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**BUSINESS VULNERABILITY DIAGNOSIS: AN INTEGRATIVE REVIEW**

**DIAGNÓSTICO DE VULNERABILIDADE EMPRESARIAL: UMA REVISÃO INTEGRATIVA**

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**RESUMO**

No Brasil, segundo o SEBRAE, em 2021 houve recorde de formação de novos empreendimentos, com mais de 3.9 milhões de novas empresas. No entanto, dados da Revista Exame mostram que um terço das empresas brasileiras fecham antes de 2 anos de funcionamento. Diagnósticos de consultorias empresariais contribuem para superar este problema, pois auxilia na consolidação e na recuperação de empreendimentos em vulnerabilidade. Neste contexto, este artigo realizou uma revisão integrativa, visando investigar a possibilidade de antecipação de diagnóstico de vulnerabilidade empresarial. A revisão seguiu os

critérios metodológicos determinados por Whitemore e Knafl (2005) e melhorados por Botelho, Cunha e Macedo (2011). Foram utilizadas as palavras-chave "Diagnóstico", "Vulnerabilidade", "Empresarial", "Antecipação" e "Previsão", em inglês, nas plataformas Scopus e Web of Science e considerados os trabalhos dos últimos 10 anos. Um total de 44650 documentos recuperados sofreram diversos filtros até restarem 16 artigos lidos integralmente para compor a revisão. Na extração dos dados, os artigos foram categorizados conforme o tipo de diagnóstico que realizava, as tecnologias, as amostras e o porte. Como resultados, apresentamos uma síntese do conhecimento sobre antecipação de diagnóstico de vulnerabilidade empresarial, uma discussão do impacto da predição de falhas para as empresas, governo e sociedade, e os constructos que puderam ser construídos com a revisão. Acreditamos que este trabalho poderá contribuir para amadurecer o tema academicamente e para o mercado, na otimização dos processos de consultorias diagnósticas empresariais, oferecendo subsídio ao setor produtivo.

**Palavras-chave:** diagnóstico; empresarial; falha; predição; vulnerabilidade.

## ABSTRACT

In Brazil, SEBRAE reported that a record number of new businesses were created in 2021, with over 3.9 million new companies. However, data from Revista Exame shows that a third of Brazilian companies close before two years of operation. Entrepreneurial Diagnosis done by business consultants contributes to overcoming this problem, as it helps consolidate and recover enterprises in vulnerability. Therefore, this article conducted a systematic review of the integrative type to investigate the possibility of anticipating a diagnosis of business vulnerability. The review followed the methodological criteria determined by Whitemore and Knafl (2005) and improved by Botelho, Cunha, and Macedo (2011). The keywords "Diagnosis," "Vulnerability," "Business," "Anticipation," and "Forecast" were used on the Scopus and Web of Science databases and papers from the last 10 years were considered. A total of 44,650 manuscripts documents underwent several filters until reaching 16 articles, which were read in full to compose the review. In data extraction, the articles were categorized according to the type of diagnosis performed, technologies, samples, and size. As a result, we present a synthesis of knowledge about anticipating the diagnosis of corporate vulnerability, a discussion of the impact of predicting failures for companies, government, and society, and the constructs that could be built with the review. We believe this study will contribute to maturing the theme academically and for the market, optimizing the business diagnostic consultancy processes and offering rewards to the productive sector.

**Keywords:** business; diagnosis; failure; prediction; vulnerability.

## 1 INTRODUCTION

According to Sebrae (2021), Brazil had the highest number of new businesses created in 2021, with over 3.9 million companies, representing a growth of 19.8% compared to 2020. A venture can be a solution to provide the market with an innovative idea that emerged in a research environment or a source of income for those seeking financial independence or an alternative means of work. In all cases, it is common for entrepreneurs to be endowed with reasonable technical knowledge of the area in which they operate and little administrative or entrepreneurial

knowledge, which may lead to business problems (PINTO JÚNIOR, 2021a). This and other types of issues lead entrepreneurs to seek consultants who can diagnose the challenges faced by the company and provide a report with the diagnosis, through which a work plan can be built to overcome the vulnerabilities found (PINTO JÚNIOR, 2021b).

