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Research article

Sustainability: Does it contribute to the survival of entrepreneurship?

Negin Salimi *, Ton Vrauwdeunt

Business Management and Organization, Wageningen University and Research, Wageningen, the Netherlands

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ABSTRACT

– The relationship between sustainability practices and business survival is increasingly critical in today's fast-evolving market environment. While sustainability is often viewed as a positive societal contribution, its role in ensuring a company's survival remains uncertain. This study explores the link between sustainability and survivability, using the alternative protein industry as a case in point. This industry, which aims to replace traditional animal-based diets with alternative proteins, prioritizes sustainability, yet questions persist about the necessity of these practices for long-term survival. Through a multi-criteria decision-making approach and semi-structured interviews with 15 Dutch experts, this research examines how companies can strategically prioritize environmental and societal sustainability aspects—such as employment, consumer health, nutrition, and climate impact—to enhance their long-term survival. The findings provide actionable insights for entrepreneurs, highlighting the importance of these sustainability dimensions in securing business survival. These insights provide practical guidance for entrepreneurs in the dynamic alternative protein industry, helping them make informed strategic decisions for sustainability and survival.

1. Introduction

Entrepreneurs and startups play a pivotal role in advancing the Sustainable Development Goals (SDGs) set by the United Nations in 2016. Sustainable entrepreneurship, a concept integrating traditional business practices with societal and environmental considerations, is crucial for achieving sustainable development (Avelar et al., 2024). This approach involves implementing technological innovations that transform prevailing market dynamics into sustainable patterns, a process known as "creative destruction" (Schaltegger and Wagner, 2011; Schumpeter, 1942). Sustainable entrepreneurship, therefore, entails the application of sustainability innovations to benefit the broader society (Schaltegger and Wagner, 2011).

The alternative protein industry exemplifies an application of "creative destruction" (McMillan, 2023). This industry seeks to produce meat, dairy, and egg alternatives from diverse sources, including plants, animal cells, microbial cells, and insects, collectively termed alternative proteins (European Commission, 2020; Good Food Institute, 2023). The conventional European food industry contributes significantly to greenhouse gas emissions, resource depletion, biodiversity loss, and adverse health impacts (Crippa et al., 2021; EU, 2020). Animal-based protein production significantly contributes to these negative impacts, adversely affecting half of the SDGs (Espinosa-Marrón et al., 2022; Kristiansen et al., 2020; Van Eenennaam and Werth, 2021). Introducing alternative proteins offers a promising avenue to mitigate these adverse consequences (Lima et al., 2022).

The Good Food Institute identifies four categories of alternative proteins: plant-based, fermentation-based, cultured meat, and insect-based (Good Food Institute, 2023). While plant-based alternatives have experienced significant growth, proteins from animal cells face regulatory hurdles in Europe, microbial protein sources are under exploration, and insect-based proteins encounter consumer acceptance challenges (Collins et al., 2019; Cultivated Meat - GFI Cultivated meat—GFI Europe, 2021; Panescu et al., 2022). Due to their environmental benefits, alternative proteins are anticipated to play a pivotal role in the future food system of the European Union (EU, 2023).

While technological advancements in the alternative protein industry have improved the palatability and quality of these products, leading to increased consumer interest (Bashi et al., 2019), the survival of companies within this rapidly evolving and disruptive sector presents significant challenges. Companies must navigate not only technological and market developments but also regulatory frameworks and changing consumer preferences.

Despite the evident contributions of sustainable entrepreneurship to achieving the SDGs, there remains a critical question that has not been fully addressed in the current literature: To what extent do sustainability

* Corresponding author.
E-mail address: negin.salimi@wur.nl (N. Salimi).

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practices contribute to the survival of entrepreneurship, especially in rapidly evolving sectors like alternative proteins? While existing studies have explored sustainability and entrepreneurial success (Weidinger, 2014; Schaltegger et al., 2016), the direct link between sustainability practices and the survivability of sustainable enterprises in the alternative protein industry remains underexplored. The complexity of this industry—with its mix of technological, regulatory, and market challenges—highlights the need for a more comprehensive understanding of how sustainability practices influence long-term viability.

This study addresses this gap by investigating whether sustainability ensures the survivability of sustainable entrepreneurship in Small and Medium-sized Enterprises (SMEs) within the Netherlands' alternative protein industry, utilizing the Triple Bottom Line (TBL) framework. The TBL framework, which considers social, environmental, and economic dimensions (Elkington and Rowlands, 1999), provides a useful lens to assess the balance of sustainability practices that can enhance long-term survivability (Hahn et al., 2015).

In particular, this study focuses on profit as a sub-dimension of the economic pillar, recognizing its importance as a critical factor for the survival and success of SMEs. While previous research has examined profitability in relation to SME survival (Serrasqueiro et al., 2023), this study offers a novel approach by linking it directly to sustainability practices across the TBL dimensions. This provides a holistic perspective that connects sustainability with financial health and long-term viability.

The main contribution of this study lies in highlighting the significance of sustainability practices—measured by the TBL model—on the survival of enterprises in the alternative protein sector. While other studies have assessed the environmental and economic benefits of sustainability (Geissdoerfer et al., 2018), this study uniquely focuses on how these practices impact business survivability in a disruptive, fast-growing industry. By doing so, it offers entrepreneurs and policymakers a comprehensive understanding of the relationship between sustainability and survival, which is critical for fostering innovation and guiding the future development of the alternative protein industry. This perspective also broadens the current literature on sustainable entrepreneurship, providing a deeper understanding of sustainability's role in enterprise survival under challenging conditions.

This study employs a Multi-Criteria Decision Making (MCDM) methodology to explore the relationship between business survival and sustainability. Specifically, the Best-Worst Method (BWM), a pairwise comparison technique, is utilized to assess the importance of sustainability dimensions within the TBL framework. BWM was chosen for its simplicity, efficiency, and ability to provide consistent results with fewer comparisons, making it an intuitive and effective tool for this analysis. The fifteen experts engaged in this study include CEOs, (co-)founders, strategy managers, and business developers from Small and Medium-sized Enterprises (SMEs), startups, and spin-offs within the alternative protein industry in the Netherlands.

The subsequent sections of this study are structured as follows: Section II reviews existing literature on sustainable entrepreneurship and entrepreneurship survival. Section III presents a systematic approach to evaluating the importance of TBL elements for sustainability and survival. Section IV applies this approach to the alternative protein industry in the Netherlands, utilizing data collected from experts and analyzed through the Best-Worst Method (BWM). Finally, Section V concludes this article.

2. Theoretical background

The literature review is divided into four parts: Sustainable entrepreneurship, Business survival, Environmental sustainability and survival, and Social sustainability and survival.

a. Sustainable Entrepreneurship

Entrepreneurship has been comprehensively investigated in diverse academic disciplines, including economics and sociology, offering distinct perspectives. Some scholars have predominantly viewed entrepreneurship as an inherent characteristic of entrepreneurs, focusing on the actions undertaken by entrepreneurs (Koellinger, 2008). Conversely, other research adopts a more process-oriented approach to entrepreneurship (Steyaert, 2007), conceptualizing it as a multifaceted process involving the creation and appropriation of value through activities such as designing, launching, and operating a new business orchestrated by an entrepreneur (George and Zahra, 2002).

Recognized as a pivotal contributor to the economy (Herrington and Kew, 2013), entrepreneurship's significance is underscored by concerns raised by the OECD (2005) about the omission of human development aspects, equality, and social cohesion in conventional measurements of economic growth, primarily based on Gross domestic product (GDP). In contrast, economic development is a nuanced concept encompassing social dimensions (Todaro and Smith, 2011). Endogenous growth theory posits a connection between economic development and internal forces (endogenous factors), including advancements in education, health, technology, and the reduction of poverty and unemployment (Carlson, 1999a,b). Economic development, more precisely, seeks to enhance the quality of life, emphasizing a balance between economic and social dimensions (Meyer and de Jongh, 2018).

