

## RESEARCH ARTICLE

# Social sustainability: Viability analysis of social firms

María Jesús Segovia-Vargas<sup>1</sup>  | María del Mar Camacho-Miñano<sup>2</sup>  | Vera Gelashvili<sup>3</sup> 

<sup>1</sup>Department of Financial and Actuarial Economics and Statistics, Faculty of Economics and Business, Complutense University of Madrid, Madrid, Spain

<sup>2</sup>Department of Financial Economics and Accounting II, Faculty of Economics and Business, Complutense University of Madrid, Madrid, Spain

<sup>3</sup>Department of Business Economics, Faculty of Economics and Business Sciences, Rey Juan Carlos University, Madrid, Spain

## Correspondence

Vera Gelashvili, Department of Business Economics, Faculty of Economics and Business Sciences, Rey Juan Carlos University, Paseo de los Artilleros s/n. 28032, Madrid, Spain.  
Email: [vera.gelashvili@urjc.es](mailto:vera.gelashvili@urjc.es)

## Abstract

Social enterprises are firms that actively create jobs for people with disabilities and reduce social and labour inequalities, thereby participating in the social economy. Due to their importance to society and the work they do towards diversity integration and social sustainability, they have recently attracted much attention in academic literature. For this reason, the main objective of this study was to analyse the survival of social enterprises, identifying key variables that condition their continuity in the market or their failure. The initial sample consisted of 999 social enterprises for the year 2022. The Altman Z-score and artificial intelligence (AI) algorithms were used to obtain the basic survival patterns. The main findings were that, on average, social enterprises are highly experienced companies and only one-third of them are at risk of bankruptcy. This means that most of these enterprises can continue their social function. Moreover, the results of return on assets (ROA), equity and debt turnover can predict being at risk of bankruptcy of social enterprises. This study contributes to the scarce academic literature on social enterprises and promotes the existence of such enterprises for social and economic sustainability.

## 1 | SOCIAL FIRMS' VIABILITY

The main objective of social enterprises is to create equal opportunities for all and to help the most disadvantaged, in line with diversity integration policies (Kachlami et al., 2021; Monzón Campos, 2013). Therefore, these companies directly contribute to the generation of social sustainability (Kamaludin et al., 2021; Segovia-Vargas et al., 2021), which, according to Stren and Polèse (2000, p. 15), is defined as 'development that is compatible with the harmonious evolution of civil society, fostering an environment conducive to the compatible coexistence of culturally and socially diverse groups, while at the same time promoting social integration, with improvements in the quality of life for all segments of the population'. In other words, social sustainability promotes social balance and creates a better world for those most in need, such as people with disabilities. The importance of these enterprises became critical during and in the aftermath

of the COVID-19 pandemic (Weaver, 2023). Social enterprises are of great importance to any developed country as their presence reduces inequality, creates jobs and profit and actively contributes to long-term sustainability (Bonfanti et al., 2024; Hunt et al., 2024; Vasserot, 2023). Governments in many countries have therefore supported these companies by increasing subsidies to mitigate the impact of challenges such as COVID-19 (Snowden et al., 2021).

Early prediction of bankruptcy is crucial for the economic sustainability of any firm, allowing stakeholders to take preventive measures, reallocate investments or restructure the firm. Korol (2013) explains that insolvency issues are not instant but should be foreseen 5–6 years before legal bankruptcy. There are forecasting techniques that can be of great help in this task (Gómez Ortega et al., 2024). The first techniques were based on scoring models, with economic and financial ratios and weightings used based on different statistical and scoring analyses (Altman, 1968; Ohlson, 1980;

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Zmijewski, 1984). Different statistical models such as linear regression or decision trees have been also widely used to predict the risk of bankruptcy (Gelashvili et al., 2022). In recent years, methodologies such as machine learning models have begun to outperform statistical models in predicting bankruptcy (Narvekar & Guha, 2021). Many technologies enable the study of solvency problems of companies in various sectors.

Additionally, the latest data on business performance show that the COVID-19 crisis affected the economic and financial situation of all sectors worldwide (Golubeva, 2021). The most challenging year was 2020 when most companies had to adapt their face-to-face operations to online work (Baert et al., 2020). Most service companies did not have the option of allowing their employees to work from home. As a result, many of these companies could not survive (Laporte et al., 2020). Thus, we investigate in this study whether social firms in the service sector were able to survive in the market on the basis of their core activities (Gelashvili et al., 2022). When analysing the literature on the functioning of these enterprises during and after the pandemic, or simply to see how they evolved, we found a lack of up-to-date data; the academic literature on these enterprises was limited. According to the study by Segovia-Vargas et al. (2021), of the 997 social enterprises analysed (specifically, sheltered employment centres), almost 70% were in the service sector. Therefore, these enterprises, like other enterprises in the market, were likely to face economic or operational problems during the pandemic.

For this reason, the main objective of this research was to analyse the economic and financial situation of social enterprises in Spain, to study their functioning after the pandemic and to examine the problems they have faced or are still facing. More specifically, the objective of the paper is to examine the survival patterns of these companies in 2022 based on their annual accounts data and to classify them as healthy or struggling/bankrupt companies. To achieve our research objective, we used a sample of social enterprises in Spain and applied the Altman Z-score methodology (Altman, 1968) to classify them into two different groups according to their business health. In addition, artificial intelligence (AI) algorithms were used to extract the main survival patterns of social enterprises, specifically the C4.5 algorithm (Quinlan, 1993) and the PART algorithm (Frank & Witten, 1998) as a robustness test.

The results showed that 2022 was a challenging year for social enterprises after the pandemic. The Z-score analysis showed that 14% were at high risk of insolvency. Their main survival pattern is classified by debt turnover as optimal results of this ratio indicate the good financial health of the company or otherwise classify it as at risk of bankruptcy. Other patterns that predict the risk of bankruptcy of the analysed companies are return on assets (ROA) and equity ratio. This means that low or negative equity and economic profitability show a high probability of social enterprises' bankruptcy. This

### Policy Implications

- As social firms are relevant for promoting work for people with disabilities, policymakers and governments should support its viability.
- The creation of social enterprises should be promoted, as well as management support, to prevent their failure. The closure of these enterprises for whatever reason negatively affects the social economy of the country, the fulfilment of the Sustainable Development Goals (SDGs) and the socio-labour integrity of people in need.
- Social enterprises must be oriented to continue their business and create jobs for people in need, while at the same time avoiding the risk of bankruptcy. Variables such as debt, profitability (ROA) and equity are the main patterns for the survival of these companies.
- The variable of public subsidies plays an important role for social enterprises in reducing the risk of bankruptcy. Subsidies can help to reduce the financial risk in difficult times. This issue is important because social enterprises are first and foremost oriented towards social work and then towards profitability.

study contributes to the academic literature in that there is a lack of quantitative studies on social enterprises. At the same time, our findings can help social enterprises know which patterns are essential to avoid bankruptcy and be economically and socially sustainable.

