

Assessing agricultural SMEs' sustainability performance: a new scoring methodology

Patrice De Micco, Sebastiano Cupertino, Niccolò Parissi and Angelo Riccaboni

Abstract

Purpose – This paper aims to re-adapt the framework by Sachs (2021) and to develop a simplified environmental, social and governance scoring system, named ESG4AGRI, to evaluate the sustainability performance of agricultural SMEs.

Design/methodology/approach – A mixed-method approach was adopted, combining survey questionnaires with the collection of financial and non-financial data from 657 Italian wine SMEs. The data collection supported the definition of a set of metrics and regional benchmarks for designing the ESG4AGRI scoring system, which was ultimately applied to 464 Italian wine SMEs.

Findings – The ESG4AGRI scoring applied to the sample showed that sustainability performance of wine SMEs generally appears modest and varies significantly across Italian macro-regions, regardless of size. Firms perform better on workforce stability, employee training and local procurement. Southern firms demonstrate higher energy efficiency and lower GHG emissions. Central Italy performs best in water management, whereas those in the South record the weakest performance. Gender balance in governance and human resources management displays mixed results.

Practical implications – The ESG4AGRI score provides SMEs with an intuitive tool to benchmark sustainability, supporting decision-making and access to financing.

Originality/value – By tailoring an established framework to agriculture, the study delivers a sector-specific methodology that balances analytical rigour with feasibility, helping SMEs overcome barriers to sustainability measurement and reporting.

Keywords ESG scoring, Agricultural SMEs, Performance measurement, Agri-food systems, Wine industry

Paper type Research paper

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1. Introduction

The (un)sustainability of food systems is a priority on international agendas (Gangi *et al.*, 2021). To accelerate the transition towards sustainable models, agricultural firms should reconsider their corporate purpose, management systems and measurement frameworks (De Micco *et al.*, 2021). This is particularly relevant in the EU, where the Corporate Sustainability Reporting Directive (CSRD) requires companies, and increasingly encourages SMEs, to adopt sustainability measurement and reporting supported by specific standards.

The adoption of integrated performance measurement systems (IPMS) is crucial for both large companies and SMEs, given the interdependencies between financial and non-financial aspects. IPMS enables monitoring of financial and non-financial results, guiding decisions and promoting long-term strategies (Engida *et al.*, 2018). However, existing systems often show ambiguities, especially in the environmental and social dimensions (Giovannoni and Quarchioni, 2018). Several international frameworks provide guidance, but implementation is challenging, particularly for SMEs that dominate agriculture.

In parallel, environmental, social and governance (ESG) ratings have proliferated, primarily to support investors (Eccles and Strohle, 2018). Yet, divergent methodologies can yield inconsistent scores for the same firm (Chatterji *et al.*, 2016), and most systems target large, listed companies with cross-sectoral scope (Diez-Cañamero *et al.*, 2020). To address these limitations, Sachs (2021) proposed a holistic set of topics and indicators to facilitate practical and effective ESG measurement and reporting. Their framework was developed by identifying best practices in non-financial disclosure among large agri-food companies and validated through a structured stakeholder engagement process. This paper addresses the challenges faced by agricultural SMEs in managing and assessing sustainability.

While regulatory developments such as the CSRD, the diffusion of IPMS and the proliferation of ESG ratings provide an important background, the primary focus of this study lies in identifying and operationalising a sustainability performance measurement framework specifically tailored to the agricultural sector. In particular, the paper addresses the challenge of translating broad sustainability principles into a feasible and sector-specific measurement approach for agricultural SMEs, where data availability, managerial resources and reporting capabilities are structurally limited.

Accordingly, we adapted and empirically validated the framework by Sachs (2021), identifying suitable sustainability topics and metrics to support internal decision-making, enable benchmarking across firms and enhance transparency. The objective of this paper is not to develop a new sustainability framework in theoretical terms, but to adapt, operationalise and empirically test an existing, theory-based framework within a specific sectoral context. While Sachs (2021) validated the four-pillar framework (4PF) through a structured stakeholder engagement process and the analysis of sustainability disclosure practices among large agri-food companies, this study focuses on validating its applicability at the operational level for agricultural SMEs. In this sense, validation in the present study refers to the empirical feasibility, internal consistency and benchmarking capacity of the adapted framework when applied to firm-level data, rather than to its conceptual soundness, which is inherited from the original framework. Building on this, we developed a simplified ESG scoring system tailored to agricultural SMEs.

The paper is structured as follows. Section 2 reviews the literature; Section 3 presents the methodological framework; Section 4 introduces the scoring system; Section 5 reports and discusses results; and Section 6 concludes.

2. Corporate sustainability evaluation: key challenges and insights from the literature

As regards corporate sustainability evaluation (CSE), the literature highlights four recurring issues: ambiguity in tool classification, lack of harmonisation, uncertainty in indicator selection and weighting and limited applicability to SMEs and sector-specific contexts. Addressing these challenges requires simplified, industry-tailored frameworks capable of balancing analytical rigour with operational feasibility. The following review discusses the main streams of literature addressing each of these issues, thereby providing the basis for identifying the research gap addressed by this study.