In contemporary discourse, the paradigm has shifted from economic development to sustainable development, where entrepreneurship emerges as a catalyst for this transition (United Nations). The United Nations General Assembly underscores the role of entrepreneurship in sustainable development across three dimensions: economic, social, and environmental. Economic aspects involve job creation, promotion of decent work, sustainable agriculture, and innovation. Socially, entrepreneurship is recognized for promoting social cohesion, reducing inequalities, and expanding opportunities for various demographic groups. On the environmental front, entrepreneurship is acknowledged for addressing environmental challenges by introducing climate change mitigation technologies and promoting sustainable practices (UN General Assembly).

The term "Entrepreneurship for Sustainable Development" is defined as the role entrepreneurs play in fostering a more socially and environmentally sustainable economy (Dean and McMullen, 2007). Sustainable entrepreneurship accentuates the entrepreneurial process, market transformations, and social developments by interlinking social, environmental, and economic dimensions (Johnson and Schaltegger, 2020).

The Triple Bottom Line (TBL) framework, introduced by John Elkington (2018), examines a company's impact on sustainable business value across three main aspects: Economic prosperity, Environmental quality, and Social justice, encapsulated as People, Planet, and Profit (Elkington, 2004). The TBL has been widely employed to gauge businesses' commitment to social, environmental, and economic issues (Gimenez et al., 2012). The framework aligns with the objective of meeting present needs without compromising the ability of future generations to meet their needs (United Nations, 1987).

Several conceptualizations of sustainability performance have emerged, including the five pillars derived from the 17 Sustainable Development Goals (Tremblay et al., 2020) and the Environmental Social and Governance (ESG) framework (UN, 2004). For simplicity and to maintain the holistic nature of sustainability, this study adopts the TBL framework for sustainability performance (Geissdoerfer et al., 2018).

DiVito & Bohnsack (2017) identified three profiles for how sustainable entrepreneurs balance the triple bottom line in their business: focus on one dimension (e.g., social or environmental), a holistic approach balancing all dimensions equally, or a flexible approach aligning with individual preferences.

Eccles et al. (2014), comparing highly sustainable companies with less sustainable companies, found that sustainable companies outperform the latter. However, the critical question remains: is sustainability

essential for the survival of enterprises, and what is the relative contribution of each of the three pillars of sustainability to survival?

The link between economic sustainability and survival is evident, as companies require financial income for survival (Bocken, 2015). Conversely, the relationship between environmental and social sustainability is less straightforward. Environmental sustainability aims to mitigate a company's environmental impact through resource use reduction, waste management, and sustainable resources (Walls et al., 2012). Contributing to the environmental pillar may identify entrepreneurial opportunities, enhance market performance, and increase firm efficiency (Cohen and Winn, 2007).

Companies contributing to the social dimension address societal needs, fostering positive stakeholder relationships (Hall et al., 2010). Social sustainability positively influences stakeholders, including customers, the local population, suppliers, the media, and employees. Discrepancies exist regarding the interactions between sustainability dimensions, with some scholars proposing mutual inclusivity between environmental and economic sustainability, while others suggest a win-lose or trade-off scenario (Dean and McMullen, 2007; Erbetta et al., 2023; Hall et al., 2010; Hart and Ahuja, 1996).

While existing literature (e.g., Johnson and Schaltegger, 2020; Dean and McMullen, 2007) acknowledges the importance of balancing the Triple Bottom Line, little attention has been paid to the relative importance of each sustainability dimension for firm survival, particularly in high-growth sectors like alternative proteins.

b. Business Survival

Business survival considered the antithesis of business failure (Josefy et al., 2017), has primarily been explored within economics and finance, its original domains (Walls et al., 2012). Initially centered on precise data and utilizing financial information for bankruptcy prediction (Walls et al., 2012), the concept of business failure has evolved into a multidisciplinary subject, extending its presence into entrepreneurship literature (Yamakawa et al., 2015) and strategic management (Josefy et al., 2017).

Within entrepreneurship literature, emphasis is often placed on the entrepreneur's perspective, encompassing diverse causes of failure, the repercussions of failure, and the learning derived from such experiences (Costa et al., 2023; Jenkins, 2006). Conversely, the strategic management domain focuses on understanding why firms fail and devising strategies to prevent failure (Josefy et al., 2017).

Despite the extensive exploration of business failure across disciplines, a universally accepted definition remains elusive (Costa et al., 2023; Josefy et al., 2017), posing challenges for comparing studies and underscoring the importance of precisely conceptualizing this construct. In the strategic management literature, discussions around business survival often hinge on whether a company continues its operations (Josefy et al., 2017). However, a business may cease operations in one market but survive in another by adapting its strategy, making survival a dynamic and context-dependent construct (Aldrich, 1999).

Josefy et al. (2017) developed a multidimensional conceptualization of survival encompassing three dimensions: operations, ownership, and solvency, to address this complexity. This framework allows for a more nuanced understanding of survival beyond the binary outcome of survival versus failure, recognizing that changes in ownership, such as mergers or acquisitions, can be part of a company's survival strategy. For example, even if a company undergoes a merger, it can continue to operate and remain solvent, indicating its survival through strategic realignment (Coad, 2014; Josefy et al., 2017).

These distinct approaches highlight the complexities of survival, especially in volatile sectors like the alternative protein industry, where external factors such as regulatory challenges and market competition are critical (Wood and Tavan, 2022; Otero et al., 2022). Scholars, including Danneels (2011), argue that survival must also be viewed through the lens of a firm's adaptability and its capacity to maintain competitiveness amid market fluctuations. Danneels' study of Smith Corona, a prominent typewriter manufacturer, illustrates how the company sought to adjust its resource base in response to the decline of its core product. This study contributes to dynamic capability theory by demonstrating how firms can leverage, create, and release resources to thrive in rapidly changing environments.

This adaptability is especially vital in fast-evolving industries like alternative proteins, where continuous innovation and responsiveness to consumer preferences are essential for survival (Wood and Tavan, 2022; Otero et al., 2022; Danneels, 2011). Companies in the alternative protein sector must navigate market shifts, regulatory hurdles, and evolving consumer demands. The concept of dynamic capabilities—effectively utilizing existing resources while developing new ones—can inform how these firms manage sustainability practices and drive innovation to stay competitive.

In this study, business survival is conceptualized as the ability of a company to continue its operations and maintain solvency within a dynamic and often challenging market environment. Additionally, changes in ownership, such as mergers or acquisitions, may still be considered a form of survival, depending on the company's strategic objectives (Josefy et al., 2017). The terms "survival" and "business survival" are used interchangeably throughout this study to reflect a broader, multidimensional understanding of survival.

c. Environmental sustainability and survival

Incorporating dimensions of environmental sustainability into business practices, such as reducing carbon footprint, enhancing resource efficiency, preserving biodiversity, and optimizing energy usage, is aligned with global ecological objectives. This strategic alignment positively influences a firm's financial performance and long-term survival (Nadeem et al., 2023). Adherence to these sustainability principles is instrumental in enhancing corporate reputation, attracting environmentally conscious consumers, and securing support from investors considering environmental, social, and governance (ESG) factors in their investment decisions (Fafaliou et al., 2022). Firms actively engaged in reducing their carbon footprint play a pivotal role in mitigating climate change, aligning with global imperatives and meeting the growing preferences of environmentally responsible consumers and investors (Schanes et al., 2016). Adopting practices such as incorporating renewable energy sources, improving energy efficiency, and implementing sustainable transportation strategies are effective measures to achieve these goals. Such initiatives help meet regulatory requirements and position the firm as environmentally responsible, enhancing its reputation and market competitiveness (Ambec and Lanoie, 2008).

Alternative protein sources, such as plant-based, microorganism-based and lab-grown meats, exhibit a lower carbon footprint compared to traditional animal agriculture, contributing to climate change mitigation (Poore and Nemecek, 2018). Resource efficiency, involving the optimization of raw material use and waste reduction, is paramount for environmental sustainability and simultaneous cost reduction in production (Bach et al., 2016). Embracing circular economy principles further enhances resource efficiency and resilience (MacArthur, 2013).