The information collected in the diagnoses is paramount for successful consultancies and their effectiveness. When carrying out consultancies, the consultant is at the mercy of a diagnosis in light of the information provided by the company. Therefore, if the information is incomplete, unreliable, or otherwise lacking integrity, these problems may reach the diagnosis.

Hence, we conducted an integrative review to investigate the possibility of anticipating the diagnosis of business vulnerability, and the results will enable researchers and consultants to implement vulnerability prediction, which is ideal for making more accurate diagnoses and providing better feedback to organizations. Moreover, the project can contribute to optimizing business diagnostic consultancy processes, increasing diagnosis accuracy, and improving actionable work plans to overcome and/or recover from weaknesses in shorter periods, especially for vulnerable enterprises. For those who are not vulnerable but seek to enhance their enterprise, gains can also be achieved more quickly.

The conclusion of this study will provide subsidies to the productive sector, and the results can be applied in specific contexts, including the development of Science and Technology. Business incubators and accelerators may also benefit as they must conduct diagnostic consultancies at the beginning of an incubation or acceleration cycle to better know the enterprises they receive and establish a work plan.

## **2 METHODOLOGY**

The integrative literature review method was used for this literature review. According to Whitemore and Knafl (2005), this type of review aims to synthesize the main relevant studies for a given research question in a systemic, organized, and comprehensive way. For Torraco (2005), integrative reviews should analyze and criticize the literature and create new knowledge about the reviewed topic and make them available as syntheses. The definition given by Botelho, Cunha, and Macedo (2011) corroborates the previous authors, as they reported that the integrative review

“allows researchers to get closer to their problem [...] so they can know the evolution of the theme over time.”

In this study, we sought to shed more light on how the issue of business vulnerability has been addressed in the literature, how it has evolved in the last ten years, and determine if it is relevant to develop proposals to support the anticipation of vulnerability diagnoses; the integrative review was the most pertinent method to achieve these purposes. Bibliographic research took place from June to July 2022, and the analysis was carried out in August of the same year.

## **2.1 Research Question**

The research question raised herein was: “Is it possible to anticipate a diagnosis of business vulnerability?”

In business consultancy processes, consultants rely on their own methods to diagnose the enterprise that receives the consultancy and identify vulnerabilities or problems that may jeopardize the company or whether recovering companies can enhance the development results. Considering that the sooner a problem or vulnerability is detected, the sooner preventive action can be taken, we sought to understand, based on the literature, whether it is possible to diagnose vulnerabilities or business problems before they occur.

## **2.2 Scope of this Study**

This study was based on studies that discussed diagnostic consulting or anticipating failure or bankruptcy to help enterprises enhance their results or recover from vulnerabilities. In addition, we investigated whether there was research employing automated computing techniques (e.g., artificial intelligence) to assist in business diagnostics or forecast business problems.

This integrative review did not focus on establishing tools, methods, or techniques for carrying out business diagnostic consultancies, analyzing the profile or competencies of agents who perform diagnostic consultancies or business forecasts, or distinguishing diagnostic consultancies by type, business size, or sector of application (private or public).

### 2.3 Keywords and Inclusion and Exclusion Criteria

The keywords that guided the bibliographic surveys were “Diagnosis,” “Vulnerability,” “Business,” “Anticipation,” and “Forecasting.” In order to establish a quality criterion in the bibliographic searches, we only searched for scientific articles, and the Scopus and Web of Science databases were used as they are the two most relevant databases for Brazilian and international researchers in the area of Knowledge Engineering.

All searches were conducted in English for better comprehensiveness and relevance of results, and any duplicates and papers that did not connect to the keywords investigated or the research question were excluded. The exclusion criteria were improved based on the search results, as seen below, to keep only the relevant papers for the study.

We defined the equivalent search keys listed in Table 1, respecting the differences in the search syntax of each platform.