Recent research highlights the growing importance of ESG performance in promoting transparency and accountability, particularly in mitigating environmental harm and social externalities. Firms face increasing pressure from regulators, investors, customers and society to demonstrate credible sustainability outcomes (Bolognesi *et al.*, 2025). Legal and policy frameworks now address challenges such as biodiversity loss, climate change, labour protection and inclusive growth (La Torre *et al.*, 2020). Consequently, companies are expected to align operations with sustainability goals, often under formal – and in some cases mandatory – reporting obligations (De Micco *et al.*, 2021).

In this scenario, sustainability has evolved from a compliance exercise into a strategic driver of competitiveness (Ren *et al.*, 2024). CSE enables firms to assess environmental and social impacts while guiding continuous improvement (Büyükoğkan and Karabulut, 2018).

Saulick *et al.* (2023) identify five main CSE approaches: established guidelines, normative frameworks, management systems, indices and ratings or rankings. Each approach relies on specific tools and methodologies for assessing, disclosing and improving sustainability performance. Within the classification proposed by Saulick *et al.* (2023), ESG4AGRI can be positioned as an indicator-based sustainability assessment tool, combining elements of management-oriented frameworks and composite indices, specifically adapted to the agricultural SME context. Among the most recognised tools are the Global Reporting Initiative (GRI), the International Integrated Reporting Council, the Carbon Disclosure Project (CDP) and the UN Global Compact, which offers a universally recognised set of sustainability principles. Indicator-based guidelines often rely on GRI and the Sustainability Accounting Standards Board (SASB) and, more recently, the European Sustainability Reporting Standards (ESRS) and the voluntary sustainability reporting standard for non-listed SMEs (VSME).

Sustainability management systems serve as organisational tools that formalise processes and criteria for managing and evaluating sustainability-related performance (Rahdari and Rostamy, 2015), typically in the form of standards. Examples include ISO 14000, ISO 26000 and the EU Eco-Management and Audit Scheme (EMAS). Indices and ratings, instead, aggregate indicators into synthetic measures of ESG performance. Instruments such as the Dow Jones Sustainability Index, FTSE4Good, MSCI ESG indices, Sustainalytics and Bloomberg ESG data are widely used, mainly by investors. ESG ratings assess resilience to material sustainability risks by assigning comparative scores. CSE can also be strengthened by advanced techniques – e.g. multi-criteria decision analysis or principal component analysis – which increase robustness and comparability (Saulick *et al.*, 2023).

Overall, these tools provide firms with insights into strengths and weaknesses, support decision-making and improve external credibility with investors, customers and regulators (Aziz and Alshdaifat, 2024). Nevertheless, CSE remains fragmented and methodologically diverse, leading to conceptual confusion and a lack of common terminology (Silva *et al.*, 2019). Divergences in weighting rules and dependency analysis undermine comparability, while ESG scores derived from disclosed data are often vulnerable to selective reporting and greenwashing. Even where assurance is provided, inconsistent quality persists (Gipper *et al.*, 2024), fuelling disagreement across ESG scores and reinforcing calls for harmonisation (Cheng *et al.*, 2023).

There is also no consensus on the dimensions that CSE should cover. While the Triple Bottom Line (TBL) paradigm (Elkington, 2018), based on economic, environmental and social pillars, remains dominant, additional pillars such as governance, finance and circularity are increasingly integrated. This multidimensionality increases data requirements, complicating collection and consistency (Ceccacci *et al.*, 2024).

The generic design of many CSE tools further limits their applicability. Indeed, most instruments lack sector-specific adjustments and, when applied to particular industries, they often require contextual adaptations. Moreover, they are typically oriented towards listed firms, and this makes existing ESG frameworks poorly suited for SMEs, which typically lack standardised disclosure practices (Mengistu and Panizzolo, 2023). This results in a persistent gap in sustainability assessment for smaller firms.

CSE fragmentation is evident in agriculture, where translating general sustainability principles into operational assessment tools remains difficult. Such assessments rely on data collection supported by IPMMS, traditionally focused on financial results, often neglecting ESG dimensions and their links to economic outcomes (Buonasera *et al.*, 2025). Embedding sustainability requires integrating financial indicators, non-financial indicators

and narratives into a unified system that supports planning, monitoring and control (Vitale *et al.*, 2025). Properly designed, these systems support firms in evaluating resource use, identifying areas for improvement and pursuing sustainable growth (Rompho *et al.*, 2024).

During the last years, several initiatives have been launched to support CSE in agriculture. The most relevant ones include FAO's sustainable assessment of food and agriculture systems (SAFA), which covers governance, environment, economy and social well-being. The Food Reform for Sustainability and Health (FReSH) initiative by WBCSD, follows a "fork-to-farm" approach, focusing on consumer behaviour, food loss reduction, nutrition and pricing. The response-inducing sustainability evaluation (RISE), developed by HAFL, combines farmer interviews with software-based analysis across 10 themes and 47 indicators. Similarly, the IDEA framework enables self-assessment through agro-ecological, socio-territorial and economic dimensions, considering 10 themes and 41 indicators, to generate aggregated scores. The SAI Farm Sustainability Assessment (SAI-FSA) applies a 112-question checklist and awards bronze, silver or gold certifications. Other tools include the Food and Agriculture Benchmark of the World Benchmarking Alliance, which rates companies across nutrition, environment, inclusion and governance using 45 qualitative indicators.