The alternative protein industry exemplifies resource efficiency by requiring less land, water, and feed for production compared to traditional livestock farming, addressing concerns related to resource scarcity and promoting sustainable food production (Lynch and Pierrehumbert, 2019). The significance of biodiversity for ecosystem stability is acknowledged, and firms integrating biodiversity considerations into their operations showcase environmental stewardship through sustainable sourcing practices and conservation initiatives (Stone et al., 1997).

In the alternative protein industry, particularly with plant-based proteins, biodiversity preservation is advanced by reducing the demand for large-scale monoculture farming and deforestation. Biodiversity-friendly practices in sourcing plant-based ingredients

further amplify these positive effects, although the direct relationship with lab-grown meats requires further elucidation (Tilman and Clark, 2014).

Efficient energy usage, a crucial aspect of environmental sustainability, is achieved through investments in energy-efficient technologies, renewable energy sources, and energy management systems. This reduces operational costs and contributes to a more sustainable energy landscape, enhancing resilience to energy price fluctuations (Energy Efficiency, 2017).

The alternative protein industry holds the potential for superior energy efficiency compared to traditional animal agriculture. The lower energy intensity associated with alternative protein production, particularly renewable energy sources, contributes to building a more sustainable and resilient food system (Lynch and Pierrehumbert, 2019).

While existing literature highlights the positive impacts of environmental sustainability on firm performance and reputation (Nadeem et al., 2023; Fafaliou et al., 2022), the direct link between environmental practices and long-term business survival in the alternative protein industry remains underexplored. Many studies focus on the environmental benefits of reducing carbon footprints, enhancing resource efficiency, and preserving biodiversity (Poore and Nemecek, 2018; Lynch and Pierrehumbert, 2019), but there is a gap in understanding how these efforts contribute to the survivability of firms operating in a highly competitive and evolving market.

d. Social sustainability and survival

Social sustainability, encompassing dimensions such as employment, consumer health and nutrition, fair sourcing, and diversity and inclusion, plays a crucial role in enhancing the survival and success of firms (Diaz-Carrion et al., 2021; Reuter et al., 2012; Scott et al., 2011).

Investing in employment practices that prioritize fair wages, safe working conditions, and employee well-being can contribute to higher job satisfaction and productivity (Diaz-Carrion et al., 2021). Socially responsible employment practices foster a positive internal corporate culture and enhance the firm's reputation externally. This can lead to improved employee retention and recruitment, reducing turnover costs and contributing to the firm's long-term survival (Freeman et al., 2010).

Prioritizing consumer health and nutrition aligns with changing consumer preferences for healthier and more sustainable food choices (Grosso et al., 2020). Firms in the alternative protein industry can enhance the nutritional profile of their products, ensuring that they meet or exceed consumer expectations for health and wellness. This attracts health-conscious consumers and contributes to the industry's overall growth and longevity.

Emphasizing fair sourcing practices, which include ethical and sustainable sourcing of raw materials, contributes to social sustainability (Seuring and Müller, 2008). Firms in the alternative protein industry can prioritize sourcing methods that ensure fair compensation to farmers and producers and environmentally sustainable practices. This supports ethical supply chain management and may enhance the firm's reputation among consumers and investors (Verbeke, 2015).

Promoting diversity and inclusion within the workforce fosters creativity, innovation, and adaptability. In the context of the alternative protein industry, which is rapidly evolving, diverse perspectives contribute to problem-solving and product development. A diverse and inclusive workplace also resonates positively with consumers who value social responsibility, enhancing the firm's market standing (Patel et al., 2017).

So it seems that prioritizing social sustainability dimensions in employment, consumer health and nutrition, fair sourcing, and diversity and inclusion aligns with broader societal goals and contributes to the long-term survival and success of firms, especially those in the dynamic and evolving alternative protein industry.

In conclusion, the evaluation of the existing literature reveals significant limitations concerning the direct impact of social factors—such as fair sourcing, diversity, and inclusion—on business survival (e.g., Diaz-Carrion et al., 2021; Reuter et al., 2012). Although these studies emphasize the social advantages of such practices, they often neglect to assess their influence on a firm's long-term viability.

3. Methodology

This study employs a Multi-Criteria Decision Making (MCDM) methodology to elucidate the intricate relationship between business survival and sustainability. MCDM methods serve as valuable tools for ranking alternatives or decision criteria in alignment with specific objectives. Given that sustainability embodies a multifaceted construct encompassing the three dimensions of the triple bottom line, an MCDM approach is proposed to ascertain an optimal equilibrium between the goals of sustainability and survival. The MCDM outcome manifests as the significance (weight) assigned to diverse dimensions (decision criteria) and corresponding sustainability sub-criteria concerning sustainability and business survival objectives.

Numerous MCDM methodologies exist for determining the optimal solution from a set of criteria, including pairwise comparisons, outranking methods, distance-based methods, interaction-based methods, or utility-based methods (Yalcin et al., 2022). This study adopts a pairwise comparison method due to its simplicity and user-friendliness. MCDM methods, being opinion-based, necessitate the involvement of experts in performing pairwise comparisons (Salimi, 2023). In this context, experts are defined as individuals whose domain-specific knowledge is acquired through learning and experience (Cornelissen et al., 2003).

The specific pairwise comparison method employed in this study is the Best-Worst Method (BWM). BWM offers distinct advantages over the more conventionally used Analytical Hierarchy Process method, requiring fewer pairwise comparisons and providing more consistent results due to its structured questioning approach (Rezaei, 2015, 2016). Moreover, BWM aligns well with decision-makers' natural thought processes and is considered intuitive (Salimi and Rezaei, 2018).

The application of BWM in the literature extends to various objectives, such as assessing R&D performance (Salimi and Rezaei, 2018), evaluating social sustainability in supply chains (Badri Ahmadi et al., 2017), and, in the context of sustainable entrepreneurship, identifying strategic social and environmental practices (Ghag and Sonar, 2023), impact of the entrepreneurship ecosystem on the success and performance of entrepreneurial start-pp firm (Salimi, 2022; Boutris and Salimi, 2022), and opportunity recognition for entrepreneurs based on a business model for sustainability (Salimi, 2021). Acknowledging the interrelated nature of sustainable dimension, a nonadditive version of BWM, known as nonadditive BWM, is employed, allowing for the consideration of criteria interactions or dependencies, which are incorporated as constraints in the model (Liang et al., 2020).

3.1. Linear Best-Worst Method

Below, the steps of BWM are explained according to Rezaei (2015):

Step 1 - Determine the set of decision criteria as $C = \{c_1, \ldots, c_n\}$ by the decision-maker or expert.

The criteria for sustainability are *people (social dimension)*, *planet (environmental dimension)*, and *profit*. Further operationalization of the *planet* and *people* criteria is done through sub-criteria.

Step 2 – The expert selects the best (c_B) and the worst (c_W) from $.C$.

Experts were asked which of the (sub-)criteria they found the most important (c_B) towards the goal, and which (sub-)criteria they found the least important (c_W) towards the goal.

Step 3 - Establish the Best-to-Others vector.$(a_{B1}, a_{B2} \ldots, a_{Bn})$.

Pairwise comparisons were carried out with the c_B and the other (sub-)criteria towards a specific goal to find the Best-to-Others vector $(a_{B1}, a_{B2} \ldots, a_{Bn})$, where a_{ij} indicates the preference for (sub-)criteria 1 over (sub-)criteria J. Pairwise comparisons were carried out using a 9-

point scale, were 1 is equally important, 3 is moderately more important, 5 is strongly more important, 7 is very strongly more important, and 9 is extremely more important. Even numbers are intermediary values.

Step 4 – Establish the Others-to-Worst vector.$(a_{1W}, a_{2W}\ldots, a_{nW})^T$.

Pairwise comparisons were then carried out by assessing the importance of other (sub-criteria) over c_W using the same scale as in step 3. The pairwise comparison between c_W and c_B was not questioned again. In total, *2n-3* comparisons should be carried out.

Step 5 Find the optimal solution [w_1*, w_2*, …w_n*].

