

Table 3 illustrates the relationship between company survival and each dimension of innovation. Three situations were presented: low innovation (*score* close to 2), medium innovation (*score* of 3.5) and high innovation (*score* 5).

Table 6. Survival of companies and dimensions of innovation

	Propensity to innovate in	Increased chance of survival		
		Low innovation	Average innovation	High innovation
Incremental Innovations	Offer	1%	2%	2%
	Customers	0%	1%	1%
	Brand	2%	2%	3%
	Network	2%	3%	3%
Radical Innovations	Square	1%	23%	38%
	Platform	1%	15%	26%
	Solutions	12%	34%	42%
	Relationship	3%	18%	30%
	Adding Value	4%	20%	32%
	Organization	4%	4%	5%
	Supply Chain	0%	9%	17%
	Processes	14%	31%	39%
	Innovative ambience	1%	6%	10%

Source: Authors (2024).

Incremental dimensions increased by a maximum of 3% in the network dimension when innovation is high, that is, a great effort is required from the company, such as implementing an information collection system and creating partnerships with partners, with customers. However, the implementation of such action by companies resulted in a small increase in the chances of survival. The same thing happened with creating and registering a brand, launching new products, etc. Such actions may be common among textile retailers in the region and are not perceived as a differentiator by customers.

On the other hand, the radical dimensions, except innovative ambience and organization, increased the chance of survival. Just a simple action in the solution dimension, such as using existing resources and structure to create a solution (product or service), already surpasses all actions developed in the incremental dimensions.

If the company creates solutions for the customer on a constant basis, whether with the existing structure or seeking complementarity for the structure and manages to incorporate an increase in revenue with such activity, the chances of survival increase by 42%. This increase is obtained not only by the advancement of the solution dimension, but also by the irradiation of the action on the other dimensions, the joint result generating this gain in the chance of survival.

Systematically seek efficiency, quality, flexibility and speed in the purchasing, stock and sales processes; obtain certifications; Management systems suited to the business increase the chances of survival by up to 39% compared to companies that are not careful with these aspects.

The positive and purposeful response of companies to the crisis by seeking new markets had a reward increasing the chance of survival by 38% compared to companies that remained static in the square dimension. Innovative companies in this dimension are constantly

searching for new sales points and new markets.

Only one dimension of innovation classified as radical had a small impact on the chance of survival, the organization. Even so, low organizational innovation exceeds the results of innovations, even high ones for incremental dimensions.

Lennerts et al. (2020) present applications of radical and incremental innovation defined in Chandy and Tellis (1998) as having technological changes linked to innovation. For these authors, radical innovation is related to the development of new products or processes for new customers, while incremental innovation is related to changing products or processes in an adaptive way, that is, based on something existing, an adaptation is made with small technological changes.

The concepts of Lennerts et al. (2020) of radical and incremental innovation refer to radical and incremental technological innovation.

Such concepts are aligned with the concept of Sheng and Chien (2016) who define radical innovation as the acquisition of new technologies or knowledge, or the concept of incremental innovation as a new use of technologies or knowledge already existing in the company.

However, as explained by Oliveira et al. (2014), when using the arithmetic mean of dimensions, the Innovation Radar does not consider the heterogeneity of each sector, which creates distortions and difficulties in comparisons. The solution suggested by the authors is to use the Sectoral Innovation Degree (GIS) for an intersectoral analysis applied to Micro and Small Enterprises (MSEs) and propose a model for identifying the potential of innovation dimensions of MPEs coming from different sectors.

For Oliveira et al. (2014) an innovative company should not necessarily have a good score in all dimensions of innovation, but rather, have scores in the dimensions that are most relevant in the company's competitive environment. Therefore, the authors used the model proposed by Oliveira et al. (2011) known as the degree of sectoral innovation (GIS). The result of the work indicates that between 3 and 5 dimensions of innovation are relevant for each sector of activity.

### *5. Conclusions*

The main objective of the work was to verify whether incremental innovation actions and radical innovation actions motivated by public policy to support innovation impact the chance of survival of micro and small Brazilian companies. To achieve this objective, it was necessary to structure a model to segregate incremental innovation actions from disruptive innovation actions. Then, the adoption of logistic regression made it possible to estimate the chances of survival depending on the innovation action adopted by the company.

