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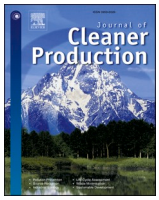

A BWM approach to determinants of sustainable entrepreneurship in small and medium-sized enterprises

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ABSTRACT

Small and medium-sized enterprises (SMEs) constitute an extremely large percentage of most nations' businesses. These companies are also expressing growing concerns about sustainability and its strategic integration into operations. However, SMEs have been prevented from making investments in sustainability by the absence of a holistic view of this topic, an overemphasis on an economic perspective, and the consequent devaluation of environmental and social perspectives. In this context, greater importance needs to be given to investigating SME sustainability and building a transparent, holistic, and realistic business model. The present study combines cognitive mapping and the best worst method (BWM) to identify determinants of sustainable entrepreneurship in SMEs. These techniques were applied in two meetings with a panel of specialists with knowledge about and experience in this subject matter. The insights obtained during the two panel meetings allowed the proposed process-oriented approach to assist decision-makers in analyzing a sample of SMEs and selecting the ones that best match the following clusters of decision criteria: (1) entrepreneur profile; (2) firm internal characteristics; (3) economic factors; (4) other external factors; and (5) market. The results were validated by four representatives of the Portuguese Institute for Small and Medium-sized Enterprises and Innovation (*Instituto de Apoio às Pequenas e Médias Empresas e à Inovação* (IAPMEI) in Portuguese). The study's contributions and limitations are also discussed.

1. Introduction

Environmental awareness has been growing around the world despite contemporary communities' characterization as part of a consumer society. As a result, numerous guidelines have been defined with reference to this issue, and the number of companies seeking to be more sustainable has been growing (Brito et al., 2019; Paiva et al., 2021). Sustainability is thus currently one of the greatest challenges of organizations, and society's perceptions of their credibility and competitiveness are directly related to these organizations' connection with the environment (Govindan, 2022a,b; Sharma et al., 2022). Consequently, a relationship exists between social and environmental responsibility and economic development (Brundtland Report, 1987; Hsu et al., 2017).

Given the globalization process and most countries' economic dynamics, organizations must strike a balance between economic, social, and environmental concerns. Companies urgently need to find ways to integrate sustainability into their business strategies, internal culture, and all stages of the value creation process (Li et al., 2018; Zarbakhshnia et al., 2022). Besides potentially conferring competitive advantages, integrating sustainability into operations allows firms to adapt to the world's current needs and requirements (Terán-Yépez et al., 2020; Paiva et al., 2021).

Companies are an essential pillar in any economy, playing an important role in technology, innovation, entrepreneurial activities, and

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market management. Small and medium-sized enterprises (SMEs) make up the largest portion of the world's businesses, so SMEs are crucial to the development of any country. However, these smaller businesses are also responsible for a large part of all environmental pollution. Although this issue is not recent, more studies are still needed on SME sustainability as most existing research has been associated with large companies. Although information remains scarce, more stakeholders now recognize SMEs' importance at the environmental level, which has generated more interest among academics and practitioners (cf. Brito et al., 2019; Terán-Yépez et al., 2020). The present study, therefore, sought to address the following research questions:

- How can sustainable entrepreneurship be assessed in SMEs?
- What qualitative and quantitative metrics can be used to do this?
- How can these metrics be integrated into an overall assessment system?

Given that the problem under analysis is quite complex, methodologies based on constructivist principles were used, namely a combination of cognitive mapping and the best worst method (BWM). The main objective is to identify which determinants of sustainable entrepreneurship influence SMEs. Additional aims are, first, to integrate objective and subjective elements into the model to be developed and, second, contribute to the rising awareness of the importance of sustainable entrepreneurship. The third objective is to expand the relevant research fields' knowledge about applying sustainable entrepreneurship to SMEs, while the last goal is to create a decision-making support tool for SMEs seeking to strengthen their sustainability.

A major practical contribution of the proposed methodology is the added flexibility and extensiveness obtained by combining cognitive mapping and the BWM. This integrated methodology provides more realistic results and displays unique and significant added value regarding the state-of-the-art of sustainable entrepreneurship at an international level. Specifically, applying cognitive mapping generates new insights based on experts' knowledge, which could have remained undiscovered if only statistical methods had been used. The BWM, in turn, facilitates the inclusion of objective and subjective points of view in the decision-making process, as well as the calculation of criteria's trade-offs.

It is worth noting that the proposed methodological procedures focused on supporting interactive learning and generating more effective recommendations for how to develop sustainable entrepreneurship strategies. The combined use of cognitive mapping and the BWM in this study thus promoted exchanges of ideas and experiences, generated a deeper understanding of sustainable entrepreneurship, and revealed possible cause-and-effect relationships among the decision criteria. The results help answer questions such as why specific tendencies occur.

This study's findings have important theoretical and practical implications regarding sustainable entrepreneurship. On a theoretical level, the results may be contextualized in nature, but they provide a well-defined starting point for other researchers and practitioners who need to analyze sustainable entrepreneurship strategies. These contributions can serve as a springboard for future analyses of sustainability and entrepreneurship, thereby complementing the existing knowledge in the relevant fields. From a methodological point of view, the present findings offer two significant contributions. The first comes from the integration of the selected methodologies, which appears to be new in this research context, while the second arises from the description of the procedures followed. The approach adopted facilitates replications in other contexts and/or with different groups of experts due to the framework's process-oriented nature. No evidence was found of previous studies that have combined cognitive mapping and the BWM to identify and analyze determinants of sustainable entrepreneurship in SMEs. This research and its proposed methodology thus constitute added value to the existing literature on entrepreneurship, sustainability, and operational research.

The rest of this paper is organized as follows. The next section presents a literature review focused on sustainable entrepreneurship. Section three discusses important concepts related to the methodologies used. Section four analyzes the results, including the proposed model's application to real SMEs. The final section offers the main conclusions, limitations, and suggestions for future research.

2. Related literature and research gap

Until recently, the success of most companies has been interpreted solely on the basis of their financial performance. Firms' primary goal has been to generate economic benefits and, in some cases, create jobs—the same factors that have traditionally determined entrepreneurship's contribution to the economy (Davidsson and Wiklund, 2007). According to Schlange (2006), firm value creation has usually been measured on an economic and financial level by indicators such as sales value or profits, and the main objective has always been to maximize profit. In other words, entrepreneurship in the past was only committed to economic development and wealth generation (Schumpeter, 1934), while environmental and social issues were mostly avoided or neglected (Rodgers, 2010; Natividade et al., 2021). In this sense, Nave and Franco (2019) and Terán-Yépez et al. (2020) assert that, since the emergence of sustainable development as an urgent issue worldwide, entrepreneurship conceptualization has moved away from being solely based on wealth generation, eventually developing into sustainable entrepreneurship. Thus, entrepreneurship needs to be based on not only economic objectives but also environmental and social initiatives that respond efficiently and effectively to economies' current needs and demands (Schaltegger and Wagner, 2011; Kostakis and Tsagarakis, 2022). Aghelie et al. (2016) report that these changes have meant that many companies and entrepreneurs are increasingly interested in understanding the real impacts of their business on the environment and society at large. Entrepreneurship is no longer centered around value creation in terms of financial outcomes, extending over time to encompass non-economic benefits as well (Shepherd and Patzelt, 2011; Terán-Yépez et al., 2020).

Sustainable entrepreneurship links sustainable development to entrepreneurial activities (Schaltegger and Wagner, 2011). Initially, research on sustainable entrepreneurship focused mainly on entrepreneurial activities and their relationships with environmental problems and solutions (Elkington, 1998). Recently, Hall et al. (2010), Nave and Franco (2019) and Natividade et al. (2021) observe that the term has gradually evolved into a broader approach that intersects with the triple bottom line (TBL) perspective. That is, sustainable entrepreneurship is composed of three dimensions. At the environmental level, this concept takes into account the environment's long-term protection and the reduction of entrepreneurial activity negative effects. In the social dimension, attention is paid to customers, partners, employees, communities, and all other stakeholders. The economic level of sustainable entrepreneurship is, in turn, dependent on organizational performance (Urbaniec, 2018; Kostakis and Tsagarakis, 2022).

