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Explaining sustainability performance and maturity in SMEs – Learnings from a 100-participant sustainability innovation project

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ABSTRACT

Small and medium enterprises (SMEs) are the backbone of many economies and shape the sustainability of both production and consumption. SMEs differ drastically in their sustainability performance and maturity. The objective of this paper is to assess what aspects of SMEs' activities, including their links to stakeholders in their supply chains, explain a company's sustainability performance. Using a literature-based theoretical framework for assessing SME sustainability performance and maturity, the study conducts a survey with participants in a 100-company sustainability innovation project conducted in the Greater Copenhagen region. The sample of companies reaches across several industries including construction, hotel/conference, information technology, and manufacturing. The study analyses survey data using paired sample *t*-tests and regression analyses. The results show that the following factors help explain the sustainability performance and maturity of SMEs in the sample: the degree of customer involvement in product and process development; engaging, communicating and partnering with customers; customer segmentation, technology and innovation as constituent parts in the business strategy; and the amount of time dedicated specifically to commercial and marketing efforts and process development. The study shows that devoting time and resources to engage with customers in product and process development will lead to increased sustainability performance and maturity. These results contrast with the traditional norm that companies develop as a reaction to changing customer requirements. The novelty of this study lies in bringing to light the aspects within the management of SMEs contribute to explaining their sustainability performance, and thus can be used to guide improvements. Unveiling this allows SMEs to deploy sustainability-focused action.

1. Introduction

Businesses have become increasingly aware that the current pace of intensive production of goods and services is unsustainable (Pezzini, 2012). Businesses recognize the need to enhance competitiveness while improving socio-economic (Porter and Kramer, 2011) and environmental conditions (Salvador et al., 2021a) by shifting focus from a short-term economic return to a broader view of shared value. In the last few years, corporate social sustainability (CSR) (Vásquez et al., 2021), or more recently Environmental Social and Governance (ESG) (Machado

and Carvalho, 2021), has promoted the reduction of impacts produced by internal activities through more efficient use of resources and embedding environmental and social aspects in the organizational strategy (Husted and de Sousa-Filho, 2019; Nirino et al., 2021). Nonetheless, simply “reducing harm” no longer makes for sustainable conduct (Barros et al., 2021), as even zero harm might not be enough to safeguard the functioning and quality of ecosystems for future generations (Vandenbrande, 2021). For that reason, the commitment to more sustainable development in all sectors has increased (Heikkurinen et al., 2019).

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Performance measurement has evolved from measurement to management (Bititci et al., 2015). Both entrepreneurs and scholars must design maturity models and frameworks (Vásquez et al., 2021). Performance and maturity evaluation helps companies identify and track improvement over time (Seidel-Sterzik et al., 2018). Such maturity models show stakeholders which changes, at different levels and places in the supply chain cause positive impacts (Seidel-Sterzik et al., 2018).

Small and medium enterprises (SMEs) have 10–249 persons employed, an annual turnover of no more than EUR 50 million, and/or a total annual balance sheet of a maximum of EUR 43 million (Eurostat, 2022). Globally, SMEs represent 90% of businesses and a sizeable portion of gross domestic product (GDP) and employment (Fatima et al., 2021). In Europe, approximately 25 million SMEs represent 50% of the GDP (Fatima et al., 2021), and 2 out of 3 jobs (European Commission, 2020). SMEs are thereby important, but many lack sustainability practices (Chu and Cheung, 2017). Unfortunately, many research areas, such as ecoefficiency (Prashar, 2021), manufacturing (Golinska and Kuebler, 2014), and sustainability and sustainable development in general (Vandenbrande, 2021), often overlook SMEs. Few studies have investigated what aspects of the activities of SMEs influence and can contribute to their sustainability performance and maturity (Vásquez et al., 2021).

The objective of this paper is to assess what aspects of SMEs' activities, including their links to stakeholders in their supply chains, explain a company's sustainability performance. We propose a framework to assess SMEs' sustainability performance and maturity. The framework development included a systematic literature review and consultation with industry experts. We use the framework to collect data from SMEs in the Greater Copenhagen area in Denmark. The respondent companies participated in the Sustainable Bottomline 2.0 project (Gate 21, 2022). The data concerned the companies' sustainability performance (herein after referred to as variables) and the companies' activities and structure (herein after referred to as aspects), both before and after the project. We conducted paired t-tests and regression analyses to identify what changed and how much each of the identified aspects (independent variables) explains the sustainability performance (dependent variables). The novelty of this study lies in bringing to light the aspects within the management of SMEs contribute to explaining their sustainability performance, and thus can be used to guide improvements.

The paper structure includes seven sections. Section 1, introduction, provides the initial considerations on the theme and the main goal of the study. Section 2, methods, depicts the methods used to propose the framework and to carry out the statistical analyses. Section 3 introduces the sustainability variables and company aspects used in our framework. Section 4 presents the main results of our research, thus the analyses of means, and the regression analysis, comparing scores from BEFORE and AFTER the project and revealing the relationships between the different aspects of SMEs and their sustainability performance. Section 5 discusses where to focus sustainability efforts based on the results. Section 6 briefly discusses how our results compare to the existing literature. Finally, Section 7 draws out the main conclusions and limitations of our research, and opportunities for future research.

2. Methods

This study used a mixed-method approach. (i) A systematic literature review identified aspects to measure sustainability performance and maturity in SMEs. (ii) A survey collected information on the perceived sustainability performance and maturity. (iii) The hypotheses focus on how the measured aspects influence sustainability performance and maturity in SMEs. (iv) The population of the study concerns the companies participating in the Sustainability Bottomline 2.0 Project, and these companies received invitations to answer the survey. (v) Paired t-tests and regression analyses of the data identified which aspects from (i)

help explain sustainability performance and maturity. To fulfill the objective of this paper, the project BB2.0 was seen as an opportunity to track the change in the companies' activities and their sustainability performance, thus analysing what internal changes help explain sustainability performance.

2.1. Systematic literature review

This systematic literature review identifies aspects to measure sustainability in SMEs. Fig. 1 illustrates the steps of the review.

Step 1. Searches in databases. The searches included the ScienceDirect, Scopus, and Web of Science databases on January 21, 2022, using the following query: "maturity" AND ("model" OR "framework") AND "SME*" AND "sustainab*". The search included all document types, such as journal articles (both original research and review, and both published and in press), conference papers, books, and book chapters. The searches resulted in 2 documents from Science Direct, 38 from Scopus, and 48 from Web of Science.

Step 2. Deleting duplicates. Out of 88 documents, 71 survived the exclusion of duplicates.

Step 3. Screening titles and keywords. The question "by analyzing its title and keywords, does this document help identify the aspects of SMEs (regarding their structure and activities)?" reduced the number of documents to 24.

Step 4. Screening abstracts. Step 3 used the question from step 2, focusing on abstracts, reducing the number of documents to 17.

Step 5. Reading full texts. Step five included reading the full texts and filling out a reading form, thus collecting information on potential dimensions and criteria for measuring sustainability performance and maturity in SMEs, while simultaneously assessing their contribution to reaching the aim of this study. One document was ruled out by not contributing in this way. Thus 16 documents remained.

Step 6. Content analysis. This step analyzed the full texts of the 16 documents, emphasizing how SMEs organize.

A series of iterative sub-steps refined the aspects as follows.

a) Listing aspects. This sub-step aimed to identify the relevant aspects concerning how SMEs organize by analyzing the existing literature.

We searched and analyzed the literature for any actions, practices, activities, or elements of any other nature of relevance for describing a company and its activities.

This mapping included ambiguous and/or double-counted terms.

b) Checking for overlap and ambiguity.

