Measuring Industrial Sustainability Performance in Small and Medium-sized Enterprises: Analysis of Sustainability Indicators

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Abstract

The purpose of this paper is to empirically select and prioritize suitable sustainability indicators for measuring and managing sustainability performance in small and medium-sized enterprises (SMEs). To achieve this objective, we applied a comprehensive methodological approach, which includes (1) conducting a systematic review to identify potential sustainability indicators in the literature, (2) designing a questionnaire based on the identified indicators, (3) pre-testing (pilot testing) of the questionnaire with selected industry experts, scholars, and researchers to further refine the indicators prior to data collection from the Italian footwear SMEs, and (4) selecting and prioritizing the final indicators using fuzzy Delphi method. The findings of the present paper show that the selected indicators emphasized measuring industrial sustainability performance related to financial benefits, costs, and market competitiveness for the economic sustainability dimension; resources for the environmental sustainability dimension; and customers, employees, and the community for the social sustainability dimension. The paper provides sustainability indicators considering the triple bottom line approach. The results of the present paper have significant academic, practical, and policy implications for measuring and managing industrial sustainability performance.

Keywords
Indicator, Triple bottom line, Sustainability performance, Industrial sustainability, Italian footwear SMEs, Fuzzy Delphi method

1. Introduction

The issues of industrial sustainability have become an essential topic of discussion (Cagno et al. 2019) and gains considerable attention among industrial decision-makers, policy-makers and scholars (Neri et al. 2018; Trianni et al., 2017). Manufacturing is the most important driving force for a country's economic growth and social development (Galal and Moneim 2015; Zeng et al. 2008). However, they are one of the main contributors to environmental and social concerns (Zeng et al. 2008); and they are duly required to improve sustainability performance and be transparent on their sustainability practices (Trianni et al. 2019). Manufacturing companies need to adopt sustainability practices mainly for the following reasons: (1) pressures from various stakeholders (Huang and Badurdeen 2018; Ocampo et al. 2016; Zarte et al. 2019), (2) growing concerns about environmental and social impacts (Beekaroo et al. 2019; Samuel et al. 2013; Wang et al. 2018), and (3) to get a competitive advantage (Tseng et al. 2009; Veleva et al. 2001; Wang et al. 2018). To effectively adopt sustainability in manufacturing companies, measuring sustainability performance is crucial (Cagno et al. 2019; Trianni et al. 2019). The adoption of industrial sustainability considers actions taken at material, product, process, plant and production system levels (Tonelli et al. 2013). As a common understanding, the concept of sustainability considers economic, environmental and social aspects (Paramanathan et al. 2004; Zeng et al. 2008). Elkington (1997) proposed the triple bottom line (TBL) approach that consists of three interrelated (economic, environmental, and social) dimensions of sustainability. It is crucial to adopt a holistic approach based on TBL to adequately address industrial sustainability (Cagno et al. 2019). Manufacturing companies have a significant impact on the three dimensions of sustainability (Ahmad, Wong, and Zaman 2019; Ghadimi et al. 2012). Subsequently, they should simultaneously consider economic, environmental and social sustainability dimensions while producing their products and services (Eastwood and Haapala 2015; Haapala et al. 2013; Lacasa et al. 2016; Watanabe et al. 2016).

Although small and medium enterprises (SMEs) are contributing significantly to the economic growth of the country through innovation, production volume, and employment generation (Sajan et al. 2017), they are less likely to address sustainability issues compared to large manufacturing companies (Mitchell et al. 2020). Unlike large manufacturing companies, it is more difficult for SMEs to effectively measure and manage sustainability performance since they have limited resources (Hsu C.H. et al. 2017; Singh et al. 2014; Trianni et al. 2019; Winroth et al. 2016), and lack the awareness and expertise required to effectively adopt sustainability (Singh et al. 2014; Trianni et al. 2019). SMEs are mainly focused on the economic aspects than the environmental and social aspects of sustainability (Choi and Lee, 2017; Trianni et al. 2019).

There is still a need for suitable sustainability indicators tailored to different manufacturing company contexts, to SMEs in particular, to effectively measure and manage industrial sustainability performance (Singh et al. 2014; Winroth et al. 2016). The lack of useful and applicable indicators has been the major challenge for measuring sustainability performance in manufacturing companies (Ahmad and Wong 2019; Ocampo et al. 2016). Contextual factors (industry type, firm size, and geographical area) affect the use of indicators in measuring industrial sustainability performance (Cagno et al. 2019; Trianni et al. 2019). Thus, tailoring useful and applicable indicators to the industry context is essential to effectively measure sustainability performance in manufacturing companies (Medini et al. 2015). In other words, it is important a set of indicators that are simple and easy to use and manage (Veleva and Ellenbecker 2001). Furthermore, by selecting and prioritizing useful and applicable indicators to the manufacturing company context (Ahmad and Wong 2019; Hsu C.H. et al. 2017), the effectiveness of industrial sustainability performance measurement can be increased (Cagno et al. 2019; Trianni et al. 2019).