Based on these dimensions, Hockerts and Wüstenhagen (2010: 482) define sustainable entrepreneurship as *"the discovery and exploitation of economic opportunities through the generation of market imbalances that initiate the transformation of a sector towards an environmentally and socially more sustainable state"*. Shepherd and Patzelt (2011) further conceptualize sustainable entrepreneurship as focused on preserving nature, supporting life and communities, and seeking opportunities to create future for-profit products, processes, and services. In this context, profit is broadly interpreted as including both financial and non-financial gains for individuals, economies, and societies. These definitions are considered to be two of the most comprehensive available as they embrace economic, environmental, and social aspects (Majid and Koe, 2012).

Sustainable entrepreneurship influences and motivates entrepreneurs and their companies to develop sustainable practices by changing

consumption patterns and market structures (Hockerts and Wüstenhagen, 2010; Horne and Fichter, 2022). Thus, sustainable entrepreneurs can become catalysts for the shift from current economic patterns to more sustainable economies (İyigün, 2015; Horne and Fichter, 2022). In practice, conventional entrepreneurs see business as a means to generate profit by exploiting resources, often based on an underlying rationale of using assets entirely for company founders' own benefit and generating the maximum financial return in the shortest possible time. In contrast, entrepreneurs who focus on sustainability see their firms as a means to preserve resources. That is, their companies use human and natural assets to maintain and improve the quality of their business operations and help them last for as long as possible (Parrish, 2010; Natividade et al., 2021).

Sustainable policies have transformed both large and small companies' activities, but the existing literature highlights that SMEs' approach to sustainability is quite different from that of large companies due to financial factors (Ghazilla et al., 2015; Fatoki, 2019; Kostakis and Tsagarakis, 2022). According to Walker et al. (2008: 4), the current lack of targeted research focused on SMEs is an obstacle to sustainable entrepreneurship as *"small businesses are not simply scaled down versions of big businesses"*. Studies must take into account the effects of SME characteristics on these companies' environmental practices.

Sustainable entrepreneurship is a relatively new concept in the entrepreneurship literature, so much confusion still exists about this term. Various researchers have described it as "sustainability-driven entrepreneurship" (Parrish, 2010), "environmental entrepreneurship" (Schlange, 2006), or "green entrepreneurship" (Dean and McMullen, 2007), but no definition of sustainable entrepreneurship is universally accepted. Over time, many definitions have been developed, with some being more thorough than others (Majid and Koe, 2012). Table 1 expands the work by Muñoz and Dimov (2015) and presents researchers' contributions to clarifying sustainable entrepreneurship. It is worth noting that the studies included in Table 1 are only a sample of the contributions found, and other up-to-date studies were also considered to complement the analysis (*e.g.*, Nave and Franco, 2019; Kostakis and Tsagarakis, 2022).

The studies summarized in Table 1 connect entrepreneurship to sustainability, highlighting the increasing importance given to this relationship and fleshing out the conceptualization of sustainable entrepreneurship (see also Nave and Franco (2019) and Horne and Fichter (2022)). However, different limitations can be identified, which affect the results in various ways. These limitations can be divided into two distinct groups. The first comprises inadequacies regarding how the decision criteria were identified during analyses of sustainable entrepreneurship determinants. The second group is the absence of analyses of the dynamics of cause-and-effect relationships among the criteria and

Table 1
Contributions to sustainable entrepreneurship development.

AUTHORS	OBJECTIVES	CONTRIBUTIONS	LIMITATIONS
Larson (2000)	- Understand environmental issues and sustainability considerations that can be successfully integrated into companies' strategies.	- Product and process innovation is significant when sustainability principles are applied in companies.	- The research was limited to a single case study, so the results are quite specific.
Cohen and Winn (2007)	- Identify market imperfections that contribute to environmental degradation and explore their role as a source of business opportunities by introducing a sustainable entrepreneurship model.	- Environmental degradation offers opportunities for the creation of disruptive technologies and innovative business models, and entrepreneurs can make a financial profit while improving social and environmental conditions locally and globally.	- No empirical evidence or support is provided, and the mutual influence of relationships between criteria was not considered.
Dean and McMullen (2007)	- Understand the concept and domains of sustainable entrepreneurship and explain how entrepreneurship can solve environmental problems worldwide.	- Environmentally significant market failures represent opportunities to generate profit while reducing economic behaviors that contribute to environmental degradation, which is how business initiatives can solve environmental challenges.	- The topic analyzed was limited and reflected a shallow perspective, and no empirical evidence or support is provided.
Dixon and Clifford (2007)	- Broaden research on sustainable and social entrepreneurship and understand how entrepreneurs who focus on sustainability can create economically viable companies while maintaining environmental and social values.	- A strong link exists between entrepreneurship and the environment, and the TBL-based business model developed offers economic, social, and environmental sustainability.	- The research was limited to a single case study in only one country, so the results are extremely specific, which reduces the findings' generalizability, and the examination of the mutual influence between criteria is shallow.
Cohen et al. (2008)	- Provide a broad view of entrepreneurship's consequences by broadening entrepreneurship research scope to include economic, environmental, and social value.	- Keeping the TBL in mind, a typology of value creation was elaborated for entrepreneurship that takes into account economic, social, and environmental dimensions.	- The analysis was limited to one journal, and only a summary of the results was presented, which reflected the absence of sufficient empirical evidence.
O'Neill et al. (2009)	- Examine sustainable entrepreneurship within a specific cultural environment.	- Cultural factors strongly influence entrepreneurship and sustainability, so sustainable entrepreneurship's overall impact may depend on its value proposition's adaptation to a variety of cultures.	- The research was limited to a single case study.
İyigün (2015)	- Provide greater impetus for multidisciplinary research and increase discussion about corporate social responsibility's implications for businesses' sustainable development.	- Businesses should not only be concerned about financial performance. Sustainable entrepreneurship requires holistic, equitable contributions to economic, social, and environmental sustainability although entrepreneurial will and sociocultural and company conditions can affect SMEs' adoption of sustainable practices.	- No evidence or empirical support is included.
Natividade et al. (2021)	- Examine intrapreneurial orientation (IO) in SMEs as a way to sustainable entrepreneurship.	- Sustainable entrepreneurship requires a holistic perspective of IO in SMEs and the combined use of cognitive mapping and the Choquet integral (CI) improves that holistic perspective.	- The empirical research was limited to a single country.
Horne and Fichter (2022)	- Study the subset of growth-oriented impact start-ups that substitute less sustainable practices through new technologies, products, or services and the factors that influence their growth and sustainability benefits.	- Provides a conceptual framework for explaining how impact startups contribute to sustainability transition through growth and how factors of startup growth and sustainability net benefits can be organized in a taxonomy.	- The conceptual framework and taxonomy presented are not supported by empirical research.

their respective trade-offs. In other words, previous research on this topic has applied inadequate technical mechanisms while identifying analysis criteria and has failed to clarify their cause-and-effect relationships and calculate their trade-offs. The present study sought to address these limitations by adopting a multiple-criteria analysis mechanism combining cognitive mapping and the BWM. This research also applies methodologies that offer greater transparency in analyses of results.

3. Methodological background

Given that the problem under analysis is quite complex, this study was based on a methodological framework built on constructivist principles. Thus, according to Belton and Stewart (2002), the decision-making process included three stages: (1) structuring; (2) evaluation; and (3) recommendations. Cognitive mapping was used in the structuring phase, and the BWM was applied in the evaluation phase. The three stages required meetings with a set of decision makers who have specialized knowledge and professional experience related to the topic under analysis.

3.1. Cognitive mapping

In decision-making processes, human cognition is understood as *"a complex process that results from the interaction between the sensorimotor system and neurological structures responsible for individual*[s'] *cognitive system*" (Grillo et al., 2018: 5). Specifically, cognition is an interaction between quantity and perceived quality of information that leads human beings to seek to relate real-life images to those produced by their own minds in order to provide an interpretation of everything around them. Vaz et al. (2022) argue that decision-support systems underpinned by human cognition can generate opportunities for problem structuring since decision makers, as a rule, think of decision situations as problems to be solved rather than opportunities to be exploited.