We analyzed the aspects in this initial list in pairs (among one another). We merged overly similar ones to avoid overlapping/double counting by comparing aspects in pairs to check whether they should be merged or deleted. At the end of this process, six aspects remained: 1. Knowledge and competencies, 2. Communication, 3. Partnerships, 4. Strategic setting, 5. Technology & innovation, 6. Process, and operations management.

c) Refining aspects and dimensions.

Section 2.2 presents further details.

Investigating the existing literature identified the aspects. The authors have contributed their knowledge and criticism to frame and detail each. The process of merging and refining them and the description of each aspect is a synthesis rather than mere reporting and summarizing existing studies. Thus, the interpretation of different sources into framing the aspects that influence sustainability performance in SMEs is

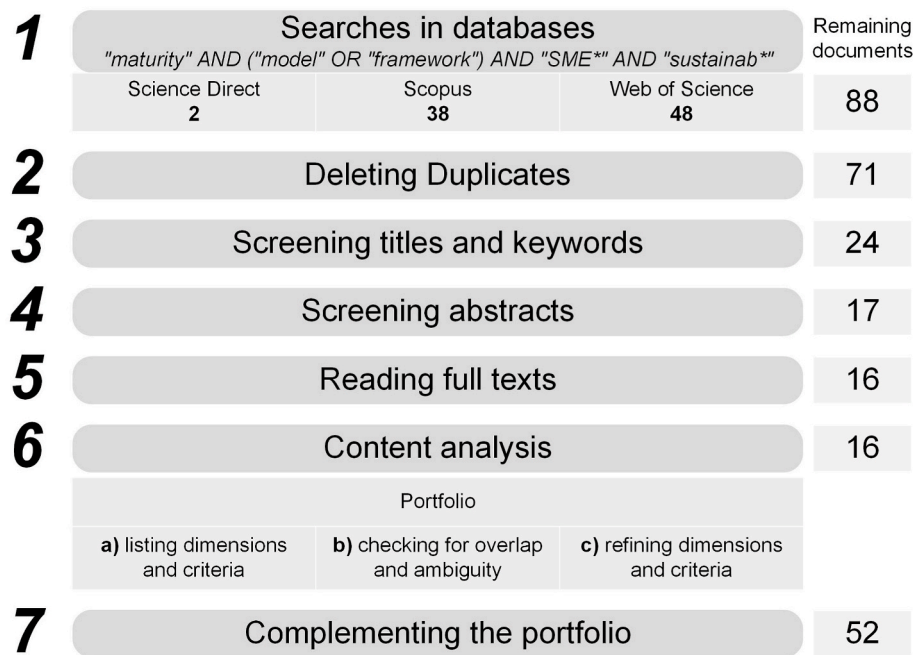


Fig. 1. Overview of research methods.

part of the contributions of this study.

Step 7. Complementing the portfolio. We complemented the portfolio of 16 articles by adding relevant sources (for literature support), firstly from a cross-reference snowballing approach and secondly from further non-systematic searches. The snowballing cross-referencing approach checked the references of the 16 articles and retrieved and analyzed the relevant studies. The approach also checked any references of those new sources deemed relevant. The non-systematic searches used the ScienceDirect, Scopus, and Web of Science databases to complement the aspects' definition and relevance. The reference query was often "sustainab*" AND "matur*" AND "SME*" AND "term", where we replaced "term" with keyword variations of the aspect under investigation. These new searches took place during the second half of February 2022. These activities included a total of 52 sources.

2.2. Building a survey to assess the sustainability performance and maturity of SMEs

Building the survey included the following steps.

2.2.1. Defining a scale

We used a 5-point Likert scale for the sustainability performance (dependent variables) and the aspects (independent variables) (see section 3.1). We used the 5-point Likert scale because it allows for a selection of an intermediate performance (i.e., it does not force the respondent to provide a skewed result). A 5-point Likert scale was effective in other research measuring sustainability in SMEs (e.g., Brendzel-Skowera, 2021; Cristoni and Tonelli, 2018; Golinska and Kuebler, 2014; Irimiás, and Mitev, 2020; Prashar, 2019; Seidel-Sterzik et al., 2018). Table 1 presents the scale (as presented in the survey – see Appendix A).

Table 1
Scale used in the survey.

Scale for performance in sustainability dimensions	1 (bad result)	2	3	4	5 (good result)
Scale to inform to what extent the aspect describes the company	1 (not at all)	2	3	4	5 (very much)

The scale and linguistic variables (at the end of the scales) for the performance in the sustainability dimensions were defined as such to avoid hedging and help control undesired variability of results, as these might be the consequence of human perception. For instance, one company might perceive a 5% reduction in energy consumption as "good", another company might perceive it as "very good". Thus, by not using the hedged ends the researchers aimed for a less unintendedly skewed distribution.

2.2.2. Drafting, revising, and troubleshooting the data collection instrument (survey)

Several rounds of drafting, receiving feedback and revising finalized the survey. We provide greater detail on the steps followed hereafter.

- 1st draft.** The authors first worked separately to do research and design the sub-aspects of each of the six aspects, then gathered, discussed, merged their findings, and made the first draft of the survey.
- 2nd draft.** After the first draft, three meetings on different days (in March 2022; each meeting took approximately 1 h) elaborated on our contributions and discussed the most representative sub-aspects to use. We also brainstormed how companies would perceive the questions in the survey and how they could interpret them. At the end of these three rounds of meetings, we drafted version 2 of the survey.
- 3rd draft.** The authors met with the project manager (beginning of April 2022; the meeting lasted approximately 1 h) and discussed the questions in the survey, considering how the questions would be perceived and understood by the respondents and how to adapt the questions to maintain research soundness while keeping the language understandable by all potential respondents. After the meeting, the researchers adapted the questions in the survey, considering the meeting outcomes. At the end of this round, we drafted version 3 of the survey.
- 4th draft.** The project manager received version 3 of the survey for feedback and further insights on making the survey understandable and easy to answer for all potential respondents. This process happened twice in this round of revisions. The project manager received version 3 of the survey (April 8) and provided feedback

(April 13), and the researchers made changes to the survey (April 19; 3 h-meeting). Following these revisions, the project manager received the survey (April 19) and provided new feedback and insights (April 28). After that, the researchers drafted version 4 of the survey.

- e. **5th draft.** The researchers met with the project manager and project facilitators (May 2022; the meeting lasted approximately 4 h). Each project facilitator managed the contact with the companies from a specific municipality during the project and had extensive knowledge of those companies. The meeting concerned various topics of the project, including discussing version 4 of the survey. They provided feedback on content and format, how easy or difficult it was for the companies to follow the survey and the perceived relevance of the topics under investigation. After this round, we built version 5 of the survey. The main contribution of this round was the perceived need to break down the environmental dimension into the areas on which the companies had based their projects. Therefore, the dimension “environmental performance” was broken down into (i) *Environment - logistics and fleet*; (ii) *Environment - Material consumption and disposal*; (iii) *Environment - Visibility of green initiatives*; (iv) *Environment - Biodiversity*; (v) *Environment - Other*. The other two dimensions were named *Financial results* and *Social aspects*. After this meeting, the researchers met again (end of May 2022; the meeting lasted approximately 2 h) and drafted version 5 of the survey.
- f. **Final version.** We gathered the contact information of 8 companies that had completed their participation in the project and contacted them to fill out the survey in a test environment. We also made ourselves available by phone and E-mail to help them clear up any doubts and go through the survey with them if needed. After that, the survey was finalized and sent to all potential respondents (see section 2.4).

In the construction of the data collection instrument, the academic view was translated into everyday language that individuals who are not used to academic language and are part of the industrial/commercial environment would understand easily.