The footwear industry is one of the leading industrial sectors driving the economic growth and social development of Italy. According to Assocalzaturifici (2020), the industry created job opportunities for around 75000 employees, generated a yearly turnover of 14.3 billion euro in 2019, and consume different input materials, which includes leather, synthetic, rubber, and textiles for production. These figures indicate that the sector has a significant potential to address issues of sustainability. However, the lack of clear sustainability goals, suitable indicators as well as limited resources are major challenges in measuring and managing the sustainability performance of footwear firms, especially SMEs. The extant literature indicates that there is a need for research on the footwear sector regarding sustainability. More specifically, research is needed on measuring the sustainability performance of the footwear sector (SMEs in particular) based on the TBL approach.

Previous research regarding the sustainability performance of the footwear industry is limited and focuses primarily on the environmental dimension (Deselnicu et al. 2014; Subic et al. 2013). There is also a need for research on context-tailored indicators and frameworks for measuring and managing the sustainability performance of SMEs. These rationales pushed to consider the footwear sector, particularly Italian footwear SMEs as the research context to carry out an empirical study. For conducting the empirical analysis, the fuzzy Delphi method (FDM) with consistency aggregation method (CAM) was applied to select and prioritize useful and applicable indicators for measuring and managing sustainability performance in SMEs. When applying the FDM, all the experts' opinions are incorporated in one investigation to comprehensively address the uncertainty and ambiguity of the experts and achieve a group consensus. Thus, the results obtained become objective and rational. The remaining of the work in this paper is organized into three sections. Section 2 describes the research methodology applied. The analysis results are discussed in Section 3. Finally, the conclusions and avenues for future research are described in Section 4.

2. Methodology

To achieve the objective of the paper (i.e., , to carry out the empirical study for selecting and prioritizing suitable sustainability indicators tailored to Italian footwear SMEs for measuring and managing their sustainability performance), we applied the following methodological approach as shown in Figure 1. The main steps applied to select and prioritize indicators include: conducting a systematic review to identify the potential sustainability indicators (step 1), designing a questionnaire (step 2), collecting data (step 3), and analyzing the data using FDM based on the consistency aggregation method (step 4).