These instruments demonstrate the growing sophistication of performance measurement systems and sustainability assessment in the agri-food sector. However, significant challenges remain as follows: indicators are not harmonised, sector-specific applicability is limited and a gap persists between disclosure and actual performance (Engida *et al.*, 2018). For SMEs, the main barrier lies in complexity and resource intensity, limiting their applicability (Jiménez *et al.*, 2021).

3. A methodological framework to evaluate the sustainability of agricultural SMEs

To address the aforementioned gaps, this study proposes a simplified, sector-specific methodology for assessing the sustainability of agricultural SMEs. We defined our CSE methodology considering the 4PF of Sachs (2021), originally introduced under the *Fixing the Business of Food* initiative. It offers a holistic yet structured framework that supports companies in measuring their sustainability performance and is the outcome of extensive research activities, validated through consultations with experts and firms across several countries. It was built by screening best practices in non-financial disclosure, applying content analysis to corporate sustainability reports, and subsequently validated through engagement with large enterprises in the Italian agri-food sector. The 4PF reformulated the traditional TBL perspective into four areas of relevance, covering 17 specific topics (see Table 1), thereby ensuring comprehensive coverage of health, environmental, social, supply chain and governance dimensions.

We developed the following two-step process to align the 4PF proposed by Sachs (2021) with the specific needs and characteristics of agricultural SMEs. We adopted a qualitative methodological approach mainly based on survey administration (Groenland and Dana, 2020) to collect data from the sampled firms under scrutiny. This qualitative method allows scholars to discuss existing concepts, identify new ones and support businesses to improve performance and processes (Dana and Dumez, 2015). This also allowed us to create a scoring system that is both scientifically robust and practically usable by SMEs and stakeholders.

Methodologically, the study adopts a mixed-methods approach, primarily based on a quantitative, survey-based research design, complemented by qualitative inputs used for validation purposes. Quantitative data were collected through structured questionnaires administered to an initial list of 4,542 Italian wine SMEs, while qualitative elements – namely the materiality assessment and focus group discussions with entrepreneurs and sustainability experts – supported the validation of topics and metrics.

Table 1 The original and adapted 4PF

Areas	Relevance	Topics of the 4PF	Topics of the “adapted” 4PF for agricultural SMEs	Metrics (with justification) of the adapted 4PF
1. Accessibility, safety and impact on human health of agricultural products	Unsuitable diets – driven by ultra-processed foods high in sugar, sodium and saturated fats – contribute to obesity and non-communicable diseases (Monteiro <i>et al.</i> , 2019). Companies are, therefore, encouraged to improve labelling, marketing practices and product safety (Miller <i>et al.</i> , 2021)	■ Portfolio of products contributing to healthy and sustainable diets ■ Food security ■ Marketing and labelling ■ Food safety (safety)	■ Portfolio of products contributing to healthy and sustainable diets	Number of initiatives promoted for sustainable consumption Directly reflects a company’s proactive role in promoting healthier and more sustainable dietary models through awareness campaigns, educational programmes, partnerships or product-related strategies. By influencing consumer choices, these initiatives contribute to shaping dietary portfolios aligned with public health goals and sustainability imperatives
2. Social and environmental sustainability of operations and internal processes	Agriculture is responsible for about 70% of freshwater withdrawals and 26% of EU energy demand (European Commission, 2022), as well as widespread biodiversity loss. Integrating environmental and social dimensions into operations is thus critical for long-term resilience	■ Non-discrimination and equality ■ Health and safety at work ■ Decent wages and income ■ Sustainable agricultural production	■ Training	Total training hours for employees/total number of employees Captures the company’s commitment to workforce development, capacity building and equal access to learning opportunities, which are critical to fostering inclusion and innovation in SMEs
3. Corporate commitment to promoting a sustainable supply chain and value creation	This area matters because sustainability challenges often extend beyond individual firms, requiring companies to engage suppliers and partners in building transparent, responsible and resilient value chains that amplify positive environmental and social impacts (Osei <i>et al.</i> , 2023)	■ Climate change and air quality ■ Biodiversity ■ Water resources ■ Waste ■ Animal welfare	■ Non-discrimination and equality ■ Decent wages and income ■ Sustainable agricultural production	Percentage of women over total employees A proxy for gender equality and inclusiveness, reflecting how effectively firms promote fair representation in their workforce Percentage of employees over total workers Measures the stability and quality of employment, distinguishing permanent employees from seasonal or precarious labour, which is highly relevant in agriculture Total energy consumption/revenues Provides a measure of resource efficiency, linking production sustainability with economic performance

(continued)

(continued)

Table 1

Areas	Relevance	Topics of the 4PF	Topics of the "adapted" 4PF for agricultural SMEs	Metrics (with justification) of the adapted 4PF
4. Integrity, responsibility and transparency in corporate governance and behaviour	This area is fundamental since governance, ethical behaviour and accountability underpin the credibility of sustainability strategies, reinforcing stakeholder trust, reducing risks of malpractice and aligning corporate conduct with long-term societal goals (Raimo et al., 2021)	■ Governance and management ■ Relations with the local community ■ Taxation ■ Anti-corruption	■ Climate change and air quality ■ Water resources ■ Supply chain sustainability ■ Governance and management ■ Relations with the local community	Total Scope 1 GHG emissions/revenues Quantifies climate impact relative to firm size, enabling comparability and assessing progress in emission reduction Total water consumption/revenues Indicates the intensity of water use per unit of economic output, a key issue in viticulture where irrigation is critical Percentage of local supply expenditure over total supply costs Assesses the firm's contribution to local economies and the promotion of sustainable, short supply chains, which reduce environmental impacts and strengthen community relations Percentage of women in governance Reflects diversity and inclusivity at the decision-making level, enhancing governance quality and legitimacy Percentage of local supply expenditure over total supply costs Measures the firm's embeddedness in the local context, its support to local communities and the promotion of regional development

