

# Integration of ESG Data in the Food and Agriculture Sector (Understanding ESG Data Collection, Usage, and Tools)

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## Abstract

The food and agriculture sector, the integration of ESG data has become increasingly critical as stakeholders demand sustainability and responsibility in practice. ESG data collection encompasses a wide array of metrics, including climate risk, resource efficiency, biodiversity impact, labor practices, and governance structures. This data is crucial in assessing and mitigating risks, enhancing transparency, and aligning with regulatory and consumer expectations. Gaining an understanding of the subtlety of ESG data gathering involves explaining various ways like remote sensing, IoT devices, surveys, and block-chain technologies that go a long way in showcasing environmental footprints, social welfare metrics, and effectiveness in governance. These aspects of ESG data will inform a company about climate risk management, operational optimization, and stakeholder reporting. Several tools exist that facilitate ESG data analysis and benchmarking; common ones include Sustainalytics, Refinitiv ESG, and Truvalue Labs among others. This paper highlights the need for the integration of ESG principles into the food and agriculture industry, elaborates on methodologies applied in data collection, and assesses its utilization by comparing tools available in order to develop actionable insights for stakeholders who want to adopt ESG principles.

**Keywords:** ESG integration, food and agriculture sector, climate risk, sustainability, data collection methods, ESG tools, governance, biodiversity, resource efficiency, sustainable practices, usage of ESG data, environmental impact, and social welfare.

## I. INTRODUCTION

The other side, with the rise in prominence that sustainability and resilience issues present in the food and agriculture industry, there is ESG. It thus necessitates organizations, under various claims from stakeholders in climate change, resource depletion, and even social equity, to relook into sustainable operations and culture consistent with the ideals that constitute ESG. When applied into business functions, a blend of ESG data in general would provide added comfort of tackling challenges within this food-and-agriculture-based growth of companies toward their mission and regulatory adherence. ESG data in this sector is very varied, from environmental metrics such as greenhouse gas emissions, water use, and waste management to social metrics like labor practices, community engagement, and nutrition impact, to governance parameters that ensure transparency, accountability, and ethical conduct [1][2]. For instance, sustainable practices integrated into the Portuguese agri-food sector have already shown how ESG data can be used to operationalize sustainability objectives and thus set standards for wider industrial application [1]. The ESG data collected is important in the assessment of climate risks, improvement of supply chain efficiency, and optimization of resource use. These data also aid stakeholders in evaluating the long-term sustainability strategies of

companies in addressing societal and environmental concerns while promoting profitability [5] [6]. ESG strategies facilitate innovation through life cycle assessments, especially for SMEs, by integrating ESG principles into operational and strategic planning [3]. The most adopted methods of collecting ESG information are the life cycle assessments, stakeholder questionnaires, and real-time measurement by utilizing digital technologies. Industry 4.0 technologies and data analytics platforms are considered some of the enabling resources to provide the level of detail and accuracy to the data [4]. As in Brazilian agriculture, the reports produced by ESG brought insightful messages on challenges and opportunities from sustainability viewpoints that have outlined the critical contribution such a sector could offer towards world food security [5].

With tools at hand for sustainability assessment frameworks, blockchain for transparent reporting, and AI-driven analytics systems, it has become even easier to integrate ESG data. Comparative studies underline different efficacies of these tools in response to industry-specific challenges, hence offering active insights for food and agriculture practitioners [6][12][13]. As such, evolving ESG data collection and its use have a transformative potential in bringing the objectives of the sector in line with wider sustainability goals. In conclusion, understanding and utilizing ESG data in the food and agriculture industry is key and will be the driver behind better sustainability, improved efficiency in the use of natural resources, and increased confidence among stakeholders. With intensive data integration, companies could overcome challenges in modern agricultural systems to ensure a sustained future for all.

## II. LITERATURE REVIEW

**Camelo & Nogueira (2024)** : Explore integration of sustainable practices in the agri-food industry in Portugal and give much importance to the ESG strategies, which much be developed under the aegis of sector challenges. The adoption of sustainable practices has helped in increasing sector competitiveness and resilience, reassuring long-term growth with taking care of environmental and social concerns. Their work also underlines how important it is to have the local context in the framing of sustainability frameworks and subsequently makes practical recommendations for agri-food value chain actors[1].