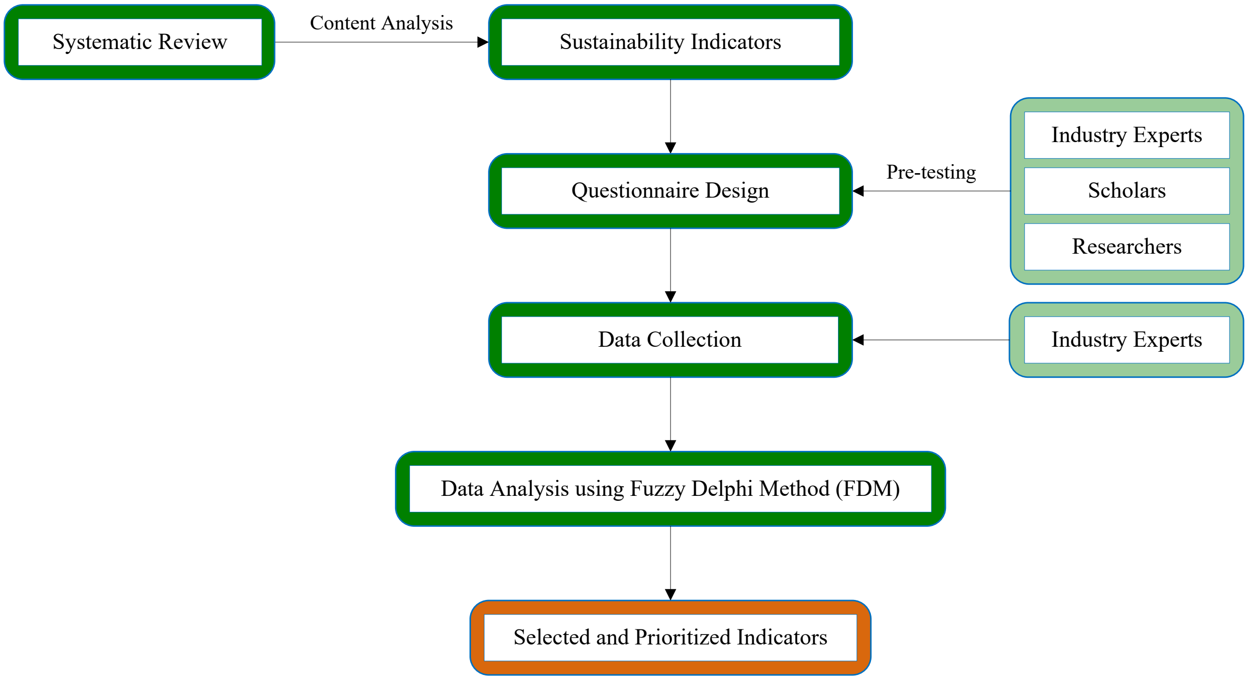

Figure 1. Methodological approach for selecting and prioritizing indicators

2.1 Identification of Potential Sustainability Indicators

We conducted a systematic review of literature to identify indicators within published peer-reviewed articles that are relevant to sustainability performance measurement of manufacturing companies. For this purpose, we used Scopus and Web of Science (WoS) as search databases since they provide an extensive coverage of peer-reviewed journal articles (Ahi and Searcy, 2015). For the search, two sets of keywords linked to the topic of this paper were used: "industrial sustainability" or "sustainable manufactur*" or "sustainable firm*" or "sustainable enterpri*" or "sustainable industr*" or "sustainable factory" or "sustainable production*" or "sustainable organi*" or "sustainable compan*" in the first set and “indicator*” or “metric*” or “performance measure*” in the second set. We initially obtained a total of 1456 papers using the keywords search in both Scopus and WoS databases published until 2020. From which, 59 papers were selected to identify and analyze the indicators.

A content analysis was carried out to identify the consistently and frequently used indicators (Ahi and Searcy 2015; Ahmad, Wong, and Rajoo 2019). A total of 1013 indicators (277 for economic, 402 environmental and for 334 social sustainability dimensions) were explored. The majority (about 85%) of them appeared only once in the reviewed literature. This figure shows a lack of consistency in the use of indicators (i.e., lack of consensus on a single set of indicators) to measure sustainability performance in different manufacturing company contexts. On the other hand, few indicators (14 for economic, 18 for environmental, and 12 for social sustainability dimensions) were consistently and frequently used to measure and manage industrial sustainability.

2.2 Questionnaire Design

Based on the consistently and frequently used indicators, we developed a questionnaire. Then, we conducted pre-testing of the questionnaire with selected industry experts, scholars, and researchers (Forza 2002; Padilla-Rivera et al., 2021). The pre-testing was carried out to check language, context, and content clarities, ensure filling the questionnaire within the shortest possible time, avoid the possibility of redundant questions, and ensure relevance of the questionnaire to the objective of the study (Mengistu and Panizzolo 2021). The feedback of the pre-test were used to modify, add, and delete indicators in order to improve the questionnaire and increase its convergence (Padilla-Rivera et al. 2021).

2.3 Data Collection

A total of 48 valid responses were obtained after distributing the questionnaire to Italian footwear firms via e-mail. In other words, experts' opinions on the sustainability indicators were collected from 48 Italian footwear SMEs. The data collection focused on industry experts to obtain empirical evidence from the users of the final selected indicators and to increase the reliability of the results. Table 1 summarizes the position and work experience of the experts.

Table 1. Profile of the experts by frequency

Variable	Position	Frequency (#)	Percentage (%)
Position	Chief Executive Officer/General Manager	21	44%
	Production Manager	7	15%
	Operation Manager	9	19%
	Expert/Professional Employee of Sustainability	6	13%
	Others	5	10%
Work experience	Over 20 years	23	49%
	15 to 20 years	4	9%
	10 to 15 years	10	21%
	5 to 10 years	6	13%
	Below 5 years	4	9%

As can be seen in Table 2, Chief Executive Officer/General Manager represents the highest percentage (44%) of the industrial experts. Most of the industry experts (49%) have over 20 years of work experience.

To assess the consistency or repeatability of the questionnaire items (i.e. the indicators), we conducted a reliability analysis. Particularly, the internal consistency method was applied for testing the reliability (Forza 2002). Cronbach's alpha (α) was used to assess the reliability of the data, and it was calculated using the IBM SPSS software (Version 26). The value of α was 0.710 for the economic sustainability dimension, 0.936 for the environmental sustainability indicators, and 0.854 for the social sustainability indicators, which are higher than the minimum acceptable value (0.7).

