

# ASSESSING MEASURABLE FINANCIAL AND SUSTAINABILITY DATA FOR AGRICULTURAL COMPETITIVENESS

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This paper investigates the availability and applicability of measurable financial and sustainability data critical for assessing the new competitiveness of agricultural entrepreneurs in Hungary and in Poland. The context is part of a larger research, focusing on a rapidly changing global landscape. This study introduces an analysis on the financial differences in 10 years from the 2004–2024 period. It includes recommendations on sustainability indicators such as the Sustainable Return on Equity (SROE), the Sustainable Profitability (%) and the Environmental, Social, and Governance (ESG) index. The larger research employs a mixed-method approach utilizing various robust databases to ensure comprehensive analysis and validity. Through careful examination of how various elements, the study clarifies the basics for financial and sustainability. Furthermore, the findings present a framework designed to facilitate enhanced performance and resilience against economic fluctuations and environmental challenges, ultimately fostering an innovative agricultural landscape that effectively meets modern consumer demands and regulatory standards. This paper is useful to the efforts in all EU Member States, while highlights the necessity for the sustainability indicators besides the financial metrics.

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## 1 Introduction

The agricultural sector is at a critical crossroads in the EU, facing multiple, interlinked challenges globally that threaten its future viability. Climate change manifests not only in altered weather patterns but also in extreme weather events that disrupt agricultural production, increasing the risk for farmers and agricultural enterprises (Fischer et al., 2020). Simultaneously, global population growth intensifies the demand for food, necessitating a transition towards more efficient and sustainable farming practices. Market demands evolve rapidly, with both consumers and regulatory bodies insisting on higher standards regarding environmental sustainability and ethical production.

Since Hungary and Poland joined to the EU, the Common Agricultural Policy (CAP) helped their agricultural sector. The success of this complex support system needs to be revised time by time. The first 20 years period in the EU gives a visible milestone for us to research. Also, we need to see that the significance of measuring financial performance in conjunction with sustainability metrics have become apparent. The Farm Accountancy Data Network (FADN) in the EU performs data collection for decades, but has not collected regularly sustainability related data up till now. This means a serious gap in the available data and need to address retrospectively with research. This is one of the goals of the authors. As of 2025, the Farm Sustainability Data Network (FSDN) is set to replace the FADN (European Commission, 2024). This study aims to analyze the dual dimensions of agricultural performance by measurable financial health alongside sustainability efforts. Covering 10 years from the 2004 to 2024 period, we provide an overview on a larger, comprehensive work, addressing gaps in current literature. Through this approach, the paper attempts to equip readers with the necessary tools to improve their understanding in a rapidly changing market that requires economic and ecological improvements.

## 2 Theoretical Background

Historically, agricultural enterprises had often been driven by a desire for short-term profits, ignoring the long-term implications of unsustainable practices on environmental and social frameworks (Hawkes et al., 2021). Recently, however, a paradigm shift is occurring. Stakeholders, including consumers, investors, and

policy makers, increasingly recognize that integrating sustainability with financial performance is essential for the industry's future (Barbier, 2019). The Environmental, Social and Governance (ESG) framework has emerged as an essential tool in aligning these interests, enabling systematic assessment and enhancement of sustainability practices across the sector (Eccles et al., 2021). Indicators such as Sustainable Return on Equity (SROE) and Sustainable Profitability increasingly serve as benchmarks for evaluating the performance of agricultural business associations or partnerships not only on financial grounds but also concerning their social impact and environmental stewardship (Lehmann et al., 2021).

Recent research highlights the importance of technological advancements in achieving goals that are integrating both financial and sustainability terms. The adoption of Artificial Intelligence (AI) and Machine Learning (ML) facilitates precise data-driven decision-making, optimally balancing financial performance and sustainability (Zhang et al., 2023). For instance, precision agriculture—using IoT devices and satellite imagery—enables farmers to optimize resource usage, leading to reduced waste and enhanced crop yields. In the EU, initiatives such as the EU Farm to Fork Strategy advocate for the adoption of green technologies, providing practical frameworks for integrating sustainability into agricultural practices, as evidenced in various member states.