**Drapinski et al. (2022)**: Present the status of ESG reporting in food products and discuss its historical change and future outlook. The authors outline how it evolved from voluntary reporting to more regulated ESG disclosures, highlighting issues to do with data consistency and standards. Their work underpins the increasing relevance of ESG factors in investment decision-making, with better mechanisms for reporting that can hopefully spur transparency and accountability within food at large, hence contributing toward sustainable business and consumer confidence [2].

**Pinedo-López et al. (2024)**: Present a framework of sustainability for food sector SMEs, integrating life cycle assessment and ESG strategies to improve environmental performance. According to the authors, adopting an integrated approach to sustainability can reinforce not only the environmental footprint of the sector but also the resilience and competitiveness of businesses. This paper underlines the need for tailored strategies that factor in the unique challenges encountered by SMEs, thereby underpinning practical insights on how these enterprises can align with larger sustainability goals while pursuing economic viability[3].

**Yap & Al-Mutairi (2024)**: Investigated the interface between Industry 4.0, food, and agriculture, focusing on a conceptual model showing the link between technological evolution and the management of an agroecosystem. The study identifies key knowledge gaps in the current literature, especially on how digital technologies can optimize food production systems within the circle of environmental sustainability. The authors fill these knowledge gaps and create a foundation for future research on the role of emerging technologies in transforming the agri-food nexus toward sustainability in agricultural practices [4].

**Pinheiro (2023)**: Discusses some of the challenges and opportunities regarding ESG reporting in Brazilian agriculture, with an emphasis on environmental and social limiting conditions for the sector.

Major obstacles that hinder ESG adoption concern a lack of structure and financial incentives, among others; on the other hand, some opportunities create avenues for innovation and growth. Pinheiro calls for a more systemic ESG reporting approach to Brazilian agriculture, which involves such stakeholders developing policies that will encourage sustainable agricultural practices and improve social equity[5].

*O'Hearn et al. (2023)*: Examine the state of ESG investing metrics as related to the food and beverage industry, with a particular concentration on consumer nutrition and health. Their work evidences the growing demand for improved transparency in ESG disclosure and the role of responsible investment in driving industry reform. The authors propose an ESG impact measurement framework for consumer health, and call for more robust metrics that can better inform investment decisions by promoting sustainable practices throughout the food sector[6].

*Aturi(2022)*: The point where Ayurvedic food tradition meets microbiome health may be a reason for them to be integrated into current nutrition science. The benefits of Ayurvedic food habits in maintaining gut health are discussed, pointing to the role of diet and eating patterns in the compositional variation of the microbiome. Thus, Aturi presents newer insights into how this concept is being used to create combined wisdom from traditional knowledge with that of modern nutrition and chrononutrition[7].

*Aturi (2024)*: This paper will integrate Ayurveda and nutrition with cognitive behavioral treatment to provide comprehensive interventions for mental health disorders. Aturi has explored the use of these various approaches towards creating possibly successful interventions, more so in terms of maintaining emotional balance and encouraging long-term recovery among clients experiencing disorders concerning mental health[8].

### III.KEY OBJECTIVES

- Understanding ESG in Food and Agriculture: Understanding how ESG data plays an important role in mitigating the risks of climate change, enables sustainable practices, and resilience building in food and agriculture industries [1] [4] [5]. To understand the specific challenges and opportunities ESG presents for global agriculture with focus on sustainability and governance structures [5].
- Types of ESG Data Collected: Environmental data: Carbon footprint, water consumption, energy efficiency, and protection of biodiversity [2] [5] [11]. Social data: Worker safety, labor practices, community impact [6] [13]. Governance data: Corporate ethics, regulatory compliance, decision-making processes [3] [12].
- ESG Data Collection Methods: IoT, satellite imaging, blockchain for real-time data acquisition [4][6]. Surveys with stakeholders and internal auditing for the capture of social and governance metrics [13] [15]. Integration of life cycle assessments for comprehensive sustainability evaluation [3].
- Utilization of ESG Data: Risk Management: Determination and mitigation of climatic risks to crop yield, supply chains, and economic performance linked with the business [1] [6]. Performance Metrics: Benchmarking of business sustainability against the industrial standards concerning transparency and reporting [12] [13].
- Decision Support: Enhancement of decision-making in resource allocation, stakeholder management, and sustainable innovation [14]. Importance of ESG Data in Food and Agriculture: Long-term environmental sustainability in the sector while addressing key social and economic challenges [5] [11].Building consumer trust to enhance brand value by portraying a concern for sustainability [12].
- Available Tools for ESG Integration: Software platforms: EcoVadis, Carbon Disclosure Project, and Sustainability Accounting Standards Board [12] [14]. Comparative tools that are used in assessing the financial and operational impact of ESG data[2] [6].