2.4 Data Analysis using Fuzzy Delphi Method

We applied fuzzy Delphi method (FDM) to select and prioritize indicators for measuring sustainability performance in Italian footwear SMEs by analyzing the experts' opinions. FDM combines the traditional Delphi method and fuzzy theory to address the limitations of the traditional Delphi method (Tsai et al. 2020). The fuzzy theory combined with the traditional Delphi method is used to resolve the vagueness and ambiguity of expert judgments to improve efficiency and quality (Lee et al. 2018; Padilla-Rivera et al. 2021). In FDM, the linguistic variables (qualitative) converted into fuzzy membership functions (quantitative) for analysis of the indicators (Tsai et al., 2020). Triangular fuzzy number, trapezoidal fuzzy number and Gaussian fuzzy number are the membership functions that have been used by previous research (Hsu Y.-L. et al., 2010). For this study, we applied the triangular fuzzy number as a fuzzy membership function (Hsu Y.-L. et al. 2010; Zhang, 2017).

FDM avoids the drawbacks of the traditional Delphi method, which includes low convergence of experts' opinions (Ma et al., 2011) and high cost and considerable time for collecting experts' opinions (Ma et al. 2011; Padilla-Rivera et al. 2021; Tsai et al. 2020) due to the several rounds of a survey applied in the traditional Delphi method (Zhang, 2017). In FDM, all the experts' opinions are incorporated in one investigation (Kuo and Chen 2008; Ma et al. 2011) to comprehensively address the uncertainty and ambiguity of the experts (Zhang 2017) to achieve a consensus (Kuo and Chen 2008). Therefore, this method is considered to be robust (Padilla-Rivera et al. 2021) and a better effect of data analysis can be achieved (Ma et al. 2011); and the results obtained are objective and rational (Zhang 2017). More specifically, we applied the consistency aggregation method (CAM). In this method, the fuzzy individual expert's opinions are aggregated into a group consensus opinion for each indicator. To incorporate all the experts' opinions, both similarity and difference among the experts were considered to apply the CAM (Lin et al. 2019; Lu et al. 2006; Mengistu and Panizzolo 2022). The following steps was used to apply the FDM:

1. *Extract experts' opinions*: Gather and organize the scores given by each expert for each sustainability indicator provided in the questionnaire.
2.
3. *Convert the experts' opinions into triangular fuzzy numbers*: Translate the linguistic variables used by the experts to assess the sustainability indicators into triangular fuzzy numbers (Zhang 2017) as shown in Table 2. The linguistic variables are used to express the experts' opinions on the importance (i.e., usefulness and applicability) of the indicator.

Table 2. Linguistic variables with their respective fuzzy scales and triangular fuzzy numbers

Linguistic variables	Fuzzy scales	Triangular fuzzy numbers (*a,b,c*)
Not important (NI)	1	(1,1,3)
Slightly important (SI)	3	(1,3,5)
Moderately important (MI)	5	(3,5,7)
Important (I)	7	(5,7,9)
Very important (VI)	9	(7,9,9)

That is the triangular fuzzy numbers of the expert opinion is defined as $EPi = (ai, bi, ci)$, for $i = 1, 2,\dots, n$.
Where, EPi is expert opinion of the i^{th} expert in the form of minimum (a), optimum (b) and maximum (c), and n is total number of experts.

4. *Determine similarity (S) between each pair of experts' opinions*: The degree of similarity between each pair of experts' opinions was calculated as the proportion of intersection area (IntsArea) relative to the union area of each pair of experts' opinions $EPi = (ai, bi, ci)$ and $EPj = (aj, bj, cj)$ as follows:

$$S(EPi, EPj) = \frac{IntsArea\ (EPi, EPj)}{Area(EPi) + Area(EPj) - IntsArea\ (EPi, EPj)}, for\ i = 1, 2, \dots, n \quad (1)$$

For the same experts' opinions $S(EPi, EPj) = 1$, and if $IntsArea(EPi,EPj) = 0$, $S(EPi, EPj) = 0$.
$S(EPi, EPj) = S(EPj, EPi)$ (i.e., $S(EP_1, EP_2) = S(EP_2, EP_1)$).

5. *Determine difference (D) between each pair of experts' opinions*: Calculate the distance between each pair of experts' opinions $EPi = (ai, bi, ci)$ and $EPj = (aj, bj, cj)$ as shown below:

$$D(EPi, EPj) = \frac{1}{2}|bi - bj|, for\ i = 1, 2, \dots, n \quad (2)$$

For identical experts' opinions, $D(EPi, EPj) = 0$.
Then, convert the absolute distance (D) into normalized distance (ND) using the following formula:

$$ND(EPi, EPj) = \frac{D(EPi, EPj)}{Max[D(EPi, EPj)]} \quad (3)$$

6. *Determine consistency degree (r) between each pair of experts' opinions*: For $i = 1, 2,\dots, n$, the consistency degree of each pair of experts' opinions $EPi = (ai, bi, ci)$ and $EPj = (aj, bj, cj)$ was calculated as follows:

$$r(EPi, EPj) = \beta S(EPi, EPj) + (1 - \beta) ND(EPi, EPj) \quad (4)$$

For this study, considering equal importance for the similarity and difference among the experts, the value β was taken as 0.5.