This study is structured as follows: the first section of the manuscript provides the motivation, justification, choice of topic, objectives, methods and final results. The second section is based on the literature background, where social enterprises and their viability and other critical key data are analysed. In addition, research questions are discussed. The third section describes the sample, methods and variables. This is followed by the results section, in which the methods described above are discussed critically. The last section of the paper gives the conclusions, theoretical implications, limitations and suggested future research on the topic.

## 2 | THEORETICAL BACKGROUND

### 2.1 | Social firms in Spain: Importance and key data

Social enterprises were defined in 2013 in the *European Union (EU) Programme for Employment and Social Innovation*.<sup>1</sup> According to this regulation, a social firm

is defined as an operator in the social economy whose main objective is to have a positive social impact rather than profits for its owners or shareholders. As with any business, social enterprises provide goods and services for the market in an entrepreneurial and innovative fashion. Additionally, their profits are mainly used to achieve social aims and they are managed openly and responsibly, involving employees, consumers and stakeholders.

Going further, the Commission's Social Business Initiative identified two fundamental dimensions of social enterprises, namely that social enterprises engage in commercial activities (entrepreneurial/economic dimension) to achieve a social or societal good (social dimension) and have an organisation or ownership system that reflects their mission (inclusive governance–ownership dimension) (Haarich et al., 2020).

During the COVID-19 pandemic and the recent wars in Ukraine and Palestine, many social economy organisations were at the forefront of responding to these crises. At the global level, the social economy is aligned with the Sustainable Development Goals (SDGs) through its role in poverty reduction, promotion of responsible consumption and production and commitment to sustainable finance. In the European context, the social economy contributes to the implementation of the principles of the European Pillar of Social Rights and the fulfilment of the 2021 Action Plan and the EU's main objectives for 2030, in line with the UN SDGs. For example, it contributes to reducing unemployment, decreasing the number of people at risk of poverty and social exclusion, promoting the integration of people with disabilities into the open labour market and providing essential services to help them live independently and improving gender equality by promoting access to the labour market through the jobs created (SWD, 2021)<sup>2</sup>.

Ultimately, the social economy contributes to the development and the achievement of sustainable development based on the three fundamental pillars of sustainability according to the 1987 Brundtland Report – economic, social and environmental development – and complements state action to provide quality social services cost effectively. Furthermore, the ability of social enterprises to respond to the SDGs has been described as linked to their DNA. That is, social enterprises are created to promote integration with sustainable development, despite the difficulties of managing them due to the diversity of types of resources mobilised, inclusive governance, stakeholder participation, etc. (European Union, 2020).

In Spain, Law 5/2011 of 29 March 2011 on the Social Economy is the central regulation for social enterprises. According to Article 5, social insertion enterprises, cooperatives, worker-owned companies, mutual companies, foundations and sheltered employment centres

are part of the social economy. However, according to the EU definition, social enterprises would comprise insertion enterprises, sheltered employment centres and social initiative cooperatives.

According to Article 43 of the General Law on the Rights of Persons with Disabilities (LGDPE), sheltered employment centres are those whose main objective is to carry out the production of goods or services, participating regularly in market operations. Their purpose is to provide paid employment for people with disabilities. At the same time, they are a means of integrating the largest number of these people into the mainstream employment system. By law, at least 70% of the staff of these centres must be made up of people with a degree of disability of 33% or more, thus ensuring quality employment for them while at the same time facilitating the integration of this group into the labour market and their gradual transition into mainstream companies. They receive public financial aid or subsidies for their creation, social security, job maintenance, etc. (Royal Decree-Law 1/2013, dated November 29, 2013).

Although cooperatives in general are social economy enterprises, as explained above, only social initiative cooperatives are social enterprises. Thus, social initiative cooperatives are defined in Law 27/1999. Article 106 defines social initiative cooperatives as 'those cooperatives which, regardless of their nature and without profit motive, have as their corporate purpose either the provision of welfare services by carrying out health, educational, cultural or other activities of a social nature, or the development of any economic activity aimed at the integration into the labour market of persons suffering from any form of social exclusion and, in general, the satisfaction of social needs not covered by the market'.

Insertion companies are defined in Article 4 of Law 44/2007 of 13 December, regulating the regime of insertion companies, which belong to the subgroup of social enterprises within the EU framework. The aim of insertion companies is to combat poverty and social exclusion while, at the same time, fulfilling the following requirements: (a) at least 51% of the share capital must be owned by a social or non-profit organisation; (b) a percentage of their employees must be insertion workers (the percentage depends on the Autonomous Community and varies between 30% and 60%); (c) at least 80% of the results or available surpluses generated in each financial year must be used to improve or expand productive and insertion structures. According to Salinas Tomás (2022), insertion companies are one of the most important mechanisms with the greatest impact on groups at risk of labour and social exclusion.

It is worth highlighting the importance of social enterprises in achieving the SDG (Littlewood & Holt, 2018; Rahdari et al., 2016). In particular, social enterprises aim to improve society by helping people who have difficulties with social and labour inclusion (Gómez-González

et al., 2023; López Penabad et al., 2019; Manzano Martín et al., 2016). That is to say, through social enterprises, people find work, gain knowledge and work experience, improve their social inclusion and in most cases obtain a permanent position. All of this has a positive impact on social sustainability since the main objective is not only to achieve equal opportunities for all people but also to promote the independence and mental health of people with disabilities, which is part of the social role of governments.

## 2.2 | Measuring the viability of social firms

The viability and hence the risk of failure of firms have been recognised as an essential issue in macroeconomic or industrial analysis. Indeed, the importance of the risk of business failure has long been taken into account. Today, this issue is even more relevant to economic sustainability. Moreover, both the number of business failures and the relative trend are considered indicators of the health of industries and the economy as a whole. This is the reason for the significant development of research on financial management for the evaluation of companies and the declaration of their viability.