Source(s): Authors' own work

The sampling process was based on data retrieved from the Bureau van Dijk AIDA database. Specifically, the study analysed Italian firms engaged in grape growing, wine production and related processing activities operating across different macro-regions and firm size classes, as defined by the EU SME classification (i.e. Commission Recommendation 2003/361/EC).

A total of 657 firms voluntarily responded to the survey, with questionnaires completed by owners, managers or sustainability officers. This enabled the authors to define the sample used to conduct the materiality assessment of sustainability topics and the selection of metrics as a preliminary step to modulate the framework by [Sachs \(2021\)](#) in line with the wine SMEs' needs. Moreover, the sample of 657 firms was aligned with the overall population of wine SMEs recorded in the Bureau van Dijk AIDA database. Accordingly, the scrutinised sample was weighed to improve its representativeness with respect to the actual distribution of Italian wine SMEs by firm size and geographical area.

The study focused on Italian wine SMEs due to their prevalence and relevance in impacting sustainability ([Broccardo et al., 2023](#)). Compared with other agricultural firms, wineries present advanced managerial capacities (ISTAT, CREA, 2022) and sustainability experience. Yet they remain highly vulnerable to climate change, with global wine production declining by 9.6% in 2023 ([OIV, 2023](#)). These dynamics underscore the need for sector-specific methodologies capable of integrating environmental resilience and sustainability practices in wine businesses. Moreover, concentrating on a particular industry is warranted due to common sustainability business practices ([Ioannou and Serafeim, 2019](#)), fostering better comparability.

Given the structural difficulties faced by agricultural SMEs in sustainability data collection and measurement ([Mengistu and Panizzolo, 2023](#)), missing values were handled through conservative, variable-specific imputation strategies (median or 0, depending on the indicator), aimed at preserving sample size while limiting potential distortions. Firm size categories were defined using a k-means clustering approach applied to firms' revenue data, with the sole purpose of creating internally consistent size classes for benchmarking rather than for inferential analysis.

Our two-step methodological approach is described as follows:

1. Materiality assessment

The study adopted a pragmatic interpretation with a primary focus on the impact of materiality. Respondents were asked to evaluate the relevance of a predefined set of sustainability topics by assigning a score from 1 to 5, reflecting the perceived environmental and social impacts of their activities. Using a five-point Likert scale, respondents evaluated the relevance of the four 4PF areas and related topics of the 4PF, approximating a materiality analysis. This was useful to validate the corporate sustainability areas and to define the list of material issues (see [Table 1](#), first and fourth columns). On average, the four areas of the re-adapted 4PF received a score above 4.2, confirming their perceived importance in this sector. Accordingly, we retained the four areas of the original 4PF. One new topic – training – was added, reflecting its high perceived relevance. Focus groups with entrepreneurs, sustainability experts and agricultural trade associations further validated the findings.

2. Selection of metrics

For each material topic, specific metrics were identified (see [Table 1](#), fifth column) by reviewing the main KPIs that emerged from recent studies (e.g. [Bathaei and Štreimikienė, 2023](#); [Viles et al., 2023](#)) and established standards (GRI, both general and sector-specific, ESRS and VSME, SASB, IFRS – International Financial Reporting Standards – CDP, TCFD). Furthermore, the revised 4PF integrates regulatory requirements from the EU's Common

Agricultural Policy (CAP) 2023–2027 regarding environmental and social sustainability, as well as standards from widely recognised sustainability certifications in the Italian agricultural sector (e.g. Equalitas, SOStain, Viva). It also benefited from an extensive analysis of agricultural firms' sustainability reports. Ultimately, a concise set of nine metrics was selected to support agricultural SMEs in collecting ESG data and assessing corporate sustainability. This allowed us to define a simple and usable scoring tool, thus accounting for the well-known internal barrier that agricultural SMEs face in collecting sustainability data (De Steur *et al.*, 2020).

Compared with existing agricultural sustainability assessment tools such as SAFA, RISE, IDEA and SAI-FSA, ESG4AGRI is not conceived as a comprehensive diagnostic or certification-oriented framework, but as a simplified, indicator-based scoring system explicitly tailored to agricultural SMEs. While established tools offer in-depth and holistic assessments, they often require extensive data collection and technical expertise, limiting their applicability for small firms. ESG4AGRI addresses this gap by relying on a limited number of standardised metrics, selected for their materiality, feasibility and alignment with European agricultural and sustainability policies, thus supporting benchmarking and decision-making under constrained reporting conditions.