7. *Determine degree of importance (e) for each expert*: The degree of importance of each expert (ei) is calculated based on their years of work experience. For this purpose, we assigned the following values for the years of work experience categorized in this study. Accordingly, 5 for over 20 years of experience, 4 for 15 to 20 years, 3 for 10 to 15 years, 2 for 5 to 10 years and 1 for below 5 years. Table 3 summarizes the degree of importance (relative of importance) of each expert (ei).

Table 3. Degrees of importance of the experts

Expert	Value	Degree importance	Expert	Value	Degree importance	Expert	Value	Degree importance
E1	5	0.0276	E17	3	0.0166	E33	1	0.0055
E2	2	0.0110	E18	5	0.0276	E34	1	0.0055
E3	5	0.0276	E19	2	0.0110	E35	5	0.0276
E4	5	0.0276	E20	5	0.0276	E36	3	0.0166

Expert	Value	Degree importance	Expert	Value	Degree importance	Expert	Value	Degree importance
E5	4	0.0221	E21	3	0.0166	E37	3	0.0166
E6	5	0.0276	E22	3	0.0166	E38	5	0.0276
E7	5	0.0276	E23	5	0.0276	E39	5	0.0276
E8	5	0.0276	E24	5	0.0276	E40	1	0.0055
E9	5	0.0276	E25	3	0.0166	E41	1	0.0055
E10	4	0.0221	E26	5	0.0276	E42	3	0.0166
E11	2	0.0110	E27	5	0.0276	E43	4	0.0221
E12	5	0.0276	E28	4	0.0221	E44	5	0.0276
E13	5	0.0276	E29	3	0.0166	E45	5	0.0276
E14	2	0.0110	E30	4	0.0221	E46	5	0.0276
E15	3	0.0166	E31	2	0.0110	E47	5	0.0276
E16	5	0.0276	E32	2	0.0110	E48	3	0.0166

8. *Determine the weighted consistency degree (C) of each expert*: For *i = 1, 2,…, n*, calculate the weighted consistency degree of each expert *Ei* as seen below:

$$C(Ei) = \sum_{i=1}^{n} r(EPi, EPj) * ei \tag{5}$$

9. *Determine the aggregation weight (w) of each expert*: For *i = 1, 2,…, n*, the aggregation weight of each expert *Ei* was calculated as follows:

$$w(Ei) = \frac{C(Ei)}{\sum_{i=1}^{n} C(Ei)} \tag{6}$$

10. *Determine the aggregate fuzzy opinion (R) for each indicator (k)*: For *k = 1, 2,…, N*, calculate the fuzzy opinion as shown below:

$$Rk = \sum_{k=1}^{N} w(Ei)(.)EPi \tag{7}$$

Which implies:

$$R_k = [(w(E_1)*a_1 + w(E_2)*a_2 + \dots + w(E_n)*a_n), (w(E_1)*b_1 + w(E_2)* b_2 + \dots + w(E_n)*b_n), (w(E_1)*c_1 + w(E_2)*c_2 + \dots + w(E_n)*c_n)] \tag{8}$$

$R_k = (a_k, b_k, c_k)$, *for k = 1, 2,…, N, where N is number of indicators.*

11. *Defuzzification*: Determine the final score of each indicator. The center of gravity method (CGM) was applied to defuzzify the aggregate fuzzy opinion of the indicator (R_k) as follows:

$$Sk = \frac{ak + bk + ck}{3} \tag{9}$$

Where, S_k is a final defuzzified score which indicates the aggregate importance of each indicator (i).

12. *Select indicators*: The final sustainability indicators were selected by setting a threshold value (T). Accordingly, if $S_k \geq T$, the indicator is selected and if $S_k < T$, the indicator is not selected.

Setting the threshold value depends on the fuzzy linguistic scale and user preference (Padilla-Rivera et al., 2021; Zhang, 2017). *For example*, the users can take a small value of the threshold if they want more indicators, and vice versa (Zhang, 2017). In this study, a threshold value (T = 6.2) was taken for a 9-fuzzy linguistic scale to select the indicators.

3. Results and Discussion

After conducting the systematic review and pre-testing the questionnaire with the selected industry experts, scholars and researcher, 40 potential sustainability indicators were identified as shown Table 4.