According to Ferretti (2016) and Brito et al. (2019), cognitive maps are tools that facilitate decision-making processes by structuring decision problems and promoting collaborative solutions for identified problems. Eden (2004) asserts that cognitive maps represent what specific individuals think about a given problem. Vaz et al. (2022) further report that these maps enable decision makers to visualize their interests, values, principles, and convictions using an epistemological approach through which these individuals can structure and organize their perspectives.

Cognitive maps are generated by cognitive mapping (Wong, 2010; Vaz et al., 2022), which is a method that brings together uncertainty, different perspectives, conflicts of interest, and multiple decision makers. This method structures highly complex decision problems in an extremely intuitive way. Cognitive mapping is widely recognized for the significant support it provides during the structuring of complex decision problems (Vaz et al., 2022). This method is thus one of the most versatile instruments applied to decision-making processes because of its dynamic nature and ability to reflect accumulated knowledge and previous experiences in the decision-support systems produced. In addition, cognitive mapping helps decision makers understand the sequence of steps leading to decisions (Brito et al., 2019). This tool is commonly applied by those dealing with complex, poorly structured, and multidisciplinary decision situations (Abramova, 2016; Grillo et al., 2018).

Cognitive maps include nodes associated with factors or concepts and arrows showing direct causal influence or causal relationships. These arrows are given positive or negative signs (*i.e.*, + or –) according to the type of causality or connection between the different variables in question (Abramova, 2016). Cognitive maps have quite specific characteristics, which include the ability to: (1) *"deal with qualitative variables"*; (2) *"allow complicated decision situations to be structured"*; (3) "support *group work"*; and (4) *"help develop and implement strategic directions"* (Faria et al., 2018: 119). Brito et al. (2019) and Vaz et al. (2022) report that this approach can thus help decision makers identify and clarify individual or group viewpoints, structure problems, and present possible alternatives. Cognitive maps can also facilitate analyses of the differences and similarities between various existing viewpoints and clarify cause-and-effect relationships between these differing perspectives.

Faria et al. (2018) observe that, although the quality of results generated by applying cognitive mapping depends on the decision makers' degree of involvement, this method is seen as simple, interactive, and versatile. By promoting increased discussion among participants in decision-making processes, cognitive mapping can reduce the number of criteria omitted, increase analysis transparency, and significantly improve decision makers' understanding of decision problems (Grillo et al., 2018). According to Tolman (1948), cognitive mapping helps participants not only anticipate what will happen but also deal with unexpected changes, fostering flexible responses to whatever contingencies may arise. However, Eden (2004) warns that cognitive mapping should not be seen as a goal but rather as a means to an end. The present study adopted precisely this approach, using cognitive mapping to structure the decision problem at hand. The results address the first two research questions presented previously: "How can sustainable entrepreneurship be assessed in SMEs?", and "What qualitative and quantitative metrics can be used to do this?".

3.2. Best worst method

Decision making can be defined as the identification and selection of a solution or a set of alternative solutions based on decision makers' preferences. In most cases, various criteria are involved in the process, so this type of challenge is referred to as multicriteria decision-making problems (Rezaei, 2016). In recent decades, different methods have been developed to solve these problems, of which the BWM is one of the most recent. This method was developed by Rezaei (2015), and it has attracted the attention of a growing number of researchers (Van de Kaa et al., 2017; Çalık, 2020; Govindan et al., 2022).

The BWM is an innovative technique that allows decision makers to select the best alternative among a set of options (Rezaei et al., 2015). This method seeks to deal with the complexity of pairwise comparisons and provide results consistent with participants' value preferences (Malek and Desai, 2019). According to Çalık (2020), the BWM can also estimate the weights of the criteria identified for a given problem (Malek and Desai, 2021; Agarwal et al., 2022).

Rezaei (2016) divides the BWM application into five steps. The first is to determine the number of evaluation criteria to be considered: $\{c_1, c_2, c_3, \ldots, c_n\}$. In the second step, the decision makers identify what is, in their opinion, the "best" criterion (*i.e.*, the most significant) and the "worst" criterion (*i.e.*, the least significant). The third step is when the decision makers express the degree of their preference for the best criterion over all others, using a scale between 1 and 9. That is, a score of 1 shows that a given criterion is considered to be as significant as the one considered to be the best. If a criterion is assigned a score of 9, this value means that the decision maker in question has an extreme preference for the best criterion. The result of this step is represented as the best-to-other vector, which is defined by Equation (1):

$$A_B = (a_{B1},\ a_{B2}, a_{B3}, \ldots,\ a_{Bn}) \tag{1}$$

in which a_{Bj} represents the preference for the best criterion B over another criterion j, such that $a_{BB} = 1$. The fourth step uses the same scale as step three. The decision makers should express their preference for all the criteria considered with regard to the worst criterion identified in step two. The results are represented by the others-to-worst vector, which is calculated with Equation (2):

$$A_W = (a_{1W},\ a_{2W}, a_{3W}, \ldots,\ a_{nW})^T \tag{2}$$

Given that a_{jW} represents the preference of a given criterion j over the

worst criterion W, $a_{WW} = 1$. The last step is to determine the criteria's optimal weights $(w_1^*, w_2^*, w_3^*, \ldots, w_n^*)$ such that the optimal weight is the one in which, for each pair w_B/w_j and $\frac{w_j}{w_W}$, $w_B/w_j = a_{Bj}$ and $w_j/w_W = a_{jW}$. To satisfy these conditions for all criteria j, a solution should be found in which the maximum absolute differences $\left|\frac{w_B}{w_j} - a_{Bj}\right|$ and $\left|\frac{w_j}{w_W} - a_{jW}\right|$ need to be minimized. The non-negativity condition and sum-of-weights method are applied to obtain the following problem results, as shown in Equation (3) :

$$\begin{aligned} &min\ max_j \left\{ \left|\frac{w_B}{w_j} - a_{Bj}\right|, \left|\frac{w_j}{w_W} - a_{jW}\right| \right\} \\ &\sum_j w_j = 1 \\ &w_j \geq 0, \textit{ for all } j \end{aligned} \tag{3}$$

Equation (3) can be transformed into a linear model expressed as Equation (4):

$$\begin{aligned} &\min \xi^L, \text{ s.t.} \\ &\left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi^L, \textit{ for all } j \\ &\left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi^L, \textit{ for all } j \\ &\sum_j w_j = 1 \\ &w_j \geq 0, \textit{ for all } j \end{aligned} \tag{4}$$

Equation (4) is used to calculate the optimal weights $(w_1^*, w_2^*, w_3^*, \ldots, w_n^*)$ and the direct indicator of the comparisons' level of consistency, represented by ξ^*. The consistency is greater the closer this value is to 0, in which case the comparisons made are more reliable.

Given that the BWM is one of the methodologies applied in this study, its advantages and limitations should be clarified. According to Rezaei (2015), an important feature that distinguish this multicriteria technique from others is that it requires fewer comparative data. In addition, it facilitates more empirically robust comparisons, and thus provides more reliable answers. Rezaei et al. (2015) point out that the high consistency and accuracy of comparisons made between the alternatives can be reinforced by using only integers in the comparison vectors. The aforementioned scale from 1 to 9 further reduces the comparisons' complexity and gets closer to how human cognition perceives information, thereby making the evaluation process easier (Mi et al., 2019).

Methods based on pairwise comparison commonly use a single vector or a full array of vectors. While using one vector makes the methods in question extremely efficient in terms of data and time, the comparisons' consistency cannot be checked. In turn, methods that use a full matrix allow consistency to be verified, but they become quite inefficient. The BWM falls in the middle of these two extremes in that this method uses two comparison vectors. In other words, this method is data efficient, as well as facilitating confirmations of the comparisons' consistency (Rezaei, 2020). In general, the BWM's advantages are: (1) suitability for group decision making; (2) applicability to qualitative and quantitative criteria; (3) ability to make structured comparisons; and (4) ease with which the method is understood and applied (BWM, 2020).