Pioneering studies on predicting business failure date back to the 1930s. Fitzpartrick (1932) and Winakor and Smith (1935) were the first to use basic univariate analysis techniques to describe trends in various financial ratios. However, it was not until the 1960s that more complex statistical techniques were used. Beaver (1966), Altman (1968) and many others attempted to develop a general theory of business failure, although still without success (Balcaen & Ooghe, 2006; Laitinen et al., 2023; Pozuelo et al., 2013). However, prior research agrees on the need to achieve a unique theory to explain financial failure (Lukason, 2016; Makropoulos et al., 2020; among others). The lack of theoretical scientific analysis of the failure phenomenon weakens the conceptualisation of failure, the understanding of the failure behaviour process, the formulation of new failure prediction models, the choice of variables for these models, the role of financial and non-financial variables and, most essential, a logical understanding of the results (Balcaen & Ooghe, 2006; Laitinen et al., 2023). Artificial intelligence and big data analysis could be used to analyse more cases of failure, albeit not yet successfully, to obtain a unique theory of business failure.

Initially, ratios or accounting data were the basis for studies that attempted to predict, and thus explain, business failure (Altman et al., 2017). Early work consisted of analysing cases of actual business failures and using an inductive method to learn the characteristics of failed firms by comparing them with 'healthy'

firms. However, even today, after more than half a century of research, researchers still do not agree on which variables best explain bankruptcy and business reorganisation (Laitinen et al., 2023). In the literature, many researchers have used the main ratios of financial analysis or financial statements (balance sheet, income statement or cash flow statement) to explain insolvency. In general, three types of ratios are the most commonly used by scholars on this topic: profitability ratios, debt ratios and break-even ratios (Korol, 2013; Tascón & Castaño, 2012). Several studies found a relationship between profitability and liquidity (De Llano et al., 2010). Companies with financial problems do not have easy access to financing, so they are under great pressure to increase income in order to access external funding sources.

One of the most widely accepted models for assessing the risk of bankruptcy of firms is the Altman Z'-score (Laitinen et al., 2023). The accounting variables are taken from the Altman Z-score model due to its current use, popularity and effectiveness according to previous literature (Altman, 1993; Altman et al., 2017; Balcaen & Ooghe, 2006). This model consists of five financial ratios, which we analyse in the methodology section, and is a mix of liquidity, profitability and leverage ratios (Gómez Ortega et al., 2024).

In the case of social enterprises, there are not many studies that analyse a complete sample of social enterprises in Spain (López et al., 2014; Manzano Martín et al., 2016), which will give a picture of the economic and financial situation of these firms. The point is that many social firms had their origins in associations and non-profit organisations, with no professional corporate directors. Managers were highly motivated as, for example, the parents of people with disabilities, but were not professional managers. This could be a handicap for this kind of firms, as human talent management is essential to ensure the long-term profitability of organisations and offer better results to shareholders (Garel & Petit-Romec, 2021; Gelashvili et al., 2019; Luna-Arocas & Danvila-del-Valle, 2022; McNulty & De Cieri, 2016; Oladapo, 2014).

A study of non-profit organisations conducted by Valeau (2015) found that most researchers suggest that these organisations should become professional to be more efficient. Studies of family enterprises have shown that professionalisation guarantees the best results in terms of growth for the company as well as the job stability of workers, quality of life, generation of new jobs and permanence of the organisation over time (Llanos et al., 2011; Rueda Galvis, 2011). Gelashvili et al. (2019) investigated whether sheltered employment centres that have a higher rate of manager professionalisation have better economic returns. A questionnaire was developed for managers. After collecting the answers, an index of professionalisation was used to classify the sheltered employment

centres with managers of high, medium and low levels of professionalism. This index was then correlated with the main financial ratios of the companies. The results show that companies with the highest level of manager professionalisation have, on average, higher economic returns than companies with medium and low rates, although the difference is minimal.

In addition to this, various studies (Jordán de Urríes & Verdugo, 2010; López Penabad et al., 2019) suggest that the success of these enterprises could be based on the various public subsidies they receive for hiring or maintaining jobs for people with disabilities or people who are socially disadvantaged. This can be justified because people with disabilities need more time to learn, and more training and, although their work is productive, the production is not as fast. All of this can affect the profitability or viability of the company. However, these theoretical assertions have been rejected in the study (Gelashvili et al., 2022) where panel data on social enterprises were analysed and it was found that public subsidies do not explain the profitability of these specific firms.

## 2.3 | Research questions

Social entrepreneurship is a type of business that actively participates in achieving the goals set out in Horizon 2023 (Hunt et al., 2024; Singh, 2023; Vasserot, 2023). They participate in creating jobs for those most in need in the market, reduce inequalities, promote responsible entrepreneurship and are promoters of the social economy (Harsanto et al., 2022; Vasserot, 2022). In short, social enterprises address social and environmental problems (Bonfanti et al., 2024; Hunt et al., 2024) while generating profits for the company, as regulations require them to be economically viable.

According to Weaver (2023), social enterprises are high-value enterprises and therefore their critical functioning is essential for various stakeholders. However, the impact of COVID-19 on the social enterprise sector is unexplored, despite the potential of this sector to mitigate some of its consequences for economic development. Other studies, such as Gelashvili et al. (2022), point to the lack of research on this type of enterprise, especially quantitative research, which could be useful for the proper management and prevention of economic and financial risks.

