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How to measure organizational resilience? Validating a simplified model

Como mensurar a resiliência organizacional? Validando um modelo simplificado

Alã Y. P. Santos and Renata G. Spers

University of São Paulo (USP), São Paulo, SP, Brazil

Authors' notes

Alã Y. P. Santos is now an alumnus from the Faculty of Economics, Administration, Accounting and Actuarial Science of University of São Paulo (Universidade de São Paulo – USP); Renata G. Spers is now general director of the Future Studies Program (Profuturo) and professor at the Faculty of Economics, Administration, Accounting and Actuarial Science of USP.

Correspondence concerning this article should be addressed to Alã Y. P. Santos, Av. das Nações Unidas, 14401, 16º andar – Torre Jequitibá, Condomínio Parque da Cidade, São Paulo, São Paulo, Brazil, ZIP code 04794-000. Email: ala.ywirgo@gmail.com

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Abstract

Purpose: This study sought to analyze the elements that compose the resilience of organizations when facing a disruptive event, using as context the crisis caused by Covid-19.

Originality/value: The study of organizational resilience helps us to theorize, more accurately, organizational adjustment and adaptation in increasingly complex and difficult-to-understand environments. However, although their research has shown promise, its concept still needs more independent attention and empirical validation. In this sense, this paper contributes to a holistic view with a consistent definition of the term through a quantitatively validated model since most of the empirical studies found in the literature are qualitative in nature.

Design/methodology/approach: A survey was applied to test a model for measuring organizational resilience, through an exploratory factor analysis, in addition to the use of simple descriptive statistics. Data collection occurred between November 9 and December 23, 2021, through an electronic form with 41 respondents (companies).

Findings: The tested model showed a high level of reliability (McDonald's ω of 0.955) and can be applied within organizations to measure their resilience. The tested model comprises 12 items: unity of purpose; stress testing plans; strategic planning; proactive posture; breaking silos; leveraged knowledge; internal resources; effective partnerships; innovation and creativity; decision-making; staff engagement; and leadership.

Keywords: organizational resilience, crisis, measurement, *survey*, exploratory factor analysis

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Resumo

Objetivo: Este estudo buscou analisar os elementos que compõem a resiliência das organizações diante de um evento disruptivo, utilizando como contexto a crise provocada pela Covid-19.

Originalidade/valor: O estudo da resiliência organizacional nos ajuda a teorizar com mais precisão o ajuste e a adaptação organizacional em ambientes cada vez mais complexos e difíceis de ser compreendidos. Entretanto, embora a sua investigação tenha demonstrado ser algo promissor, o seu conceito ainda necessita de maior atenção independente e validação empírica. Nesse sentido, este trabalho contribui para que haja uma visão holística com uma definição consistente do termo, por meio de um modelo validado quantitativamente, pois a maioria dos estudos empíricos encontrados na literatura é de natureza qualitativa.

Design/metodologia/abordagem: Foi aplicada uma *survey* a fim de testar um modelo para a mensuração da resiliência organizacional, por meio de uma análise fatorial exploratória, além da utilização de uma estatística descritiva simples. A coleta dos dados ocorreu entre os dias 9 de novembro e 23 de dezembro de 2021, por meio de um formulário eletrônico, que contou com 41 respondentes (empresas).

Resultados: O modelo testado apresentou um alto nível de confiabilidade (ω de McDonald de 0,955), podendo ser aplicado no âmbito das organizações para medir sua resiliência. O modelo testado é composto por 12 itens: unidade de propósito; planos de teste de estresse; planejamento estratégico; postura proativa; quebra de silos; conhecimento aproveitado; recursos internos; parcerias eficazes; inovação e criatividade; tomada de decisão; engajamento da equipe; e liderança.

Palavras-chave: resiliência organizacional, crise, mensuração, *survey*, análise fatorial exploratória

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INTRODUCTION

We live in a dynamic, complex, uncertain, and often turbulent environment. In the realm of organizations, it is no different. Constantly, unexpected events such as natural disasters, pandemic diseases, terrorist attacks, economic crises, and industrial accidents surprise organizations and threaten the continuity of their operations (Bhamra et al., 2011; Linnenluecke, 2017). Only flexible, agile, and dynamic organizations will succeed during these situations. In many cases, it is necessary to go beyond survival and thrive amidst hostile environments (Lengnick-Hall et al., 2011).

In this context, the study of resilience emerges as a way of understanding the effectiveness and prosperity of organizations under adverse conditions, helping us to theorize, more accurately, organizational adjustment and adaptation in increasingly complex and difficult-to-understand environments (Sutcliffe & Vogus, 2003).

Organizational resilience is the company's ability to absorb, develop situation-specific responses, and ultimately engage in transformative activities to capitalize on disruptive surprises that threaten the organization's survival. Thus, despite having similar characteristics to other organizational attributes (such as flexibility, agility, and adaptability), organizational resilience differs by being tied to a specific and unexpected event (Lengnick-Hall et al., 2011).

Although the study of organizational resilience has shown promise, its concept still needs more independent attention for a consistent definition. In addition, there is little empirical measurement and validation of the idea, given that most studies are qualitative in nature (Sutcliffe & Vogus, 2003; Somers, 2009; Linnenluecke, 2017; Hillmann & Guenther, 2020; Hillmann, 2020).

Historically, studies on organizational resilience tend to develop after disturbances: such as accidents, crises, disruptions, or large-scale disasters (Linnenluecke, 2017; Hillmann & Guenther, 2020). Following this logic, by presenting unprecedented and high-impact business problems, the widespread crisis caused by Covid-19 provides us with an enabling environment for large-scale investigations into what enables organizations to survive adversity.

The Covid-19 pandemic presented itself as one of the most significant crises in decades, with new challenges and the need for simultaneous improvisational processes at all levels. Consequently, organizations needed to address a series of unprecedented actions to minimize risk and maximize safety (Bailey & Breslin, 2021).

Many organizations proved to be resilient during this period, feeling less of the impact of the pandemic or recovering more quickly than others

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(Rai et al., 2021). Understanding what makes a company resilient in a given situation can be essential to make it more adapted to the environment and better prepared to face future adversities (Sutcliffe & Vogus, 2003), with the phenomenon of change playing a crucial role in its conceptualization (Hillmann & Guenther, 2020).

Understanding the elements of organizational resilience is also essential to community resilience as a whole, given the services these companies provide and the income generated by the jobs they provide (McManus et al., 2008; Lee et al., 2013).

In this sense, this study has the following research question:

- What elements stimulate the resilience of Brazilian organizations when facing a disruptive event?