The optimal weight for the (sub-)criteria is the one where, for each pair of $\frac{w_B}{w_j}$ and $\frac{w_j}{w_W}$, the condition of $\frac{w_B}{w_J} = a_{Bj}$ and $\frac{w_j}{w_W} = a_{jW}$ is satisfied. Hence, $\left\{\left|\frac{w_B}{w_J} - a_{Bj}\right|, \left|\frac{w_J}{w_W} - a_{jW}\right|\right\}$ should be minimized. When transformed to a linear model, the following model should be solved, where w_i* represents the weight of the (sub-) criteria and ξ^L is the value of the objective function (Rezaei, 2016):

$$\min \xi^L$$

Subject to.

$$\left|w_B - a_{Bj}w_J\right| \le \xi^L, for\ all\ j$$

$$\left|w_j - a_{jw}w_W\right| \le \xi^L, for\ all\ j$$

$$\sum_j w_j^* = 1$$

$$w_J \ge 0\ for\ all\ j$$

Solving the above linear min-max problem yields a unique cardinal order of numbers, which gives the importance $(w_1^*, w_2^*\ldots w_n^*)$ of the criteria for the goal. In this study, it is important to emphasize that two distinct objectives are being pursued. The first goal centers around evaluating the importance of criteria and sub-criteria concerning sustainability. Concurrently, the second goal involves assessing the importance of criteria and sub-criteria pertaining to organizational survival. This necessitates executing all steps twice: once for the first goal and subsequently for the second goal. The A_W and A_B vectors can result in an inconsistent outcome. Therefore, it is important to check how inconsistent the order of the criteria based on the value of the objective function (ξ^L). To conclude that A_W and A_B vectors are consistent; it is checked whether ξ^L is lower than the associated threshold, according to Liang et al. (2020).

3.2. Nonadditive Best-Worst Method

In contrast to the linear BWM, the nonadditive BWM introduces a nonlinear minmax problem, allowing for the identification of multiple solutions (Y. Liang et al., 2022). Nonadditive BWM incorporates considerations of criteria interactions as provided by experts. These interactions can take four distinct forms: positive (+), negative (−), no interaction (Δ), or an unknown interaction (u) between criteria. The experts' inputs regarding criteria interactions can be translated into correlation-based numerical values, subsequently serving as constraints in the nonlinear model (Y. Liang et al., 2022).

It is noteworthy that criteria interactions, as articulated by experts, remain independent of the specific goal for which the pairwise comparisons are conducted. Consequently, the criteria interaction matrix is established only once, irrespective of the goal. Steps 1–4 in nonadditive BWM remain consistent with those in linear BWM, as elucidated in Section 3.1. Subsequent steps are expounded upon below.

Step 5 – Establish the criteria interaction matrix.

The expert provides qualitative assessments for the relationships among criteria t_{ij} where $t_{ij} \in \{+, -, \Delta, u'\}$ *for all i and j*. t_{ij} is converted to a numerical value using the following equation.

$$\left\{\begin{array}{l} I_{ij} > 0 \quad if\ t_{ij} = +; \\ I_{ij} < 0 \quad if\ t_{ij} = -; \\ I_{ij} = 0 \quad if\ t_{ij} = \Delta; \\ I_{ij} \in [-1, 1] \quad if\ t_{ij} = 0. \end{array}\right\}$$

The criteria interaction I_{ij} is equivalent to the Möbius representation m_{ij}. Then, the relative importance of the criteria I_j, can be formulated as a Shapely value (Shapley, 1953):

$$I_J = m_j + \frac{\sum_{c_i \in C}\{c_j\} m_{ij}}{2}\ for\ all\ j$$

Step 6 – Establish the relative importance of the criteria.

The relative importance of the criteria (I_j) is obtained such that the absolute difference for the provided pairwise comparisons and their associated weight ratios are all minimized according to the following model, where C = the criteria set, c_j are the criteria.

$$\min \max\left\{\left(\frac{I_B}{I_J} - a_{Bj}\right), \left(\frac{I_J}{I_W} - a_{jW}\right)\right\}\ for\ all\ j$$

With the constraints:

$$m(0) = 0; \sum_{c_j \in C} m_j + \sum_{c_i,\ c_j\ \in C} m_{ij} = 1;$$

$$m_j + \sum_{c_j \in T} m_{ij} \ge 0, for\ all\ j\ and\ i, T \subseteq \mathrm{C}\ \{\mathrm{c_j}\}, \mathrm{T} \ne 0;$$

$$I_{ij} = m_{ij}, i \ne \mathrm{j}, \mathrm{i}, \text{for all i and j}$$

$$I_j = m_j + \sum_{c_i \in C\ \{\ c_j\ \}} \frac{m_{ij}}{2}, i \ne \mathrm{j}, \text{for all j and i}$$

$$I_{ij} > 0, if\ t_{ij} = +, i < j, \text{for all i and j}$$

$$I_{ij} < 0, if\ t_{ij} = -, i < j, \text{for all i and j}$$

$$I_{ij} = 0, if\ t_{ij} = \Delta, i < j, \text{for all i and j}$$

$$I_{ij} \epsilon [-1, 1], if\ t_{ij} = u', i < j, \text{for all i and j}$$

The weights are then determined for every expert. Aggregation of the weights is done with the use of the geometric mean, as it is more resistant to outliers than the arithmetic mean (Das and Imon, 2014), which increases the reliability of the results. The geometric mean is calculated through the following equation:

$$\overline{W_{geom}} = \left(\prod_{j=1}^{n} I_j^*\right)^{\frac{1}{n}}$$

3.3. Data collection

Initially, a broader list of potential experts was developed, consisting of 46 individuals. From this list, 31 companies were contacted, and 15 experts ultimately agreed to participate in interviews. The fifteen experts engaged in this study comprise CEOs, (co-)founders, strategy managers, and business developers from Small and Medium-sized Enterprises (SMEs), startups, or spin-offs within the alternative protein industry. To maintain a focused context and minimize the impact of external factors, only experts operating in the Netherlands were approached for participation, aligning with the approach suggested by Pourhoseingholi et al. (2012). Experts were recruited through communication channels such as LinkedIn, email, and telephone, leveraging databases including the Good Food Institute, Protein Directory, and the Protein Community (Good Food Institute, 2023; Protein Directory, 2023; TPC, 2023).

Upon securing the agreement of an expert to participate in the research, a comprehensive document detailing operationalizations (Section 3.6), criteria, and sub-criteria with explanatory notes was shared with each participant. This approach aimed to ensure a uniform understanding of the concepts among all experts. The interviews, which ranged from 15 to 40 min, commenced with a request for additional company information if not previously known. Subsequently, participants were queried about their years of experience in entrepreneurship.

The interviews were conducted online platforms using Microsoft Teams or in-person interactions. Before each interview, explicit consent was obtained from participants regarding the utilization of the gathered information, and each participant affirmed their agreement to data usage. Criteria and sub-criteria were visually presented throughout the interview sessions on screen or paper, allowing participants to observe these elements while engaging in pairwise comparisons. Concurrently, an Excel file designed for the linear Best-Worst Method (BWM) was employed to ensure and evaluate consistency, as detailed in Section 3.1.

A comprehensive overview of the experts involved in the study is provided in Table 1. Among the 15 conducted interviews, four were conducted in English (with experts 8, 9, 11, 13), and one interview was conducted via telephone rather than Microsoft Teams (with expert 2). In the latter case, a detailed explanation of the sub-criteria was provided prior to the interview.

The companies the experts represent are primarily operational and produce either plant-based alternative proteins or fermentation-based proteins. The latter category includes proteins derived from precision fermentation, microbial cells, and animal cells.