Appendix A presents the survey from the respondents' view. The following is an overview of how the questions in the survey relate to the aspects assessed in this research.

- Questions 1–5: identifying information
- Questions 6–12 – BEFORE the BB2.0 project
 - o Question 6: sustainability performance
 - o Question 7: knowledge and competencies
 - o Question 8: communication
 - o Question 9: partnerships
 - o Question 10: strategic setting
 - o Question 11: technology and innovation
 - o Question 12: process and operations management
- Questions 13–19 – AFTER the BB2.0 project
 - o Question 13: sustainability performance
 - o Question 14: knowledge and competencies
 - o Question 15: communication
 - o Question 16: partnerships
 - o Question 17: strategic setting
 - o Question 18: technology and innovation
 - o Question 19: process and operations management

2.3. Hypothesis formulation

We proposed a series of hypotheses about how the measured aspects influenced sustainability performance and maturity in SMEs.

From a knowledge and competencies perspective. Companies acknowledge the need to manage resources within planetary boundaries, but the monetary return on investments in more sustainable practices is still blurry (Cristoni and Tonelli, 2018). A challenge concerns unveiling the

path where increased sustainability leads to increased profitability (Vandenbrande, 2021). Such results and vision might only result from reaching a certain level of maturity regarding sustainability aspects, where the different dimensions (environmental, economic, and social) converge to a balance (Prado et al., 2020). Therefore, SMEs must acquire knowledge and competencies to achieve greater sustainability maturity.

From a communication perspective. The needs and issues to resolve to achieve sustainability goals raise questions and requirements to which stakeholders at the various levels of an organization need to respond (Vásquez et al., 2021). Such response requires engagement from top management to shop floor employees and often from partners outside the organization (Hsu et al., 2017). The company needs to communicate objectives (Bititci et al., 2015) and sustainability efforts (Prashar, 2019). SMEs often communicate more simply in smaller, more flexible communication chains (Richert, 2017).

From a partnership perspective. Aspects such as the relationships and behavior towards employees (concerning, e.g., labor practices, training, employee support) (Machado and Carvalho, 2021), customers (concerning, e.g., communication with and support to customer segments), and society at large (identifying groups that the organization's activities might impact) (Chu and Cheung, 2017) influence the sustainability performance of a company. Therefore, the level of interaction with different partners (both understanding their needs and receiving support) can shape a company's sustainability performance.

From a strategy perspective. Regardless of company size, sustainability needs to be rooted in the business strategy (Vandenbrande, 2021) to seep through the various hierarchical levels within an organization (Swarr et al., 2015). A sustainability-driven strategy provides better cost-effectiveness, drives innovation (Golinska and Kuebler, 2014), and helps companies understand how to move forward (Hamidi et al., 2018). It helps them add resources and capabilities to develop distinctive competencies that enable them to adapt to changing environments (Alexander and Martin, 2013; Cristoni and Tonelli, 2018).

From a technology and innovation perspective. SMEs suffer from a few weaknesses when it comes to administration, including lack of strategic planning, limited capital, and low level of technology (Shi et al., 2019), for which they tend to struggle more than their bigger competitors. SMEs often find it more challenging to adapt to changes and the latest trends because they must devote proportionally greater efforts in organizational and financial terms (Brendzel-Skowera, 2021). They need investments in technology and innovation (Casalino et al., 2014) to maintain or increase competitiveness (Machado and Carvalho, 2021) and achieve growth (Vandenbrande, 2021).

From a processes and operations management perspective. Companies need to meet market requirements (Dutta et al., 2020). Customers demand sustainability, and competitors force companies to improve. Economy-related actions can help companies (especially SMEs) stay ahead of future market demands and competitors (Font et al., 2016). Nonetheless, realizing their strategy requires time and effort devoted to management and operational activities (Prashar, 2021). Management systems help organize management and operations besides providing support to processes (Vásquez et al., 2021) to facilitate compliance with environmental standards and regulations (Johnstone, 2020) and provide a solid basis for informed decision-making (Bititci et al., 2015).

Taking into consideration the above, we hypothesize the following.

Hypothesis 1. high level of knowledge and competencies has a positive influence on the sustainability performance (economic, environmental and social) of an SME.

Hypothesis 2. communication with different stakeholders has a positive influence on the sustainability performance (economic, environmental, and social) of an SME.

Hypothesis 3. establishing partnerships has a positive influence on the sustainability performance (economic, environmental and social) of an SME.

Table 2
Details of invitations to fill out the survey.

Date	Nature and message of contact
01-06-2022	Initial invitation to fill out survey until June 16
09-06-2022	First reminder to fill out the survey by June 16
17-06-2022	First extension of the deadline and reminder to fill out the survey. Deadline extended until June 23
24-06-2022	Second extension of deadline and reminder to fill out the survey. Deadline extended until June 30

Hypothesis 4. business strategy (i.e., low cost,¹ differentiation,² or focus³) has a positive influence on the sustainability performance (economic, environmental, and social) of an SME.

Hypothesis 5. investing in technology and innovation has a positive influence on the sustainability performance (economic, environmental, and social) of an SME.

Hypothesis 6. dedication to processes and operations management has a positive influence on the sustainability performance (economic, environmental and social) of an SME.

Our analysis tests these hypotheses in section 4.

In this research, accepting a hypothesis requires fulfillment of two criteria: (i) one or more sub-aspects needed to be statistically significant to explain the sustainability performance of the sample, and (ii) the aspect is significant (or set of aspects) needed to help explain the performance across the three sustainability dimensions, not for only one or two.

Furthermore, the difference in sustainability performance, comparing the BEFORE and AFTER data, results from the actions taken by the companies. The sustainability projects referred to in this manuscript (under the Sustainable Bottomline 2.0 project) are responsible for part of this change. However, other actions taken by the companies unrelated to these projects might have (and probably did) influenced the changes in their sustainability performance too. Nonetheless, we cannot predict how much of the changes were driven by what actions. Therefore, the projects referred to in this manuscript play a part in driving changes in sustainability performance but are not solely responsible.

2.4. Data collection

The eligible population of this study concerns eligible companies participating from beginning to end of the Sustainable Bottomline Project 2.0 (BB2.0) (Gate 21, 2022). Eligibility concerns (i) having participated in and completed the BB2.0 project; (ii) providing up-to-date contact information allowing the researchers to contact the company. Eligible companies received an e-mail invitation on June 1. The details of the invitations and reminders can be seen in Table 2. Respondents accessed the survey (see Appendix A) in Microsoft forms.

28 out of the 74 eligible and invited companies filled out the survey resulting in a response rate of 37.83%. A sample size of 25 is enough to identify plausible data patterns in regressions (Jenkins and Quintana-Ascencio, 2020). The companies invited to participate in this research filled out the survey providing self-declarations of their performance. This self-declaration is addressed hereon after in this manuscript as self-assessment. The profile of respondents was the following: Top-level Manager (68% of respondents), Owner/CEO (18%), Head of

Department (14%).

2.5. Statistical treatment of data

Paired t-tests and regression analyses of the data identified which aspects help explain SMEs' sustainability performance and maturity.

The survey included two parts. Part one represents the state of their company before the start of the project (this is the BEFORE data). The second part concerns data from after project completion (this is the AFTER data). The BEFORE data focused on the state of their company in 2019, thus before the start of the Covid-19 pandemic. Nonetheless, both sets of data (BEFORE and AFTER) were collected after the project had ended.

The paired t-tests identified changes in sustainability performance and how the companies work (i.e., what they are like according to the aspects in our framework). Thus, a statistically significant change in the means (comparing before and after) would indicate a change in the company.