The economic viability of social enterprises is the key to their survival, even if they are not-for-profit organisations, as it is the condition for the normalisation of people with disabilities, their families and society in general. It is therefore necessary for this sector of the social economy to know the characteristics of these enterprises and, in this way, to indirectly predict the risk of business failure. Several works in the literature study the explanatory factors of business failure

for small and medium-sized enterprises (SMEs) (Rico et al., 2021; Williams, 2014), family businesses (Kücher et al., 2020) or sheltered employment centres (Gelashvili et al., 2015). However, such failure factors are unknown for social enterprises in Spain. According to the literature (Gelashvili et al., 2019; Gómez-González et al., 2023), social enterprises may be at a disadvantage in that most of them are created by the relatives of people with disabilities; the lack of management knowledge may affect the continuity of these enterprises in the market. Another important factor is public subsidies, as their high amount could be key to their business success (Jordán de Urríes & Verdugo, 2010; López Penabad et al., 2019). Therefore, the first research question that motivates this study is as follows:

**RQ1:** *What percentage of social firms are at risk of bankruptcy?*

When studying the prediction of bankruptcy in different types of firms, several variables have been identified. Success is the opposite of bankruptcy. For example, some works in the literature study the explanatory factors of success in Spanish firms, in particular success factors for SMEs (Rubio & Aragón, 2002), exporting firms (Landa-Torres et al., 2012) or family firms, which are an important part of the business world in Spain (Sánchez et al., 2009). However, such success factors are unknown for social enterprises. The literature review has mostly focused on the theoretical analysis of social enterprises because obtaining financial data is a challenge. Most studies have undertaken a financial structure analysis or regulatory analysis (Jordán de Urríes & Verdugo, 2010; López Penabad et al., 2019; Manzano Martín et al., 2016). A study by López Penabad et al. (2019), using a sample of sheltered employment centres from Galicia with panel data from 2010 to 2015, analysed different solvency, profitability and liquidity ratios, reaching the conclusion that these companies have a high level of indebtedness, especially in the short term, and low solvency and liquidity ratios – even negative results of profitability that put in doubt their survival and the employment stability of their workers. A more recent study (Gelashvili et al., 2022) used the sample of social enterprises for 2016, where the variables age and size explained business profitability and survival. According to Altman et al. (2017), variables such as size, age or industry may be relevant for predicting firm failure. Another study by Gelashvili et al. (2015), using the AI methodology, concluded that the debt/net sales ratio is a primary variable for predicting bankruptcy, while variables such as age, size or location were not relevant for the bankruptcy prediction model.

A more recent study on the prediction of research and development (R&D) firm failure (Flores-Ureba et al., 2023) concluded that short-term liquidity,

long-term solvency and profitability variables predict firm failure. At the same time, testing the difference in the means for younger and mature firms and SMEs and large firms has shown that there is a difference in the means. Furthermore, the cash flow variable has been found to be crucial for the survival of the firm, especially during economic downturns (Kim & Upneja, 2021). A study analysing the prediction of business failure in three European countries concluded that the age of the enterprise is positively related to bankruptcy, which means that only a small percentage of social enterprises manage to survive in the long run (Jace et al., 2022). The second research question is posed:

**RQ2:** Which variables condition the viability of social firms?

Taking into account the literature reviewed and the research questions posed in this study, this research aims to identify patterns for the economic sustainability of social enterprises, that is, those with a high probability of survival. These patterns are relevant as those social firms with viability and economic sustainability will be firms that will contribute to social sustainability by hiring people with disabilities.

### 3 | VARIABLES, METHODOLOGY AND SAMPLE

#### 3.1 | Variables

The control variables used to study the problem of financial stress in social firms were as follows:

- The age of each social firm: the number of years from its foundation until the reference year of the latest financial statements, 2022. In theory, companies with more experience in the market should have more strategies to survive (Blasco & Carrizosa, 2007; Williams, 2014).

- Their size: measured by the number of employees. There are contradictory studies regarding this variable. Some studies correlate size positively with profitability (González Pérez, 1995), while others point to a negative relationship (Illueca & Pastor, 1996).

- The amount of capital subsidies they receive: as reported in the balance sheet of each company. There are theoretical studies that suggest that the public subsidies received by social firms guarantee their viability (Jordán de Urrés & Verdugo, 2010; Laloma, 2007).

- The economic profitability ratio or ROA: measured as operating profit divided by total assets. This is the capacity of a company's assets to generate value, regardless of how they have been financed. It can be broken down into sales margin and asset turnover. In fact, profitability is the most widely used indicator in the literature on corporate viability, despite its limitations (Hewitt et al., 2017; Hull & Rothenberg, 2008). In

particular, the ROA result cannot be used across different sectors as the sector determines the result because some industries need more investment in assets than others to generate revenues.

In addition to the ROA, other ratios are widely used in the literature on bankruptcy prediction. A pioneering study by Laitinen (1991) on the importance of these variables in the bankruptcy process justifies our choice. Moreover, according to Balcaen and Ooghe (2006), these ratios reflect the basic financial dimensions that are important according to empirical research on business failure. These dimensions are growth, efficiency, profitability, cash flow, financial leverage and liquidity. Another study by Laitinen et al. (2014) supports their use for predicting insolvency in seven countries. The full list of variables used in the study is presented in Table 1.

In addition, the Altman Z-score indicator has been calculated for unlisted companies, as explained in the previous section. This score is the decision variable in the chosen methodology.

#### 3.2 | Methodology: Algorithm C4.5 and Z-score Altman

Artificial intelligence (AI) methods are a new approach to analysing financial problems (Sanchis et al., 2007; Díaz et al., 2009, Camacho-Miñano et al., 2015; Muñoz-Izquierdo et al., 2022, applied to Spanish data). They can be seen as complementary to statistical methods and, in some cases, as substitutes. They provide a different perspective on the problems we are analysing. Consequently, we studied the financial variables that characterise the failure or survival of sheltered employment centres using the C4.5 decision tree. We obtained the variables associated with the survival of companies using an AI tool. The aim was to identify which of the financial variables described above are associated with a Z-score of bankruptcy or 'healthy'. The number of objects that satisfy the part of the conditions specified by the rule is called the rule strength and is a valuable concept for validating a rule.

Decision trees are part of what is known as machine learning. Indeed, they are perhaps the easiest machine learning systems to use and understand. A decision tree can essentially be interpreted as a set of rules compressed into a tree representation. Each branch represents a rule and the rules are logical sentences: *if ... conditions ... then ... decisions*. That is, if some *conditions* (ratios, attributes or variables) are satisfied, *then* the firm belongs to a determined category or class (*decisions*). Each rule has a specific *strength*: the number of objects that satisfies the condition part of the rule and, this way, they belong to the class or category indicated by the rule.