3.4. Criteria and sub-criteria

The decision criteria in this study are People (Social dimension), Planet (Environmental dimension), and Profit. As mentioned earlier, since profit is a critical factor for the survival and success of SMEs and serves as a key indicator of a company's financial health and sustainability, this study focuses solely on profit among the various sub-dimensions of the economic dimension. Sub-criteria for People and Planet criteria, were determined through carefully analysing primary data, specifically the websites of all companies listed in several protein databases (Good Food Institute, 2023; Protein Directory, 2023; TPC, 2023). The websites of all companies in the alternative protein industry were scanned for sustainability practices, which could often be found on the website's home page, an 'About us' page, or a dedicated 'Sustainability' page, if present. Examples of sustainability practices that were found are 'Healthy ingredients which support wellbeing', 'Reduce waste & recycle', 'No soy and palm-oil', and 'Reusable packaging material'. In total, the websites of 45 companies in the alternative protein industry in the Netherlands were analyzed.

Upon identifying the sustainable practices pursued by companies, a clustering approach was employed to categorize these practices based on the specific goals they aimed to address. This clustering process yielded pre-sub-criteria aligned with the people and planet criteria. The gathered sub-criteria were cross-referenced to ensure comprehensiveness with the criteria outlined in the General Reporting Initiative (GRI) material topics and the Corporate Sustainability Reporting Directive (CSRD). Both the GRI and CSRD serve as reporting directives within the industry, facilitating companies in monitoring their sustainability performance (CSRD, 2022; GRI, 2021).

Following this comparison, the identified sub-criteria were appropriately named. Eight distinct sub-criteria were delineated, with four each falling under the people and planet criteria. To enhance the validity of the identified sub-criteria, a validation step was implemented involving consultation with two experts selected from the pool of 15 participants. The goal was to ascertain these sub-criteria's relevance within the study's scope. This validation process sought expert opinions to confirm and validate the alignment of the identified sub-criteria with the objectives of the study. The insights provided by these two experts played a crucial role in reinforcing the credibility and robustness of the identified sub-criteria. These sub-criteria encompass consumer health and nutrition, diversity and inclusion, fair sourcing, employment, carbon footprint, resource efficiency, biodiversity, and energy usage. For a detailed explanation of each sub-criterion, refer to Table 2 below.

3.5. Contextual factors

The correlation between sustainability and survival is susceptible to contextual factors associated with the entrepreneur and the entrepreneur's business, as Fischer et al. (2020) highlighted. In the context of the Best-Worst Method (BWM), which is inherently opinion-based, considering contextual factors related to the entrepreneur (referred to here as an expert) becomes crucial. One such potential contextual factor is the gender of the expert, given studies suggesting that female entrepreneurs tend to exhibit a higher inclination towards sustainability than their male counterparts (Josefy et al., 2017). However, conflicting findings exist, with Van Opstal & Borms (2023) revealing no significant difference in implementing environmentally sustainable strategies between female and male entrepreneurs. In contrast, De Masi et al. (2021)

Table 1
Overview of the experts.

n	Based on	Type of company	Business model type	Role of expert in company	Experience with the topic [years]
1	Plant-based	Producer	B2B	Co-founder	2.5
2	Plant-based	Producer	B2C	Founder	3
3	Fermentation	Producer	B2B	CEO	8
4	Plant-based	Producer	B2B	CEO	23
5	Plant-based	Producer	B2B	CEO	5
6	Food Waste	Producer	B2B	Business Developer	37
7	Plant-based	Distributor	B2B	CEO	12
8	Plant-based	Co-Producer	B2B	CEO	8
9	Fermentation	Producer	B2B	Co-founder	4.5
10	Fermentation	Producer	B2C	Strategy manager	5
11	Fermentation	Producer	B2B	CEO	14
12	–	Accelerator	–	CEO	23
13	–	Accelerator	–	Business Coach	4
14	Plant-based	Producer	B2B	Business Developer	23.5
15	Fermentation	Producer	B2B	CEO	14

Table 2
Sub-criteria in the alternative protein industry.

Sub-criteria	Description	Reference
Employment	Focus on involving employees in decision-making, training and educating of employees or having additional (non-financial) benefits.	Souza Piao et al. (2023)
Consumer	Focus on serving a nutritional and healthy product for the end-consumer	FAO (2023)
Fair sourcing	Focus on sourcing ingredients which do not harm the population at the origin.	Fafaliou et al. (2022)
Diversity and inclusion	Focus on reducing the inequalities in society through actively embracing diversity and inclusion. Diversify teams and governance bodies in companies.	Syed and Ozbilgin (2019)
Carbon footprint	Focus on carbon neutral or carbon reduction goals	Fischer et al. (2020)
Resource efficiency	Focus on sustainable resource management, reduce waste, and increase efficiency of resources.	Huang et al. (2023)
Biodiversity	Focus on biodiversity through sourcing no ingredients which may harm biodiversity.	Fafaliou et al. (2022)
Energy usage	Focus on energy reduction or the use of green energy.	Ghag and Sonar (2023)

conducted a quantitative analysis indicating a positive impact on Environmental, Social, and Governance (ESG) performance when a company has at least three women on its board.

National cultural differences of the entrepreneur are another set of contextual factors that may come into play (Morris et al., 1994). It is defined as "the collective programming of the mind which distinguishes the members of one human group from another" (Hofstede, 1984, p21), cultural influences may lean towards individualistic or collectivistic orientations. An individualistic culture emphasizes self-focus and control, while a collectivistic culture promotes harmonious relationships among individuals, potentially influencing the extent to which organizations pursue sustainable practices (Cho et al., 2013).

In addition to entrepreneur-related contextual factors, the business model itself can significantly impact outcomes. The choice between business-to-business (B2B) and business-to-consumer (B2C) models can contribute differently to the sustainability and survival of a firm. However, the specific strategies employed will depend on various factors, such as the nature of the business, industry dynamics, and market conditions. Finally, alternative protein (fermentation-based/plant-based) companies can make a difference. The company that produces plant-based alternatives often relies on soy from developing countries, where ethical sourcing challenges may arise (Pinnington et al., 2023).

This study conducted a Mann-Whitney *U* test to assess the impact of moderating variables/contextual factors (Mann and Whitney, 1947) on several key variables. These variables included the language spoken during the interview (Dutch/English), the gender of the entrepreneur (male/female), the type of business model (B2B/B2C), and the type of alternative protein (fermentation-based/plant-based). The choice of language during the interview was employed as a proxy to examine potential cultural differences between entrepreneurs raised in Dutch and non-Dutch cultures.

4. Results and discussion

The Nonadditive Best-Worst Method (BWM) was employed to ascertain the ultimate weights of criteria and sub-criteria concerning the sustainability and survival of firms (refer to Table 3). For a visual depiction of the criteria weights, see Fig. 1, while Fig. 2 illustrates the global weights of the sub-criteria. Global weights are computed by multiplying the local weight of each sub-criterion with the weight of its corresponding criterion.

4.1. The relation between three pillars and survival

In the context of survival, a noteworthy consensus among the majority of experts (87%) underscores profit as the most crucial criteria, as detailed in Table 3 and depicted in Fig. 1. Interestingly, the criteria of people (weight = 0.19) and planet (weight = 0.21) were identified as equally significant for survival, reflecting the industry's environmental emphasis. An insightful observation from one expert validated this interconnectedness: "We've found that focusing on sustainable practices does indeed attract a consumer base that is willing to invest in plant-friendly products, thus aiding in profitability."

While a slight majority of experts (53%) asserted the greater importance of the planet criteria compared to people, Expert 11 offered a nuanced perspective, emphasizing the significance of the people criteria: "I guess some people would say the planet should come first, but we're in a food business, a lot of the time it is the interaction with people which matters the most." This underscores the idea that prioritizing the people criteria in the alternative protein industry can be pivotal, given the inherent importance of interpersonal connections in the food sector. Profit emerges as the primary determinant for survival, yet the acknowledgment of the interplay between social, environmental, and economic aspects highlights the comprehensive approach necessary for sustained success in the alternative protein industry.

Table 4 and Fig. 2 highlight that Carbon footprint emerges as the most critical sub-criteria for survival. This emphasis can be attributed to the alternative protein industry's role in displacing a segment of the conventional animal-based protein sector, renowned for its significant greenhouse gas emissions (Espinosa-Marrón et al., 2022). As articulated by Expert 12, "Nowadays, you have to contribute to the planet; otherwise, you are not going to sell your products. Consequently, companies in the alternative protein industry should prioritize addressing their carbon footprint".