Table 1 - Search keys

| Bibliographic Basis | Search Key  |
|---------------------|---|
| Web of Science      | (TI=((“business” OR “company”) AND (“diagnosis” OR “vulnerability diagnosis” OR “diagnosis anticipation” OR “vulnerability diagnosis anticipation” ))) OR<br>(AB=((“business” OR “company”) AND (“diagnosis” OR “vulnerability diagnosis” OR “diagnosis anticipation” OR “vulnerability diagnosis anticipation” ))) OR<br>(AK=((“business” OR “company”) AND (“diagnosis” OR “vulnerability diagnosis” OR “diagnosis anticipation” OR “vulnerability diagnosis anticipation” ))). |
| SCOPUS              | TITLE-ABS-KEY((“business” OR “company”) AND (“diagnosis” OR “vulnerability diagnosis” OR “diagnosis anticipation” OR “vulnerability diagnosis anticipation”))   |

Source: the author (2023)

Given that a well-designed search strategy can acquire more significant information for the integrative review, and in order to reach the key highlighted in Table 1, we performed various search tests with different keywords and connectors. We only defined the key after better understanding the main terms used in this area and how they connect.

### 2.4 Search Results and Filters Performed

The SCOPUS platform obtained the most results in the searches, with an initial total of 40,210 documents. A series of filters were applied to eliminate irrelevant results for this purpose.

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The first filter was to taper the last ten years of publications, from 2012 to 2022; 11,800 documents went through the second filter. The four areas related to the search theme that had results were selected: Computer Science, Business Management and Accounting, Economics, Econometrics and Finance, and Multidisciplinary Research. We reached 1044 documents that went through two more filters: first, the publication status, accepting only publications already in the final stage, and in the second stage, the language, reserved for articles in English. Eight hundred eighty-six articles were filtered by excluding keywords that did not identify with the theme: Human, Humans, Fault Detection, Health Care, Medical Imaging, Pattern Recognition, Diseases, Support Vector Machines, Manufacture, Patient Treatment, Constraint Theory, and Forecasting. Once this was done, applying any other filter did not seem feasible, leaving 546 articles for the reading of titles. After reading and eliminating those whose titles were divergent from the purpose of the study, 53 the articles' abstracts were read. In the end, 23 articles remained for a full reading. One of these articles, entitled "A map for the holistic BPM diagnosis," could not be retrieved in full, so it was removed from the list, leaving 22 documents.

In the Web of Science, the initial search result was 4,240 documents; the first filter applied was categories. The eight categories that converged with the review included Management, Computer Science Artificial Intelligence, Computer Science Information Systems, Computer Science Theory Methods, Business, Computer Science Interdisciplinary Applications, Multidisciplinary Sciences, and Business Finance. There were 686 documents left that were filtered for the only two available research areas that intersect with the theme, Computer Science and Business Economics, reaching 654 documents. The same 10-year period of the previous database was also applied here, and 391 documents were found, of which their titles were read, leading to 31 documents passed to the next filter (language). Only four documents were in a language other than English; therefore, 27 documents remained for reading the abstracts. In the end, we reached nine documents, five of which had already been found on the Scopus platform. Thus, the Web of Science final search returned four articles; however, one of them, entitled "The Economical-Financial Diagnosis, An Essential Condition Of Survival For Companies Being In Financial Difficulty," published in 2012 at the "International Conference on Business Excellence," was not found on the internet except in the Web of Science database itself. The conference no longer provides the proceedings of this year. Thus, this article was excluded as it was impossible to

analyze. Thus, three articles were added to the 22 already extracted from SCOPUS, resulting in a total of 25 documents to be reviewed in full. A summary of the search steps, containing the bases, filters, and results, is provided in Table 2.

Notably, even after the area filters were applied, some articles remained that were not of relevance to this study. For instance, in the area of computing, an article related to forecasting and risk, although it was not directed to companies but to the health area: “Machine learning model from a Spanish cohort for prediction of SARS-COV-2 mortality risk and critical patients.” The study was excluded when reading the abstract.