Several algorithms develop decision trees, and what distinguishes one decision tree from another is the

**TABLE 1** List of variables.

Name	Definition	Formula
AGE	Age of the company from inception to the latest available data (2022).	
SIZE	Number of employees.	
Subsidies	Capital grants received by companies in 2022.	
(1) ROA	Operating result refers to the results from the main activity of the firm; Total Assets = Non-current assets + Current assets.	Operating Results/Total Assets
(2) Net profit margin	Result is net result of the period (the bottom line of the income statement); Net turnovers are the same as net sales.	Net income/Net Sales
(3) Operating cash flow margin	Cash flow refers to operating cash flow from the main activity of the firm.	Cash flow/Net Sales
(4) Quick ratio	Current assets are short-term assets owned by the company; Inventory is stocks owned by the business; Current liabilities are all short-term obligations.	(Current Assets – Inventory)/Current Liabilities
(5) Debt turnover	Debt refers to total liability of the company.	Total Debt/Net Sales
(6) Equity Ratio	Equity shows the owners' wealth and the total amount of the own resources of the company.	Equity/Total Assets
Zscore_Dummy	Probability of bankruptcy. Safe zone = Z-score > 2.9; Grey zone = Z-score < 2.9 and > 1.23; Distress zone = Z-score < 1.23.	Safe zone companies = 0; Grey and distress zone companies = 1.

Source: Own elaboration.

algorithm that generates it. The algorithm developed by Quinlan and implemented in C4.5 (Quinlan, 1993) is probably the most popular of all decision tree algorithms. The criterion used for partitioning is based on several concepts from information theory and has undergone several notable improvements over time. A more detailed description can be found in Quinlan (1993) and Díaz et al. (2009).

The J48 algorithm is the freely available Java implementation of the C4.5 algorithm included in the WEKA software. WEKA is the data mining package developed by the University of Waikato (Witten & Frank, 2005) that we used for our analysis.

The C4.5 classification algorithm, unlike some statistical methods, does not require that the data satisfy specific statistical assumptions. In fact, C4.5 does not assume any particular distribution of the data (e.g. normality). This makes it flexible and applicable to a wide range of problems and data types. Nor do the attributes need to be independent of each other. The C4.5 tree can handle complex correlations and relationships between attributes (Quinlan, 1993; Witten & Frank, 2005).

However, it is recommended that the data are properly preprocessed (i.e. deal with missing values, see whether there are highly correlated attributes that may not add additional value to the model and can be removed to simplify the tree) or that classes should not be excessively unbalanced. It should be noted that C4.5 can handle both continuous and categorical attributes. In addition, the algorithm includes a pruning phase to avoid overfitting, which improves the model's ability to generalise to new data.

In the academic literature and practice, there are several scoring models for the early prediction

of business failure with an accuracy of more than 90% (Altman, 1968; Ohlson, 1980; Springate, 1978; Zmijewski, 1984). However, the first Z-score model developed by Altman is still the most widely used compared to the other scoring models developed over the decades (Altman, 1968). Therefore, despite the number of existing studies, we have chosen an indicator that has been in use for almost 50 years, namely the Altman Z-score (Altman, 1968). Based on Altman's experience with financially distressed companies, an index was developed using five ratios and five weights to predict the risk of bankruptcy of listed manufacturing companies. This model has been adapted over time and adjusted to the Z'-score for unlisted companies. The model is formulated as follows:

$$Z' = 3.107 \frac{\text{Operating results}}{\text{Total assets}} + 0.998 \frac{\text{Net sales}}{\text{Total assets}} + 0.420 \frac{\text{Equity}}{\text{Total liability}} + 0.77 \frac{\text{Working capital}}{\text{Total assets}} + 0.847 \frac{\text{Retained earnings}}{\text{Total assets}},$$

where Z' is the bankruptcy rate. Altman's results show that, in practice, firms can be classified into three different zones:

- Safe zone: Z' is greater than 2.9. This means that the firm is far from bankruptcy. In our model, if a firm is in this zone, it has been coded with the value 0 for the analysis.
- Grey zone: Z' between 1.23 and 2.9 implies that insolvency is possible, so the firm needs to take measures

to survive. In our model, a firm within this range of  $Z'$  is given a code with the value of 1.

- Distress zone:  $Z'$  less than 1.23 means a high probability that the firm will fail. In our model, we have coded firms classified in this zone with the value of 2.

Altman shows that bankrupt and non-bankrupt firms have very different financial profiles 1 year before bankruptcy, which is reflected in the financial ratios on which the Z-score model is based (Altman, 1993). Since its formulation, the Z-score has been widely used in studies of corporate failure. Altman (1993) gives a detailed explanation of it and its applications. Among the most important related studies is that of Luoma and Laitinen (1991). Subsequently, the model has been revisited for further generalisation and application to non-manufacturing firms (Ross et al., 2010).

### 3.3 | Sample

The initial sample of the study consisted only of sheltered employment centres and insertion companies operating in Spain. Financial data were obtained from 36 insertion companies and 963 sheltered employment centres. Unfortunately, it was not possible to obtain data on social cooperatives, as there is no public list. However, the Iberian Balance Sheet Analysis System (SABI) database was used to search individually for social cooperatives operating in Spain, although none had updated data for 2022. The data of social enterprises in 2022 were chosen as the final sample for this study, as this year, companies from different sectors were able to return to financial normality or learned to adapt and be resilient (Kaftan et al., 2023; Kročil et al., 2023). In 2022, 1807 sheltered employment centres were operating in Spain compared to 2215 in 2020 (Comité Español de Representantes de Personas con Discapacidad (CERMI), 2022).<sup>3</sup> This indicates a drop in the number of these companies of 408 (almost 23%). The decrease in the number of these centres may have been caused by COVID-19, which affected the solvency of Spanish companies (Blanco et al., 2021; Crespí-Cladera et al., 2021). Therefore, 53% of the whole sample of sheltered employment centres has been analysed. According to Federación Asociaciones Empresas Inserción (FAEDEI) (2022),<sup>4</sup> more than 150 insertion companies were operating in 15 different sectors. FAEDEI does not provide a list of these companies, which makes it difficult to search for financial data. In total, 24% of the insertion companies have been analysed.

The main characteristics of the selected sample were that it consisted of 29% micro-enterprises, 38% small enterprises, 26% medium-sized enterprises and, finally, 7% large enterprises with more than 250 employees. In terms of legal form, 919 enterprises were limited partnerships, that is, almost 92% of the final

sample; 7.8% were public limited companies and there were only 2 enterprises with the legal form of partnerships. According to the NACE 2 revision, most social enterprises were active in administrative and support service activities (35%); wholesale and retail trade and repair of motor vehicles, transport and storage (15%); and health and social work (9%), while the rest of the sample was engaged in other activities.