Among the innovation dimensions, four were classified by the method as incremental innovations; that is, innovations with lower risk, but also lower potential return. The remaining nine dimensions were classified as incremental innovations, high risk, but with potential for significant return.



The results demonstrate that investment in incremental actions brought few effects to companies from the point of view of their survival during the turbulent environment caused by the recent Brazilian crises. On the other hand, radical actions, even despite the risk aspect associated with such actions, contribute significantly to the company's survival.

However, it is essential to assess whether incremental innovation alone was sufficient to explain such results, or whether elements adjacent to radical innovation were responsible for survival. Radical innovation tends to be developed in companies that have no longer found space for incremental innovation in the organizational environment; Thus, entrepreneurs with greater technical and management knowledge find it easier to radically innovate, but they also find it easier to manage the company in a period of crisis. Radical innovation generally requires greater investment of resources, so financially well-structured companies innovate, but also have greater stamina to survive crises. Such elements can be better investigated in future work with a view to better understanding the elements that give companies competitiveness.

However, regardless of radical innovation being the cause, being an important adjacent element in the construction of competitive advantage, the work in question demonstrates that the effort for radical innovation added value to the companies that are the focus of the study.

In this context, the model proposed in this work has the potential to guide investment in innovation by entrepreneurs and assist public managers in the construction of policies for the dissemination of efficient innovative practices in small companies, in addition to being the starting point for future work in area.

The main limitation to the work was using data from companies located in only one market. Therefore, a suggestion for further work is to incorporate more markets to evaluate asymmetries and similarity and it is suggested to formalize a model for capturing radical innovation in the format of an index.

## References

- Avelar, S., Borges, T., Almeida, A., & Tiago, F (2024). Confluence of sustainable entrepreneurship, innovation, and digitalization in SMEs. *Journal of Business Research*, 170, Artigo e114346. <https://doi.org/10.1016/j.jbusres.2023.114346>
- Bachmann, D. L., & Destefani, J. H. (2008). 28 de novembro). Metodologia para estimar o grau das inovações nas MPE. <https://docplayer.com.br/103668-Metodologia-para-estimar-o-grau-de-inovacao-nas-mpe-cultura-do-emprededorismo-e-inovacao.html>
- Balderston, J. (1984). *Modern management techniques in engineers and P&D*. Van Nostrand Reinhold.
- Ballot, G., Fakhfakh, F., Galia, F., & Salter, A. (2015). The fateful triangle: complementarities in performance between product, process and organizational innovation in France and the UK, *Research Policy*, 44(1), 217–232. <https://doi.org/10.1016/j.respol.2014.07.003>

Centro de Pesquisa em Ciência, Tecnologia e Sociedade. (2021). *Análise da Nova Estratégia Nacional de Inovação* [Nota Técnica]. Instituto de Pesquisa Econômica Aplicada. <https://www.ipea.gov.br/cts/pt/central-de-conteudo/artigos/artigos/278-analise-da-nova-estrategia-nacional-de-inovacao>

Chandy, R. K., & Tellis, G. J. (1998). Organizing for radical product innovation: The overlooked role of willingness to cannibalize. *Journal of Marketing Research*, 35(4), 474-487. <https://doi.org/10.2307/3152166>

Demircioglu, M. A., & Audretsch, D. B. (2017). Conditions for innovation in public sector organizations. *Research Policy*, 46(9), 1681–1691. <https://doi.org/10.1016/j.respol.2017.08.004>

Demircioglu, M. A., Audretsch, D. B., & Slaper, T. F. (2019). Sources of innovation and innovation type: firm-level evidence from the United States. *Industrial and Corporate Change*, 28(6), 1365-1379. <https://doi.org/10.1093/icc/dtz010>

Den Hertog, P., Van Der Aa, W., & De Jong, M., W. (2010). Capabilities for managing service innovation: towards a conceptual framework. *Journal of Service Management*, 21(4), 490-514. <https://doi.org/10.1108/09564231011066123>

Dewar, R. D., & Dutton, J. E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, 32(11), 1422-1433. <https://www.jstor.org/stable/2631501>

Dewett, T., Whittier, N. C., & Williams, S. D. (2007). Internal diffusion: The conceptualizing of innovation implementation. *Competitive Review: An International Business Journal*, 17(1/2), 8-25. <https://doi.org/10.1108/10595420710816579>