This article has the following structure to answer this question: after this introduction, a theoretical synthesis of the subject is made, focusing on how it has been treated in organizational studies. After that, the methodology used is presented, detailing the form of data collection and analysis. Subsequently, the results obtained from the research are disclosed and discussed. And finally, the final considerations are presented.

At the end of this paper, it is expected to provide a holistic and integrated view of organizational resilience, supported by a simplified general model based on literature and empirically validated, that can be applied in organizations.

THEORETICAL REFERENCE

The word "resilience" originates from the Latin *resilire* and *resilio* (which means "to jump" or "bounce back") and has a long history, with diverse meanings in art, literature, law, science, and engineering (Alexander, 2013). In scientific production, the term is used in many fields, including: Ecology (Holling, 1973), Psychology (Masten & Reed, 2002), Sociology (Tobin, 1999), Economics (Batabyal, 1998), and Management (Sutcliffe & Vogus, 2003). Although the context varies, in all these areas, the concept is related to the capacity and ability of an element to return to a stable state after an interruption (Bhamra et al., 2011).

In the corporate realm, the origins of the concept of resilience lead us to the seminal articles by Staw et al. (1981) and Meyer (1982), which elaborate variation-selection-retention mechanisms postulated by evolutionary theory,

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but with distinct propositions about how organizations respond to external threats (Linnenluecke, 2017).

Both works contributed to the literature on resilience in organizations by looking at how organizations respond to external threats through organizational processes that can be decisive for the organization's survival. However, there is still much to be discussed, mainly about how organizations can avoid rigidity and be resilient during a threat and how resilience can be successfully built at different levels (Linnenluecke, 2017).

The following are some variations of how the theme has been studied in the organizational sphere, which must be considered when delimiting new investigations.

Different perspectives: resistance or adaptation

We can identify two distinct perspectives regarding understanding the term in organizational studies and other areas. The first one resembles definitions in the physical sciences and passively sees resilience as the ability to recover from adverse, unexpected, and stressful situations and return to its initial state. However, some authors expand this view of resilience to include the development of new capabilities to accompany and even create new opportunities. This second perspective sees organizational resilience as an essential factor that allows the firm to leverage its resources and abilities to resolve current dilemmas, explore opportunities, and build a successful future (Somers, 2009; Lengnick-Hall et al., 2011).

Different levels: individual, group, or organizational

Organizational resilience can also vary in terms of the level of analysis (individual, group, or company). Understanding resilience at the individual level can be a useful starting point for understanding organizational resilience, as the actions and interactions between individuals in the organization underpin the emergence of collective capability (Lengnick-Hall et al., 2011). Although related to the previous level, resilience at the group level does not directly investigate resilience itself. Still, several seemingly divergent subfields, such as team learning, work on collective efficacy and group disaster analysis. On the other hand, those seeking to understand resilience at the company level examine elements such as organizational learning and adaptation, dynamic capabilities, and high-reliability organization (Sutcliffe & Vogus, 2003).

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Different moments: before, during, or after crises

The study of resilience in organizations can also differ regarding the analysis timing: before, during, or after adversity. In general, works on resilience focus on the environment after an unexpected event (Somers, 2009). However, some authors also highlight the importance of the management period before the disturbance, given that adversities can arise from unexpected day-to-day occurrences, which remain unnoticed until they significantly impact organizations' activities (Williams et al., 2017).

Different means of measurement: focus on elements or steps

Several attempts have been made to measure organizational resilience, with a wide range of factors that can improve organizational resilience, which vary according to perspective and context (Sawalha, 2015). In general, the literature presents two ways to measure it: 1. focus on the elements that precede resilience, identifying the variables that compose it (Somers, 2009; Erol et al., 2010; Demmer et al., 2011; Lee et al., 2013); or 2. focus on the process, with phases that companies need to be aware of to achieve resilience (Crichton et al., 2009; Ates & Bititci, 2011; Burnard & Bhamra, 2011).

The tested model: Resilience Benchmark Tool

This work uses as its primary basis the Resilience Benchmark Tool, a model for measuring organizational resilience that is continuously revised and updated by its developers as part of the ongoing research program. Its updated version is available at www.resorgs.org.nz. Currently, it is composed of three interdependent attributes: 1. leadership and culture; 2. networks and relationships; and 3. change ready – divided into 13 indicators.

However, 12 of the 13 variables were used for constructing the tested model, as we consider that "situational awareness" would be one of the characteristics present in the variable "decision-making." Based on McManus (2008), situational awareness is the organization's ability to be continuously aware of itself and the environment in which it operates, thus being a driving factor of "decision-making," an element already present in the model.

This relationship becomes even more evident in Henriqson et al. (2009), which presents a situational awareness model composed of three levels of representation and management of cognitive resources. According to the authors, these levels precede decision-making, influencing the operators' cognitive control mode for a given situation.

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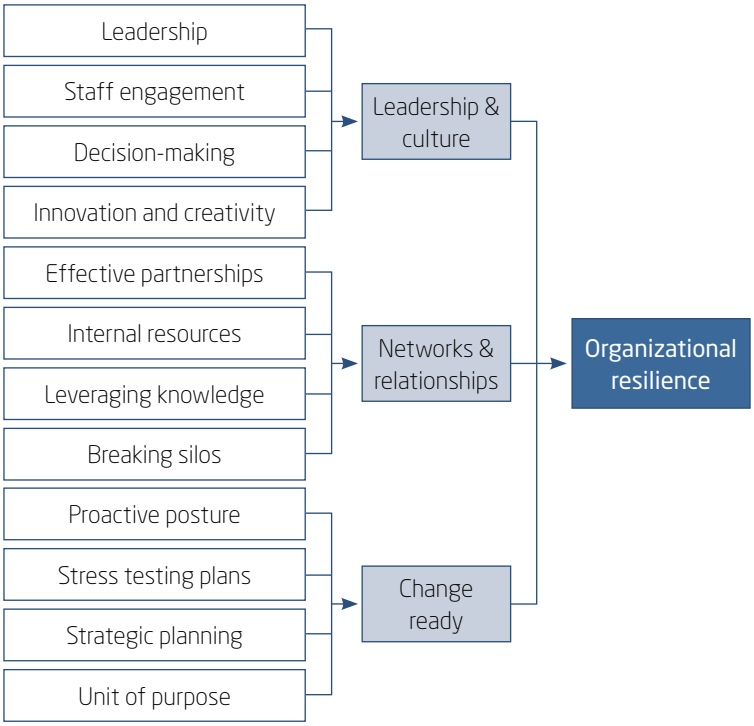
In this sense, the tested model can be seen in Figure 1. Together, these attributes build the effectiveness of organizations, as well as a robust and agile response and recovery from crises. A brief presentation of each of these indicators follows.