Table 2 - Search results and filters

|                       | SCOPUS   | Web of Science  |
|-----------------------|--|---|
| <b>Initial result</b> | 40,210 documents   | 4,240 documents   |
| <b>Filter 1</b>       | Year of publication: 2012 to 2022  | Eight categories were selected: Management, Computer Science Artificial Intelligence, Computer Science Information Systems, Computer Science Theory Methods, Business, Computer Science Interdisciplinary Applications, Multidisciplinary Sciences, Business Finance. |
| <b>Results</b>        | 11,800 documents   | 686 documents   |
| <b>Filter 2</b>       | Four areas were selected: Computer Science, Business Management and Accounting, Economics, Econometrics and Finance, Multidisciplinary Research.   | Two research areas were selected: Computer Science, Business Economics.   |
| <b>Results</b>        | 1044 documents   | 654 documents   |
| <b>Filter 3</b>       | Publication status: final  | Year of publication: 2012 to 2022   |
| <b>Results</b>        | 1017 documents   | 391 documents   |
| <b>Filter 4</b>       | Selected language: English   | Reading titles  |
| <b>Results</b>        | 886 documents  | 31 documents  |
| <b>Filter 5</b>       | Keyword exclusion: Human, Humans, Fault Detection, Health Care, Medical Imaging, Pattern Recognition, Diseases, Support Vector Machines, Manufacture, Patient Treatment, Constraint Theory, Forecasting. | Selected language: English  |
| <b>Results</b>        | 546 documents  | 27 documents  |
| <b>Filter 6</b>       | Reading titles   | Reading abstracts   |
| <b>Results</b>        | 53 documents   | 9 documents   |
| <b>Filter</b>         | Reading abstracts  | Repeated documents at SCOPUS were   |

|                      |                                      |                                     |
|----------------------|--------------------------------------|-------------------------------------|
|                      |                                      | excluded                            |
| <b>Final Results</b> | 23 documents (1 full text not found) | 4 documents (1 full text not found) |

Source: the author (2023)

In reading the full articles, we identified nine more articles that did not fit the research proposal; in the end, 16 documents were selected to compose the integrative review.

### 3 DATA EXTRACTION AND CATEGORIZATION

Data were extracted using an interpretative approach to construct a synthesis matrix. In this matrix (Table 3), for each article reviewed, the following information was extracted: author, type of diagnosis performed, technologies used, sample size and type, and company size.

Table 3 - Synthesis Matrix

| AUTHOR                        | DIAGNOSIS  | TECHNOLOGIES   | SAMPLE   | SIZE           |
|-------------------------------|--|--|--|----------------|
| Acuña-Carvajal et al. (2019)  | Plan, structure, and validate a strategic business unit. | BSC; MCDM; Fuzzy DEMATEL; Forms; ICP Matrix.                   | 1 Colombian bank   | Large          |
| Ceballos et al. (2021)        | Incorporating business rules                             | Relational Database; MBD; CSP; minLik parameter; AHP           | 15 BDCs - 864 instances  | Any            |
| Chuang (2013)                 | Predicting business failure                              | CBR hybrid model; RST-CBR; RST-GRA-CBR; CART-CBR               | 279 healthy companies and 42 with problems. All IT in Taiwan based on Taiwan Stock Exchange Corporation (TSEC) and Taiwan Economic Journal (TEJ) database. | All            |
| Govender and Parumasur (2016) | Diagnose critical aspects for business effectiveness     | Descriptive and inferential statistics.                        | 1 Trade and Investment Agency  | Not informed   |
| Hernández-Díaz et al. (2021)  | Business sustainability of SMEs                          | Qualtrics; 106-item questionnaire with the 5 MOPSE dimensions. | 108 questionnaires (SMEs)  | Micro and SMEs |
| Ho and Tuyen                  | Aptitude for digital transformation                      | Linear and non-linear regression algorithms;                   | 510 SMEs   | SMEs           |



|                            |   |  |   |                |
|----------------------------|---|--|---|----------------|
| (2021)                     |   | the fuzzy method;                          |   |                |
| Le et al. (2019)           | Bankruptcy prediction based on financial data.          | HAOC; CBoost; Python; Scikit-learn         | Korean bankruptcy database. 307 bankrupt companies and 120,048 "normal" ones. | All            |
| Martynjuk (2017)           | Business failures                                       | Fuzzy; OWA;                                | Modeling  | Not applicable |
| Metz (2017)                | Organizational diagnostic model                         | Questionnaires; Statistical analysis;      | 1 Multinational ICT industry in Romania; 776 employees;                       | Large          |
| Ozmen and Ozcan (2022)     | Diagnosis of employee turnover.                         | CNN; ECDDT; ECDDT-GRID                     | 1186 employees  | SMEs           |
| Salazar et al. (2022)      | Feasibility of e-commerce implementation                | No computer technologies                   | 29 companies and 261 clients  | SMEs           |
| Santos and Martinho (2020) | Maturity related to Industry 4.0                        | Questionnaires                             | 2 automotive companies  | Large          |
| Scherger et al. (2014)     | Diagnose the cause of failure in groups of SMEs.        | Fuzzy model                                | 15 companies  | SMEs           |
| Scherger et al. (2017)     | Business management and technological maturity          | Convolutional algorithms with fuzzy logic. | 6 companies   | Large          |
| Terceño et al. (2018)      | Predicting causes of business failure                   | Fuzzy; OWA;                                | Modeling of 5 companies, no case study  | Not applicable |
| Vigier et al. (2017)       | Enterprise failure diagnostics with fuzzy OWA operators | Fuzzy; OWA;                                | 98 SMEs   | SMEs           |