Table 4. Indicators identified after literature analysis and pre-testing

Economic indicators	Environmental indicators	Social indicators
Profit	Water consumption	Employment/Job opportunity
Revenue	Recycled water use	Fair salary
Material cost	Energy consumption	Employee turnover

Economic indicators	Environmental indicators	Social indicators
Labor cost	Renewable energy use	Employee satisfaction
Energy cost	Energy efficiency	Occupational health and safety
Maintenance cost	Energy intensity	Training and development
Packaging cost	Material consumption	Working conditions
Inventory cost	Recycled material use	Work-related injuries
R&D expenditure	Packaging material consumption	Working hours
Product quality	Land use	Lost working days
Lead time	Greenhouse gas emissions	Customer health and safety
On-time delivery	Wastewater discharge	Customer satisfaction
	Solid waste disposal	Customer complaints
	Recyclable waste	Corruption

In the empirical analysis using the FDM, the final defuzzified scores were compared with the threshold value (T = 6.2). Accordingly, 25 indicators (i.e., 8 economic indicators, 4 environmental indicators, and 13 social indicators as shown in Figures 2, 3, and 4, respectively) were selected and prioritized for measuring and managing sustainability performance in Italian footwear SMEs. However, this does not mean that the unselected indicators are irrelevant but they have, compared to the selected indicators, a lower priority. As can be seen in Figure 2, product quality (8.091) was the top prioritized indicator in the economic sustainability dimension followed by on-time delivery (7.978), lead time (7.740), profit (7.325), revenue (6.856), research and development (R&D) expenditure (6.747), labor cost (6.488), and material cost (6.380). As shown in Figure 3, material consumption (6.944) followed by recycled material use (6.740), energy efficiency (6.688), and energy consumption (6.285) were found to be more suitable indicators in the environmental sustainability dimension. From Figure 4, it can be seen that customer satisfaction (8.221) was given the top priority followed by working conditions (7.885), customer complaints (7.813), occupational health and safety (7.713), work-related injuries (7.644), employee satisfaction (7.630), customer health and safety (7.607), fair salary (7.352), employment/job opportunity (7.088), training and development (7.020), working hours (6.833), lost working days (6.324), and employee turnover (6.323) in the social sustainability dimension.

To measure and manage the economic sustainability performance, indicators linked to financial benefits (profit and revenue), costs (labor cost and material cost) and market competitiveness (R&D expenditure, on-time delivery, lead time and product quality) were given high priority. On-time delivery, lead time and product quality are crucial to ensure market competitiveness and financial performance of SMEs in the short run. Moreover, SMEs need to allocate reasonable expenditure to conduct R&D activities for promoting innovation for producing sustainable products and improving market competitiveness in the long run.