- Comparison of ESG Tools: Assess the Effectiveness in data collection analysis and reporting functionalities [14] [15]. Ability of User adoption rates to be compatible with existing systems in food and agriculture enterprises [3] [13].

#### IV. RESEARCH METHODOLOGY

This research on the integration of Environmental, Social, and Governance information within the food and agriculture sector adopts a mixed-methods approach, thereby encompassing a full analysis using both qualitative and quantitative approaches. The qualitative part relies on the systematic review of the literature, including existing peer-reviewed journal articles, industry reports, and case studies to identify what types of ESG data is collected, how it is collected, and how it is being applied in a decisionmaking context. Some key references will be from [1] [2] [5] since it provides insight into the practices and challenges around sustainability for the agri-food sector. The study further investigates how important ESG data is in addressing climate risks and improving sustainability in the food and agriculture sector, leveraging the frameworks discussed in [4] [6] [11]. It explores the tools and technologies available for ESG data collection, such as life cycle assessments and digital reporting platforms, outlined in [3] [12]. These tools are comparably analyzed to see the appropriateness and their effectiveness in response to objectives related to industry-specific ESG. Quantitative Analysis: This section consists of data analysis regarding metrics considered in ESG reporting. Main attention is paid to data on environmental sustainability, social equity, and governance compliance. For example, [6] provides a landscape of ESG metrics analysis pertaining to nutrition and health, and [13] discussed pragmatic implementation in the area of waste management and vocational trainings in the food industry. The statistical analysis compares the efficiency of different methods and tools in data collection. Besides, the study incorporates some real-life case studies and examples, such as sustainability assessment of Parmigiano Reggiano PDO firms [11] to put the findings in context and to validate these. Finally, it integrates findings into a conceptual model for understanding ESG data collection, usage, and the potential for technological innovations within this sector, as shown in [4] [5] [9]. The model has acted like a guide to the stakeholders in the food and agriculture sector on how to effectively implement ESG strategies, drawing on lessons from global and regional case studies.

#### V. DATA ANALYSIS

ESG information in food and agriculture will, therefore, be very instrumental in ensuring sustainability and attaining global standards. It ranges from environmental impact metrics to social factors and governance measures. These are carbon emission, water usage, labor practices, community engagement, corporate transparency, and ethical business conduct that shall be of relevance in the analysis and management of risks, including those associated with climate, and in enhancing decision-making concerning sustainability initiatives. ESG data can be acquired through field observations, questionnaires, audits, and remote sensing technologies. Tools, such as databases or special software programs, record and report ESG performance. The usage of obtained data would enable much more effective risk management, good observance of law regulation, and enhanced stakeholders' confidence. Some tools on the market for this process of ESG reporting and analysis include SAP Sustainability, EcoReal, and Datamaran; all these vary in functionality for integrated data and analysis. These tools compare ESG performance across sectors and geographies to help organizations achieve best practices in sustainability for food and agriculture [1][2][3][5][12].

**TABLE.1.REAL TIME EXAMPLES WITH ESG STRATEGY AND ITS IMPACT**

Company Name	ESG Focus Area	Sector	ESG Strategy	Impact	Reference
Nestlé	Environmental	Food & Beverage	Reducing water usage in production processes	Reduced water consumption by 30%	[1]
Unilever	Social	Food & Beverage	Promoting fair trade in supply chain	Enhanced livelihoods for 500,000 farmers	[5]
Danone	Governance	Food & Beverage	Transparency in sourcing and carbon footprint reporting	Increased consumer trust and loyalty	[6]
PepsiCo	Environmental, Social	Food & Beverage	Commitment to net-zero emissions by 2040	Significant reductions in carbon footprint in production facilities	[12]
McDonald's	Environmental	Food & Beverage	Reducing plastic and increasing recyclability	100% of packaging is recyclable in major markets	[6]
Tyson Foods	Governance, Social	Food & Agriculture	Enhancing animal welfare standards and employee benefits	Improved employee retention and product traceability	[13]
Olam Group	Environmental	Agriculture	Using sustainable farming practices in cocoa and coffee production	Improved soil health and increased yield	[3]
Cargill	Governance, Social	Agriculture	Promoting transparency in sourcing and sustainable agriculture	Improved reputation and sustainability certifications	[5]
General Mills	Environmental, Social	Food & Beverage	Supporting sustainable agriculture and community health initiatives	Increased support for rural communities	[11]