This revised 4PF preserves the multidimensional logic of the framework proposed by Sachs (2021) while tailoring it to the needs of agricultural SMEs and remaining simple enough to be implemented with limited data availability. By integrating materiality insights with, international and sector-specific standards, it provides a balanced basis for measuring performance across ESG dimensions. Building on this foundation, the next step of our study developed a scoring methodology for wine SMEs that operationalised the selected metrics, enabling a systematic assessment and benchmarking of sustainability performance.

In short, this study contributes to the existing literature in three main ways. Firstly, it developed a sector-specific ESG scoring methodology explicitly designed for agricultural SMEs, addressing the structural mismatch between existing sustainability assessment tools – largely conceived for large or listed firms – and the data, resources and managerial constraints faced by smaller agricultural enterprises. Secondly, ESG4AGRI translated a comprehensive, theory-based framework (the 4PF by Sachs, 2021) into a concise and operational set of nine metrics, balancing analytical rigour with feasibility and minimising data collection burdens. Thirdly, the methodology explicitly integrated regulatory and policy requirements relevant for European agriculture, including the EU Common Agriculture Policy 2023–2027 and emerging voluntary standards for non-listed SMEs, thus enhancing its policy relevance and practical usability.

4. A simplified scoring methodology for wine SMEs

To translate the revised 4PF into a practical CSE tool, we developed a transparent, replicable and sector-specific scoring system for agricultural SMEs named ESG4AGRI. The methodology was structured in two main steps, combining analytical rigour with operational usability.

4.1 Step 1: creation of the benchmarking database

A second questionnaire was administered among the same firms previously involved in the materiality analysis. For each of the nine proposed metrics, survey participants assessed relevance for sustainability purposes, using a one- to five-point Likert scale. This evaluation allowed the calculation of metric-specific weights (Table 2) used in the ESG4AGRI score formula.

Firms were also asked to report their own data for the nine selected metrics, referring to the year 2024. This data collection enabled the creation of a reference benchmarking data set and the assessment of each firm's sustainability score. To make this data set statistically representative of the Italian population and capture territorial and size heterogeneities, firms

Table 2 Weights of each metric and area of the 4PF revised version to set up the scoring process

<i>Metrics</i>	<i>Metric weight</i>	<i>Area weight</i>
Number of initiatives promoted for sustainable consumption	3.778	4.823
Total training hours for the employees/total number of employees	4.488	4.583
Percentage of female employees	4.394	
Percentage of employees out of total workers	4.394	
Energy consumption/revenues	4.534	
Scope 1 GHG emissions/revenues	4.534	
Water consumption/revenues	4.563	
Percentage of women in governance	4.709	4.251
Percentage of expenditure on local suppliers	4.153	4.665
Source(s): Authors' own work		

were grouped into four macro-regions (Northeast, Northwest, Centre and South and Islands) and three revenue-based size categories (micro, small, medium) using the k-means approach (MacQueen, 1967). The Bureau van Dijk AIDA database was used as the population frame to weight the sample according to the actual distribution of Italian wine SMEs.

Given the incidence of missing responses in the original data set, we increased usable observations by imputing either the median or 0, depending on the variable. Specifically, missing values for “number of initiatives promoted for sustainable consumption” were imputed as 0, assuming non-reporting indicated absence. To allow comparability across firms of different sizes, some of the selected metrics were normalised by revenues or number of employees. For the metrics “total training hours for employees/total number of employees”, “energy consumption (kWh)/revenues” and “water consumption (m³)/revenues”, we imputed the macro-region median. The median was chosen over the mean due to its robustness and lower sensitivity to outliers. For all the remaining variables, we did not impute any values.

To ensure comparability, each metric was rescaled to a 0–100 range through a piecewise linear transformation, which reduces distortions from skewed distributions. This normalisation step ensures that all metrics – despite differing in units or scales – can be consistently aggregated in subsequent phases of the scoring system. Median macro-regional values were used as breakpoints for most metrics (e.g. “sustainable consumption initiatives”, “total training hours for the employees/total number of employees”, “percentage expenditure on local suppliers”, energy, GHG and water intensities). For gender indicators, parity (50%) was set as the optimal target, with scores decreasing symmetrically as values deviated from balance. To reduce the influence of higher values, all variables were winsorised at the 5th and 95th percentiles (Greene, 2003).

4.2 Step 2: definition of the scoring formula

Firm-level scores were then calculated by aggregating all metrics into composite indices ranging from 0 to 100. Our scoring process used a double-weighted mean approach, applying both metric-specific and area-specific weights that reflect stakeholder relevance, as determined through materiality analysis (Table 2). The following formula illustrates the algorithm, which is applied in two steps:

$$\bar{X} = \frac{\sum_{i=1}^n w_i X_i}{\sum_{i=1}^n w_i},$$

where $\bar{x}$ is the overall ESG4AGRI score for firm i , x_i is the normalised value of metric i and w_i its weight.

Finally, the ESG4AGRI scores of all firms were aggregated, and their average was computed, also distinguishing results by region and metric.

To facilitate use among small firms, the methodology was digitalised into a free web-based platform, developed within the Agritech project (www.agritech-metriqa.it/dashboard/wp2/index.php?F=ValutaLaTuaSostenibilitap). The tool allows SMEs to enter data for the nine selected metrics and instantly receive an overall score, benchmarked against national and regional averages, with disaggregated results by area and metric.