Figure 1

Tested organizational resilience model



Source: Adapted from Lee et al. (2013), Resilient Organization (2017), and Martins (2019).

METHODOLOGICAL PROCEDURES

This work is quantitative and descriptive in nature. Quantitative studies suggest a relationship between the studied variables and present it as research questions (Cresswell, 2007). Descriptive research has as its main function the description of the characteristics of a given phenomenon or the establishment of relationships between variables (Gil, 1999).

As mentioned, this research has a question: "What elements stimulate Brazilian organizations' resilience when facing a disruptive event?". In order

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to answer it, a survey was applied, which, according to Fowler Jr. (2014), is a methodology used to statistically estimate the characteristics of a given population.

The survey questionnaire was divided into three moments. The first refers to the respondents' profile, who must be at a managerial level in the organization. The second part brings questions about the organization itself (for example, the field of activity, time of existence, size, and impact suffered by the pandemic). Finally, the organizational resilience variables identified in the literature are addressed, with space for addressing other necessary factors, according to the managers, but which were not cited by the model.

In Table 1, we can see the variables that make up the tested model and its assertions. All assertions were prepared based on the literature on the subject; the starting point of this investigation was a model based on the Resilience Benchmark Tool due to its popularity and ability to measure organizational resilience from different aspects (Sawalha, 2015).

After developing the questionnaire, based on the literature, five test rounds were conducted with professionals with a similar profile to respondents. These validation rounds included the collection of feedback, which led to some adjustments at the end of each round to guarantee the understanding of the form in its entirety.

Data collection occurred between November 9 and December 23, 2021, via internet, through an electronic form prepared on Google Forms, sent to the database of Future Studies Program (Profuturo), which helps companies and public and private institutions to improve their planning processes, through studies, research, and service provision. This process resulted in the return of representatives from the 41 companies analyzed in this study.

As for the analysis, in addition to descriptive statistics – which consists of the collection, analysis, and interpretation of numerical indicators (Reis, 1996) – exploratory factor analysis was also applied, a multivariate statistical technique that is very useful for organizational research, being used to refine measures, assess constructs validity, and, in some cases, test hypotheses (Conway & Huffcutt, 2003).

As computational support, this work relied on the JASP 0.16.2.0 and JAMOVI 2.2.5 software (both free to use) and the office professional plus 2016 package to analyze the collected data.

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Table 1

Summary of tested model variables

1st order variables	2nd order variables	Assertives
Leadership and culture	Leadership	Managers provide good management and decision-making in times of crisis, as well as continuous evaluation of strategies and work programs concerning organizational goals.
	Staff engagement	Employees are empowered and use their skills to solve problems. There is engagement and involvement by staff who understand the link between their work, the organization's resilience, and its long-term success.
	Decision-making	The organization operates with a decision-making process that keeps pace with the internal and external environment changes through leaders who support their teams to have the power and freedom to make decisions within their purview.
	Innovation and creativity	The organization can build innovative and creative solutions to problems, processes, and products; employees are encouraged and rewarded for using their knowledge in innovative ways to solve problems.
Networks and relationships	Effective partnerships	The organization clearly views the relationships and resources it may need from other organizations during a crisis and plans and manages itself to ensure that access.
	Internal resources	The organization mobilizes and manages the physical, human, and procedural resources needed to ensure its ability to operate during regular business and can provide the extra capacity required during a crisis.
	Leveraging knowledge	Organization-critical information is stored in multiple formats and locations, and staff can access expert opinions whenever needed. Roles are shared, and the team is trained so that someone is always available to perform critical functions.
	Breaking silos	The organization is concerned with minimizing social, cultural, and behavioral barriers, usually manifested as communication barriers, creating scrappy, disconnected, and harmful working methods.
Change ready	Proactive posture	The organization proactively identifies and manages vulnerabilities, sees change as something positive, and develops adaptive capacity, as it seeks growth opportunities during adversity situations and does not consider them a problem.
	Strategic planning	The organization develops and evaluates vulnerability management plans and strategies concerning the business environment and its stakeholders.

(continues)

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Table 1 (conclusion)

Summary of tested model variables

1st order variables	2nd order variables	Assertives
Change ready	Stress testing plans	The organization relies on staff participation in simulations or scenarios designed to practice response arrangements and validate plans before they are needed in an actual situation.
	Unit of purpose	The organization is mainly aware of its post-crisis priorities at all organizational levels and knows the minimum requirements for its operation.

Source: Adapted from Lee et al. (2013), Resilient Organization (2017), and Martins (2019).

RESULTS AND DISCUSSION

This section aims to present the results obtained to answer the research question of this work based on the methodology described above. To this end, it was divided into four parts. The first and second of them seek to evaluate the profile of the professionals who answered the online form and the profile of the analyzed companies, respectively. The third part presents the results of the exploratory factor analysis of the organizational resilience model tested. And finally, the results of a descriptive study of each element that composes the proposed model are presented.

Profile of respondents

Regarding the profile of the online form respondents, we can see in Figure 2 that most hold a leadership position (78.1%), with almost half currently holding a management position in the organization (48.8%).

In addition to the positions held, the professionals were also asked about the time they have been working in the sector and the organization (Figure 3), and relevant knowledge about the industry was verified, considering that 68% of the professionals in the sample have been working in the sector for more than four years; and 48.8% of them have more than 11 years of market experience. In addition, about the time working for the company, specifically, it was found that the majority (56.1%) have been working for the company for more than four years, and 24.4% of the respondents have been in the organization for more than 11 years.