Source: the author (2023)

We classified the 16 articles according to three attributes: business size, type of diagnosis, and technologies used. We did not classify the type and size of samples, as this proved to be heterogeneous, although we will also discuss this in the following session.

#### 4 ANALYSIS AND INTERPRETATION OF THE RESULTS

In the categorization regarding business size, we used the information provided in the articles regarding the samples/applications/case studies used, separating them according to their size given by the legal classification. Table 4 shows that one article analyzed data from small and medium enterprises (SMEs), five articles only analyzed SMEs, and four papers worked large companies. Chuang (2013) and Le et al. (2019) did not distinguish companies by their size and considered all sizes, whereas Ceballos et al. (2021) developed a generic model applicable to any business. Govender and Parumasur (2016) did not report the size of the trade agency in their case, and two other papers developed modeling that is not linked to business size (TERCEÑO *et al.*, 2018; MARTYNYUK, 2017).

Table 4 - Classification according to business size

| CATEGORIZATION ACCORDING TO BUSINESS SIZE |  |
|---|--|
| <b>Micro and SMEs</b>                     | Hernández-Díaz et al. (2021)   |
| <b>SMEs</b>                               | Hoa and Tuyen (2021); Ozmen and Ozcan (2022); Salazar et al. (2022); Scherger et al. (2014); Vigier et al. (2017); |
| <b>Large</b>                              | Santos and Martinho (2020); Acuña-Carvajal et al. (2019); Metz (2017); Scherger et al. (2017)                      |
| <b>All</b>                                | Chuang (2013); Le et al. (2019)  |
| <b>Any</b>                                | Ceballos et al. (2021)   |
| <b>Does not inform</b>                    | Govender and Parumasur (2016)  |
| <b>Not applicable</b>                     | Terceño et al. (2018); Martynyuk (2017)  |

Source: the author (2023)

Regarding the type of diagnosis, Table 5 lists the groups formed based on the similarity of the diagnostic objective of the studies. We identified that Hoa and Tuyen (2021), Salazar et al. (2022), and Santos and Martinho (2020) sought to perform a business diagnosis related to technological maturity/readiness, with a view, respectively, to digital transformation, the feasibility of implementing e-commerce, and maturity related to industry 4.0. Acuña-Carvajal et al. (2019) aimed to validate business strategies, and Ceballos et al. (2021) covered the incorporation of business rules; hence, it was classified as “business validation.”

The largest group was organizational diagnostics, and Scherger et al. (2017), Metz (2017), Govender and Parumasur (2016), Scherger et al. (2014), Vigier et al. (2017), Ozmen and Ozcan (2022), and Hernández-Díaz et al. (2021) developed, respectively, studies aimed at diagnosing business maturity, organizational diagnostics, critical aspects for business effectiveness, causes of failure in SMEs, business failures, employee turnover, and business sustainability.

The last group, failure prediction, comprised the studies of Le et al. (2019), who aimed to predict bankruptcy contexts based on financial data, and Terceño et al. (2018), Martynyuk (2017), and Chuang (2013), who sought to predict business failures. Apart from the “business validation” group, all the other 14 surveys share that they sought to identify failures or points of improvement to avoid business problems.