Table 3
The calculated weights of criteria and sub-criteria for reaching the Sustainability and Survival goals.

Goal	Criteria	Weight	Sub-criteria	Local weight	Global weight
Survival	*people*	0.19	*Consumer*	0.291	0.056
			Employment	0.298	0.057
			Diversity and inclusion	0.132	0.025
			Fair sourcing	0.156	0.030
	planet	0.21	*Carbon footprint*	0.305	0.063
			Biodiversity	0.101	0.021
			Resource efficiency	0.279	0.057
			Energy usage	0.229	0.047
	profit	0.46		0.46	0.46
Sustainability	*people*	0.21	*Consumer*	0.258	0.055
			Employment	0.140	0.030
			Diversity and inclusion	0.126	0.027
			Fair sourcing	0.319	0.068
	planet	0.41	*Carbon footprint*	0.307	0.127
			Biodiversity	0.145	0.060
			Resource efficiency	0.254	0.105
			Energy usage	0.187	0.077
	profit	0.19		0.19	0.19

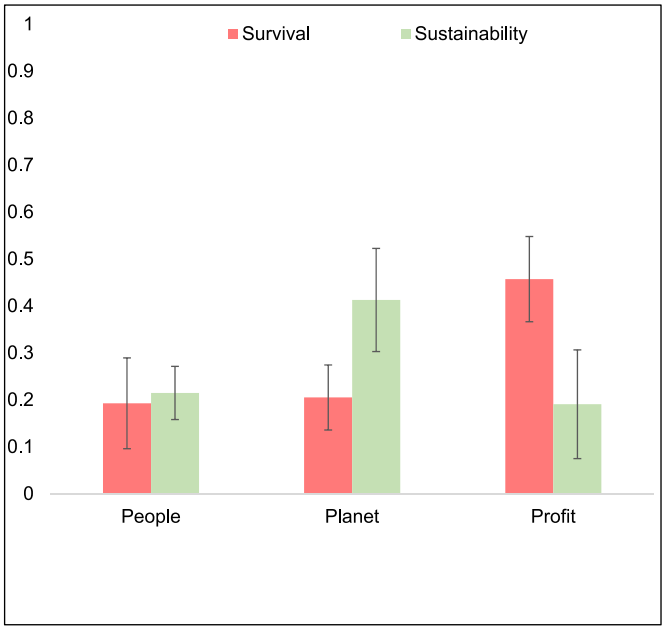

Fig. 1. Global Weights of criteria for Sustainability and Survival.

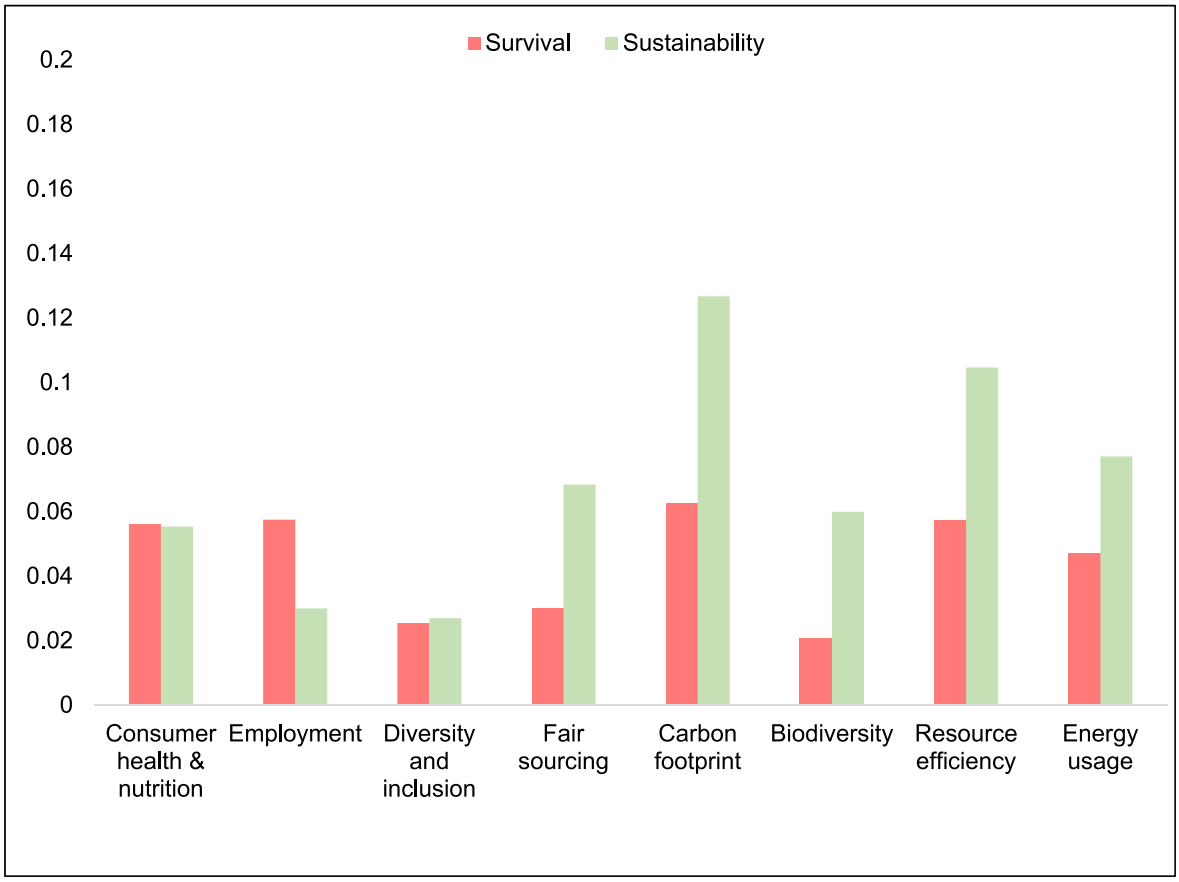

Fig. 2. Global weights of sub-criteria for Sustainability and Survival.

Table 4
The influence of contextual factors, global weights were used for the sub-criteria.

Groups	Geometric mean	*P* Value	Goal	(Sub-) criteria
Producer – fermentation (n = 5)	0.068	0.0057	Survival	*fair sourcing*
Producer – plant-based (n = 7)	0.029			
Producer – plant-based (n = 5)	0.29	0.018	Sustainability	*people*
Producer – fermentation (n = 7)	0.14			

Furthermore, the consumer motivation to purchase alternative proteins is significantly influenced by the perceived environmental friendliness of these products (Panescu et al., 2022). In the literature, achieving carbon neutrality is linked to effective resource efficiency in the supply chain (Patil et al., 2023). In addition to optimizing resource use, adopting green transportation practices, such as biofuels, is crucial in enhancing the industry's overall environmental sustainability.

Consumer stands out as the most pivotal sub-criterion for survival, aligning with insights from a market report by Panescu et al. (2022), which emphasizes that key motivators for plant-based proteins include being "healthier than meat" and a "good source of protein." Upon reviewing the results, one expert expressed interest in the high consumer ranking: "At company X, we've made consumer health a cornerstone of our product development".

Beyond recognizing the significance of this sub-criterion, several experts underscored the importance of organizational culture when a company prioritizes consumer health and nutrition. Expert 6 emphasized, "If you work on consumer, you have to take along your employees. It needs to be in your culture." Similarly, Expert 15 highlighted, "The more we focus on consumer health and nutrition, the more 'employment,' the people who work at our company are purpose-driven".

Interestingly, a third of the experts highlighted a positive relationship between consumer health and nutrition and diversity and inclusion, a perspective not universally shared among the majority of experts. Expert 8 provided insight into this perspective, noting, "Each different culture has its own definition of health." This suggests that a focus on diversity and inclusion may impact organizational culture, subsequently influencing the extent to which companies prioritize consumer health and nutrition.