Regarding the method's limitations, Liang et al. (2020) mention complexity and no mechanism that provides immediate feedback to decision makers about comparison consistency. In addition, when the method is applied to real-world decision-making processes, it makes use of subjective judgments, and decision makers cannot always easily choose only one criterion as the best or worst without hesitation. Nonetheless, the method's advantages arguably compensate for its disadvantages. In the present study, the BWM was used to address the third research question: "How can the selected metrics be integrated into an overall assessment system?".

4. Application and results

The empirical component of the present research involved an integrated application of cognitive mapping and the BWM. These techniques facilitated the development of a realistic, transparent, and complete model that can be used to assess the propensity for sustainable entrepreneurship of any SME. As a rule, these methodologies are applied in in-person sessions. However, the pandemic meant that the sessions had to be conducted online via the *Zoom* platform.

4.1. Structuring phase: participants and procedures

To develop the desired model, the structuring phase consisted of two groupwork sessions with a set of participants who are considered experts or decision makers with specialized know-how in entrepreneurship, sustainability, and SMEs. According to Brito et al. (2019), decision-maker panels should have from 5 to 12 members. In the present study, the panel comprised seven decision makers who were chief executive officers (CEOs), top-managers, heads of committee, executive board members, or administrative staff members of SMEs from different sectors of activity, and who have extensive experience in and knowledge about sustainable entrepreneurship. There were no participants from the same company. Although these specialists were all based in Portugal and joined the panel voluntarily, they had previously been involved in projects in other parts of Europe. They all had had more than one decade of professional experience in relevant areas, and were fully acquainted with sustainable entrepreneurship projects in SMEs, providing an enriched view of the topic discussed. Additionally, we ensured that participants occupied significant decision-making positions, while also ensuring diversity/balance regarding their age and gender (*i.e.*, 4 men and 3 women). Due to this research's constructivist and process-orientated nature, one should bear in mind that the objective of the group meetings was not to achieve representativeness or make generalizations but rather to ensure a strong focus on process (Belton and Stewart, 2002; Bell and Morse, 2013; Ormerod, 2020). This approach generated an enriched discussion of sustainable entrepreneurship in SMEs. The group sessions were led by two facilitators (*i.e.*, researchers) who guided the negotiation process and recorded the results.

As mentioned previously, the model was structured using cognitive mapping. To this end, the "post-its technique" was applied (Ackermann and Eden, 2001), which consists of the experts writing evaluation criteria considered relevant on post-it notes. Since the sessions were conducted online, a tool had to be introduced that allowed this technique to be applied in Zoom. The *Miro* platform (https://miro.com/) was chosen because, among other features, it can be used to construct and adapt whiteboards during the activity in question, as well as facilitating multi-users interaction in real time.

The first session lasted approximately 3 h and 30 min. The meeting began with a brief presentation of the expert panel members and the facilitators responsible for guiding the panel through the technique application and taking notes on the results. The participants were introduced to the methodological framework used in the study, and information was given about how the Miro platform functions. The facilitators briefly outlined the session's three tasks: (1) contribute inputs to construct the model; (2) group the inputs into clusters or areas of interest; and (3) extend the map designed in the first two steps by developing a hierarchy of criteria within each cluster.

The decision makers' interaction started with the following trigger question: *"Based on your values and professional experience, what characteristics and/or factors influence sustainable entrepreneurship in SMEs?"*. The experts were asked to add to the post-it notes—immediately after writing each criterion—a positive (+) or negative (−) sign according to

the causal relationship between that factor and the decision problem. This phase was complete after the decision-maker panel reached a consensus that no more significant criteria remained to be defined and expressed their satisfaction with the final results. The second step of the first session was to group the criteria into clusters or areas of interest, which was accompanied—according to the strategic options development and analysis (SODA) approach (Ackermann and Eden, 2001)—by a discussion in which the experts shared their values and perceptions. Five clusters were identified: (1) entrepreneur profile; (2) firm internal characteristics; (3) economic factors; (4) other external factors; and (5) market. Although "simple" visual representations of information and knowledge have been pointed out as an essential dimension of cognitive mapping-based approaches to support decision making (Vaz et al., 2022), it should be noted that all concepts comprised in a cognitive map have a density/centrality index (cf. Eden, 2004). The panel members used the concepts' density/centrality indexes to identify which clusters play a fundamental role as catalysts for sustainable entrepreneurship. The session ended with the third task, in which the panel was asked to reorganize the criteria within each cluster according to the importance of each evaluation criterion and its repercussions for the other factors. The most significant criteria were placed at the top of their respective cluster, while the least important were placed at the bottom. Any intermediate factors were situated somewhere in between these extremes.

All the information collected during the first group session was generated by knowledge sharing and discussion, based on which a group cognitive map could be constructed with a total of 147 evaluation criteria. The *Decision Explorer* software (www.banxia.com) was used to generate the map. Fig. 1 presents the final version of the group cognitive map, which was validated by the panel members collectively after intensive analysis and discussion (for clearer visualization, the map can be provided in editable format upon request). This collective discussion was important to legitimize the results obtained. As recognized in the literature (cf. Vaz et al., 2022), the form and content of this map could have been different had the context or the participants involved been different or had the session lasted longer. However, this is an inherent characteristic of the cognitive mapping approach, which it is more than compensated by the direct involvement of experts, the amount of information discussed and by the iterative and interactive nature of the process. The cognitive mapping process was fundamental to ensuring the BWM could be applied in the evaluation phase.

4.2. Evaluation phase

The second session with the decision makers comprised the evaluation phase of the multi-criteria decision support process. This meeting began with the review and validation of the cognitive map, after which the BWM was applied by following the steps presented in Fig. 2. The facilitators first briefly presented this method and its procedures to the panel.

The process began with the identification of the criteria that the experts felt should be considered in subsequent analyses. The nominal group technique and multi-voting were used to help the decision makers select the criteria they considered most important within each cluster. The final result is shown in Table 2.

The next step was to identify the best—or most significant—and the worst—or least significant—clusters, as well as the relevant criteria within each cluster. The decision makers then assessed each cluster using an importance scale ranging from 1 to 9, which was previously presented to the expert panel. The scale values had the following meanings: 1 = "equal importance"; 2 = "between equally and moderately important"; 3 = "moderately more important than …"; 4 = "between moderately and strongly important"; 5 = "more important than …"; 6 = "between strongly and very strongly important"; 7 = "very much more important than …"; 8 = "between very strongly and absolutely important"; and 9 = "absolutely more important than …". All the data used were directly provided by the participants after intense group discussion and negotiation. This is a non-linear and inherently subjective collective procedure, but it allowed for interactive explorations of changes in the inputs to the model, offering opportunities for further discussion—again, a reflection of the constructivist and recursive