The regression analyses helped explain the changes seen in the means. Thus, for instance, if companies report improvement in financial performance, one could identify what aspects help explain this improvement.

2.5.1. Paired T-Test

Paired t-tests compared the means of the scores assigned by the companies to their sustainability performance and the scores assigned to the aspects. Forty paired t-tests compared the before and after means of each of the seven sustainability variables (economic, social, and the six components of the environmental dimension) and the 33 sub-aspects (see section 3.2).

We selected a 2-tail t-test for paired sample for means with a 95% confidence level and ran it using Excel (from Microsoft 365 Apps for enterprise, Excel version 2207). The Supplementary Material includes the detailed results of these tests.

2.5.2. Regression analysis

Regression analyses were carried out for each of the aspects to determine whether they can help explain a company's performance on the sustainability dimensions. For instance, one analysis checked whether strategy (Low costs, Differentiation, Focus, and Other) helps explain the financial results. Then we ran the same analysis for social and each of the environmental (logistics and fleet, material consumption and disposal, visibility of green initiatives, Biodiversity, and other) variables. We did the same for all aspects and sub-aspects for both the BEFORE and AFTER data. The results of the regression analysis point to which aspects help explain the sustainability performance in the different dimensions. Nonetheless, each aspect helps explain only part of those results and not in their entirety. Therefore, in the results and discussion sections (4 and 5) we often refer to the aspects as partially explanatory of the sustainability results.

Before the regression analyses, we conducted correlation analyses between every two sub-aspects within an aspect to check for collinearity. The Supplementary Material shows the detailed results. We consider sub-aspects correlated 0.8 or more as collinear and isolate such sub-aspects from one another in the regression analyses. For instance, for the AFTER data, for the aspect *Technology & Innovation*, the sub aspects *Technology and innovation to improve financial performance*, *Technology and innovation to improve environmental performance*, and *Technology and innovation to improve social performance* were all correlated to one another, and only the aspect, Other, was not correlated to them. Therefore, we ran separate regression analyses for each of the sustainability variables, as exemplified below.

- Analysis 1: Independent variables: *Technology and innovation to improve financial performance & Other*; Dependent variable: Financial Performance;

¹ Strategy in which the organization competes by offering the product with the lowest cost.

² Strategy in which the organization competes by offering a unique product, thus differentiating itself from competitors.

³ Strategy in which the organization offers products that are targeted to specific market segments.

- Analysis 2: Independent variables: *Technology and innovation to improve environmental performance & Other*; Dependent variable: Financial Performance;
- Analysis 3: Independent variables: *Technology and innovation to improve social performance & Other*; Dependent variable: Financial Performance;

We did the same concerning the remaining sustainability variables. Moreover, we did the same analysis with each of the other aspects with all sustainability variables, using the BEFORE and AFTER data.

We selected the sub-aspects with a $p\text{-value} \leq 0.05$ for a second iteration, ran a new regression analysis, and rechecked the p -values. When conducting these analyses, using Excel and a 95% confidence level, the first iteration provided the p -value for the sub-aspect predicting the sustainability result. If all sub-aspects had a $p\text{-value} \leq 0.05$, we annotated the p -values. Otherwise, only the sub-aspects with a $p\text{-value} \leq 0.05$ went through a third iteration. No analysis needed to go beyond the third iteration to have only sub-aspects whose statistical significance helped explain the results of the sustainability variable.

Moreover, we plotted the residuals during these analyses to check for heteroskedasticity. The Supplementary Material shows the detailed results of these analyses.

3. Framework for measuring sustainability performance in SMEs

3.1. Dimensions of sustainability performance in SMEs

The assessment included the three dimensions of sustainability (i.e., economic, environmental, and social). Nonetheless, as reported in section 2.2.2, the framework refinement revealed the need to break down the environmental dimension into different topics. That was necessary given the different areas towards which the companies participating in the BB2.0 project directed efforts. Table 3 presents the final arrangement of the dimensions considered for building the framework.

3.2. Aspects of sustainability performance in SMEs

3.2.1. Knowledge and competencies

This aspect entails knowledge of aspects permeating the different dimensions of sustainability. Distinct levels of knowledge will yield different impacts from corporate sustainability measures. It also refers to the capabilities to identify, acquire, and manage knowledge, including capturing, managing, and utilizing valuable data (Els et al., 2020). Lack of knowledge is a critical barrier for SMEs on the road to improving their corporate sustainability practices (Murillo-Luna et al., 2011). The presence and level of knowledge have strong links to the organization's absorptive capacity (Heeley, 1997). Thus, the company needs to build capacity before internalizing knowledge (Salvador et al., 2021a), which entails building awareness and giving the necessary personnel the resources needed to retain acquired knowledge. Providing training and sharing through socialization (Vásquez et al., 2021; Foshammer et al., 2022; Søberg, 2011) can do this. In that sense, competency gaps are troublesome because shifting to more sustainable practices requires overcoming knowledge barriers (Brendzel-Skowera, 2021) by raising

awareness and enabling adequate training and communication, as it usually requires highly qualified staff and knowledge of solutions to sustainability-related concerns (Brendzel-Skowera, 2021). Brendzel-Skowera (2021) claims that a lack of knowledge and qualified staff is one of the main barriers for businesses to implementing more sustainable practices.

For this study, knowledge, and competencies have been summarized into eight sub-aspects, and companies can consider to what extent these approaches characterize their knowledge and competencies.

- Work processes are documented;
- The work requires a lot of experience;
- The work requires a lot of knowledge;
- Involving employees in product/service development and process improvements;
- Involving suppliers in product/service development and process improvements;
- Involving customers in product/service development and process improvements;
- Involving other partners in product/service development and process improvements;
- Other.

3.2.2. Communication

Communication embeds the transfer of data, information, or knowledge between different parties. It can be internal, i.e., among stakeholders within the organization, or external, i.e., between the organization and a range of stakeholders outside the organization. Both internal and external communication plays a significant role in a company's corporate sustainability. Communication also needs to be a two-way channel (McQuail and Windahl, 2015), where the sender sends information and allows the receiver to provide feedback (Seidel-Sterzik et al., 2018). Another important aspect of communication is sharing knowledge. When knowledge is acquired and retained, it needs to be communicated throughout the organization through different channels to permeate the diverse levels in the organizational structure. Communication concerns the engagement of different stakeholders in sustainability practices, thus also being a vital aspect of an organization's maturity (Reyes-Rodríguez and Ulhøi, 2022). For this study, we summarize communication into six sub-aspects, and companies can consider to what extent these approaches define the type of communication they practice or allow.

- Supplier;
- Customers;
- Competitors;
- Neighbor;
- The local authority;
- Other.

3.2.3. Partnerships

Partnerships include links and collaborations with upstream and downstream partners in the value chain. These partnerships enable SMEs to increase their reach by, for instance, providing highly specialized services and products to larger companies who tend to focus on more general demands (Els et al., 2020). Partners can also be research and education-based organizations (Collier et al., 2016), and transdisciplinary partnerships are needed for a more sustainable conduct (Plummer et al., 2022). Partnerships often allow both (or all) partners to mutually reach their own goals (Els et al., 2020). This study summarizes partnerships into six sub-aspects, and companies can consider to what extent these approaches define the type of partnership they practice.

- Supplier;
- Customers;
- University/research institutions;

Table 3
Dimensions of sustainability performance.

Dimension	How dimension/subdimension was communicated to the SMEs in the survey
Economic	Financial results
Environmental	Environment - logistics and fleet
	Environment - Material consumption and disposal
	Environment - Visibility of green initiatives
	Environment - Biodiversity
	Environment - Other
Social	Social aspects (e.g., quality of working environment)

- Public organizations;
- Non-governmental/non-profit organization (NGO);
- Other.