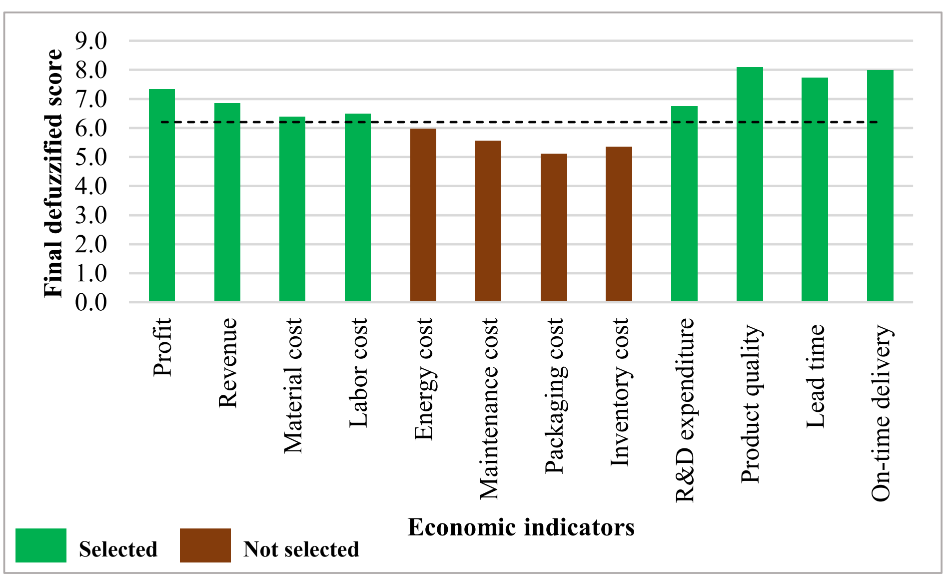

Figure 2. Final selected economic indicators

Meanwhile, material consumption, recycled material use and energy efficiency were selected for measuring and managing environmental sustainability performance. Different input materials are utilized by footwear industries to produce a range of products (Staikos and Rahimifard 2007). Among which, leather, synthetics, plastic, rubber, textiles are the most common input materials that are consumed by the footwear production process (Sellitto and Almeida, 2019). The footwear industry has placed a significant effort in improving material efficiency and eliminating the use of hazardous materials during the production (Staikos and Rahimifard 2007). The Italian footwear SMEs gave more attention to material consumption to measure their progress in terms of material efficiency improvement, hazardous materials reduction, and the use of eco-friendly and biodegradable materials. Subsequently, they can minimize waste generation by improving material efficiency. The safety of their products to the customers can be improved by reducing the use of hazardous materials. Moreover, reducing the use of hazardous materials, increasing the use of eco-friendly and biodegradable materials, and encouraging the use of recycled materials are crucial in minimizing growing concerns from environmental and social impacts of the end-of-life (EOL) products in the post-use phase. It is also essential for SMEs to measure their progress in energy saving and cost reduction using energy efficiency as one of the prioritized indicators.

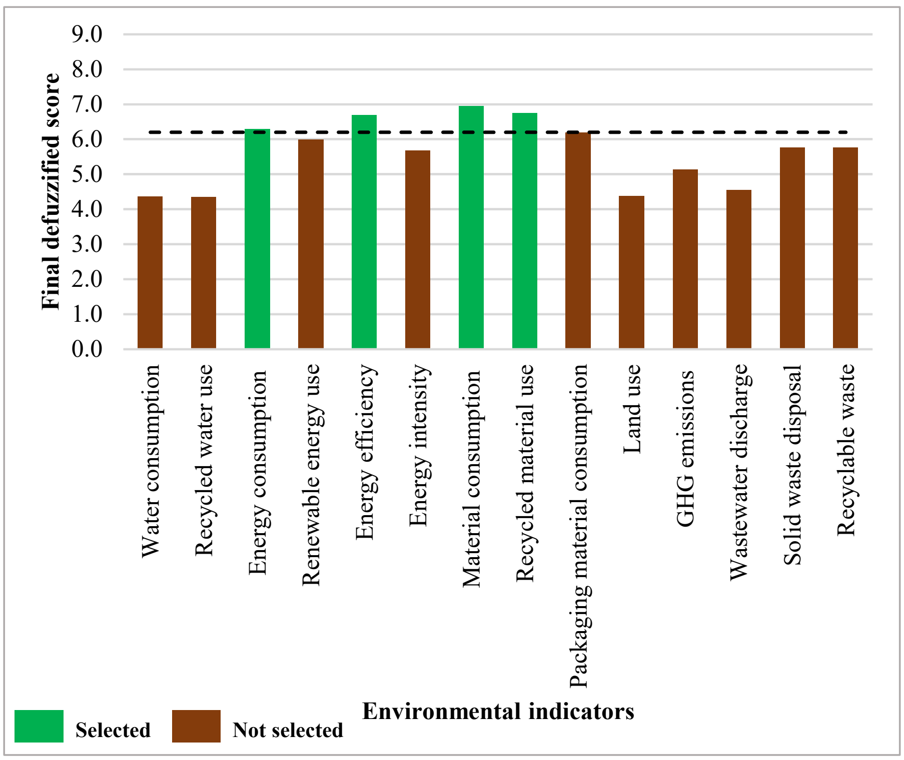

Figure 3. Final selected environmental indicators

Moreover, indicators that promote sustainability performance measurement related to employees, customers and the community were selected to measure and manage social sustainability performance. The footwear industry is one of the most low-technology and labor-intensive industries (Scott 2006). Since it is a labor-intensive industry, improving the well-being of the employees is essential in the Italian footwear SMEs. To measure the progress towards this goal, working conditions, occupational health and safety, work-related injuries, fair salary, training and development, and employee satisfaction were the top prioritized indicators. SMEs also need to measure the progress in improving the well-being of their customers. To achieve this goal, customer satisfaction, customer complaints, and customer health and safety were found as a more suitable indicators. High priority was also given to employment/job opportunity to measure progress towards community development. In addition, working hours and lost-working days were key indicators to measure performance associated with the working time management of employees.