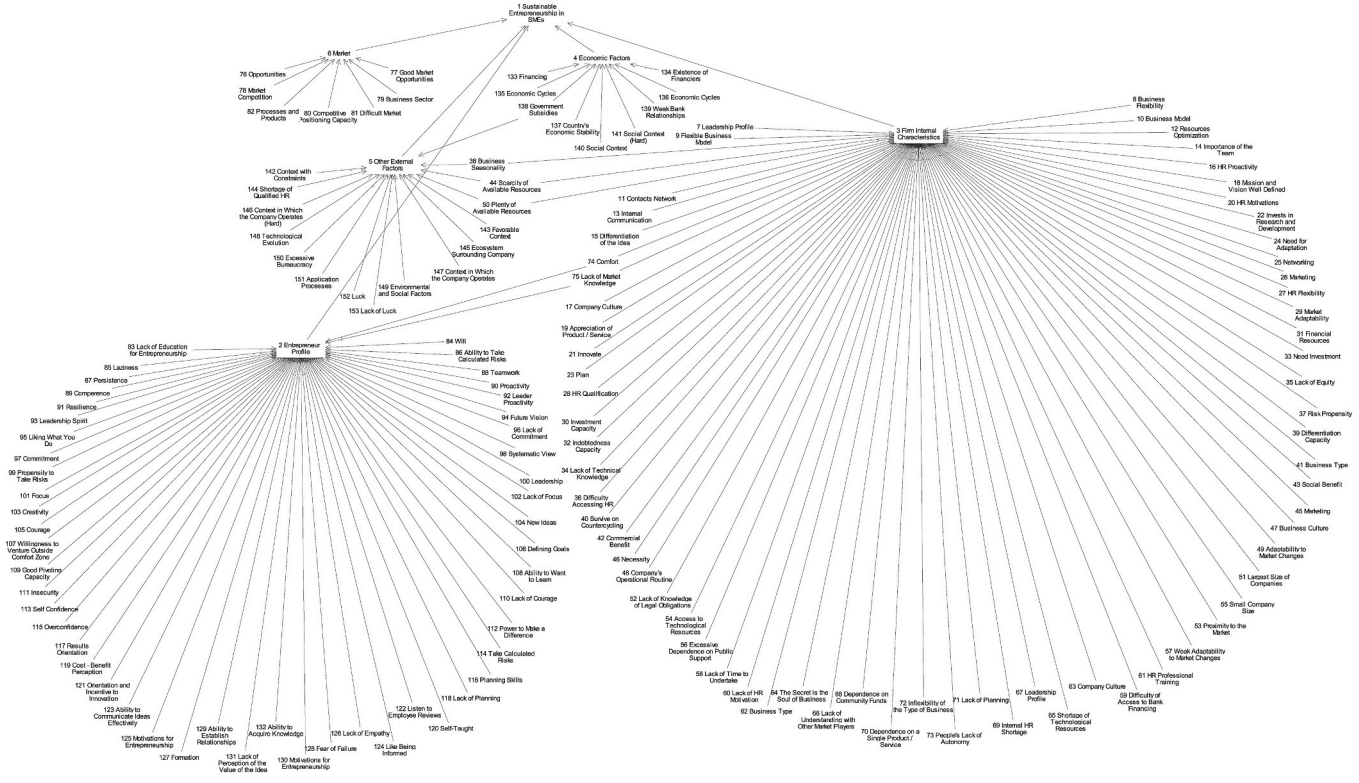

Fig. 1. Group cognitive map.

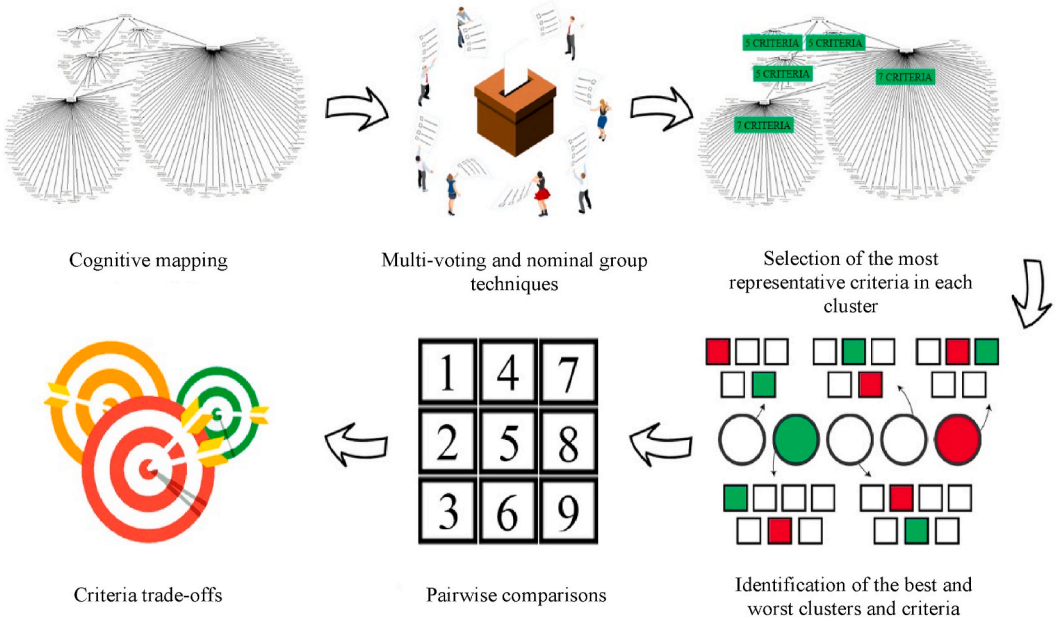

Fig. 2. BWM application.

Table 2
Criteria selected for analyses.

ENTREPRENEUR PROFILE	FIRM INTERNAL CHARACTERISTICS	ECONOMIC FACTORS	OTHER EXTERNAL FACTORS	MARKET
Proactivity	Business model	Country's economic stability	Ecosystem surrounding company	Processes and products
Leadership	Business culture	Economic cycles	Business seasonality (−)	Opportunities
Resilience	Networking strategy	Financing (−)	Technological evolution	Difficult market (−)
Planning skills	Market adaptability	Weak bank relationships (−)	Scarcity of available resources (−)	Business sector
Ability to establish relationships	Human resources' qualifications	Government subsidies	Shortage of qualified human resources (−)	Competitive positioning capacity
Focus	Marketing			Market competition
Willingness to venture outside comfort zone	Investment capacity			

orientation of the framework, which allows for updates and/or the addition of new information at any time. Indeed, the direct involvement of experts based on group dynamics, the amount of information discussed, and the iterative and interactive nature of the process allow individuals to confront different opinions and to understand the relationships between concepts better. In this sense, the decision makers' choice for the best cluster was *entrepreneur profile*, while the worst cluster was *other external factors*. Table 3 and Fig. 3 present the calculations and results, respectively. The numerical values presented were obtained using the BWM mathematical formulae (see *Section 3*).

After the clusters were evaluated, the same procedure was followed with the criteria within each cluster to determine which should be included in subsequent analyses. Table 4 shows the most important—or significant—and the least important—or least significant—decision criteria in each cluster, according to the panel members' collective perceptions.

The results of the BWM application were then used to conduct an assessment of the operationalization of the determinants of sustainable entrepreneurship in SMEs. In other words, real SMEs were evaluated based on the 30 criteria selected for analysis (see Table 2) to identify which SMEs have a greater propensity toward sustainable entrepreneurship. This application of the BWM facilitated a ranking of SMEs that

Table 3
BWM application to five clusters.

Number of Clusters = 5	C1	C2	C3	C4	C5
Names of Clusters	Entrepreneur profile	Firm internal characteristics	Economic factors	Other external factors	Market
Best Cluster	Entrepreneur profile	–	–	–	–
Worst Cluster	–	–	–	Other external factors	–
Best-to-Other Vector	Entrepreneur profile	Firm internal characteristics	Economic factors	Other external factors	Market
Entrepreneur profile	1	2	4	6	2
Others-to-Worst Vector	–	–	–	Other external factors	–
Entrepreneur profile	–	–	–	9	–
Firm internal characteristics	–	–	–	8	–
Economic factors	–	–	–	5	–
Other external factors	–	–	–	1	–
Market	–	–	–	7	–
Weights	0.365591398	0.23655914	0.11827957	0.043010753	0.236559
Key Success Indicator Star			0.107526882		

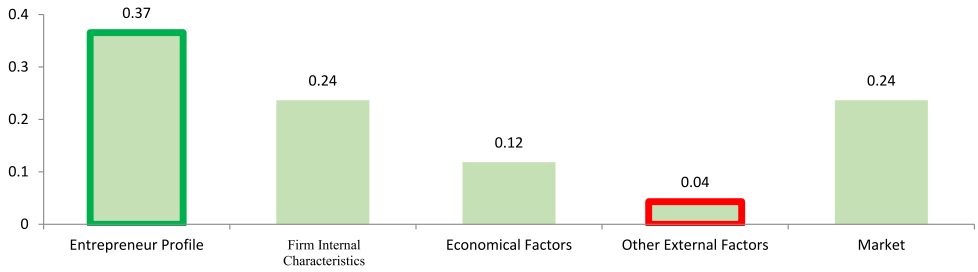

Fig. 3. Clusters' weight.

Table 4
Criteria selected for analyses.