5. The application of ESG4AGRI scoring to Italian wine SMEs: results and discussion

The ESG4AGRI scoring system was tested on a subsample of the scrutinised firms used to re-adapt the framework of Sachs (2021) that ranks 464 Italian wine SMEs. One of the most significant findings concerned the persistent difficulty encountered by firms in reporting data such as GHG emissions, confirming prior evidence of structural barriers that still hinder small agricultural enterprises from effectively measuring and disclosing sustainability performance (e.g. De Steur *et al.*, 2020). Although the ESG4AGRI platform provided a manual explaining all metrics, several of them require technical skills in data collection and processing that agricultural SMEs often lack. This limitation showed the high rate of missing data and underscores the need for capacity-building initiatives enabling firms to assess, monitor and report sustainability practices (Ceccacci *et al.*, 2024).

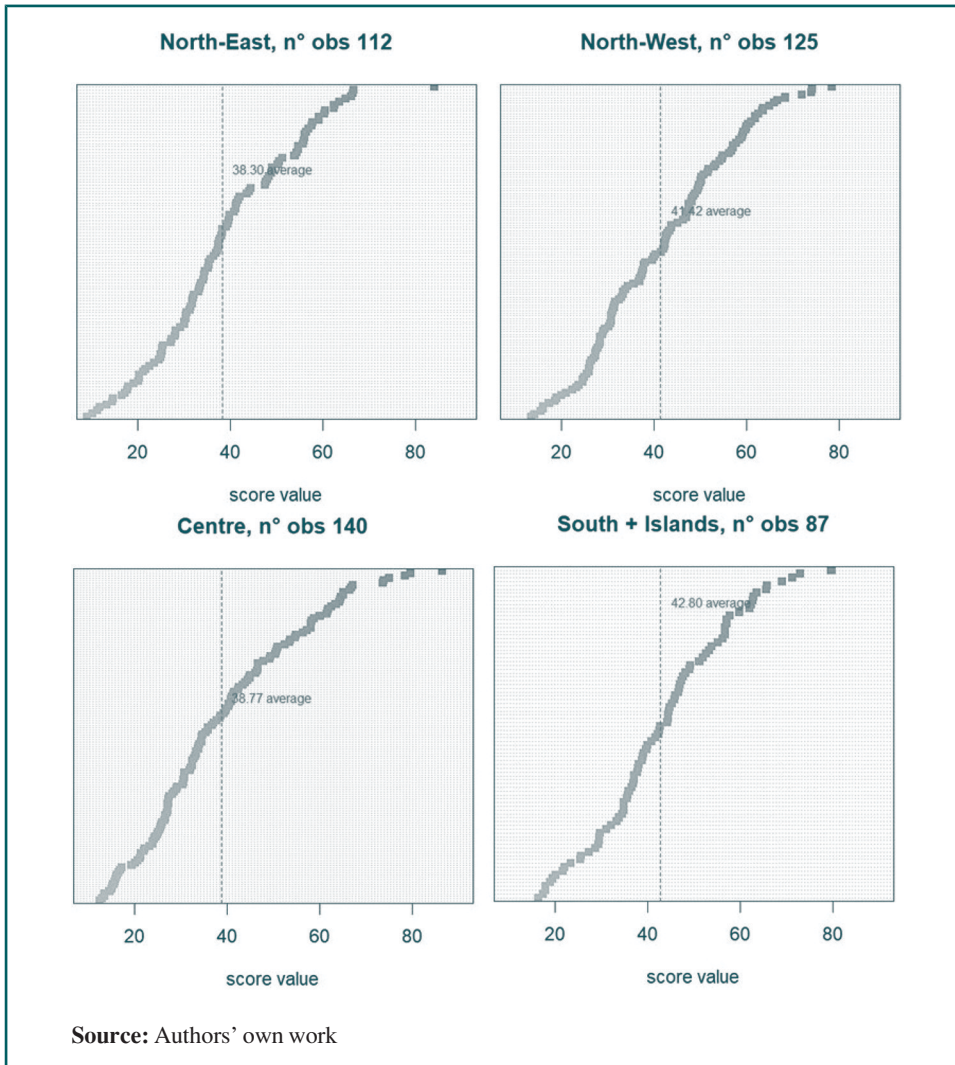
Results highlighted limited engagement in sustainable consumption initiatives (mean = 0.62; median = 0). Training remains modest (5.6 h per employee/year), with large variability. Gender imbalances persist, with women representing 33.7% of employees and 32.9% of governance roles. Employees account for 59.6% of the workforce, indicating a reliance on seasonal or temporary labour. Environmental metrics (energy, GHG and water per revenue) exhibited low average intensities but wide dispersion, suggesting heterogeneous practices. Conversely, firms displayed strong local embeddedness: 62% of expenditure is on local suppliers (median 70%). Overall, Italian wine SMEs performed relatively better in aspects linked to local economic sustainability and workforce stability. In contrast, the analysis showed a lack of environmental reporting and proactive social initiatives. This evidence contrasts with the common view that emerged in literature, which considers the wine sector as ecologically driven due to its relevant environmental business impacts (Kariyapperuma and Collins, 2021). Indeed, as highlighted in this paper and in prior studies (e.g. Borsellino *et al.*, 2016), wine SMEs still tend to overlook several sustainability determinants.