We can see significant actions under the CAP Strategic Plans and discussions on Member States level about the implementation of agri-environmental and sustainability measures. This demonstrates how such practices can simultaneously improve environmental sustainability and agricultural efficiency (Kádár et al., 2021).

### **3 Methodology**

This study employs a mixed-methods approach, strategically blending quantitative and qualitative methodologies to achieve a comprehensive outcome. The analysis was based on EUROSTAT, the European FADN and the Crefoport, focusing on financial performance indicators. Data also arrive from publicly accessible financial statements and EU reports, ensuring a broad representation across different agricultural sectors.

In parallel, qualitative insights was gathered through interviews with agricultural researchers from the Hungarian Institute of Agricultural Economics and practitioners. The aim was to explore their perceptions regarding the challenges and opportunities associated with implementing sustainable practices in their enterprises. This qualitative phase prepares nuanced understanding of the contextual factors influencing the integration of sustainability within the financial framework. These results are used as guiding lines, and will be presented in a later stage.

The data analysis encompassed statistical evaluations. The thematic analysis employed to interpret qualitative data, pinpointing concerns expressed by practitioners regarding the availability of data on sustainability. This mixed-methods approach yields insights that bridge the gap between theoretical frameworks and practical applications in the agricultural sector.

## 4 Results

In this study, we utilized comprehensive databases, including Crefoport, Eurostat, and the FADN, to assess the agricultural sectors of Hungary and Poland.

Our findings indicate that the agricultural industry in the EU27 has generated significant improvements, such as in the Gross Value Added (GVA). Notably, the financial results of the agricultural sector in both Hungary and Poland have increased since their accession to the EU.

**Table 1: Production value at basic price, GVA at basic (million euro).**

	2005	2013	2023
Hungary	1 800,38	2 895,57	3 768,01
Poland	5 159,23	9 385,50	12 673,06
EU27	126 396,44	162 921,89	218 006,71

Source: Eurostat

However, significant differences exist in the various financial measures between the two countries, in which Poland performs better. It is crucial to note that the data utilized are usually aggregated, which may bias the results by not accounting for variations in operational structures and income levels across different types of farms.

The analysis also examined the level of engagement with sustainable initiatives, which proved more challenging to compare. Unfortunately, the FADN does not currently provide historical data, prompting us to supplement our analysis with financial reports from selected companies based on their geographical location.

In Hungary, the focus was on business associations and partnerships, whereas in Poland, data were compiled from a broader spectrum of company types, including individual entrepreneurs.

Our findings reveal that agricultural business associations or partnerships started to actively incorporate ESG metrics into their strategies. This demonstrates significantly higher SROE and overall profitability. Specifically, associations that successfully leveraged EU funding for sustainable initiatives—such as renewable energy adoption and organic farming practices—reported an average profitability increase of 15% over the past decade (European Commission, 2022). The EU's CAP plays a pivotal role in incentivizing sustainable practices, resulting in observable financial gains for those participating in these initiatives.

Furthermore, the integration of AI and Machine Learning (ML) technologies is revolutionizing farming practices globally. These advancements enhance irrigation schedules and fertilization techniques using real-time data, contributing to a 20-25% increase in efficiency, a 15-20% boost in yields, and a 25-30% reduction in operational costs due to more intelligent investment strategies and decreased reliance on manual interventions (Padhiary et al., 2024). The use of predictive analytics and IoT sensors has effectively mitigated the overuse of water and fertilizers, resulting in substantial cost savings. Additionally, drone technology for crop monitoring has enabled farmers to reduce pesticide utilization by 30%, illustrating how technological advancements can enhance productivity while protecting environmental resources (Wolfert et al., 2017).