## 4 | RESULTS AND DISCUSSION

Firstly, a descriptive analysis of the study was carried out to analyse all the variables used. Variables have been winsorised at 1% to avoid outliers. The results show that social enterprises are, on average, businesses with a positive rate of profitability (see Table 2), as their average is 6%. This figure is in line with previous studies, which show that social firms are companies with low but positive profitability (Gelashvili et al., 2022; Segovia-Vargas et al., 2021). The same is true for the other profitability ratio (2) net profit margin, which has a positive average profitability. If we analyse the minimum and maximum for these enterprises, there are firms with very different results, so not all social enterprises have positive profitability.

The results for the enterprise age variable showed an average age of more than 16 years; the youngest enterprise was 2 years old and the oldest had 39 years of experience in the market. The number of employees measures the size of the enterprise. The descriptive table shows that these enterprises have an average of 75 employees, with the largest enterprise having 949. Upon analysing the capital subsidies received by social enterprises, we found that there were firms without subsidies and others that received a significant amount (subsidies are measured in thousands).

One of the interesting results is for the equity ratio; as we can see in the descriptive table, the minimum result is negative, which means that there were companies that closed their net equity with negative results. However, overall, the average result of the ratio is not bad, at almost 0.46, which means that almost half of the economic resources are purchased through internal financing. Social firms have a high portion of non-distributed profits as reserves.

Looking separately at the average results of the two groups of healthy and distressed enterprises, the average net profit margin shows a large difference in results. In particular, healthy enterprises have an average result of 90% profit, while distressed ones have a negative result. Another big difference is in the case of the debt turnover ratio, where we see the low level of debt of healthy companies and the high level of debt of companies at risk of bankruptcy.

Secondly, the Z-score analysis was carried out to rank enterprises according to their level of insolvency.

**TABLE 2** Descriptive Statistics.

Variables	Class	Min	Max	Mean	Std. dev.
AGE	Safe	2	39	16.91	8.13
	Distressed	2	39	16.72	8.60
	Total	2	39	16.81	8.37
SIZE	Safe	1	949	81.79	165.90
	Distressed	1	949	69.20	130.78
	Total	1	949	75.24	148.71
Subsidies	Safe	0	1489.45	35.21	161.60
	Distressed	0	1489.45	66.80	198.68
	Total	0	1489.45	51.66	182.44
(1) ROA	Safe	-60%	58%	12%	15%
	Distressed	-60%	37%	0.56%	14%
	Total	-60%	58%	6%	15%
(2) Net profit margin	Safe	-90%	49%	90%	15%
	Distressed	-90%	49%	-0.04%	18%
	Total	-90%	49%	4%	17%
(3) Operating Cash Flow Margin	Safe	0	2.28	0.30	0.45
	Distressed	0	2.28	0.15	0.24
	Total	0	2.28	0.22	0.36
(4) Quick ratio	Safe	0.14	30.88	4.63	5.16
	Distressed	0.11	30.88	1.78	2.25
	Total	0.11	30.88	3.14	4.17
(5) Debt turnover	Safe	0.04	2.33	0.23	0.18
	Distressed	0.04	5.89	1.03	1.10
	Total	0.04	5.89	0.64	0.90
(6) Equity Ratio	Safe	-0.64	0.82	0.28	0.27
	Distressed	-0.24	0.98	0.66	0.23
	Total	-0.64	0.97	0.46	0.31

Source: Own elaboration.

**TABLE 3** Z'-score analysis of social firms.

		Safe zone	Grey zone	Distress zone
Sheltered employment Centres	No.	466	367	130
	%	48%	38%	14%
Insertion Companies	No.	13	16	7
	%	36%	44%	20%
Total	No.	479	383	137
	%	48%	38%	14%
		Safe firms	Distressed firms	

Source: own elaboration.

As defined in the previous sections, 999 social enterprises were classified according to their level of insolvency. In the 'safe' zone, 479 enterprises were classified. In the 'grey' zone, 383 enterprises were classified, which means that they might have some insolvency problems in the future. Finally, 137 enterprises were classified in the 'distressed' zone. Table 3 shows the detailed Z-score analysis.

Although there is a large difference in the number of enterprises analysed between sheltered employment centres and insertion enterprises, it can be seen that, overall, 48% of sheltered employment centres are in the 'safe' zone, while only 36% of insertion enterprises are in the same group. An analysis of the 'distress zone' shows that 20% of the insertion companies have a high probability of the risk of bankruptcy, compared

to 14% of the sheltered employment centres. As there are few insertion enterprises, only 14 of 100 social firms have a probability of going bankrupt. The result in Table 3 answers research question 1 (RQ1). A study by Flores-Ureba et al. (2023) on the bankruptcy of Spanish R&D companies showed that 27% of these companies were in the bankruptcy zone after the pandemic. Compared to the results of this study, we can say that 14% is rather low. Another study on urban collective transport companies in Spain (Gelashvili et al., 2023) showed that companies classified in the bankruptcy zone in 2020 totalled 43% of the final sample, while that percentage in 2019 was 20%. All this indicates that the percentage of social enterprises located in the bankruptcy zone is not high.

As shown in Table 4, the Kruskal–Wallis test was performed to see if there was a difference in the means of the variables for the companies without and with probability of the risk of bankruptcy. The Z-score variable was classified as a dummy, where 0 indicates enterprises in the ‘safe’ group versus 1 otherwise; this means that bankrupt and grey group enterprises are classified as ‘distressed’. The choice of variable coding is determined because, in this type of analysis, the dummy variable can give a more accurate result (see Gelashvili et al., 2015).

The results show that there is a difference in means for the social enterprises and their analysed variables. It is notable that the only two variables that do not show the difference in means for predicting business failure are age and size. This result is not in line with previous

studies (Altman et al., 2017; Gelashvili et al., 2022; González Pérez, 1995). Therefore, this represents a contribution to the academic literature, as ours is the first study to analyse social enterprises through their financial outcomes after the pandemic. It is worth highlighting the importance of the subsidies variable, as there is a difference between the averages for healthy and bankrupt companies. This indicates the need for more subsidies for social enterprises, thus solving the financial problems they face (Gelashvili et al., 2015). For the rest of the ratios, the difference in the mean for bankrupt and non-bankrupt social enterprises is also confirmed. These results are in line with research undertaken on different industries in recent years (Flores Ureba et al., 2023; Kim & Upneja, 2021).