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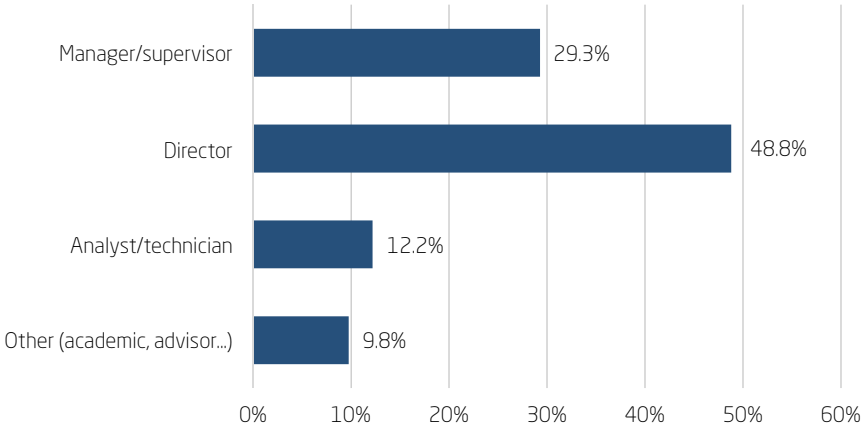
Figure 2

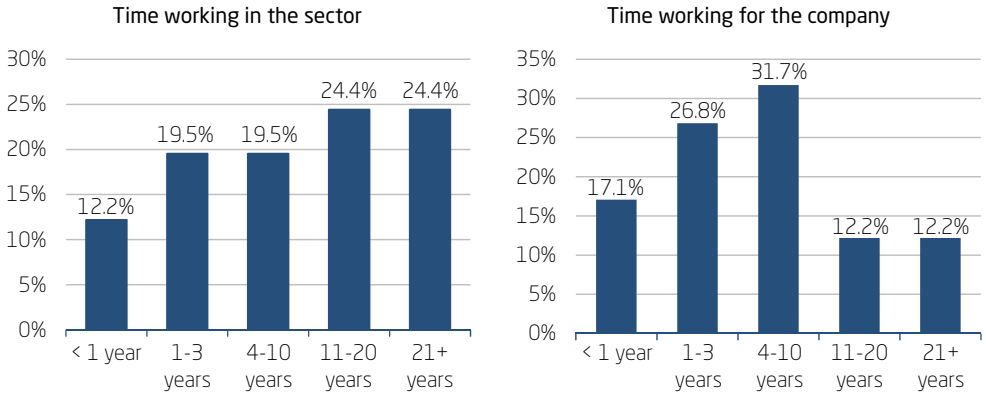
Respondents' professional performance levels



Source: Elaborated by the authors.

Figure 3

Time working in the sector and organization



Source: Elaborated by the authors.

In this way, it was possible to validate the respondents' ability to take part in the research, considering the high degree of visibility they have of the company as a whole, enabled by their level of performance; this capacity is further reinforced by their market knowledge, provided by their considerable time working in the sector and for the organization investigated.

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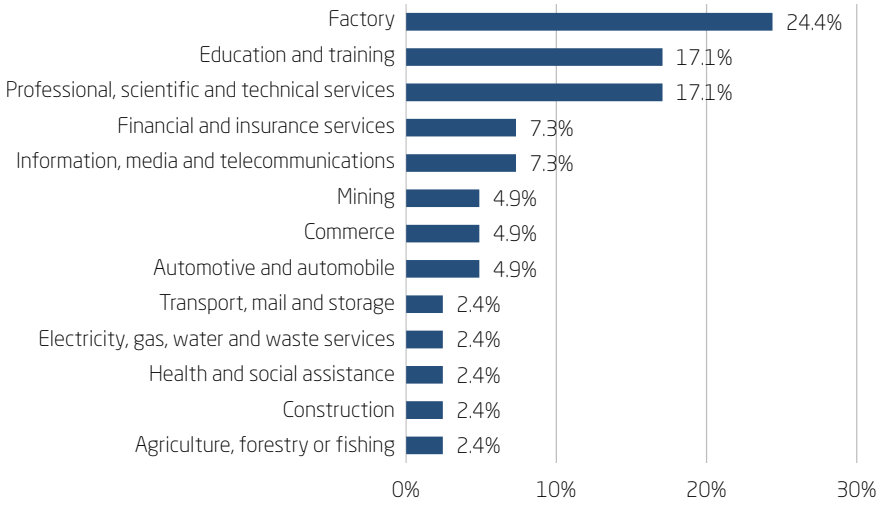
Profile of analyzed companies

As previously explained, this research sought to investigate organizational resilience, analyzing 41 organizations operating in the national territory during the challenging context caused by Covid-19. This section verifies the profile of the organizations present in the sample.

Figure 4 shows that companies from different sectors were selected. The majority of the companies (58.6%) are divided between the sectors of factory (24.4%); education and training (17.1%); and professional, scientific, and technical services (17.1%). However, they are also present in the survey companies in the sectors: financial services and insurance (7.3%); information, media, and telecommunications (7.3%); mining (4.9%); commerce (4.9%); automotive and automobile (4.9%); transport, mail, and storage (2.4%); electricity, gas, water, and waste services (2.4%); health and social assistance (2.4%); construction (2.4%); and agriculture, forestry or fishing (2.4%).

Figure 4

Sectors of activity of the companies present in the sample



Source: Elaborated by the authors.

The profile of companies was also analyzed concerning their size. For this, the number of people working in the company was used as a criterion (Figure 5), where the sample proved to be quite diverse, with 38.8% of the companies having a maximum of 500 employees. On the other hand, 41.5% have more than a thousand employees.

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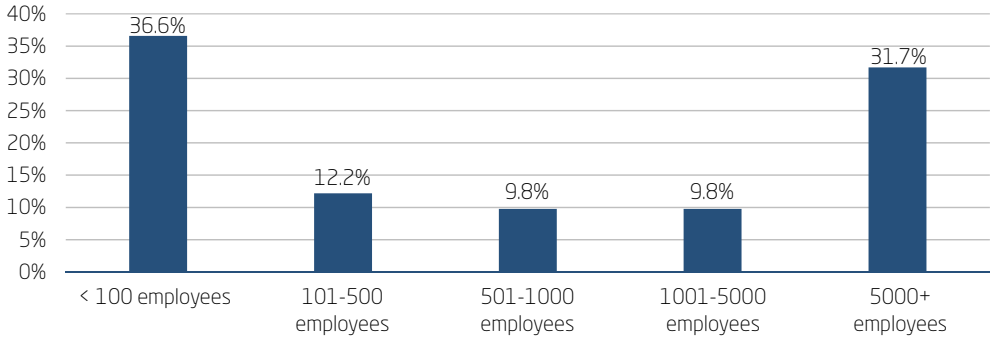
Figure 5

Size of companies according to the number of employees

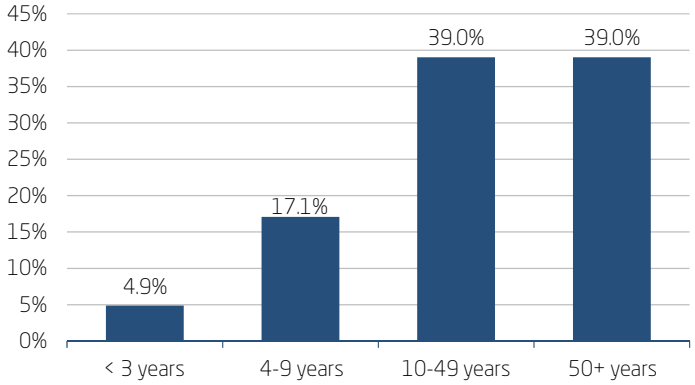


Source: Elaborated by the authors.