Dunlap, D., Parente, R., Geleilate, J. M., & Marion, T. J. (2016). Organizing for Innovation Ambidexterity in Emerging Markets. *Journal of Leadership & Organizational Studies*, 23(2), 175–190. <https://doi.org/10.1177/1548051816636621>

Esma, B., & Amine, M. M. (2024). L'impact du management des connaissances sur l'innovation organisationnelle: cas institutions bancaires de Skikda. *Journal of Contemporary Business and Economic Studies*, 7(1), 229-244. <https://www.asjp.cerist.dz/en/article/238448>

Ettlie, J. E., & Rosenthal, S., R. (2011). Service vs manufacturing innovation. *Journal of Product Innovation Management*, 28(2), 285-299. <https://doi.org/10.1111/j.1540-5885.2011.00797.x>

Ettlie, J. E., Bridges, W. P., & O'Keefe, R. D. (1984). Organization strategy and structural differences for radical versus incremental innovation. *Management Science*, 30, 682-695. <https://doi.org/10.1287/MNSC.30.6.682>

Garcia, J. G. (2008). *Um estudo sobre as formas de inovação e os critérios de avaliação dos prêmios de inovação* [Dissertação de mestrado, Universidade de Caxias do Sul, Brasil]. Repositório <https://repositorio.ucs.br/handle/11338/323>

- Guan, J., & Ma, N. (2003). Innovative capability and export performance of Chinese firms. *Technovation*, 23(9), 737-747. [https://doi.org/10.1016/S0166-4972\(02\)00013-5](https://doi.org/10.1016/S0166-4972(02)00013-5)
- Johnson, H. (2020). The Moderating Effects of Dynamic Capabilities on Radical Innovation and Incremental Innovation Teams in the Global Pharmaceutical Biotechnology Industry. *Journal of Innovation Management*, 8(1), 51-83. [http://dx.doi.org/10.24840/2183-0606\\_008.001\\_0006](http://dx.doi.org/10.24840/2183-0606_008.001_0006)
- Laforet, S., & Tann, J. (2006). Innovative characteristics of small manufacturing firms. *Journal of Small Business and Enterprise Development*, 13(3), 363-380. <https://doi.org/10.1108/14626000610680253>
- Lawson, B., & Samson, D. A. (2001). Developing innovation capability in organizations: a dynamic capabilities approach. *International Journal of Innovation Management*, 5(3), 377-400. <http://dx.doi.org/10.1142/S1363919601000427>
- Lennerts, S., Schulze, A., & Tomczak, T. (2020). The asymmetric effects of exploitation and exploration on radical and incremental innovation performance: An uneven affair. *European Management Journal*, 38(1), 121-134. <https://doi.org/10.1016/j.emj.2019.06.002>
- Machado, R. E., & Fracasso, E. M. (2012, 18 a 20 de novembro). A influência dos fatores internos na capacidade absorptiva e na inovação: proposta de um framework. [apresentação de artigo] XXVII Simpósio de gestão da inovação tecnológica da ANPAD 2012, Salvador, Bahia, Brasil. [https://arquivo.anpad.org.br/eventos.php?cod\\_evento=&cod\\_evento\\_edicao=64&cod\\_edicao\\_subsecao=865&cod\\_edicao\\_trabalho=15225](https://arquivo.anpad.org.br/eventos.php?cod_evento=&cod_evento_edicao=64&cod_edicao_subsecao=865&cod_edicao_trabalho=15225)
- Martins, R. C. A. (2020). *O impacto do apoio financeiro público à inovação no desempenho das empresas portuguesas antes e depois da crise de 2011* (Publicação n° 29112743) [Dissertação de Mestrado, Faculdade de Economia. Universidade do Porto. Portugal]. ProQuest Dissertations.
- Musetti, T. F., Nagano, M. S., & Filho, A. G., A. (2024). Analysis of strategic behavior in micro and small technology-based firms in brazil. *Journal of International Entrepreneurship*. <https://doi.org/10.1007/s10843-023-00347-0>
- Oliveira, M. R. G., Cavalcanti, A. M., Brito Filho, J. P., Torres, D. B., & Matos, S. M. (2011, 4 a 7 de outubro). Grau de Inovação Setorial: Uma abordagem a partir do Radar de Inovação. [apresentação de artigo] XXXI Encontro Nacional de Engenharia de Produção, 2011, Belo Horizonte, Minas Gerais, Brasil. <https://www.abepro.org.br/publicacoes/index.asp?pesq=ok&ano=2011&area=&pchave=&autor=Oliveira&categ=>
- Oliveira, M. R. G., Cavalcanti, A. M., Paiva, F. G. Júnior, & Marques, D. B. (2014). Mensurando a inovação por meio do grau de inovação setorial e do carácterístico setorial de inovação. *Revista de Administração e Inovação*, 11(1), 114-137. <https://doi.org/10.5773/rai.v11i1.1120>