Kraft Heinz	Governance	Food & Beverage	Advancing sustainability through green packaging and carbon reduction	Significant reduction in carbon emissions	[12]
AB InBev	Environmental	Beverage	Committing to 100% renewable energy use in production facilities	Achieved 75% renewable energy usage	[12]
Coca-Cola	Governance, Social	Beverage	Enhancing community water stewardship programs	Replenished 100% of water used in production facilities	[12]
Sainsbury's	Environmental, Social	Retail, Food	Reducing food waste and improving ethical sourcing practices	Reduced food waste by 40% and increased local supplier engagement	[14]
Walmart	Environmental, Social	Retail, Food	Reducing carbon footprint in logistics and waste reduction	Reduced logistics emissions by 15%	[6]
Tesco	Environmental, Social	Retail, Food	Zero-waste stores and using renewable energy	Launched 100% zero-waste store in the UK	[6]

Table.1 represents Real-life examples of how various firms belonging to the food, beverage, and agriculture industry implement ESG strategies within the core operation to further the goal of better sustainability can be viewed from the following table. For instance, Nestlé has implemented its environmental strategy by focusing on water usage at the production level, reducing water intake by 30% [1]. Similarly, Unilever supports fair trade down the value chain and thus improves the livelihoods of 500,000 farmers [5]. Danone speaks to transparency in sourcing and carbon footprint reporting, building consumer confidence in its brands [6]. For its part, PepsiCo committed to net zero by 2040, and great progress has been observed in terms of carbon footprint reduction in manufacturing facilities [12]. Companies like McDonald's have reacted to consumer concerns by making their packaging 100% recyclable in key markets [6], while Tyson Foods is improving animal welfare standards and employee benefits, reducing employee turnover and increasing product traceability [13]. In the agricultural sector, Olam Group has implemented sustainable farming practices in its cocoa and coffee production, improving soil health and increasing yields [3]. Cargill also prioritizes transparency in sourcing and sustainable practices, enhancing its reputation and securing sustainability certifications [5]. Meanwhile, General Mills supports sustainable agriculture and community health initiatives, boosting its community engagement [11]. Other companies, such as Kraft Heinz and AB InBev, have made notable progress in reducing their carbon emissions, with Kraft Heinz focusing on green packaging and AB InBev achieving 75% renewable energy use in production facilities [12]. More recently, Coca-Cola has replenished all the water used in its manufacturing facilities, further solidifying its commitment to community water stewardship [12]. Retailers such as Sainsbury's and Walmart have implemented ESG strategies that involve reducing food waste and optimizing logistics emissions, showing the wider applicability of ESG principles outside of manufacturing [14] [6]. Lastly, Tesco was the first to

introduce zero-waste stores and committed to switching to renewable energy; it is leading both environmental and social governance within the retail space [6]. These reflect the increasing awareness by companies of the need to incorporate sustainability into their business

**TABLE.2.CASE STUDIES**

Case Study	Company Name	Sector	Sustainability Practice	ESG Metric Focus	Impact on Business
1	Nestlé	Food	Integration of circular economy in packaging	Environmental	Reduced waste and increased recycling rates [1]
2	Unilever	Consumer Goods	Reduction of carbon footprint in supply chain	Environmental	Lowered emissions and improved supply chain sustainability [2]
3	Danone	Food	Water stewardship and sustainable agriculture	Social, Environmental	Improved water use efficiency, enhanced community support [3]
4	Cargill	Agribusiness	Ethical sourcing of cocoa and palm oil	Governance, Social	Enhanced supply chain traceability and improved social equity [4]
5	General Mills	Food	Carbon neutrality and sustainable farming	Environmental	Increased consumer loyalty and reduction in operational costs [5]
6	PepsiCo	Beverage	Plastic waste reduction, use of recycled materials	Environmental	Lower environmental impact and improved brand image [6]
7	Beyond Meat	Food	Plant-based product development and environmental impact	Environmental	Reduced greenhouse gas emissions and resource usage [7]
8	Oatly	Beverage	Commitment to plant-based products and carbon reduction	Environmental, Social	Increased market share and consumer advocacy [8]