Concerning the time that companies have been in business (Figure 6), it was verified that the great majority were created more than ten years ago (78%), a considerable portion was between four and nine years of existence (17.1%), and only 4.9% was less than three years old. Thus, the sample comprises companies consolidated in the market almost entirely.

Figure 6

Time companies have been operating in the market



Source: Elaborated by the authors.

Another characteristic that makes up the profile of the companies analyzed is the experience acquired through previous crises, presented in Figure 7. This topic verified that most companies (60.98%) had already gone through crises before the arrival of Covid-19. Among the other organi-

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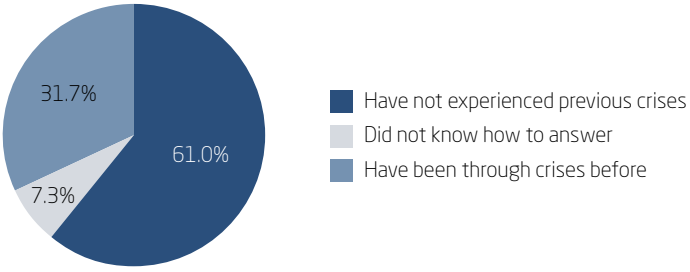
zations, 31.7% answered that they had never experienced a crisis before, and only 7.3% could not answer.

Figure 7

Experience with previous crises of the companies present in the sample



Source: Elaborated by the authors.

The companies that answered that they had already been through previous crises were also asked about the factors that led to these other events that threatened their survival. The reasons were quite diverse, being divided between:

- economic-financial problems;
- tax and legal issues;
- cyber attacks;
- industrial accidents;
- structural or business focus change; and
- change in market demand.

Finally, the impact caused by Covid-19, specifically on these companies, was also ascertained. First, they were asked about the level of impact, understanding that the pandemic did not affect them all to the same degree; for this question, a Likert scale with seven answer options was used, ranging from 1 (no impact) to 7 (very high impact). In a second moment, they were asked about the impact category, understanding that this new environment could be adverse or beneficial for the company; for this question, a Likert scale with seven response options was used, ranging from 1 (totally negative) to 7 (totally positive).

In order to calculate the impact of Covid-19 on organizations, the scale of the question on the category was later transformed into a scale from -3 to 3, continuing with the original seven response levels. In this way, it was possible

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to multiply the level (weight) by the category (value), arriving at an impact scale from -21 to 21, with negative values meaning unfavorable levels, positive values favorable levels, and zero a neutral position.

In Figure 8, it is possible to see the values obtained by each organization present in the sample regarding the crisis caused by Covid-19. We can conclude that the crisis impacted organizations in different ways. Regarding companies that were negatively affected by this new environment (41.46%): 9.76% reported feeling the maximum possible negative impact (-21), while 12.20% felt an adverse effect, but to a slight degree (between -5 and -2). Among the companies that were able to capture positive benefits from this new environment (46.34%): 12.20% reported feeling the most positive impact possible (21), and 19.51% felt a positive effect but to a slight degree (between 5 and 2). The remaining 12.20% felt a neutral impact (0), neither positive nor negative.

In light of the analyses set out in this section, we can conclude that the companies investigated have very diverse profiles, both in terms of their size and field of activity, as well as concerning the experience acquired by previous crises. This allows us to believe that the results obtained through this study represent a broad set of organizations from the investigated population, as guided by Lee et al. (2013).

Furthermore, we can prove that the pandemic that started in 2020 influenced their businesses in different ways, varying in terms of level (high or low) and impact category (positive or negative).

At the same time, the fact that a considerable portion positively sees the pandemic environment reinforces the perspective of the literature that sees organizational resilience as a factor that enables the development of new capabilities and the expansion of its resources, which leads to new opportunities, that is not limited to returning to the state before the disruptive phenomenon, but which evolves during adversity (Lengnick-Hall et al., 2011).

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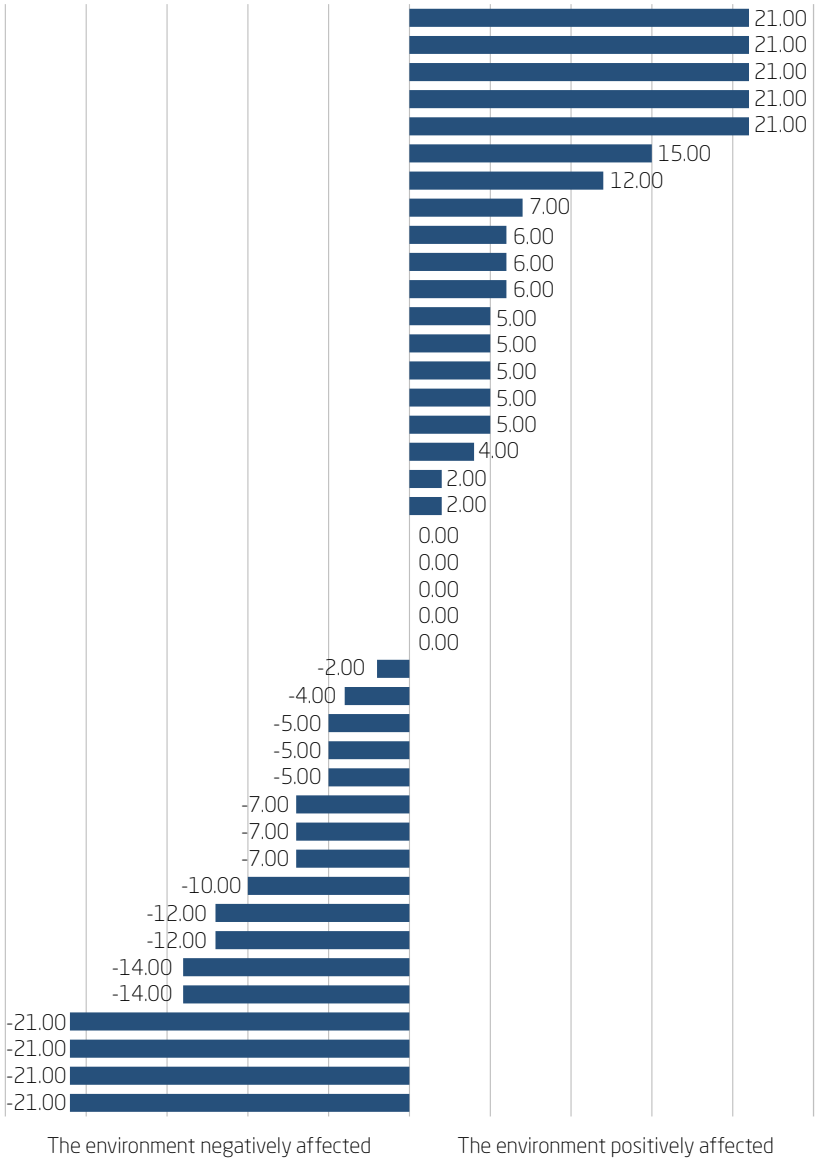
Figure 8