Overall ESG4AGRI scores range between approximately 38% and 43% across macro-regions, with very few firms exceeding the 70% threshold, which supports the characterisation of sustainability performance as generally modest rather than advanced. Results highlighted modest overall performance across regions (Figure 1). North-East firms ($n=112$) recorded the lowest average score (38.3%), with only one firm above 70%. The North-West firms ($n=125$) performed slightly better (41.4%), with a few exceeding 80. Firms in Central Italy ($n=140$) averaged 38.8%, showing high heterogeneity, while those in the South and Islands ($n=87$) reached 42.8%, the highest regional average. Overall, scores remained low, confirming that Italian wine SMEs face significant challenges in achieving solid ESG performance, as prior studies pointed out (e.g. Merli *et al.*, 2018).

The following Figure 2 summarises the main results obtained by applying the ESG4AGRI scoring method.

The findings aligned with prior findings (e.g. Bertorelli *et al.*, 2023), showing large variability in sustainability performance across Italian macro-regions, independently of firm size.

Figure 1 ESG4AGRI score results distribution by Italian macro-regions



Regarding the social dimension, initiatives promoting sustainable consumption remain weak and largely independent of both size and geographic area, suggesting that such practices are disconnected from business strategies. This is consistent with Broccardo *et al.* (2024), who observed that Italian wine SMEs often prioritise environmental certifications over social engagement. Conversely, the analysis found that training hours per employee is a more established practice, with a prevalence of “good performers”, particularly among firms in Central and Southern Italy. The North-East lags behind, possibly reflecting lower regional policy support or limited access to vocational programmes. Training, therefore, emerges as a key driver for human capital development and a prerequisite for embedding a sustainability culture within SMEs (Vitale *et al.*, 2025).

Gender-related indicators present mixed evidence. Female participation in governance roles is slightly higher among small firms than among medium-sized ones, suggesting that firm size may influence inclusiveness at decision-making levels. Female employment approaches parity, especially among small firms, suggesting more progress in workforce equality than in managerial structures – a trend consistent with earlier research on gender gaps in agri-food SMEs (Ceccacci *et al.*, 2024).

Figure 2 Main results of the study

Metrics	Natio nal avg. Score (%)	Firms' score compared to national avg.	Centre			North-east			North-west			South+Isles		
			Mi cro	Sm all	Medi um	Mi cro	Sm all	Medi um	Mi cro	Sm all	Medi um	Mi cro	Sm all	Medi um
Number of initiatives promoted for sustainable consumption	14.44	n° of good performers ^a	11	12	10	13	5	9	8	12	9	6	12	9
		n° of bad performers ^b	36	44	27	34	33	18	35	41	20	16	27	17
Percentage women in governance	39.14	n° of good performers ^a	22	30	14	24	17	14	19	32	17	11	25	11
		n° of bad performers ^b	25	26	23	23	21	13	24	21	12	11	14	15
Total training hours for the employees/Total number of employees	42.93	n° of good performers ^a	38	39	18	41	22	10	37	27	14	19	24	14
		n° of bad performers ^b	9	17	19	6	16	17	6	26	15	3	15	12
Percentage expenditure on local suppliers	49.56	n° of good performers ^a	25	32	14	28	23	14	19	27	14	13	22	16
		n° of bad performers ^b	22	24	23	19	15	13	24	26	15	9	17	10
Percentage of woman employees	53.50	n° of good performers ^a	22	29	26	25	20	15	17	27	21	9	21	12
		n° of bad performers ^b	25	27	11	22	18	12	26	26	8	13	18	14
Percentage employees out of total workers	80.01	n° of good performers ^a	30	27	17	18	21	18	30	28	22	12	22	17
		n° of bad performers ^b	17	29	20	29	17	9	13	25	7	10	17	9
Energy consumption/Revenue s	54.91	n° of good performers ^a	3	5	11	4	5	7	2	7	6	18	28	22
		n° of bad performers ^b	44	51	26	43	33	20	41	46	23	4	11	4
Scope 1 GHG emissions/Revenues	71.30	n° of good performers ^a	0	0	2	0	1	3	40	53	29	20	37	26
		n° of bad performers ^b	47	56	35	47	37	24	3	0	0	2	2	0
Water consumption/Revenue s	53.46	n° of good performers ^a	43	47	31	3	2	4	0	6	5	1	6	6
		n° of bad performers ^b	4	9	6	44	36	23	43	47	24	21	33	20
a: n° of firms presenting score > national avg. score for each metric → good performers;														
b: n° of firms presenting score ≤ national avg. score for each metric → bad performers.														

Source: Authors’ own work

Turning to local-procurement practices, the share of expenditure on local suppliers is markedly higher in southern regions, independent of firm size. This confirms the stronger territorial embeddedness and community orientation of Southern SMEs, in line with findings by [Broccardo et al. \(2023\)](#) on relational capital and territorial cohesion in family-owned wineries. In contrast, higher variability in the North-West suggests more heterogeneous procurement strategies, possibly due to stronger integration in national or export markets.