Scott et al. (2011) argue that aligning organizational culture with diversity-related goals yields improved employee outcomes, increased benefits, and reduced costs. Despite this, diversity and inclusion were identified as the least important criteria concerning survival. Expert 14 clarified that diversity and inclusion, while not directly linked to survival, become crucial when overlooked, potentially leading to significant repercussions. Upon reviewing the results, one expert disagreed with the low weight assigned to diversity and inclusion, emphasizing that "diverse teams bring in diverse perspectives, contributing to innovative solutions for complex problems such as sustainability" This notion aligns with the hypothesis presented in Zouaghi et al. (2020). However, this hypothesis was refuted, as an excess of diversity was found to potentially fragment groups, create social barriers, and complicate teamwork within a team.

After extensive discussions with a sustainability expert, it was emphasized that while contributing to diversity and inclusion might not be a crucial factor for survival, it becomes significantly more important when the goal is 'growth.' In pursuing growth, incorporating diverse

perspectives is deemed essential for innovation and moving beyond mere survival, aligning with the insights from Scott et al. (2011).

In contrast, employment emerged as particularly crucial for survival but did not carry the same weight in the context of sustainability. The significance of employment for survival aligns with existing literature, which highlights that sustainable practices related to employment can positively impact a firm in achieving its objectives (Diaz-Carrion et al., 2021).

Both fair sourcing and biodiversity, representing the initial stages of the value chain for producing companies, were identified as the least important sub-criteria for survival. The rationale behind this perspective was the perceived invisibility of supply chains to consumers, limiting their contribution to the company's survival. Expert 3 underscored this point, stating, "Sourcing can be hard, let alone fair sourcing; you're limiting yourselves to certain channels whilst not being able to buy from those."

However, one expert responded after reviewing the results, emphasizing the importance of fair sourcing for the company, particularly in enhancing brand trust. This sentiment is supported by a study conducted for a large B2C coffee-producing company (Chen and Lee, 2015). Nonetheless, Pinnington et al. (2023) argue that firms lacking transparency in their supply chain, and those that have not analyzed it require significant incentives to overcome the costs and risks associated with transparency or supply chain assessment. These incentives may not be substantial enough for companies solely focused on survival in this industry.

The sustainability expert highlighted that the perceived low importance of biodiversity and fair sourcing concerning survival may be attributed to the European-centric value chains of several companies. Additionally, the expert noted that the chosen goal, such as survival, may influence the perceived importance of these sub-criteria. While they may not be critical for survival, contributing to fair sourcing and biodiversity becomes crucial when aiming for company growth. Sustainable entrepreneurs are urged to move beyond the narrow financial business case and contribute to the complex task of generating value for all stakeholders (Hörisch et al., 2014). To thrive and make a significant impact, it is essential for sustainable entrepreneurs to go beyond mere survival and actively contribute to all aspects of sustainability, gaining a competitive advantage in the process (Busch et al., 2023).

4.2. The relation between three pillars and sustainability

When queried about the criteria deemed most important for sustainability, most experts (87%) identified the "planet" dimension as the paramount focus. According to expert 14, everything in the alternative protein industry related to sustainability predominantly revolves around environmental considerations, making the planet dimension the foremost priority. Conversely, one expert (expert 5) took a different stance, asserting that all three dimensions—people, planet, and profit—held equal importance. The emphasis on the planet's significance aligns with the increasing transgression of planetary boundaries (Rockström et al., 2009). After consultation with the experts, it was noted that the social dimension was perceived as less critical, with societal issues being less visible in the Netherlands compared to other countries.

There was no unanimous consensus among experts regarding the impact of profit on sustainability. While some experts (3 and 9) expressed that financial resources enable technological advancements and act as a catalyst for positive change, expert 8 contended that profit was the least important factor for sustainability. The latter expert argued that money can drive consumption, which inherently poses risks to the planet. These differing viewpoints can be categorized as eco-efficiency and eco-sufficiency, where eco-efficiency strategies aim to increase economic output value while simultaneously reducing environmental impact, and eco-sufficiency primarily focuses on reducing consumption (Figge et al., 2014; Jungell-Michelsson and Heikkurinen, 2022).

The sustainability expert acknowledged the validity of arguments on both sides. From the perspective of eco-sufficiency, it is crucial to avoid stimulating overconsumption, as highlighted by Young & Tilley (2006). The alternative protein industry's goal is to substitute animal-based proteins rather than increase overall consumption partially. In this context, profit becomes essential for bringing these substitutes to the market.

4.3. Macroeconomic condition, survival, and sustainability

Numerous experts (3, 5, 9, 14) highlighted the critical role of venture capital in the survival of companies in the alternative protein industry, particularly when these companies are not yet profitable. Expert 5 expanded on this point by noting that macroeconomic conditions, such as central bank interest rates, substantially influence venture capital availability. The relationship between higher interest rates and firm survival was emphasized, with the argument that during periods of elevated interest rates, loans become more expensive for small and medium-sized enterprises (SMEs), potentially impacting their ability to secure financial capital. This creates a scenario where venture capitalists may seek greater certainty of profitability before investing, elevating the importance of profit in such economic conditions (Expert 5).

Earlier research by Highfield and Smiley (1987) suggested that lower interest rates signal a robust economy, attracting more companies. However, studies by (Audretsch and Acs, 1994) found no correlation between interest rate levels and firm terminations. While interest rates may not directly influence business survival, higher interest rates can impact companies by reducing investments and negatively affecting those with substantial debt (Box, 2008).

Expert 5 also drew a connection between interest rates and sustainable practices, noting that lower interest rates make venture capitalists more willing to invest in start-ups, providing more leeway for sustainable practices. This underscores the influence of financial stakeholders on sustainability initiatives in companies. Study has explored the impact of macroeconomic conditions on company sustainability, revealing that economies with higher inflation rates tend to exhibit fewer sustainable practices (Chih et al., 2010). Higher inflation rates are associated with higher interest rates (Plakandaras et al., 2023), so elevated interest rates may limit the scope for sustainable practices in companies.

4.4. Analysing the impact of contextual variables on criteria and sub-criteria weights for survival and sustainability

A Mann-Whitney *U* test (Mann and Whitney, 1947) was conducted to analyse several variables: the language spoken during interviews (Dutch/English), gender of the entrepreneur (male/female), type of business model (B2B/B2C), and type of alternative protein (fermentation-based/plant-based), see section 3.4. The language spoken during the interview was examined to gauge any cultural differences between entrepreneurs raised in Dutch versus non-Dutch cultures. Among these variables, only the type of alternative proteins (fermentation-based/-plant-based) yielded significant results, as shown in Table 4.

The significant criteria identified were fair sourcing and people. Notably, "fair sourcing" emerged as significantly more important for survival in companies producing plant-based proteins. While none of the other sub-criteria yielded significant results, the criterion of "people" was found to be significantly less important for fermentation-based producers (geomean = 0.14) compared to plant-based producers (geomean = 0.29). Conversely, "profit" was deemed more crucial for experts from fermentation-based producers (geomean = 0.32) than for those from plant-based producers (geomean = 0.16) concerning sustainability. Although this difference was not statistically significant, one possible explanation is that plant-based companies prioritize concerns related to the "planet" and "people" over "profit". This could be attributed to the fact that many fermentation-based companies are not yet selling products due to regulatory and technological challenges (Bashi et al., 2019).

According to sustainability experts, fermentation technology is costly, requiring substantial research and development efforts to improve profit margins, which may adversely affect short-term financial performance (Guldiken and Darendeli, 2016). Thus, profitability is crucial for bringing sustainable alternative proteins to market. In contrast, plant-based companies are often already established in the market (Panescu et al., 2022). One expert emphasized that "whenever profit is sufficient, there is more room for sustainability."

4.5. Comparing the results obtained from nonadditive BWM with those from linear BWM

The superior features of nonadditive BWM in comparison to other types of BWM (such as linear, nonlinear, and Bayesian) are that nonadditive BWM enables decision-makers to make more accurate, comprehensive, and well-informed decisions. In other words, nonadditive BWM can capture nonlinear relationships and dependencies between criteria and alternatives, which may help in reflecting real-world decision scenarios more accurately.