3.2.4. Strategic setting

Plenty of evidence in the literature suggests that corporate sustainability, or ESG, needs a strategy to be realized (e.g., Saunila et al., 2019), especially for SMEs (Falle et al., 2016) with companies either being aware or not that they are setting a strategy (Ortiz-Martínez and Marín-Hernández, 2022). The strategy establishes targets and goals to move the organization in a particular direction (Els et al., 2020). The strategy includes the mission, vision, values, and goals of an organization (Vandenbrande, 2021), how management uses organizational resources to realize the mission, vision, etc., and how it responds to the stimuli and changes within the environment in which the company is (Irimiás and Mitev, 2020). This study summarizes the strategic setting into four sub-aspects, and companies can consider how these approaches characterize their strategic setting.

- Low costs (competitive prices);
- Differentiation (focus on unique products/services);
- Focus (segmentation, focusing on niche markets);
- Other.

3.2.5. Technology & innovation

This aspect refers to using technology such as physical devices and structures or knowledge and action, mainly regarding innovation, to help achieve sustainability goals. One of the most often addressed subjects currently involves the use and exploration of Industry 4.0, in the form of digitization and digital technologies (Irimiás and Mitev, 2020) or smart systems (Hamidi et al., 2018). Up-to-date technological advancements (Irimiás and Mitev, 2020), as well as innovation and creativity (Souto, 2021), can have a major impact on several aspects of sustainability. Those can, for instance, enable the establishment of more resource-efficient processes (Seidel-Sterzik et al., 2018), allow more intelligent and effective monitoring systems (Fatima et al., 2021), which provide insights on behavior and help identify various forms of waste (Seele and Lock, 2017), and allow better communication (Swarr et al., 2015).

This study summarizes the efforts/resources devoted to technology and innovation into three sub-aspects, and companies can consider to what extent these approaches characterize the time and effort dedicated to technology and innovation.

- Technology and innovation to improve financial performance;
- Technology and innovation to improve environmental performance;
- Technology and innovation to improve social performance;
- Other.

3.2.6. Process and operations management

Process and operations management refers to the means used by the company to transform inputs into outputs, i.e., the processes which a resource or set of resources go through and the specific singular operation or set of operations that take place in the different processes. These activities help fulfill the company's objectives (Els et al., 2020) by realizing the overall strategy. Companies can, for instance, integrate specific (e.g., environmental) objectives into the quality and operational objectives (Sundström et al., 2019; Vandenbrande, 2021) when planning process improvement. Often, quality management-related actions such as using Total Quality Management (TQM) or Six Sigma programs (Vandenbrande, 2021) include goals that encompass environmental concerns.

This study summarizes the efforts/resources devoted to process and operations management into five sub-aspects, and companies can consider to what extent these approaches characterize the time and effort dedicated by them related to process and operations management.

- Commercial and marketing activities;
- Management activities;
- Operational activities;
- Development activities;
- Other.

4. Results

4.1. Analysis of means

Table 4 summarizes the results of the paired *t*-test to check for the change in means of the sustainability performance scores and the representativeness of sub-aspects with the sample. Table 4 highlights with green color the variables and aspects that change in the score considering a 95% confidence interval. The *t* critical two-tail is 2.0518. Thus, if $t_{\text{Stat}} > t_{\text{critical two-tail}}$, then the AFTER mean is significantly lower than the BEFORE mean, and if $t_{\text{Stat}} < (-)t_{\text{critical two-tail}}$, then the AFTER mean is significantly higher than the BEFORE mean.

Table 4 shows that neither economic nor social performance shows a statistically significant change. It should be noted that the assessment shows whether there has been a significant change in the scores across all companies. This change could take place either by big changes in a few companies or smaller changes in a big number of the analyzed companies.

On the environmental dimension, the scores for *material consumption and disposal*, *visibility of green initiatives*, and *Biodiversity* have improved, while *logistics and fleet*, and *other* environmental aspects have remained the same.

Regarding knowledge and competencies, the results suggest increases in documentation of *work processes* (thus, greater formalization) and more *involvement of employees, suppliers, and customers in product/service development and process improvements*.

Regarding communication, the results suggest increased communication with the *local authority*, *universities/research institutions*, and *public organizations*, but not with *suppliers, customers, NGOs*, or *other* partners.

The results do not suggest changes in the strategic setting have taken place.

The results suggest that Investments and efforts towards the implementation of technology and innovation improved *financial and social performance*, but especially *improving environmental performance*.

Concerning managing processes and operations, the results suggest increases for *commercial and marketing activities* and *development activities*, whereas *management*, *operational*, and *other* activities remained virtually unchanged.

Overall, one can see that if there was a change in the sustainability performance and in the representativeness of a sub-aspect in how a company is structured, then the change has made the sustainability-related effect more accentuated after the project, since no lower scores (with statistical significance) have been noted. In a nutshell, if there were changes, they were for the better.

4.2. Regression analysis

The regression analyses show how much a sub-aspect helps explain the results of a sustainability variable. Tables 5 and 6 summarize the results of the regression analyses for BEFORE and AFTER data, respectively, and show the *p*-values for the statistically significant sub-aspects in the regression analysis. The Supplementary Material further elaborates the details of the regression analyses. The analysis ID helps identify the tabs in the Supplementary Material.

Table 7 also shows the regression coefficients for the sub-aspects whose analysis yielded statistical significance. Tables 5 and 6 show the results for the same sub-aspects. In paragraphs 4.2.1–4.2.3 changes in the three areas of sustainability performance (economic, environmental and social) are summarized.

Table 4Comparison of means – paired *t*-test at 95% confidence intervals.

Variable/ aspect	Subvariable/ subaspect	P(T<=t) two- tail	Mean (BEFORE)	Mean (AFTER)
Economic	Financial results	0.9117	3.3214	3.3571
Environmental	Environment - logistics and fleet	0.8847	2.6429	2.6786
	Environment - Material consumption and disposal	0.0001	2.6786	3.6429
	Environment - Visibility of green initiatives	0.0000	2.2857	3.5714
	Environment - Biodiversity	0.0086	2.1429	2.7500
	Environment - Other	0.0767	1.9286	2.5000
Social	Social aspects (e.g., quality of working environment)	0.4350	2.8929	3.1429
Knowledge and Competencies	Work processes are documented	0.0155	2.6071	3.2857
	The work requires a lot of experience	0.8134	3.1429	3.1071
	The work requires a lot of knowledge	0.5369	3.1071	3.1786
	Involving employees in product / service development and process improvements	0.0001	2.9643	3.6786
	Involving suppliers in product / service development and process improvements	0.0009	2.6071	3.2500
	Involving customers in product / service development and process improvements	0.0035	2.4643	3.1429
	Involving other partners in product / service development and process improvements	0.1233	2.1071	2.5357
	Other	0.5868	0.8929	0.7857
Communication	Supplier	0.8514	3.6429	3.6786
	Customers	0.0696	3.3214	3.7143
	Competitors	0.0710	2.1071	2.4286
	Neighbor	0.3753	2.0000	2.2143
	The local authority	0.0110	2.3571	3.0714
Partnerships	Other	0.6021	0.6786	0.7500
	Supplier	0.2064	2.7500	2.9643
	Customers	0.1058	2.3929	2.7500
	University / research institutions	0.0002	1.6429	2.5000
	Public organizations	0.0298	1.8214	2.2857
	Non-governmental / non-profit organization (NGO)	0.1330	1.4643	1.7500
	Other	0.5732	0.7857	0.8929
Strategic setting	Low costs	0.3807	3.5714	3.7143
	Differentiation	0.2832	3.8214	4.0000
	Focus	0.1997	2.6786	2.9643
	Other	0.5732	0.6429	0.6071
Technology & Innovation	Technology and innovation to improve financial performance	0.0002	2.5000	3.1429
	Technology and innovation to improve environmental performance	0.0000	2.2143	3.5000
	Technology and innovation to improve social performance	0.0000	2.3214	3.2500
	Other	0.5868	0.7500	0.6429
Process and Operations Management	Commercial and marketing activities	0.0082	2.5714	3.2143
	Management activities	0.0537	2.6429	3.0357
	Operational activities	0.1341	2.6429	3.0357
	Development activities	0.0105	2.8929	3.3929
	Other	0.8015	0.6071	0.5714

Legend: green indicates statistical significance at a 95% confidence level

Table 5

P-values that indicate statistical significance in regression - BEFORE.