CLUSTER	MOST SIGNIFICANT CRITERIA	LEAST SIGNIFICANT CRITERIA	OBSERVATIONS
Entrepreneur profile	Proactivity	Willingness to leave comfort zone	The resilience and leadership criteria were given the same weight as the most significant criterion.
Firm internal characteristics	Company culture	Investment capacity	The business model criterion was given the same weight as the most significant criterion.
Economic factors	Country's economic stability	Government subsidies	
Other external factors	Ecosystem surrounding company	Shortage of qualified human resources (−)	
Market	Competitive positioning capacity	Processes and products	

demonstrates the results value in terms of real-world decision making. In this step, the panel members were asked to evaluate actual SMEs (hereafter referred to as "Alphas" to maintain confidentiality) about which they had close knowledge. Eighteen companies were ranked, as shown in Fig. 4, based on 30 parameters (*i.e.*, the total number of decision criteria selected for analysis).

Fig. 4 reveals that Alpha 8 was evaluated as having the weakest propensity for sustainable entrepreneurship. This company was given extremely poor scores for all the clusters, so its managers need to find ways to improve in all areas to improve its overall assessment score. Alpha 14 was given the best evaluation, which means this firm has the highest propensity to engage in sustainable entrepreneurship. As shown in Fig. 5, this company did not receive the best evaluation in the cluster with the most weight (*i.e.*, *entrepreneur profile*), but Alpha 14 has a higher score in the *firm internal characteristics*, *market*, and *economic factors* clusters. The cumulative score thus placed this SME at the top of the ranking.

Alpha 16 has a more positive evaluation than Alpha 14 in the *entrepreneur profile* cluster (*i.e.*, the cluster with the most weight), but Alpha 16 has a less positive assessment for the remaining clusters, including the worst evaluation of all the SMEs for the *economic factors* cluster. Thus, for this SME to cultivate a higher propensity for sustainable entrepreneurship, its managers need to work on strengthening the relevant economic factors. Alpha 1 is in fourth place in the SME ranking despite extremely positive evaluations for the clusters with greater weights. This company's only score below the overall average for all the SMEs is for the cluster with the least weight (*i.e.*, *other external factors* cluster). Alpha 1's managers must improve its staff qualifications and invest in strategies that diminish its business seasonality, which are key criteria belonging to the *external factors* cluster, so that this SME can achieve sustainable entrepreneurship. Alpha 4 comes second in the ranking, with good scores for most clusters. However, this firm should improve its relationships with banking institutions and invest in its employees' qualification (*i.e.*, criteria belonging to the *economic factors* and *other external factors* clusters, respectively) to improve its level of sustainable entrepreneurship.

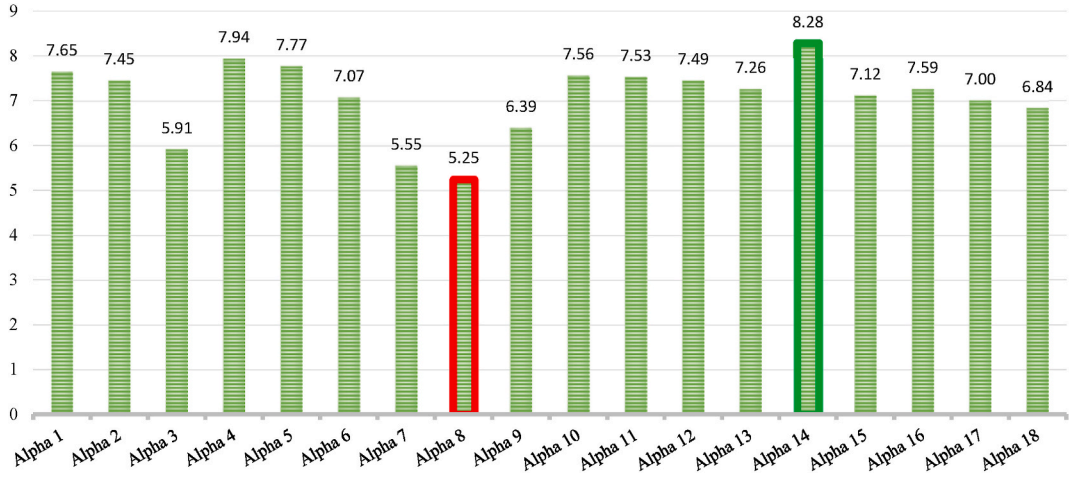

Fig. 4. SME ranking.

Fig. 5. Alphas' partial performance.

Once the SME ranking was finalized, the evaluation phase of the decision process was complete, and recommendations could be formulated. In this final phase, an additional session was held with impartial experts to consolidate the results.

4.3. Discussion, consolidation, limitations and recommendations

The main objective of the consolidation session was to analyze the importance of the decision-support system developed and its practical applicability. A request for a meeting was submitted to the Portuguese Institute for Small and Medium-sized Enterprises and Innovation (*Instituto de Apoio às Pequenas e Médias Empresas e à Inovação* (IAPMEI) in Portuguese)—a public agency with strong connections to SMEs that promotes competitiveness and business growth. The session was attended by four staff members with expertise in sustainable entrepreneurship from the Directorate of Entrepreneurship and Innovation Department and the Business Support Center. All four participants had not been part of the two group sessions, so these experts were considered impartial/neutral about the results of the previous steps in the process.

This final session was also held online, and it lasted approximately 1 h. The meeting was structured to fulfill four objectives. The first was to provide brief background information about the topic under analysis and the methodologies applied to design the analysis system. The second objective was to present and discuss the results, while the third was to analyze the proposed model's practical applicability. The last part was dedicated to a discussion of the four participants' suggestions and recommendations regarding the model's implementation. These experts agreed with the evaluation criteria selected by the panel for use in analyses. However, the four participants suggested that the criteria should be compared with those mentioned in European and Portuguese public policy documents to determine if the criteria defined coincide with current policies promoting sustainability in the business sector. In addition, these experts recommended that a software application be developed based on the results to facilitate assessments of SME sustainability. One participant said that the proposed methodology could provide *"clues of what is missing at the SME level in order for them* [these companies] *to be more sustainable"* (in the participant's words). The experts also mentioned that this *"diagnostic tool could be marketed"*, and that it would provide even more added value if it could *"define action plans"* (also in the participants' words).

After reflecting on the model developed and presented, all the participants agreed that the study findings are *"very useful"* (citing the participants). Regardless, those seeking to apply the proposed model need to bear in mind that this decision-support system should be considered as a learning analysis system rather than as a tool to produce optimum solutions. The goal is to provide a methodological framework whose application could produce different findings in diverse contexts. Thus, the study contributions to the process of selecting sustainable entrepreneurship strategies in part result from the research's process-oriented nature. Further advantages are provided by the added versatility and comprehensive analyses offered by the mixed use of cognitive mapping and the BWM. Although the proposed model focuses on methodology, it is also realistic because it takes into consideration that each SME has unique, specific characteristics that require different strategies to promote sustainable entrepreneurship. Finally, the research's complementary perspective needs to be highlighted since the objective is not to replace previous methods or models but instead to augment their applicability. The expert panel members had previously noted that, because the proposed approach permits the addition of new information at any time, the model developed is both empirically robust and versatile. The combined methodology applied in this study facilitated the construction of a decision-support system that is different from—yet complements—existing models. Overall, the proposed methodology is a transparent, holistic, and process-oriented approach integrating both objective and subjective components.

5. Conclusion

Given the growing environmental concerns worldwide, SMEs must remain abreast of recent developments regarding sustainable entrepreneurship and respond in positive ways to the current demands of all stakeholders. Environmental pollution and sustainability are much discussed concepts, stimulating SMEs to become one of the epicenters of efforts to promote sustainable entrepreneurship, which includes reducing pollution. The weight that this topic has in most countries' business structure means that the definition of tailored action plans for SMEs could be crucial to stopping environmental degradation.