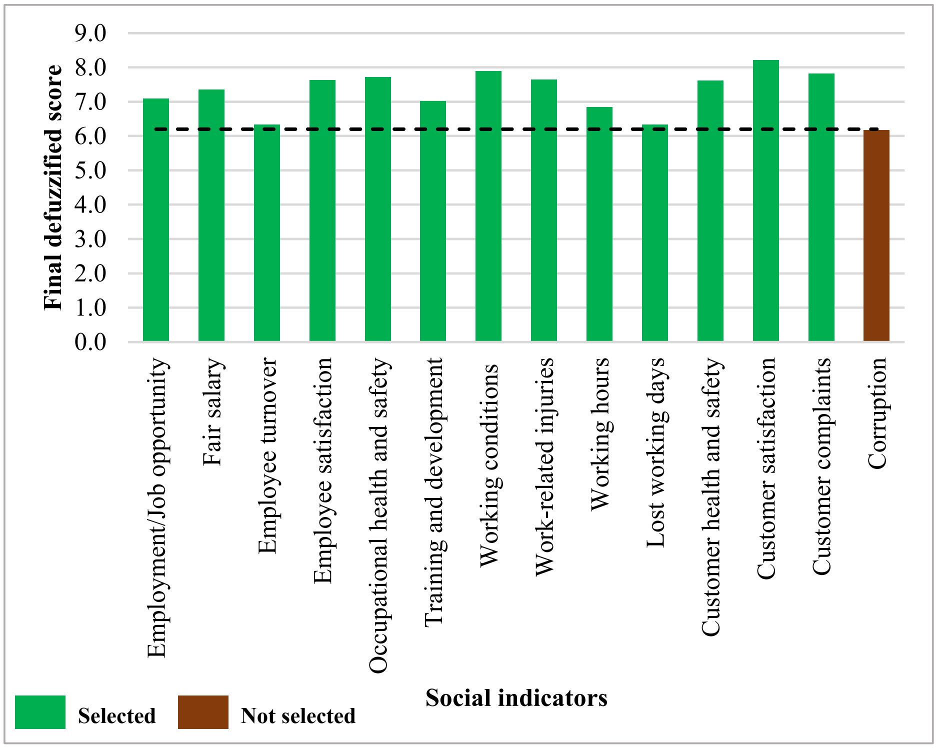

Figure 4. Final selected social indicators

4. Conclusions

This paper presents a set of suitable indicators for measuring and managing sustainable performance in Italian footwear SMEs. To achieve this, we applied a comprehensive methodological approach, which includes (1) conducting a detailed analysis of sustainability indicators available in the literature using a systematic review and (2) carrying out an empirical study to select and prioritize the indicators by applying the FDM.

The results of the present paper show that the 25 selected indicators emphasized measuring and managing industrial sustainability performance linked to financial benefits, costs, and market competitiveness for the economic sustainability dimension; resources for the environmental sustainability dimension; and employees, customers, and the community for the social sustainability dimension. Subsequently, SMEs are suggested to allocate their limited resources to effectively apply the selected indicators for measuring and managing progress towards industrial sustainability goals in terms of (1) increasing financial benefits, reducing costs, and improving market competitiveness for the economic sustainability dimension; (2) improving the effectiveness of resources utilization for the environmental sustainability dimension; and (3) promoting the well-being of employees, customers, and the community for the social sustainability dimension.

The present paper has considerable academic, practical, and policy implications. From an academic viewpoint, the research provides a solid theoretical foundation for future research on measuring and managing the sustainability performance of the footwear industry. It will also encourage further discussions on the sustainability performance of the footwear industry by providing avenues for future research. From a practical viewpoint, by providing a set of suitable indicators supported by empirical evidence, this paper can be used as a managerial tool to assess and improve the sustainability performance of the footwear industry so that it can fulfill the requirements of stakeholders regarding sustainable manufacturing practices. This paper also has policy implications. It addresses the economic, environmental, and social sustainability issues that can influence policies such as environmental policy, socio-economic, and social responsibility.

By providing useful and applicable indicators supported by empirical evidence in the context of SMEs, the present paper contributes to the existing knowledge in the field of industrial sustainability performance measurement.

However, it is subjected to the following limitations, which open opportunities for future research. The scope of this paper was limited at the firm level. However, it would be helpful to determine additional indicators that could be used to measure sustainability performance at the supply chain level for a more holistic view of sustainable manufacturing. Hence, it would be interesting for future research to expand the scope to the entire supply chain, which includes supply, production, distribution, use, and post-use stages. The paper focused on the indicators that have been used by scientific papers (i.e., academic papers). Therefore, as an additional avenue, future research could consider analyzing indicators used by the sustainability documents of organizations engaged in the sustainability performance measurement. Furthermore, it would be interesting for future research to consider governance indicators in addition to economic, environmental, and social indicators. In addition to Italian footwear firms, it would also be interesting for future research to carry out a comparative analysis considering the footwear firms of different countries (e.g., European countries) to assess the similarities and differences in the idicators from the perspective of geographical or national diversity.

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