Impact of Covid-19 on each company present in the sample



Source: Elaborated by the authors.

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Exploratory factor analysis: validating the instrument

This section of the work seeks to present the results obtained through exploratory factor analysis to validate the structure of the proposed model for measuring organizational resilience. For this, it was divided into four parts, namely: 1. adequacy to factoring; 2. multivariate normality test; 3. retention and rotation of factors; and 4. reliability of the factorial structure.

Adequacy to factoring

Before carrying out any factorial analysis, it is necessary to verify whether the sample can be factored, for which the two main methods were used: Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) criterion.

The first method applied was Bartlet's Test of Sphericity, which had a p-value less than 0.001, indicating that the matrix is factorable by rejecting the null hypothesis that the data matrix is similar to an identity matrix.

Similar to Bartlet's test, we can see in Table 2 that the KMO criterion also indicated that the sample could be factored, having, in general, a KMO considered excellent (0.858), in which the KMOs of their items were considered good (between 0.7 and 0.8), great (between 0.8 and 0.9) and excellent (above 0.9).

Table 2

Olkin sample adequacy measure

	KMO
Overall	0.858
Leadership	0.948
Staff engagement	0.841
Decision-making	0.925
Innovation and creativity	0.784
Effective partnerships	0.775
Internal resources	0.917
Leveraging knowledge	0.899
Breaking silos	0.935

(continues)

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Table 2 (conclusion)

Olkin sample adequacy measure

	KMO
Proactive posture	0.823
Strategic planning	0.858
Stress testing plans	0.742
Unit of purpose	0.892

Source: Elaborated by the authors.

Multivariate normality test

After confirming that the sample was suitable for factoring, its multivariate normality distribution indices values were checked to choose the most appropriate extraction method.

For this, the Shapiro-Wilk multivariate normality test was used, which presented a p-value lower than 0.001, revealing that the general residuals of the sample do not follow a normal distribution.

Given this result, for the exploratory factor analysis of the sample, it was decided to use the principal axis factoring (PAF) technique, which is the most recommended in the literature for samples with non-normal distribution.

Retention and rotation of factors

The definition of the number of factors to be retained in the model is essential for its correct interpretation. For this to be done in the most straightforward and interpretable way possible, the oblimin method (for oblique rotations) was applied, allowing the factors to be correlated.

The first method applied was the Kaiser-Guttman criterion (Table 3), which revealed that it is a unidimensional (or "one-factor") model since only one factor presented an eigenvalue greater than 1, being responsible for a more significant explained variance (64.1%), which is already considered enough.

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Table 3

Eigenvalue of the first 12 factors

Factor	Eigenvalue
1	7.6933
2	0.4822
3	0.3145
4	0.2311
5	0.0583
6	0.0364
7	-0.0641
8	-0.1222
9	-0.1467
10	-0.2219
11	-0.2450
12	-0.3220

Source: Elaborated by the authors.

In addition to the Kaiser-Guttman criterion, the graph of the eigenvalues was also observed, called the screen plot test or Cattel's test (Figure 9). Through visual analysis, it is possible to verify that after the second factor, the eigenvalues present a linear decreasing trend, supporting the previous result that it is a unifactorial model.

This information was further reinforced by the parallel analysis (PA) method, also present in Figure 9, which proved that, besides only one factor having an eigenvalue greater than 1, it presented a value greater than the respective eigenvalue obtained through the simulated data.

With this, we found that the proposed simplified model is one-dimensional – that is, all items explain the same factor, organizational resilience – differing from the Resilience Benchmark Tool, which is divided into three attributes: leadership and culture, networks and relationships, and change ready; composed of 13 indicators. In other words, the proposed model opposes the reference model by understanding that dividing organizational resilience into other attributes is unnecessary. However, it is important to

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point out that this difference may be due to the sample size tested, although this proved significant.

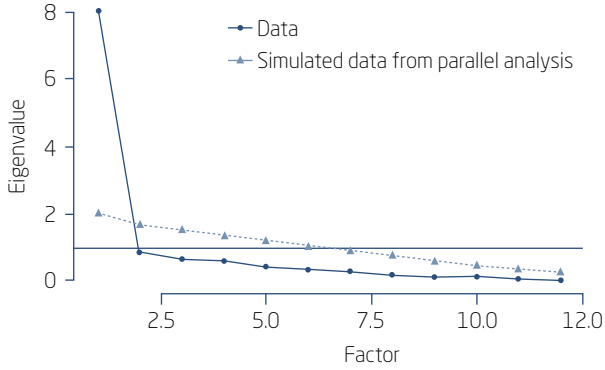
In this way, the proposed model provides a holistic and integrated view of the resilience of organizations, reinforced as a latent variable, which must be understood and conceptualized as a higher-order construct (Hillmann & Guenther, 2020).

Subsequently, the selection of items that should be part of a factor was made based on the magnitude of the factor load. In Table 4, where the factor loading of each item is presented, we can see that all of them showed high factor loadings (above 0.7).

It is also worth highlighting that during data collection, the respondents were also asked, through open questions, about the existence of other elements that contributed to the resilience of their organizations during the pandemic. No other factors were mentioned besides the variables already present in the framework, which further reinforces the breadth of the model.

Figure 9

Screen plot of the sample



Source: Elaborated by the authors.

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Table 4

Factorial load of each item

	Factor	Singularity
	1	
Decision-making	0.904	0.183
Proactive posture	0.866	0.250
Innovation and creativity	0.811	0.343
Staff engagement	0.810	0.344
Effective partnerships	0.802	0.357
Internal resources	0.802	0.357
Leveraging knowledge	0.801	0.358
Breaking silos	0.796	0.367
Unit of purpose	0.792	0.373
Leadership	0.765	0.415
Strategic planning	0.725	0.474
Stress testing plans	0.718	0.485

Source: Elaborated by the authors.