Table 5 - Classification as to Diagnosis

| CATEGORIZATION BY DIAGNOSIS        |   |
|------------------------------------|---|
| <b>1. Technological diagnosis</b>  | Hoa and Tuyen (2021); Salazar et al. (2022); Santos and Martinho (2020)   |
| <b>2. Business validation</b>      | Acuña-Carvajal et al. (2019); Ceballos et al. (2021)  |
| <b>3. Organizational diagnosis</b> | Scherger et al. (2017); Metz (2017); Govender and Parumasur (2016); Scherger et al. (2014); Vigier et al. (2017); Ozmen and Ozcan (2022); Hernández-Díaz et al. (2021). |
| <b>4. Failure prediction</b>       | Le et al. (2019); Terceño et al. (2018); Martynyuk (2017); Chuang (2013)  |

Source: the author (2023)

As for the technologies used, we classified them into four categories (Table 6), the last of which is only Salazar et al. (2022) because the authors did not demonstrate the use of any technological tool to develop their study. Hernández-Díaz et al. (2021), Santos and Martinho (2020), Metz (2017), and Govender and Parumasur (2016) are in the same category, as they all collected data using questionnaires and followed a subsequent statistical analysis. In the case of the second group, the studies share that they applied the fuzzy method to analyze their results. Vigier et al. (2017), Terceño et al. (2018), and

Martynyuk (2017) used fuzzy modeling integrated with ordered weighted averaging (OWA). Acuña-Carvajal et al. (2019) integrated the fuzzy method with various other techniques, more notably the balanced scorecard (BSC). Scherger et al. (2014) only used the fuzzy method, whereas Hoa and Tuyen (2021) also applied linear and non-linear regression and Scherger et al. (2017) used convolutional algorithms with the fuzzy method. Hybrid models, which combine several techniques and algorithms for data analysis, were the solutions adopted by Ozmen and Ozcan (2022), Chuang (2013), Le et al. (2019), and Ceballos et al. (2021).

Table 6 - Classification according to technologies

| CATEGORIZATION BY TECHNOLOGY |  |
|------------------------------|--|
| <b>Questionnaires</b>        | Hernández-Díaz et al. (2021); Santos and Martinho (2020); Metz (2017); Govender and Parumasur (2016).  |
| <b>The fuzzy method</b>      | Hoa and Tuyen (2021); Scherger et al. (2014); Vigier et al. (2017); Scherger et al. (2017); Terceño et al. (2018); Martynyuk (2017); Acuña-Carvajal et al. (2019). |
| <b>Hybrids</b>               | Ozmen and Ozcan (2022); Chuang (2013); Le et al. (2019); Ceballos et al. (2021)  |
| <b>No tec.</b>               | Salazar et al. (2022)  |

Source: the author (2023)

The samples used for analysis, diagnosis, and prediction varied, as demonstrated in Table 3. Some studies carried out case studies in a single company but had various data to analyze. Some used databases with business information to analyze and perform the intended diagnosis or forecasting. Moreover, some studies did not start from real data but created models that could later be applied to predict business failures.

Regarding the authors, we observed little connection between them. For instance, Scherger et al. (2017) published two of the articles, and Terceño et al. (2018) is the main author of one of the papers and is present as a co-author in two others. The other authors did not demonstrate connections between their studies.

## 5 DISCUSSION AND SYNTHESIS OF KNOWLEDGE

### 5.1 Anticipating business vulnerability diagnosis

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None of the reviewed papers employed “vulnerability” to characterize the addressed research problems. Nevertheless, considering that “business vulnerability” is a state that a company is in due to the diagnosis of business problems, 14 of the 16 articles reviewed converge with this theme. Only Acuña-Carvajal et al. (2019) and Ceballos et al. (2021) are an exception, and the others contributed to answering the research question proposed herein.

The articles categorized in group 1 (Technological Diagnosis) of the categorization by diagnosis showed that it is possible to diagnose technological issues in companies, although the authors did not discuss anticipating or forecasting this type of diagnosis. Those in group 3 (Organizational Diagnosis) also demonstrated diagnostic possibilities but with cutouts for macro-organizational and management vision. Those in group 4, however, presented models that allow forecasting, which can be seen as a form of anticipating business failures. Nonetheless, most of the variables used were financial.

In this integrative review, which covered the last ten years, we found that the issue of vulnerability or business failure was little addressed in the literature during the ten years, considering the small number of articles published on the subject. Some authors, such as Scherger et al. (2017) and Terceño et al. (2018), helped us perceive an evolution of research in this period, from modeling to application in case studies.