During data analysis, both financial and sustainability dimensions were considered. This means quantitative evaluation of financial performance and qualitative sustainability impacts, such as reductions in carbon footprint and improvements in biodiversity.

The results of our dual measurement approach can be effectively applied not only in Hungary and Poland but across all EU Member States as well. To further enhance the integration of Environmental, Social, and Governance (ESG) metrics into agricultural performance, we make the following recommendations:

- A comprehensive reporting framework that extend beyond basic ESG metrics should be developed. The FSDN will facilitate more consistent and relevant data reporting.
- Encouraging partnerships between research institutions and agricultural entrepreneurs is essential for collecting data on equitable terms. Also, additional ESG-linked loan products should be developed that offer favorable terms to businesses adopting sustainable practices.
- To verify the benefits of ESG initiatives, further empirical research is necessary to quantify the impacts of these initiatives on both financial metrics and agricultural output.

By implementing these strategies, agricultural sectors across the EU can enhance their sustainability practices, drive innovation, and improve overall performance in alignment with broader EU sustainability targets.

## 5 Discussion

Integrating sustainability metrics with financial data yields numerous benefits for consumers, companies, and society at large. For consumers, it fosters transparency and allows for informed purchasing decisions, leading to ethical consumerism. Companies benefit by enhancing their reputation, attracting sustainability-focused investments, and reducing operational costs through improved efficiencies. Societally, integrating these metrics promotes responsible stewardship of natural resources and aids in tackling climate change, ultimately leading to healthier communities.

The results underscore the importance of integrating sustainability metrics with financial data as a means to cultivate a competitive edge in the agricultural sector. The interplay between technological advancements and sustainable practices emerges as a critical factor enhancing this competitiveness. Agricultural

entrepreneurs adopting a comprehensive framework, including both financial and sustainability benchmarks, are positioned to navigate market fluctuations and increasingly stringent regulatory requirements effectively.

Future research should explore the impact of specific sustainable technologies on agricultural productivity across different climates and regions. Additionally, examining consumer behavior towards sustainable agricultural products can provide insights into market dynamics. Questions related to the data availability is always the core to understand trends. The structure of data collection and the willingness from the stakeholders to share stays a major question. Data protection, dissemination of best practices and keeping technological secrets are key. Investigating the role of government policies in incentivizing sustainability within agriculture can also yield valuable information for stakeholders.

## **6 Conclusions**

This study affirms that integrating measurable financial and sustainability data is essential for assessing the competitiveness of agricultural entrepreneurs in Hungary and in Poland. The shift from FADN to FSDN bears opportunities, though it also means sustainability approach, such as the ESG indicator was not collected in a public form. The effectiveness of the data collection has a barrier, though the Member State level research institutions establishing systems. The common approach should be a multi/mixed and the identification of best practices should be supported in EU level, for example by the EIP- and the CAP Network. By employing a mixed-methods approach, the research not only quantifies the financial impacts of sustainability initiatives but also highlights the important role of technology, particularly AI, in fostering competitiveness.

Various stakeholders play essential roles in ensuring positive outcomes. EU Institutions can enhance effectiveness by providing comprehensive guidelines and funding opportunities that promote sustainable practices. Countries can implement supportive policies that prioritize technological investments and sustainability education among farmers. Research institutions and the scientific community should prioritize research on innovative sustainable practices and technologies, providing knowledge and resources that can assist farmers in making informed decisions.

Future research should explore the longitudinal impacts of these metrics beyond the 2024 timeframe, encapsulating the evolving dynamics of the agricultural landscape. The shift from FADN to FSDN is welcomed. For Eurostat, it would be beneficial to collect data on sustainability metrics too, linked to specific agricultural practices, the environmental impact of production methods, and consumer purchasing behaviors regarding sustainable agricultural products. This data would not only facilitate a comprehensive understanding of agricultural sustainability in the EU but also inform policymakers in structuring incentives effectively.

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