Note. The "principal axis factorization" extraction method was used in combination with an oblimin rotation.

With that, it was not necessary to add or delete any item from the proposed model, which led us to create the diagram of the validated model, present in Figure 10, which is composed of the elements considered necessary for the resilience of Brazilian organizations during the crisis caused by Covid-19.

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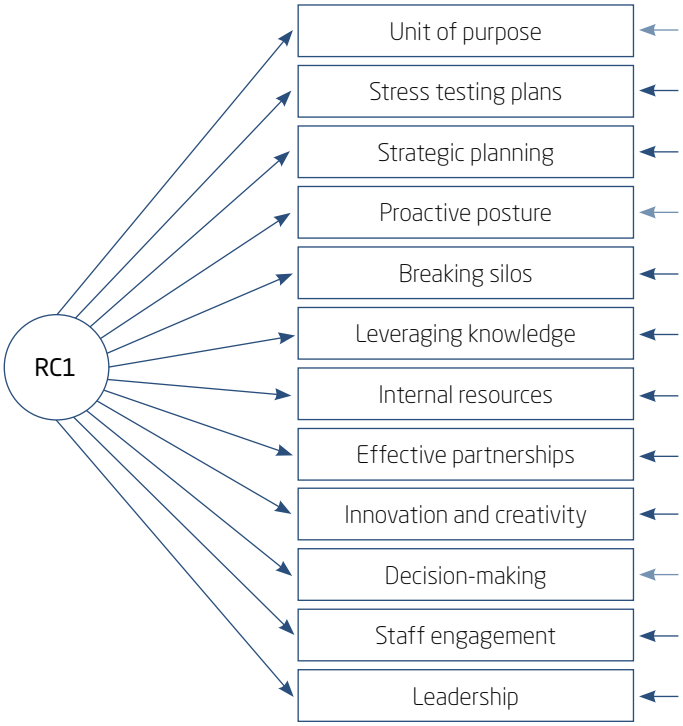
Figure 10

Validated model diagram



Source: Elaborated by the authors.

Reliability of the factorial structure

As the last step of the exploratory factor analysis, the reliability of the factor structure was verified. For this, an index of internal consistency of the model was used, more specifically, the McDonald's ω method, which presented an excellent score (0.955).

Consistent with the analyzes carried out previously, Table 5 presents the results of the item's reliability test, confirming that excluding any of them would significantly improve the model's reliability level.

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Table 5

Item reliability statistics

	If you remove the item McDonald's ω
Leadership	0.960
Staff engagement	0.959
Decision-making	0.956
Innovation and creativity	0.959
Effective partnerships	0.959
Internal resources	0.959
Leveraging knowledge	0.959
Breaking silos	0.959
Proactive posture	0.957
Strategic planning	0.960
Stress testing plans	0.961
Unit of purpose	0.959

Source: Elaborated by the authors.

For organizational resilience to be considered a valuable and valid concept, it is necessary to have a solid understanding of the variables that compose it and how it can be evaluated, maintained, and improved over time (Linnenluecke, 2017).

According to Vakilzadeh and Haase (2020), empirical research on resilience focuses on a single level of analysis, as researchers tend to relate the term to their academic interests, especially as it is comprehensive. However, it is necessary to understand the interdependent nature of the different organizational resilience elements and the interaction of factors related to leadership, employees, and the entire organization.

Therefore, the efforts directed at this work meet these assumptions by presenting a model tested in the national territory during a disruptive event on a global scale, with a high degree of reliability, besides having been evidenced, quantitatively, that the items measure the same latent trait, organizational resilience.

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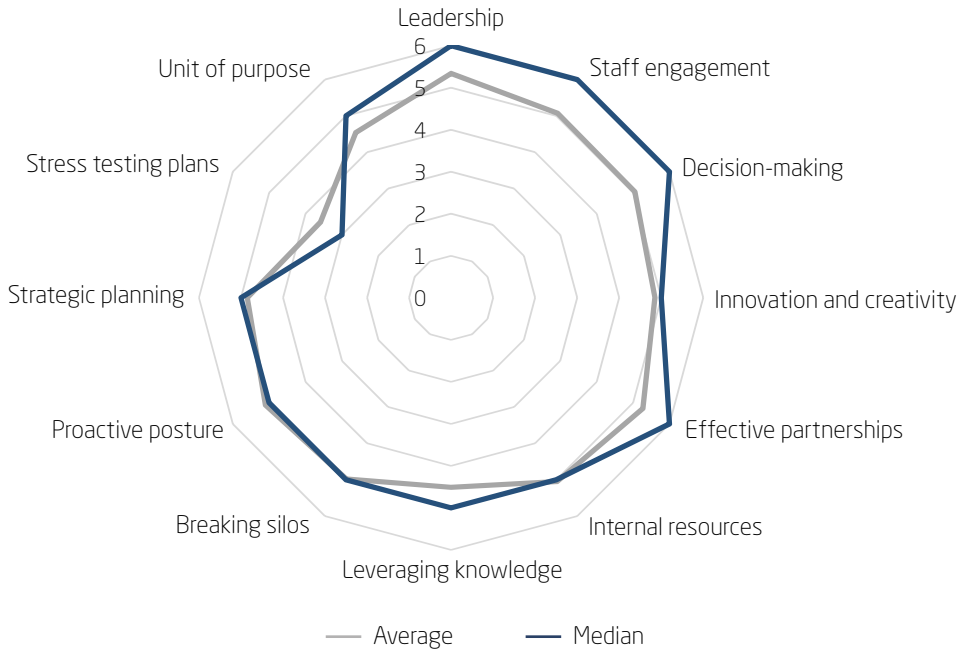
Assessing the resilience of the study companies

An analysis of the results obtained in each of the elements that make up organizational resilience was also made (Figure 11), where we can see that the items most in need of attention by the companies analyzed are the stress testing plans, followed by the leveraging knowledge and the company's unity of purpose.

In light of this, it becomes evident the need for investment by companies in raising employee awareness of the consequences of organizational dangers and obligations, as well as concerning the organization's priorities after a challenging event (McManus, 2008; Lee et al., 2013).

Figure 11

Average and median of scores per organizational resilience item



Source: Elaborated by the authors.