Analysis ID	Independent variables	Dependent variable/p-value						
		1. Financial results	2. Environment - logistics and fleet	3. Environment - Material consumption and disposal	4. Environment - Visibility of green initiatives	5. Environment - Biodiversity	6. Environment - Other	7. Social aspects (e.g., quality of working environment)
1.1	Knowledge and Competencies	Work processes are documented	0.0238*					
		The work requires a lot of experience						
		The work requires a lot of knowledge						
		Involving employees in product/service development and process improvements	0.0433*					
1.2	Communication	Involving suppliers in product/service development and process improvements				0.0195*		
		Involving customers in product/service development and process improvements						
		Involving other partners in product/service development and process improvements						
		Other						
1.3	Partnerships	Supplier	0.0015*	0.0001*	0.0001*		0.0451*	0.0139*
		Customers						
		Competitors						
		Neighbor		0.0042*				
1.4	Strategic setting	The local authority						
		Other						
		Supplier						
		Customers					0.0064*	0.0121*
1.5	Technology & Innovation	University/ research institutions						
		Public organizations						
		Non-governmental/ non-profit organization (NGO)						
		Other						
1.5	Technology & Innovation	Low costs						
		Differentiation						
		Focus		0.0031*			0.0092*	
		Other						
1.5	Technology & Innovation	Technology and innovation to improve financial performance						
		Technology and innovation to improve environmental performance			0.0006*	0.0042*	0.0365*	
		Technology and innovation to improve social performance		0.0013*				
		Other				0.0279*	0.0177*	

(continued on next page)

Table 5 (continued)

Analysis ID	Independent variables	Dependent variable/p-value						
		1. Financial results	2. Environment - logistics and fleet	3. Environment - Material consumption and disposal	4. Environment - Visibility of green initiatives	5. Environment - Biodiversity	6. Environment - Other	7. Social aspects (e.g., quality of working environment)
1.6	Process and Operations Management	Commercial and marketing activities Management activities Operational activities Development activities Other			0.0024*	0.0159*		

Legend: * 2nd iteration. ** 3rd iteration.

4.2.1. Economic sustainability

BEFORE the project, financial results were explained by *involving suppliers in product/service development and process improvements* ($p = 0.0433$, see Table 5) and *communicating with customers* ($p = 0.0015$, see Table 5). In contrast, AFTER the project, those forces were no longer relevant to explain the companies' financial results. Instead, *partnerships with customers* ($p = 0.0017$, see Table 6), *investing in technology and innovation to improve financial, environmental, and social performance* ($p = 0.0076$, 0.0002 , and 0.0012 , respectively, see Table 6), and *dedicating efforts to management activities* ($p = 0.0004$, see Table 6) predicted a company's financial results.

4.2.2. Environmental sustainability

BEFORE the project, environmental performance related to logistics and fleet was partially explained by

- *Work required experience* ($p = 0.0238$, see Table 5)
- *The communication with customers* ($p = 0.0001$, see Table 5)
- *Communication with neighbors* ($p = 0.0042$, see Table 5)

AFTER the project, *partnerships with customers* ($p = 0.00085$, see Table 6) and *investments in technology and innovation to improve financial performance* ($p = 0.0286$, see Table 6) predicted a company's performance on logistics and fleet.

BEFORE the project, environmental performance related to material consumption and disposal was partially explained by *communication with competitors* ($p = 0.0001$, see Table 5), *setting strategy based on market segmentation (focus)* ($p = 0.0031$, see Table 5), and *investment in technology and innovation to improve social performance* ($p = 0.0013$, see Table 5) partially explained. AFTER the project, that changed to *communication with customers* ($p = 0.0013$, see Table 6) and *investment in technology and innovation to improve environmental performance* ($p = 0.0215$, see Table 6).

BEFORE the project, environmental performance related to the visibility of green initiatives was partially explained by *investment in technology and innovation to improve environmental performance* ($p = 0.0006$, see Table 5), and *time and effort spent on management activities* ($p = 0.0024$, see Table 5). AFTER the project, what became relevant to explain these results was how much *customers are involved in product/service development and process improvements* ($p = 0.0061$, see Table 6), *communication with customers* ($p = 0.0002$, see Table 6), *partnerships with suppliers* ($p = 0.0145$, see Table 6) and *customers* ($p = 0.0017$, see Table 6) and *university/research institutions, investment in technology and innovation to improve social performance* ($p = 0.0351$, see Table 6), and *time and effort spent on commercial and marketing activities* ($p = 0.0360$, see Table 6).

BEFORE the project, environmental performance related to Biodiversity was partially explained by how much *customers were involved in*

product/service development and process improvements ($p = 0.0195$, see Table 5), *investments in technology and innovation to improve environmental performance* ($p = 0.0042$, see Table 5) and for *Other* ($p = 0.0279$, see Table 5) purposes, and *time and effort spent on management activities* ($p = 0.0159$, see Table 5). AFTER the project, *communication* ($p = 0.0131$, see Table 6) and *partnerships* ($p = 0.0063$, see Table 6) with customers and *investments in technology and innovation to improve environmental performance* ($p = 0.0314$, see Table 6) became relevant.

BEFORE the project, Environmental performance related to other aspects was partially explained by General (other) aspects of *communication* ($p = 0.0451$, see Table 5), *partnerships with customers* ($p = 0.0064$, see Table 5), having a *segmentation (focus) strategy* ($p = 0.0092$, see Table 5), *investing in technology and innovation to improve environmental performance* ($p = 0.0365$, see Table 5), and for *Other* ($p = 0.0177$, see Table 5) purposes. AFTER the project, only the *communication with customers* ($p = 0.0017$, see Table 6) was statistically significant.

4.2.3. Social sustainability

BEFORE the project, social sustainability was partially explained by *Partnerships with suppliers* ($p = 0.0139$, see Table 5) and *customers* ($p = 0.0121$, see Table 6). AFTER the project, it was partially explained by *partnerships with customers* ($p = 0.0002$, see Table 6), having a *segmentation (focus) strategy* ($p = 0.0016$, see Table 6), *investing in technology and innovation to improve financial, environmental, and social performance* ($p = 0.0056$, 0.0155 , and 0.0012 , respectively, see Table 6), and *time and effort dedicated to commercial and marketing activities* ($p = 0.0001$, see Table 6).

Overall, one can see that only the variables Biodiversity (partially explained by *investment in technology and innovation to improve environmental performance*) and Social aspects (partially explained by *partnerships with customers*) remained partially explained by some of the same variables AFTER the Project.

5. Discussion: where to focus sustainability efforts

We assume that the changes in the means of the sub aspects help explain the changes in the means of the sustainability performance (for the seven sub-variables). This section dwells on which sub-aspects (with statistically significant changes) help explain the companies' sustainability performance and maturity after the deployment of sustainability-driven efforts.