However, SMEs often lack adequate knowledge, human, and financial resources, and the benefits of applying and promoting sustainable practices are often delayed. In addition, environmental and social components are commonly undervalued, which prevents SMEs from becoming more sustainable and thus investing more deeply in sustainable entrepreneurship. Other factors, however, encourage SMEs to protect the environment and develop and implement sustainable entrepreneurship strategies. These factors include public and social pressures, accelerating technological innovation, and the dissemination of communication networks. Another factor is SMEs' strong connections to supply chains of large companies, which, as a rule, more easily implement practices aimed at strengthening sustainability and, consequently, require parallel efforts from their suppliers (*i.e.*, SMEs).

The present study's results are encouraging as the proposed methodology was able to create a holistic and realistic model that includes both objective and subjective aspects of sustainable entrepreneurship. The findings also reflect the research's constructivist epistemological

basis, which combined with the methodologies applied to facilitate the sharing of different values, experiences, and opinions related to the subject under study. These positive features are tempered by limitations, such as the ambiguity verified in some evaluation criteria and the appearance of quite similar determinants in the system developed. In addition, although the cognitive map does contain environment-related factors, no environmental cluster was formally created while considering sustainable entrepreneurship behaviors, and some important criteria such as *tax incentives to encourage business activity*, *friendly trade policies* or *easiness to do business* were not taken into consideration. Another limitation may be that the model was based only on the decision makers' opinions, believes, values, and experiences.

This study's main objective was, nonetheless, not to construct an optimal model in this research context but rather to create a learning model that can assist decision makers identify which sustainable entrepreneurship behaviors SMEs should adopt. In this regard, one should bear in mind that the recursive, constructivist and process-oriented nature of the proposed framework permits updates and the addition of new information at any time. Thus, the model is versatile and simple, and the proposed methodology has potential for practical applications within the scope of sustainable entrepreneurship in SMEs. The present results facilitate a fuller understanding of the determinants of sustainable entrepreneurship in the real world. The decision-support system developed has the potential as a tool to raise awareness about the need to adopt strategies that integrate not only economic but also environmental and social concerns into SME business activities. Although always subject to adjustment, the methodology applied in this study can be used by any SME aiming to improve its sustainability.

In light of this reasoning, our study contributes theoretically and methodologically to the extant literature. Although process-oriented in nature, in theory it can be an important starting point for other researchers and practitioners who wish to analyze determinants of sustainable entrepreneurship. Thus, our addition to the literature complements previous contributions in the field and is available as a springboard for additional, complementary analyses. Methodologically, the combined use of cognitive mapping and the BWM is a novel approach in this subject matter, and our contribution is derived from the description of the applied process, which allows for replications with different groups of experts and/or in different contexts.

Further research on this topic could be stimulated in various ways. First, different methods can be used and/or the procedures followed in the present study can be replicated with a different panel of experts to achieve other results or generalize the present ones. Second, the proposed methodological approach could be expanded and used in other contexts. Third, researchers may want to design/develop a software application based on the evaluation system constructed in the present study, as recommended by the consolidation session participants. In addition to providing easy access to the results, this software application would enable decision makers to assess more quickly SME propensity toward sustainable entrepreneurship. Last, future studies could compare the current findings with those obtained in international contexts given that the implementation of sustainability practices by SMEs is urgently needed worldwide. The evaluation model developed in the present study significantly enriches the literature on sustainable entrepreneurship applied to SMEs. Any improvements that can be made to advance this research field further can be seen as a valuable contribution to efforts to increase SME sustainable entrepreneurship.

CRediT authorship contribution statement

Ana C.S. Mendes: Conceptualization, Methodology, Formal analysis, Writing – original draft. **Fernando A.F. Ferreira:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing, Funding acquisition. **Devika Kannan:** Conceptualization, Supervision, Writing – original draft, Writing – review & editing, Funding acquisition. **Neuza C.M.Q.F. Ferreira:** Methodology, Formal analysis, Visualization, Funding acquisition, Writing – review & editing. **Ricardo J.C. Correia:** Methodology, Formal analysis, Visualization, Writing – review & editing.

Declaration of competing interest

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

Data will be made available on request.

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References

Abramova, N., 2016. The cognitive approach to the problem of identification validity in cognitive mapping. IFAC-PapersOnLine 49 (12), 586–591.
Ackermann, F., Eden, C., 2001. Soda – journey making and mapping in practice. In: Rosenhead, J., Mingers, J. (Eds.), Rational Analysis for a Problematic World Revisited: Problem Structuring Methods for Complexity, Uncertainty and Conflict. John Wiley & Sons, Chichester, pp. 43–60.
Agarwal, S., Kant, R., Shankar, R., 2022. Exploring sustainability balanced scorecard for performance evaluation of humanitarian organizations. Clean. Logist. Supply Chain 3, 100026.
Aghelie, A., Sorooshian, S., Azizan, N., 2016. Research gap in sustainopreneurship. Indian J. Sci. Technol. 9 (12), 1–6.
Bell, S., Morse, S., 2013. Groups and facilitators within problem structuring processes. J. Oper. Res. Soc. 64 (7), 959–972.
Belton, V., Stewart, T., 2002. Multiple Criteria Decision Analysis: an Integrated Approach. Kluwer Academic Publishers, Dordrecht.
Brito, V., Ferreira, F., Pérez-Gladish, B., Govindan, K., Meidutė-Kavaliauskienė, I., 2019. Developing a green city assessment system using cognitive maps and the Choquet integral. J. Clean. Prod. 218, 486–497.
BWM, 2020. The First International Workshop on Best-Worst Method available online at. http://bestworstmethod.com/wp-content/uploads/2020/06/BWM2020-Book-of-Abstracts.pdf. (Accessed November 2020).
Çalık, A., 2020. Evaluation of social media platforms using Best Worst Method and fuzzy VIKOR methods: a case study of travel agency. Iran. J. Manag. Stud. 13 (4), 645–672.
Cohen, B., Winn, M., 2007. Market imperfections, opportunity and sustainable entrepreneurship. J. Bus. Ventur. 22 (1), 29–49.
Cohen, B., Smith, B., Mitchell, R., 2008. Toward a sustainable conceptualization of dependent variables in entrepreneurship research. Bus. Strat. Environ. 17 (2), 107–119.
Davidsson, P., Wiklund, J., 2007. Levels of analysis in entrepreneurship research: current research practice and suggestions for the future. Entrepreneurship: Concepts Theor. Perspect. 25 (4), 245–265.
Dean, T., McMullen, J., 2007. Toward a theory of sustainable entrepreneurship: reducing environmental degradation through entrepreneurial action. J. Bus. Ventur. 22 (1), 50–76.
Dixon, S., Clifford, A., 2007. Ecopreneurship: a new approach to managing the triple bottom line. J. Organ. Change Manag. 20 (3), 326–345.
Eden, C., 2004. Analyzing cognitive maps to help structure issues or problems. Eur. J. Oper. Res. 159 (3), 673–686.
Elkington, J., 1998. Partnerships from cannibals with forks: the triple bottom line of 21st-century business. Environ. Qual. Manag. 8 (1), 37–51.