Here, the comparison between nonadditive BWM and linear BWM results validates these characteristics, see Table 5.

As depicted in Fig. 3, the difference between nonadditive and linear BWM outcomes is more pronounced in sustainability than survival. This suggests that there is not a prominent relationship or dependency among (sub)criteria for survival. Conversely, sustainability has more interconnections between (sub)criteria.

5. Conclusion and future research

This study provides valuable insights that can inform strategic decisions within the alternative protein industry. Interviews with 15 experts reveal the importance of a balanced sustainability approach, incorporating both social and environmental dimensions, as critical to long-term success in this sector.

Key findings highlight two critical social aspects: the adoption of sustainable employment practices and the development of nutritionally sound products that enhance consumer well-being. From an environmental perspective, maintaining a low carbon footprint—through resource efficiency, reduced energy consumption, or the adoption of green energy sources—emerges as a crucial driver of sustainability. To enhance the chances of survival and growth, it is recommended that entrepreneurs in the alternative protein industry actively contribute to sustainability efforts. The following policy recommendations are proposed:

Support *for sustainable employment practices*: Policymakers should incentivize companies to adopt fair labor practices and provide training programs that promote skill development within the workforce. This can enhance job satisfaction, retention, and overall productivity.

Regulatory framework for nutritional standards: Governments can establish guidelines for nutritional quality in alternative protein products, encouraging companies to prioritize consumer health alongside sustainability.

Encouragement of resource efficiency: Financial incentives or grants could be provided to companies that implement energy-efficient technologies and sustainable sourcing practices. This support can facilitate the transition to greener operations, minimizing carbon footprints.

Biodiversity protection initiatives: Policies should be designed to ensure that sustainable practices do not negatively impact local ecosystems. This includes promoting sustainable ingredient sourcing and practices that mitigate adverse effects on biodiversity.

Research and development funding: Increased funding for research into alternative protein sources beyond plant-based and fermentation-based options, such as insect-based and cell-based proteins, will foster innovation and diversification in the industry.

While all aspects of sustainability are important, the study emphasizes that not all sustainable practices hold equal weight in terms of business survival. However, for companies aspiring to thrive, a comprehensive focus on all facets of sustainability is essential, not only to secure viability but also to generate value for all stakeholders.

The study also briefly explored the role of macroeconomic conditions, particularly central bank interest rates, in influencing sustainability and survival. Findings suggest that higher interest rates can reduce sustainable performance, prompting entrepreneurs to take fewer risks. While these rates may not directly impact survival, they present an interesting avenue for further research.

In conclusion, this study stresses the importance of directing focus toward sustainability as a pathway to growth. Sustainable growth occurs when companies effectively contribute to the triple bottom line—-people, planet, and profit—satisfying all stakeholders. For those aiming at long-term success, integrating 'growth' as a strategic goal alongside sustainability is a promising area for future exploration.

As with any research, certain limitations must be acknowledged. External validity may be a concern, as the results are specific to the alternative protein industry in the Netherlands and may not be directly generalizable to other countries or industries due to cultural differences. Additionally, there may be sample bias, given the impracticality of interviewing every company in the Dutch alternative protein sector.

The cross-sectional nature of the study presents another limitation. Previous research (Fischer et al., 2020) suggests that the balance of the triple bottom line can shift after stakeholder interactions over time. Although the entrepreneur and business model largely dictate this balance, minor variations may occur in the short term. Despite efforts to

Table 5
Weights of sub(criteria) using nonadditive and linear BWM.

Goal	Criteria	Weight (nonadditive)	Weight (linear)	Sub-criteria	Weight (nonadditive)	Weight (linear)
Survival	*people*	0.19	0.20	*Consumer*	0.291	0.290
				Employment	0.298	0.28
				Diversity and inclusion	0.132	0.140
				Fair sourcing	0.156	0.150
	planet	0.21	0.20	*Carbon footprint*	0.305	0.310
				Biodiversity	0.101	0.10
				Resource efficiency	0.279	0.270
				Energy usage	0.229	0.230
	profit	0.46	0.46			
Sustainability	*people*	0.21	0.23	*Consumer*	0.258	0.240
				Employment	0.140	0.14
				Diversity and inclusion	0.126	0.11
				Fair sourcing	0.319	0.37
	planet	0.41	0.53	*Carbon footprint*	0.307	0.29
				Biodiversity	0.145	0.19
				Resource efficiency	0.254	0.20
				Energy usage	0.187	0.18
	profit	0.19	0.15			

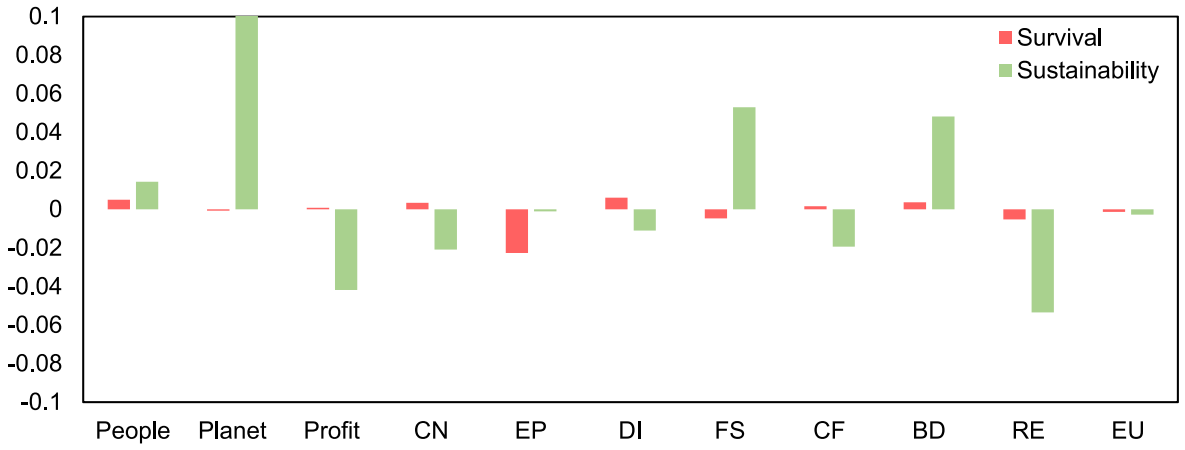

Fig. 3. The absolute difference of weights of (sub) criteria between nonadditive BWM and linear BWM. CN = consumer health and nutrition, EP = Employment, DI = Diversity and inclusion, FS = Fair sourcing, CF = Carbon footprint, BD = Biodiver

address confounding variables with a Mann-Whitney *U* test, other factors may still influence outcomes. Prior studies have examined the balance between sustainability and competitive advantage (Ghag and Sonar, 2023) and the pursuit of sustainability for its own sake (Diaz-Carrion et al., 2021), while stakeholder influence on entrepreneurs has also been noted (Fischer et al., 2020). This study uniquely integrates survival and sustainability goals, emphasizing the need to balance both.

Several recommendations for future studies are proposed, including comparing sustainability visions across management levels, introducing distinct decision criteria for environmental and social pillars, and examining alternative goals such as 'competitive advantage' or 'growth' alongside sustainability. These avenues promise valuable insights into how companies can integrate sustainability with broader strategic objectives. Future research in the alternative protein industry should also consider expanding the scope of data collection to include experts from diverse alternative protein sources, such as insect-based and cell-based proteins. By broadening the expert pool, subsequent studies can gain deeper insights into sustainability challenges and survival strategies across the full spectrum of alternative proteins. This comprehensive approach will enhance the understanding of industry dynamics and contribute to a more complete analysis of the factors driving sustainability and success in this sector. Future research could explore other extensions of Best-Worst Method (BWM), such as Belief-based BWM (Liang et al., 2021), Bayesian BWM (Mohammadi and Rezaei, 2020), Parsimonious BWM (Corrente et al., 2024), and Stratified BWM (Asadabadi et al., 2023), to address uncertain situations.

CRediT authorship contribution statement

Negin Salimi: Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Ton Vrauwdeunt:** Writing – original draft, Methodology, Formal analysis, Conceptualization.

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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