Regarding knowledge and competencies, the sub-aspect *work processes are documented* was not statistically significant in helping to explain the performance on any of the sustainability variables. The same applies to the sub-aspects *involving employees in product/service development and process improvements* and *involving suppliers in product/service development and process improvements*. However, *involving customers in product/service development and process improvements* was deemed

Table 6

P-values that indicate statistical significance in regression – AFTER.

Analysis ID	Independent variables	Dependent variable/p-value						
		1. Financial results	2. Environment - logistics and fleet	3. Environment - Material consumption and disposal	4. Environment - Visibility of green initiatives	5. Environment - Biodiversity	6. Environment - Other	7. Social aspects (e.g., quality of working environment)
2.1	Knowledge and Competencies	Work processes are documented The work requires a lot of experience The work requires a lot of knowledge Involving employees in product/service development and process improvements Involving suppliers in product/service development and process improvements Involving customers in product/service development and process improvements Involving other partners in product/service development and process improvements Other			0.0061*			
2.2	Communication	Supplier Customers Competitors Neighbor The local authority Other		0.0013*	0.0002*	0.0131*	0.0017*	
2.3	Partnerships	Supplier Customers University/ research institutions Public organizations Non-governmental/ non-profit organization (NGO) Other	0.0017*	0.0085*	0.0145* 0.0017*	0.0063*		0.0002**
2.4	Strategic setting	Low costs Differentiation Focus Other						0.0016*
2.5	Technology & Innovation	Technology and innovation to improve financial performance Technology and innovation to improve environmental performance Technology and innovation to improve social performance Other	0.0076* 0.0002* 0.0012*	0.0286* 	 0.0215* 0.0351*	 0.0314*		0.0056* 0.0155* 0.0012*

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Table 6 (continued)

Analysis ID	Independent variables		Dependent variable/p-value						
			1. Financial results	2. Environment - logistics and fleet	3. Environment - Material consumption and disposal	4. Environment - Visibility of green initiatives	5. Environment - Biodiversity	6. Environment - Other	7. Social aspects (e.g., quality of working environment)
2.6	Process and Operations Management	Commercial and marketing activities				0.0360*			0.0001**
		Management activities	0.0004*						
		Operational activities							
		Development activities							
		Other							

Legend: * 2nd iteration. ** 3rd iteration.

statistically significant for partially explaining the performance on visibility of green initiatives.

The results render [hypothesis 1](#): high level of knowledge and competencies has a positive influence on the sustainability performance (economic, environmental, and social) of an SME, false. Even though the coefficient for the sub-aspect of knowledge and competencies in [Table 7](#) is positive, only one sub-aspect is significant, and it only affects one sub-variable in the environmental dimension.

Regarding communication, one can see that there has been an increase in the *communication with the local authority*. However, this sub-aspect does not help explain or predict the performance on any sustainability aspect. Instead, the *communication with customers* explains sustainability performance but no changes (average performance) were noted in this aspect. This renders [hypothesis 2](#) false. ([hypothesis 2](#): communication with different stakeholders has a positive influence on the sustainability performance (economic, environmental, and social) of an SME). Even though the regression coefficients for the sub-aspect of communication in [Table 7](#) are positive, only one sub-aspect is significant, affecting only the environmental dimension.

Regarding partnerships, the companies seem to have engaged more with *universities/research institutions and public organizations*. Nonetheless, these have not proven statistically relevant in explaining the companies' sustainability performance. Instead, if the companies want to invest in partnerships to help explain/predict their sustainability performance, they should engage primarily in partnerships with *customers and suppliers*. The results render partially true and partially false [hypothesis 3](#): establishing partnerships has a positive influence on the sustainability performance (economic, environmental, and social) of an SME. Partnerships with suppliers influence negatively (see [Table 7](#)) the performance on the visibility of green initiatives (environmental dimension). However, partnerships with customers influence positively (see [Table 7](#)) the performance on all the three dimensions of sustainability, i.e., financial, environmental, and social.

Regarding the strategic setting, the research revealed no significant changes. Nonetheless, if companies want to improve their performance in social aspects, they should have a *market segmentation (focus) strategy*. This renders false [hypothesis 4](#): low cost, differentiation, or focus as a business strategy has a positive influence on the sustainability performance (economic, environmental, and social) of an SME. Even though the coefficient for the sub-aspect of the strategic setting in [Table 7](#) is positive, only one sub-aspect is significant, and it affects only the social dimension.

Regarding investments in technology and innovation, this is where we see the most significant change when comparing AFTER the project to BEFORE the project. These investments help explain/predict the companies' performance across the three dimensions of sustainability. This renders true [hypothesis 5](#): investing in technology and innovation has a positive influence on the level of sustainability performance

(economic, environmental, and social) of an SME. The different sub-aspects of technology and innovation influence positively influence (see [Table 7](#)) the performance on the three sustainability dimensions.

Regarding process and operations management, *commercial and marketing and development activities* have seen significant changes. *Commercial and marketing activities* have been identified as significant to help explain/predict sustainability performance, whereas *development activities* have not. Moreover, *management activities* have also been identified as significant in explaining/predicting sustainability performance. This renders true [hypothesis 6](#): dedication to processes and operations management has a positive influence on the sustainability performance (economic, environmental, and social) of an SME. The different sub-aspects of process and operations management positively influence (see [Table 7](#)) the performance on the three sustainability dimensions.

6. Discussion: how our results compare to the existing literature

Our findings suggest that sustainability is built in many forms and from many angles. SMEs are the backbone of many countries ([Vásquez et al., 2021](#)). However, they often lack the strategies and motivations that allow them to mitigate the adverse effects of their products and operations, thus having a low level of maturity towards sustainability ([Vásquez et al., 2021](#)). Sustainability often stays functionally isolated while the focus of the business remains on gaining capital efficiency ([Chu and Cheung, 2017](#)), hence the need to integrate sustainability throughout the organization. Our research suggests that organizational activities previously not often dealt with in the literature in relation to sustainability performance, such as commercial and marketing activities, can still influence it.

In the existing literature, it has been discussed that SMEs do not always have the resources necessary to realize changes for reasons such as production schedules, or pressing competitive priorities ([Swarr et al., 2015](#)), hence the support of partners can be important to overcome such inertia ([Akande et al., 2016](#)). Our findings are in line with the relevance of this support, since many different partnerships predict sustainability performance. However, the particular interactions necessary along the supply chain are still insufficiently examined ([Kot, 2018](#)), and knowledge of these is important as enterprises often require connections to stakeholders, being hardly ever self-dependent ([Zhou et al., 2023](#)).

Social sustainability is often the last of the dimensions in the spotlight for business action. Our research shows that partnerships with customers can drive sustainability performance in all dimensions, including social. From within the company, [Chu and Cheung, \(2017\)](#) state that employees sometimes might not be aware that sustainability can be addressed by, e.g., caring for the well-being of employees and enabling a better work-life balance. Moreover, employee engagement can be a key enabler in improvement strategies (e.g., waste reduction,

Table 7

Regression coefficients for sub aspects with statistical significance - AFTER.