Faria, P., Ferreira, F., Jalali, M., Bento, P., António, N., 2018. Combining cognitive mapping and MCDA for improving quality of life in urban areas. Cities. Int. J. Urban Pol. Plann. 78, 116–127.
Fatoki, O., 2019. Drivers and barriers to sustainability manufacturing practices by small and medium enterprises in South Africa. Acad. Enterpren. J. 25 (3), 26–86.
Ferretti, V., 2016. From stakeholders analysis to cognitive mapping and multi-attribute value theory: an integrated approach for policy support. Eur. J. Oper. Res. 253 (2), 524–541.
Ghazilla, R., Sakundarini, N., Abdul-Rashid, S., Ayub, N., Olugu, E., Musa, S., 2015. Drivers and barriers analysis for green manufacturing practices in Malaysian SMEs: a preliminary findings. Proc. CIRP 26, 658–663.
Govindan, K., 2022a. Tunneling the barriers of blockchain technology in remanufacturing for achieving sustainable development goals: a circular manufacturing perspective. Bus. Strat. Environ. https://doi.org/10.1002/bse.3031.
Govindan, K., 2022b. How artificial intelligence drives sustainable frugal innovation: a multitheoretical perspective. IEEE Trans. Eng. Manag. https://doi.org/10.1109/TEM.2021.3116187.
Govindan, K., Nasr, A.K., Karimi, F., Mina, H., 2022. Circular economy adoption barriers: an extended fuzzy best–worst method using fuzzy DEMATEL and Supermatrix structure. Bus. Strat. Environ. https://doi.org/10.1002/bse.2970.
Grillo, C., Ferreira, F., Marques, C., Ferreira, J., 2018. A knowledge-based innovation assessment system for small-and medium-sized enterprises: adding value with cognitive mapping and MCDA. J. Knowl. Manag. 22 (3), 696–718.
Hall, J., Daneke, G., Lenox, M., 2010. Sustainable development and entrepreneurship: past contributions and future directions. J. Bus. Ventur. 25 (5), 439–448.
Hockerts, K., Wüstenhagen, R., 2010. Greening Goliaths versus emerging Davids: theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. J. Bus. Ventur. 25 (5), 481–492.
Horne, J., Fichter, K., 2022. Growing for sustainability – enablers for the growth of impact startups: a conceptual framework, taxonomy, and systematic literature review. J. Clean. Prod. 349, 1–16.
Hsu, C., Chang, A., Luo, W., 2017. Identifying key performance factors for sustainability development of SMEs e integrating QFD and fuzzy MADM methods. J. Clean. Prod. 161, 629–645.
İyigün, N., 2015. What could entrepreneurship do for sustainable development? A corporate social responsibility-based approach. Proc. Soc. Behav. Sci. 195, 1226–1231.
Kostakis, I., Tsagarakis, J., 2022. The role of entrepreneurship, innovation and socioeconomic development on circularity rate: empirical evidence from selected European countries. J. Clean. Prod. 348, 1–10.
Larson, A., 2000. Sustainable innovation through an entrepreneurship lens. Bus. Strat. Environ. 9, 304–317.
Li, Y., Kannan, D., Garg, K., Gupta, S., Gandhi, K., Jha, P.C., 2018. Business orientation policy and process analysis evaluation for establishing third party providers of reverse logistics services. J. Clean. Prod. 182, 1033–1047.
Liang, F., Brunelli, M., Rezaei, J., 2020. Consistency issues in the best worst method: measurements and thresholds. Omega Int. J. Manag. Sci. 96, 102–175.
Majid, I., Koe, W., 2012. Sustainable entrepreneurship (SE): a revised model based on triple bottom line (TBL). Int. J. Acad. Res. Bus. Soc. Sci. 2 (6), 293–310.
Malek, J., Desai, T., 2019. Prioritization of sustainable manufacturing barriers using Best Worst Method. J. Clean. Prod. 226, 589–600.
Malek, J., Desai, T.N., 2021. A framework for prioritizing the solutions to overcome sustainable manufacturing barriers. Clean. Logist. Supply Chain 1, 100004.
Mi, X., Tang, M., Liao, H., Shen, W., Lev, B., 2019. The state-of-the-art survey on integrations and applications of the best worst method in decision making: why, what, what for and what's next? Omega Int. J. Manag. Sci. 87, 205–225.
Muñoz, P., Dimov, D., 2015. The call of the whole in understanding the development of sustainable ventures. J. Bus. Ventur. 30 (4), 632–654.
Natividade, J., Ferreira, F., Zopounidis, C., Pereira, L., Çipi, A., Ferreira, J., 2021. Developing a composite index for intrapreneurial orientation in small and medium-sized enterprises: a comprehensive dual methodology. J. Oper. Res. Soc. 72 (7), 1674–1687.
Nave, A., Franco, M., 2019. University-Firm cooperation as a way to promote sustainability practices: a sustainable entrepreneurship perspective. J. Clean. Prod. 230, 1188–1196.
Ormerod, R., 2020. The pragmatic logic of OR consulting practice: towards a foundational view. J. Oper. Res. Soc. 71 (11), 1691–1709.
O'Neill, G., Hershauer, J., Golden, J., 2009. The cultural context of sustainability entrepreneurship. Green Manag. Int. 55, 33–46.
Paiva, B., Ferreira, F., Carayannis, E., Zopounidis, C., Ferreira, J., Pereira, L., Dias, P., 2021. Strategizing sustainability in the banking industry using fuzzy cognitive maps and system dynamics. Int. J. Sustain. Dev. World Ecol. 28 (2), 93–108.
Parrish, B., 2010. Sustainability-driven entrepreneurship: principles of organization design. J. Bus. Ventur. 25 (5), 510–523.
Report, Brundtland, 1987. Our Common Future: Report of the World Commission on Environment and Development. Oxford University, Oxford.
Rezaei, J., 2015. Best-worst multi-criteria decision-making method. Omega Int. J. Manag. Sci. 53, 49–57.
Rezaei, J., 2016. Best-worst multi-criteria decision-making method: some properties and a linear model. Omega Int. J. Manag. Sci. 64, 126–130.
Rezaei, J., 2020. A concentration ratio for nonlinear Best Worst Method. Int. J. Inf. Technol. Decis. Making 19 (3), 891–907.
Rezaei, J., Wang, J., Tavasszy, L., 2015. Linking supplier development to supplier segmentation using Best Worst Method. Expert Syst. Appl. 42, 9152–9164.
Rodgers, C., 2010. Sustainable entrepreneurship in SMEs: a case study analysis. Corp. Soc. Responsib. Environ. Manag. 17 (3), 125–132.
Schaltegger, S., Wagner, M., 2011. Sustainable entrepreneurship and sustainability innovation: categories and interactions. Bus. Strat. Environ. 20 (4), 222–237.
Schlange, L., 2006. What drives sustainable entrepreneurs? Appl. Bus. Entrepreneur. Assoc. Int. 24, 16–20.
Schumpeter, J., 1934. The Theory of Economic Development. Harvard University Press, Cambridge, MA.
Sharma, R., Kannan, D., Darbari, J.D., Jha, P.C., 2022. Analysis of collaborative sustainable practices in multi-tier food supply chain using integrated TISM-Fuzzy MICMAC model: a supply chain practice view. J. Clean. Prod. 354, 131271.
Shepherd, D., Patzelt, H., 2011. The new field of sustainable entrepreneurship: studying entrepreneurial action linking "what is to be sustained" with "what is to be developed". Enterpren. Theor. Pract. 35 (1), 137–163.
Terán-Yépez, E., Marín-Carrillo, G., Casado-Belmonte, M., Capobianco-Uriarte, M., 2020. Sustainable entrepreneurship: review of its evolution and new trends. J. Clean. Prod. 252, 1–21.
Tolman, E., 1948. Cognitive maps in rats and men. Psychol. Rev. 55 (4), 189–208.
Urbaniec, M., 2018. Sustainable entrepreneurship: innovation-related activities in European enterprises. Pol. J. Environ. Stud. 27 (4), 1773–1779.
Van de Kaa, G., Kamp, L., Rezaei, J., 2017. Selection of biomass thermochemical conversion technology in The Netherlands: a best worst method approach. J. Clean. Prod. 166, 32–39.
Vaz, A., Ferreira, F., Pereira, L., Correia, R., Banaitis, A., 2022. Strategic visualization: the (real) usefulness of cognitive mapping in smart city conceptualization. Manag. Decis. 60 (4), 916–939.
Walker, B., Redmond, J., Sheridan, L., Wang, C., Goeft, U., 2008. Small and Medium Enterprises and the Environment: Barriers, Drivers, Innovation and Best Practice – A Review of the Literature. Edith Cowan University, Perth, Western Australia.
Wong, C., 2010. Cognitive mapping on user interface design. In: *Proceedings of the International Conference on Computer Applications and Industrial Electronics (ICCAIE 2010)*, 5-7 December. Kuala Lumpur, Malaysia, pp. 288–293.
Zarbakhshnia, N., Govindan, K., Kannan, D., Goh, M., 2022. Outsourcing logistics operations in circular economy towards to sustainable development goals. Bus. Strat. Environ. https://doi.org/10.1002/bse.3122.