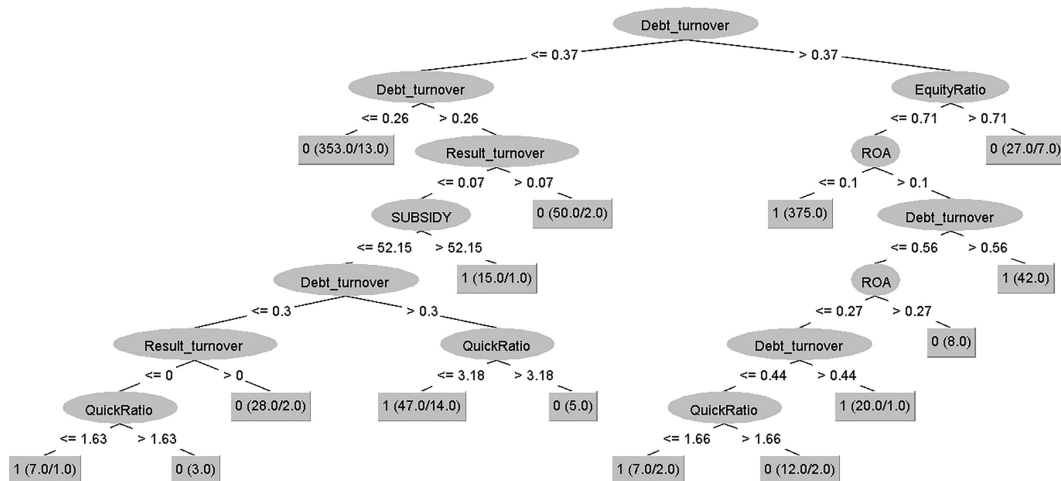
The decision tree enabling to follow the survival patterns of social enterprises was then analysed using the C4.5 algorithm. In order to validate the rules, a cross-validation procedure was used, which resulted in 91.39% of social enterprises being correctly classified. The results of the model are shown in Figure 1. The strongest branches for each class (0, 1) are shown in the Figure 2.

Consequently, the branches must be interpreted according to their strength, since a large number of cases support them and show the strongest patterns. In our case, this pattern is the answer to research question 2 (RQ2). As can be seen in the figure, the most critical branch that classifies social enterprises as insolvent is when the debt turnover ratio is greater than 0.37, the equity ratio is less than or equal to 0.71

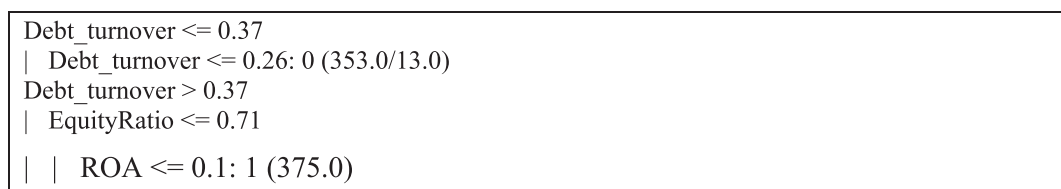
**TABLE 4** Mean difference test.

Variables	Z-score	Obs	Rank sum	$\chi^2$	Probability
AGE	Safe	479	241543.00	0.201	0.6539
	Distressed	520	257957.00		
SIZE	Safe	479	240416.00	0.040	0.8408
	Distressed	520	259084.00		
Subsidies	Safe	479	223153.50	12.873	0.0003
	Distressed	520	276346.50		
(1) ROA	Safe	479	299356.50	172.610	0.0001
	Distressed	520	200143.50		
(2) Net profit margin	Safe	479	287966.50	113.169	0.0001
	Distressed	520	211533.50		
(3) Operating cash flow margin	Safe	479	266117.50	34.133	0.0001
	Distressed	520	233382.50		
(4) Quick ratio	Safe	479	315088.50	275.267	0.0001
	Distressed	520	184411.50		
(5) Debt turnover	Safe	479	126523.50	614.920	0.0001
	Distressed	520	372976.50		
(6) Equity Ratio	Safe	479	332001.00	412.226	0.0001
	Distressed	520	167499.00		

Source: Own elaboration.



**FIGURE 1** Decision Tree Obtained through Algorithm C4.5. Branches are interpreted as logical sentences: If the conditions are satisfied then the firm belongs to the category indicated by the branch (0 or 1). The figure in brackets is the number of firms that verifies the branch. In the case of two figures, these indicate success/errors. *Source:* Own elaboration.



**FIGURE 2** Main branches of the C4.5 decision tree in the form of a list. Branches are interpreted as logical sentences: If the conditions are satisfied then the firm belongs to the category indicated by the branch (0 or 1). The figure in brackets is the number of firms that verifies the branch. In the case of two figures, these indicate success/errors. *Source:* Own elaboration.

Debt\_turnover > 0.37 AND EquityRatio <= 0.71 AND ROA <= 0.1: 1 (375.0/1.0)

Debt\_turnover <= 0.29 AND ROA > -0.12 AND SUBSIDY <= 72 AND Debt\_turnover <= 0.24: 0 (260.0)

**FIGURE 3** The main rules of the PART algorithm. Rules are interpreted as logical sentences: If the conditions are satisfied, then the firm belongs to the category indicated by the branch (0 or 1). The figure in brackets is the number of firms that verifies the branch. In the case of two figures, these indicate success/errors. *Source:* Own elaboration.

and the ROA is less than or equal to 0.1 (this branch is supported by 375 firms, which represents 72.11% of insolvent companies). This is the strongest branch. According to prior research, the return on assets ratio seems to be the most powerful predictor (Altman et al., 2017), as it consistently outperforms other measures in assessing the risk of failure. Our result is in line with the previous literature on social enterprises (Gelashvili et al., 2015).

In the case of solvent enterprises, it was verified when the debt turnover ratio was less than or equal to 0.26 (this branch is supported by 353 enterprises, with 13 errors which represent 71.4% of the solvent firms).

This is a strong branch, as it is supported by more than a third of the cases. In addition, it is important to highlight that we can discriminate against solvent social firms with only one ratio.

Additionally, for the robustness test, AI analysis based on the PART algorithm has been performed. Witten and Frank (2005) have defined this algorithm as a rule learning algorithm based on partial decision trees. The results of PART generate decision rules and have the form ‘if conditions, then decisions’, that is, they draw decisions when some conditions are met. Figure 3 shows the main rules of the PART model.