Analysis ID	Independent variables	Dependent variable/coefficient in regression						
		1. Financial results	2. Environment - logistics and fleet	3. Environment - Material consumption and disposal	4. Environment - Visibility of green initiatives	5. Environment - Biodiversity	6. Environment - Other	7. Social aspects (e.g., quality of working environment)
2.1	Knowledge and Competencies	Work processes are documented The work requires a lot of experience The work requires a lot of knowledge Involving employees in product/service development and process improvements Involving suppliers in product/service development and process improvements Involving customers in product/service development and process improvements Involving other partners in product/service development and process improvements Other			0.5483			
2.2	Communication	Supplier Customers Competitors Neighbor The local authority Other		0.4144	0.8063	0.6937	0.9774	
2.3	Partnerships	Supplier Customers University/ research institutions Public organizations Non-governmental/ non-profit organization (NGO) Other	0.5143	0.4041	−0.5983 0.7311	0.5429		0.6204
2.4	Strategic setting	Low costs Differentiation Focus Other						0.5096
2.5	Technology & Innovation	Technology and innovation to improve financial performance Technology and innovation to improve environmental performance Technology and innovation to improve social performance Other	0.5448 0.6182 0.5756	0.4172	0.2364	0.4636 0.3902		0.5897 0.4545 0.6049

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Table 7 (continued)

Analysis ID	Independent variables	Dependent variable/coefficient in regression						
		1. Financial results	2. Environment - logistics and fleet	3. Environment - Material consumption and disposal	4. Environment - Visibility of green initiatives	5. Environment - Biodiversity	6. Environment - Other	7. Social aspects (e.g., quality of working environment)
2.6	Process and Operations Management	Commercial and marketing activities Management activities Operational activities Development activities Other	0.5682		0.376			0.6606

energy saving) (Chu and Cheung, 2017). It has also been argued elsewhere (Kot, 2018) that SMEs hold greater potential to make changes in the social dimension compared to larger companies. The present study suggests that even investments in technology and innovation to improve financial and environmental performance might help increase performance on social sustainability (see Table 7).

Measuring performance and maturity play a pivotal role in bridging the gap between knowledge and implementing more sustainable practices (Fatima et al., 2021). Performance and maturity measurement help build and maintain mature governance, in which standards, norms, laws, and projects comply with ethical ideals, contemporary social (Del Baldo, 2017), and environmental (Salvador et al., 2021b) expectations.

Although methods for assessing and controlling sustainability exist, such as strategies within corporate sustainability, they are often not applicable for SMEs. SMEs often lack the knowledge, capability, and infrastructure to adapt to these methods, models, and frameworks (Golinska and Kuebler, 2014), especially in relation to their supply chain structure (Nurchayati et al., 2020). Moreover, it can vary significantly in different economies (Kot et al., 2020). The framework built in this paper measures SMEs' sustainability performance and maturity is easy to understand, and SMEs can assess themselves.

7. Concluding remarks

7.1. Main conclusions

All aspects identified in our framework somehow explain the sustainability performance of the companies in our specific sample, with different sub-aspects contributing specifically to each sustainability dimension. Based on our analysis, identifying what subaspects contribute to explaining the sustainability performance of an SME, a few recommendations can be made to SMEs in order to improve their sustainability performance. These recommendations can be seen in Table 8.

We built the six listed aspects in ways allowing SMEs to self-assess their sustainability. The process of synthesizing the aspects also considered the possibility of SMEs to express their performance and maturity within their possible limits. That is, the maturity of each organization is not comparable to another's, since they have distinct, e.g., structures, strategies, and customers.

The recommendations state which aspects companies should invest time and money in to make significant efforts to improve their sustainability performance and maturity. Nonetheless, this does not imply that the remaining aspects do not play a part in the company's sustainability performance and, therefore, should not be considered. We do not draw recommendations for which aspects should not receive effort, as it falls outside the scope of our study.

The main contributions of this study, and thus its pros, lie in its very novelty, bringing to light the aspects within the management of SMEs that contribute to explaining their sustainability performance, and thus

Table 8

Main aspects influencing sustainability performance.

Aspects which companies should deploy efforts in	What efforts should be deployed
Knowledge and competencies	Involving customers in product/service development Process improvements
Communication	Engaging with customers
Partnerships	Engaging with customers Engaging with suppliers
Strategic setting	Investing in segmentation
Technology and innovation	Investing in technology and innovation to improve financial performance Investing in technology and innovation to improve environmental performance Investing in technology and innovation to improve social performance
Process and operations management	Dedicating time and effort to commercial and marketing activities Dedicating time and effort to management activities

can be used to guide improvements.

7.2. Limitations

This research has limitations. The framework proposed to collect information on sustainability performance and the aspects that influence it was based on the literature review and the specific interactions with different stakeholders of the Sustainability Bottomline 2.0 Project, both presented in section 2 of this manuscript. Thus, different experiences and interactions with different stakeholders from a different project would have likely yielded a somewhat different framework. We believe the framework to be generic enough (and we tried to keep it as so) to apply to any company or set of companies. The data in this research originates from self-assessments and has not gone through third-party verification. Another limitation is that our research collected data on the companies' sustainability performance BEFORE and AFTER an individual project as part of a larger collective project (Sustainable Bottomline 2.0). Although some actions derived from the Sustainable Bottomline 2.0 project drive (but are not solely responsible) differences in sustainability performance, other actions taken by the companies, which were not related to that project, might have (and likely did) influenced changes in their sustainability performance, too. It should also be noted that the measurements made in this research might not be assessing the usual behavior of the participating companies, but the impact of the BB2.0 project in their journey. We do, however, highlight that the research results show that changes in the aspects pointed out can drive changes in their sustainability performance.

Furthermore, we do not claim that the effects observed in our sample

of 28 SMEs, within an eligible population of 79 (see section 2.4) will be observed in any other SME. The claims we make here are limited to our sample and population, and we believe our sample to be representative (37.83%). We argue, nonetheless, that the effects observed in our study can serve as a proxy to help explain sustainability performance of SMEs in other contexts.

7.3. Suggestions for future and further research

Suggestions for further research begin by stating that the limitations presented in the previous section could be the subject of new studies, in order to identify whether they can be overcome. Some of which potentially include: increasing sample size, isolating variables to assess their individual contribution.

Moreover, the analyses conducted here can only explain so much and might not have accounted for synergies among the different aspects, which our models and methods did not capture. For instance, changes in a set of aspects that did not appear to be statistically significant might have jointly influenced the results of one specific variable, which when analyzed alone might have proven to be statistically significant. Moreover, even the aspects accounted for in this research might have acted together and hindered or boosted one another's performance (e.g., communication with suppliers and communication with customers if happening separately might each contribute to increase the company's performance by 10%, but if happening at the same time might have a combined result of 30%). We leave exploring these relationships for future research.

In order to reach greater detail of analysis, one could break down the financial and social sustainability dimensions into sub-aspects, like it was done for the environmental dimension in this study. Such a breakdown might be inspired by the sub-aspects in the reporting scheme of the Global Reporting Initiative (Global Reporting Initiative, 2022).

Something else that is worth to be further explored is the implications of the changes made by the companies that allowed their performance to change. In this research we could identify aspects that helped explain SMEs' sustainability performance BEFORE and AFTER carrying out a project. An analysis of what changes took place (what tasks, activities, managerial actions) in the different companies has not been done.

Future research could also use our framework to assess sustainability performance and to investigate what aspects of companies can be used to explain their sustainability performance. These results could be compared to the ones in this manuscript to check if future research observes the same behavior. Furthermore, we encourage the framework to be used with start-ups and larger companies to check whether the aspects in the framework are enough to help describe these types of companies. We also welcome other researchers and practitioners to tailor further and develop the framework we have established and used in this manuscript.

CRedit authorship contribution statement

Rodrigo Salvador: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing. **Peder Veng Søberg:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Michael Søgaard Jørgensen:** Methodology, Writing – review & editing. **Lise-Lotte Schmidt-Kallesøe:** Methodology, Writing – review & editing. **Samuel Brüning Larsen:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Funding acquisition.

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

The authors do not have permission to share data.

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Appendix A. Supplementary data

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