## **5.2 How does failure prediction affect business, government, and society?**

The existing scientific gap in the last ten years on business failure prediction gives pertinence to new proposals to support anticipating or predicting business vulnerability/failure diagnoses. In addition to the academic contribution that new research in this area could provide to academia, there is also a significant contribution to businesses, government, and society. This is paramount for companies since forecasting problems before they occur is an opportunity to solve them with fewer costs and lower impact. Failure to foresee problems can sometimes lead to new issues leading companies to crisis or bankruptcy. In both cases, government and society can lose from this, either because the former ceases to receive taxes (or receives less) or because the latter loses employment and access to the company’s products/services.

## **5.3 Constructs that can be built on the review**

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This review showed that “anticipation of business diagnosis” can also be understood, without loss of meaning, by other terms, such as “prediction of business diagnosis,” “prediction of business failure,” “anticipation of business failure,” and “prediction of business bankruptcy.” Furthermore, this topic is closely correlated in the literature with corporate sustainability and bankruptcy. By corporate sustainability, we mean the ability of a company to exist sustainably in all organizational aspects. A failure in any of the aspects can jeopardize the desired sustainability. Regarding bankruptcy, it was possible to realize that it occurs when a context of failure happens repeatedly or when there is a major failure in engendering. It was not predicted or anticipated in time.

#### **5.4 Opportunities for novelty and originality**

We identified opportunities for novelty through this integrative review. As discussed by Bicas (2008), “novelty [...] in isolation means nothing”. We agree! For this reason, the novelties identified herein, in addition to dealing with issues not discussed or little explored before, will allow knowledge about business vulnerability diagnosis to positively impact Brazilian companies, endorsing the legitimacy of unprecedented findings.

The first opportunity is the review itself, as we did not find any integrative review that sought to answer the research question, “Is it possible to anticipate a diagnosis of business vulnerability?” We also found no other type of systematic review for this purpose. Another opportunity for novelty is related to the variables analyzed. Among the studies analyzed, most only considered variables related to financial issues. Therefore, there is an opportunity for novelty in studies that discuss corporate vulnerability in a broader scope in the organization and beyond the financial aspect. In this study, our novelty is due to the literature review integrating how business vulnerability diagnoses have been made in the last ten years.

We also have an unprecedented contribution to conceptualizing the term vulnerability in business. Until now, similar concepts had been developed, although none of them employed this term, including with the meaning we attributed herein. These contributions open new avenues for research as they seek to clarify questions about the theme and present knowledge and points of view in relation to the problem explored.

## 6 CONCLUSION

In the knowledge synthesis, we considered the research question “Is it possible to anticipate a diagnosis of business vulnerability?” and found that none of the articles used the term “business vulnerability.” However, considering that “entrepreneurial vulnerability” is a state that a company is in due to the diagnosis of business problems, 14 of the 16 articles reviewed converge with this concept. The articles categorized into group 1 demonstrated that it is possible to diagnose technological issues in companies but did not discuss the anticipation or prediction of this type of diagnosis. Those in group 3 demonstrated diagnostic possibilities but with parts for macro-organizational and management vision. Group 4 presented models that allow prediction, which can be seen as anticipating business failures. However, most variables used were only financial.

Another topic covered in the knowledge synthesis is the recognition that business failure prediction can contribute to both business and government and society. As for the main constructs identified, we realized that “anticipation of business diagnosis” can also be understood, without loss of meaning, by other terms, including “prediction of business diagnosis,” “prediction of business failure,” “anticipation of business failure,” and “prediction of business bankruptcy”; these themes are closely correlated in the literature with corporate sustainability and bankruptcy.

The Scopus database proved more relevant to research this theme, considering that we retrieved 40,210 documents from it compared to only 4,240 from the World of Science database. The articles were searched in 10 years, although only 16 studies were deemed relevant from the last nine years.

One fact to note is that except for two articles, the other 14 sought to identify failures or points of improvement to avoid business issues. Some articles demonstrated that it is possible to diagnose technological issues in companies, and others presented diagnostic possibilities with clippings for macro-organizational and management vision, and some even presented models for predicting business failures.

Lastly, we found opportunities for novelty concerning the research method (i.e., a literature review) and the topic investigated; we did not find another article with the same purpose, the management variables explored, and the term “vulnerability” in the organizational context. We

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hope that these contributions will help increase research on business failures and that innovative studies will emerge to consolidate the study of business vulnerabilities.

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