In addition, it is also necessary to ensure the best use of the knowledge already present in these companies. According to Lee et al. (2013), this is only possible through storing critical information in various formats and locations and the availability of specialists to clarify any doubts that the team may have, in addition to sharing functions, especially those considered primordial.

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Among the items that stood out positively were leadership, effective partnerships, and the proactive posture of the companies in the sample. This means that organizations see change as something positive and develop adaptive capacity. Their leaders provide sound management and decision-making in times of crisis, continuously evaluating strategies and work programs with organizational goals (Lee et al., 2013; Martins, 2019).

In addition, organizations have also demonstrated that they understand they do not operate in isolation in the environment in which they are inserted. As they develop their activities, they affect and are affected by the government, suppliers, partners, and competitors; consequently, they understand their restrictions, dependencies, and, especially, the interconnections with society as an opportunity for interaction (Martins, 2019).

However, it is important to understand that organizations also cannot be satisfied with already achieved levels of resilience. They must seek to progress on their resilience, quantifying improvements in each aspect observed and tracking changes in this measurement over time (Lee et al., 2013).

Lee et al. (2013) also highlight four main organizational needs related to the measurement of organizational resilience, namely:

- The need to demonstrate progress in your level of resilience.
- The need to lead resilience indicators.
- The need to link improvements in resilience with competitiveness.
- The need to demonstrate a *business case* for investments in resilience.

Finally, it is worth mentioning that the business environment caused by Covid-19 was just the background for the investigation, with organizational resilience being our central element. In this sense, we should not limit ourselves to the specific lessons of the pandemic but instead use these specific cases rigorously to question and investigate the organization's identification and assessment of the risks that threaten its existence, seeking to understand to what extent the organization is capable of control them (Crichton et al., 2009).

FINAL CONSIDERATIONS

This study sought to analyze the elements that compose the resilience of organizations when facing a disruptive event, using the crisis caused by Covid-19 as a context. For this, a transformational vision of organizational resilience was adopted, which is not limited to the previous state of the

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organization but allows a company to leverage its resources and capabilities not only to solve current dilemmas but to explore opportunities and build a successful future (Lengnick-Hall et al., 2011).

In this sense, we focused on investigating the elements that makeup resilience, understanding that the other aspect is more limited to resolving a specific event. This led us to consider the Resilience Benchmark Tool the broadest and most popular framework among attempts to understand and measure the investigated term. After verifying that the Resilience Benchmark Tool was a complete model, a simplified model for measuring organizational resilience was validated, based mainly on this tool, but being open to the possibility of adding other variables based on the results of the available questions included in the *survey*. However, the collection results demonstrated that adding others elements would not be necessary.

Also, a unidimensional model was validated, which presented a level of reliability considered excellent, and it was not necessary to exclude any item. Thus, the final model comprises 12 items: unity of purpose; stress testing plans; strategic planning; proactive posture; breaking silos; leveraged knowledge; internal resources; effective partnerships; innovation and creativity; decision-making; staff engagement; and leadership.

Although no other elements were added to the model, the present study assures us that those already present in the literature, applied in first-world countries, are also valid for use in the national territory, which has unique socioeconomic aspects and a more volatile, a common feature in countries that are still developing.

When verifying that the model has elements that measure a single factor (unifactorial) – in this case, the resilience of organizations – it differs from the model used as a reference, which subdivides resilience into elements of "leadership and culture," "networks and relations," and "change ready".

This means that the proposed model presents itself as the first order by having covariances between its constructs explained by a single relationship of latent variables. Whereas the Resilience Benchmark Tool contains two levels of latent variables, the variables "leadership and culture", "networks and relationships", and "change ready" are of the first order and together form organizational resilience (construct of second order). However, this difference may be because the model tested in this work was applied to a small sample, although this proved significant.

Furthermore, the level of organizational resilience of Brazilian companies was also analyzed in each of the items of the proposed model through

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descriptive analysis. The things that showed the most need for attention by the companies surveyed were the stress testing plan, which was followed by leveraging knowledge and the company's unity of purpose. Among the items that stood out positively are leadership, effective partnerships, and the proactive posture of the companies in the sample.

Through this descriptive analysis, when we obtain a view of the general panorama – although timidly when we consider the extension of the Brazilian territory – we can analyze a given organization's resilience capacity compared to the sample average. In addition, we can also individually evaluate each of the aspects present in the model. For example, a company may focus on improving its leadership, effective partnerships, and proactive posture, as it considers itself lagging compared to other organizations.

Regarding the study's limitations, we can highlight that the analyses were based on the respondents' perception, which is subject to errors in the individual's cognitive analysis process. Only professionals working in the company and sector for a considerable time were selected to mitigate this risk. Questions were also elaborated straightforwardly, based on the literature, in addition to conducting test rounds, with feedback collection, to guarantee understanding of what was being asked.

Another limitation is that the analysis had a sample of 41 companies. However, the companies present in the study demonstrated to have different profiles (size, field of operation, and experience with crises), representing well the study population (Brazilian companies), which was confirmed through the analysis of statistical significance.

This investigation only related the validated model to the perception of the crisis caused by Covid-19. In this sense, future studies could further support the model, linking it to financial indicators, among other sustainability indicators of organizations.

Due to its size, this model facilitates the correlation of resilience with other organizational constructs. It is another opportunity for future investigations to relate resilience with other organizational elements, such as the capacity for innovation, flexibility, agility, and adaptability.

As emphasized by Bhamra et al. (2011), to add value to the real world, more research on the natural world must be done, especially focused on empirical methods, to validate theoretical constructs in a meaningful way.

In this sense, this paper contributes to investigations about organizational resilience by approaching the subject independently, emphasizing its specificities, and providing a holistic view of the subject through a simplified model validated quantitatively with companies from different sectors and

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sizes. Moreover, this is one of the first studies centered on a developing country, although these are the ones that deal most with disruptive environments.

Concomitantly, this study also reinforces the transformational view of the term, understanding that organizations can grow during adversity, improving the capabilities and resources at their disposal and becoming more able to deal with challenging situations in the future.

It is also worth highlighting the practical contributions of this study. Because by providing companies with a model for measuring their resilience, we encourage situational awareness through a tool that allows general visibility of their strengths and weaknesses and, consequently, the points that need attention.

Seeking to understand, measure and develop organizational resilience goes far beyond the direct benefits obtained by those organizations that propose to do so. Through resilience, we ensure not only the survival of a given organization but also the continuity of the benefits offered by it to society, whether through the jobs generated or the satisfaction of the needs of its current or potential customers, in addition to believing in the possibility that these companies add greater value to their activities, despite the uncertainties caused by adversities.

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