Organisation for Economic Cooperation and Development and Statistical Office of the European Union (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation* (4th Edition, OECD Publishing, Paris/Eurostat, Luxembourg). <https://doi.org/10.1787/9789264304604-en>

Panayides, P. (2006). Enhancing innovation capability through relationship management and implications for performance. *European Journal of Innovation Management*, 9(4), 466-483. <https://doi.org/10.1108/14601060610707876>

Raghuvanshi, J., Ghosh, P. K., Agrawal, R., & Gupta, H. (2017). Hierarchical structure for enhancing the innovation in the MSME sector of India. *International Journal of Business Excellence*, 13(2), 181-199. <http://dx.doi.org/10.1504/IJBEX.2017.086327>

Rajapathirana, R., P. J., & Hui, Y. (2018). Relationship between innovation capability, innovation type, and firm performance. *Journal of Innovation & Knowledge*, 3(1), 44-55. <https://doi.org/10.1016/j.jik.2017.06.002>

Roman, D. D. (1968). *Research and development management: the economic and administration of technology*. Appleton-Century Crofts.

Saab, T. B., & Antonello, I. T. (2023). O sistema nacional de inovação brasileiro e os parques tecnológicos na região sul do país e no Brasil. *Caderno Prudentino de Geografia, Presidente Prudente*, 45(1), 39-60. Recuperado de <https://revista.fct.unesp.br/index.php/cpg/article/view/9386>.

Saboia, A. C. S. O., Tavares, J. M., & Perinotto, A. R. C. (2022). Inovação em serviços no setor turístico: um estudo de caso nas barracas da praia do futuro (fortaleza-cearã-brasil). *Revista anais brasileiros de estudos turísticos / ABET*, 12, 1 – 12. <http://dx.doi.org/10.5281/zenodo.6415099>

Santos, R. T. S. (2020). A inovação como vantagem competitiva das empresas. *Revista Gestão Empresarial – RGE*, 6(1). <https://periodicos.ufms.br/index.php/disclo/article/view/10887>

Sawhney, M., Wolcott, R. C., & Arroniz, I. (2006). The 12 different ways for companies to innovate. *MIT Sloan Management Review*, 47(3), 75-81. <http://mitsmr.com/1qY1iJg>

Schumpeter, J., A. (1988). *A teoria do desenvolvimento econômico*. Nova Cultural.

Sheng, M. L., & Chien, I. (2016). Rethinking organizational learning orientation on radical and incremental innovation in high-tech firms. *Journal of Business Research*, 69(6), 2302–2308. <https://doi.org/10.1016/j.jbusres.2015.12.046>

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350. <https://doi.org/10.1002/smj.640>

Torugsa, N., & Arundel, A. (2016). Complexity of innovation in the public sector: a workgroup-level analysis of related factors and outcomes. *Public Management Review*, 18(3),

392–416. <https://doi.org/10.1080/14719037.2014.984626>

Valladares, P. S. D. A., Vasconcellos, M. A., & Di Serio, L. C. (2014). Capacidade de Inovação: Revisão Sistemática da Literatura. *RAC - Revista de Administração Contemporânea*, 18(5), 598-626. <https://doi.org/10.1590/1982-7849rac20141210>

Villers, R. (1964). *Research and development: planning and control*. Raustentrauch & Villers.

Zawislak, P., Alves, C., A., Tello-Gamarra, J., Barbieux, D., & Reichert, F. (2012). Innovation capability: From technology development to transaction capability. *Journal of Technology Management & Innovation*, 7(2), 14-27. <https://dx.doi.org/10.4067/S0718-27242012000200002>

### Copyright Disclaimer

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).