The accuracy of the PART algorithm is 91.7%, which allows us to validate the model. The PART algorithm shows the same pattern for insolvent firms. With respect to the solvent firms, once again the most relevant variable is debt turnover, but in this case, it is also necessary to characterise the solvent firms' ROA (greater than  $-0.12$ ) and the subsidy variables (less than 72, slightly below the average value).

Through this analysis, the results of Algorithm C4.5 have been robustly confirmed. The results of this study are in line with the previous literature. According to the study by Gelashvili et al. (2022), which analysed data on social enterprises before the pandemic, the capital subsidy variable did not condition the profitability of these enterprises. This means that they could be profitable on the basis of their core business. Other variables considered, such as age and size, are not relevant to the pattern of economic sustainability of this type of enterprise.

## 5 | CONCLUSIONS, LIMITATIONS AND FURTHER RESEARCH

During the COVID-19 pandemic, companies around the world faced a business crisis, which resulted in many closing down or going bankrupt. Among these were social enterprises, which actively participated in the creation of the social economy. As their main objective is to improve the lives of disabled and diverse workers, it is essential to ensure their survival. The bankruptcy of this kind of company would be a disaster due to the social approach and labour pool.

Therefore, this study aims to analyse social enterprises operating in Spain (sheltered employment centres and social inclusion enterprises) to study their survival patterns. Our findings show that enterprises with many years of experience in the market (based on the average age) have strategies to mitigate the financial problems caused by crises, as they are still operational since the pandemic.

Another relevant result of analysing the survival patterns of social enterprises is that age, size, net result and cash flows on net turnover did not condition their economic sustainability. The main pattern for these enterprises is that, like debt, profitability (ROA) and equity guarantee their continuity in the market. These three ratios should be controlled by managers in order to avoid financial distress. In addition, it has been shown that public subsidies received by these enterprises can prevent business failure. This is important because social enterprises are first and foremost oriented towards social work and then towards profitability. Therefore, it is essential to have subsidy coverage, which in difficult times helps to reduce the economic risk. Based on the results, theoretical, practical and policy implications can be drawn.

### 5.1 | Theoretical implications

Social enterprises have been studied based on the communities or data available from an incomplete sample (Gelashvili et al., 2015, 2022; López Penabad et al., 2019). These studies have focussed on their work and importance, as well as the regulations governing them. Analysis has shown that the most current sample of economic and financial data is from 2016. Therefore, this study contributes to the academic literature by presenting the variables to guarantee the economic sustainability of social firms. Specifically, our study points out the key role of the subsidy variable because it is unusual in other sectors. Moreover, this research gives academic visibility to this type of enterprise as an important part of the social economy oriented to participate in meeting the SDGs.

### 5.2 | Practical implications

It is important to point out the practical implications for better management of these enterprises. First of all, managers of social enterprises should be aware that low ratios such as ROA, and equity and a high debt ratio are indicators of financial problems in a firm. Therefore, investing in early detection of business failure by periodically reviewing these indicators can prevent the risk of bankruptcy. In addition, public subsidies for these companies, which have different purposes (elimination of architectural barriers, adaptation of workplaces, covering wage costs, etc.), can reduce costs and increase profit.

### 5.3 | Policy implications

The importance of social enterprises is indisputable not only for stakeholders but also for society in general. People with disabilities can find a job through them, improve their professional skills, become economically independent and integrate into the labour market. The governments of each country and region should encourage regulations for the creation of social enterprises because their contribution to the social economy is indisputable. According to the European Commission,<sup>5</sup> social enterprises at the European level employ more than 160 million people, which means a reduction in the number of people who are jobseekers receiving government support.

### 5.4 | Limitations and future research areas

This study is not without its limitations. The impossibility of accessing national data or data on social cooperatives in Spain severely limited the scope of the study. This makes it difficult to generalise the results. The study

only used data from 2022, whereas in the case of panel data, it would be possible to compare results from different years. Therefore, in future research, it would be helpful to enlarge the sample to present more robust results. At the same time, it is expected that we should be able to compare the data of social enterprises at the European level, as the parent regulation comes from the European Commission, although each country sets its own standards and requirements for social enterprises.

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## CONFLICT OF INTEREST STATEMENT


The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## DATA AVAILABILITY STATEMENT

Data will be available by means of an official request to the corresponding author, undertaking that the data will not be published and will only be used for scientific purposes. We have a commitment to data protection with the Spanish Government.

## ORCID

María Jesús Segovia Vargas  <https://orcid.org/0000-0002-6578-8017>

María del Mar Camacho-Miñano  <https://orcid.org/0000-0001-5852-338X>

Vera Gelashvili  <https://orcid.org/0000-0001-5951-6392>

## ENDNOTES

<sup>1</sup> Regulation (EU) No 1296/2013 of the European Parliament and of the Council of 11 December 2013 on a European Union Programme for Employment and Social Innovation ('EaSI').

<sup>2</sup> SWD = Staff Working Document, an important series of publications issued by the European Commission.

<sup>3</sup> <http://www.estadisticasocial.es/indicador.php?id=10>.

<sup>4</sup> <https://faedei.org/organizacion/>.

<sup>5</sup> [https://single-market-economy.ec.europa.eu/sectors/proximity-and-social-economy/social-economy-eu\\_en](https://single-market-economy.ec.europa.eu/sectors/proximity-and-social-economy/social-economy-eu_en).

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## AUTHOR BIOGRAPHIES

**María Jesús Segovia-Vargas** is the co-principal researcher of the Research Project entitled 'Patterns to identify risks of zombie business and bioeco-firms using financial information'. Her research topic focuses on operational research methods for financial problems (risk management and social entrepreneurship). She has published several papers in internationally renowned journals and has led several research projects.

**María Camacho-Miñano** is a member of the research group 'risk in insurance, finance, financial distress and entrepreneurship' and co-principal researcher of the Research Project entitled 'Patterns to identify risks of zombie business and bioeco-firms using financial information' from the 2020 Spanish Ministry of Science and Innovation. Her publications can be seen here: <https://produccioncientifica.ucm.es/investigadores/140977/detalle?lang=en>

**Vera Gelashvili** is the author of several papers presented at national and international conferences. Her main research line is the analysis of social firms' prediction of bankruptcy and establishment of survival patterns. The secondary lines of research are (i) social value creation, economic sustainability and social sustainability; and (ii) business viability analysis of transport enterprises.

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