Environmental indicators reveal the widest divergences across regions. Energy intensity is lowest among Southern firms, indicating greater efficiency or more attention to energy management. GHG emissions (Scope 1) are comparatively lower in the South and North-West, whereas water intensity shows the opposite pattern: Central Italy performs best, while the South records the poorest performance, reflecting regional differences in water scarcity and management systems. These findings confirm the environmental asymmetries documented by [Kariyapperuma and Collins \(2021\)](#) and highlight the need for location-specific sustainability strategies.

These findings are consistent with the literature on sustainability performance measurement systems in SMEs, which highlights the persistent gap between sustainability awareness and the effective integration of ESG dimensions into structured management and control systems, particularly under conditions of limited data availability and managerial resources ([Engida et al., 2018](#); [Vitale et al., 2025](#)). In

the agricultural context, this gap often translates into fragmented and reactive sustainability practices rather than fully embedded IPMS, as documented in prior studies on agri-food and wine SMEs (De Steur *et al.*, 2020; Merli *et al.*, 2018). In summary, while Italian wine SMEs display encouraging results in local economic integration, gender balance and training, they remain limited in social engagement and environmental monitoring. Regional disparities persist: southern firms tend to perform better in energy consumption and local procurement, while northern ones lag in social and environmental performance. These results support prior claims (e.g. Ceccacci *et al.*, 2024; Bertorelli *et al.*, 2023) that sustainability performance in agricultural SMEs remains fragmented and primarily reactive, rather than embedded in strategic management systems.

6. Conclusions

Measuring sustainability performance has become essential for companies of all sizes, driven by increasing stakeholder expectations and regulatory pressure. Yet most standards and tools remain too complex for SMEs, particularly in agriculture, where limited resources and data constraints hinder adoption.

From a theoretical perspective, this study adapts the 4PF of Sachs (2021) to the specific needs of agricultural SMEs. Based on field analysis, we identified the most material topics and translated them into nine metrics, integrated within the ESG4AGRI scoring methodology. The strength of the ESG4AGRI scoring system lies in its simplicity: it requires minimal data, provides clear guidance and still ensures coverage of all major sustainability dimensions (Ceccacci *et al.*, 2024). Designed as a digital tool, it combines comprehensiveness with accessibility, supporting SMEs in structuring and monitoring their sustainability journey.

This revised framework preserves the multidimensional logic of the 4PF while tailoring it to the needs of agricultural SMEs and ensuring usability under limited data availability. By integrating materiality insights, internationally recognised standards and sector-specific regulations, it provides a balanced and operational basis for measuring performance across ESG dimensions. Building on this foundation, our analysis develops a scoring methodology that operationalises these metrics, enabling the systematic assessment and benchmarking of sustainability performance among agricultural SMEs.

Furthermore, this study responds to prior calls for evidence on sustainable business practices implemented in a specific sector (Ortiz-Martínez and Marín-Hernández, 2022) and locally (Rossi and Luque-Vílchez, 2021), offering insights regarding the complex nature of sustainability, which is influenced by both the characteristics of SMEs and the industry in which they operate. Our work not only proposes an original and innovative methodology but also reinforces prior evidence that agricultural SMEs show limited ability to measure and collect sustainability data (De Steur *et al.*, 2020). These findings point to significant room for improvement and the need for sector-specific, user-friendly tools to guide progress.

As for practical implications, the ESG4AGRI scoring can serve firms as a decision-making tool that raises awareness, identifies priorities and supports the strategic integration of sustainability. For stakeholders such as banks and investors, it provides transparent and comparable indicators that reduce information asymmetries and reward sustainable practices, aligning with the demand for synthetic, decision-oriented non-financial metrics. From a managerial perspective, ESG4AGRI can be incorporated by agricultural SMEs as a lightweight planning and decision-support tool. By periodically calculating the score, firms can identify priority areas for improvement, integrate ESG considerations into internal planning and risk assessment processes,

and monitor progress over time using a small set of standardised indicators. Moreover, the ESG4AGRI scores can support interactions with financial institutions by providing transparent and comparable ESG information, facilitating access to sustainability-linked finance, public incentives or green credit instruments. With respect to generalizability, the ESG4AGRI framework can be adapted to other agricultural sub-sectors under conditions of sector-specific materiality assessment and metric recalibration. While the underlying structure and scoring logic remain applicable, the selection and normalisation of indicators should reflect the production characteristics, environmental pressures and regulatory context of each sub-sector.

Furthermore, ESG4AGRI can strengthen firms' relationships with financial institutions by offering transparent and comparable ESG indicators. This transparency reduces information asymmetries and facilitates access to green loans, public incentives and sustainability-linked finance, particularly relevant for SMEs that often face barriers in demonstrating their non-financial performance.

Some limitations remain. The nine metrics, while usable, do not capture the full complexity of sustainability. Although the empirical application focuses on the wine sector, ESG4AGRI is conceived as a flexible, agriculture-oriented CSE framework. The wine industry is used as a pilot case due to data availability and sector relevance; however, the underlying structure, indicator logic, and scoring methodology can be adapted to other agricultural sub-sectors by adjusting context-specific metrics and benchmarks. Future research should refine and expand the scoring system, enhance benchmarking robustness and test its applicability across agricultural sub-sectors beyond viticulture. Despite these limitations, our findings highlight the potential of simple, scalable tools to bridge the gap between sustainability ambitions and operational realities, fostering more inclusive and actionable sustainability assessments.

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