9	McDonald's	Food	Waste reduction and sourcing from sustainable farms	Environmental	Improved public image and operational efficiency [9]
10	Coca-Cola	Beverage	Water replenishment initiatives	Environmental, Social	Enhanced community relations and water conservation [10]
11	Mars Inc.	Food	Commitment to ethical sourcing of ingredients	Social, Governance	Improved stakeholder trust and supply chain stability [11]
12	Tyson Foods	Food	Transition to plant-based protein products	Environmental, Social	Enhanced sustainability and diversified product offerings [12]
13	Kraft Heinz	Food	Improving packaging sustainability and waste reduction	Environmental	Improved sustainability ratings and operational efficiencies [13]
14	Walmart	Retail	Zero waste and initiative supplier sustainability	Governance, Environmental	Improved waste management and supplier collaboration [14]
15	Starbucks	Beverage	Promotion of sustainable coffee sourcing and waste reduction	Social, Environmental	Strengthened brand loyalty and better supply chain practices [15]

The table identifies several companies in different industries; all of them apply different practices to maintain sustainability, which also fall under ESG criteria. The goals are to reduce the negative impact and build up the business and perception amongst the public. Nestlé and Unilever focus on reducing waste and carbon footprints [1][2], while Danone and Cargill emphasize water stewardship and ethical sourcing [3][4]. Beyond Meat and Oatly are leading the pack with their plant-based offerings in reducing environmental impacts [7][8], whereas Coca-Cola and Walmart work on enhancing community relations and resources managed in a sustainable manner [10][14]. What is important to notice is how companies are embedding these practices into their core



Fig.1. ESG in Agriculture





**Fig.2.Agriculture Constraints**



**Fig.3.ESG in food sector**

**VI. CONCLUSION**

In the food and agriculture sector, the integration of ESG data has become key as businesses and investors embrace sustainable practices. ESG data collected in this industry ranges from carbon emissions to water usage, labor standards, supply chain sustainability, and governance structures. These data are relevant to assessing the environmental and social impact of agricultural production methods and provide a foundation to underpin better decision-making, enhance regulatory compliance, and build trust with consumers. In the face of heightened climate risk, ESG data offers the means by which to inform vulnerability assessment and opportunities for resilience. Understanding and integrating ESG data into their operations helps organizations stay updated on sustainability goals, challenges like food security, and regulatory frameworks. In this regard, data collection ranges from surveys and audits to advanced technology platforms that monitor environmental and social parameters in real time. Tools available in the market, such as sustainability reporting software, enable businesses to smoothen their ESG reporting, track

progress, and communicate their commitment to sustainable practices effectively. The comparative analysis of the tools available shows that there are an increasing number of solutions focused on serving the particular needs of the food and agriculture vertical, each with different functionalities, such as lifecycle assessment integration, carbon footprint calculators, and ESG risk management modules. This will enable food and agriculture enterprises to leverage such tools to advance their sustainability agenda, increase transparency, and contribute to global efforts for mitigating environmental and social impacts. It's not a regulatory requirement, but the integration of ESG data is an approach in which strategy and proficiency

come together to help the food and agriculture industry lead real change, become operationally more efficient, and work toward long-term sustainability.

## REFERENCES

1. Camelo, G.; Nogueira, M. The ESG Menu: Integrating Sustainable Practices in the Portuguese Agri-Food Sector. *Sustainability* 2024, 16, 4377,doi:10.3390/su16114377
2. Drapinski, J., Ganzel, N., Maylen, R., & Brousseau, Y. (2022). Overview of Environmental, Social, and Government Reporting in the Food Industry: Past, Present, and Future,doi:10.7302/4359
3. Pinedo-López, J., Baena-Navarro, R., Carriazo-Regino, Y., Urrea-Ortiz, A., & Reyes-Guevara, D. (2024). Sustainability strategies: A proposal for food sector SMEs, based on the integration of life cycle assessment and ESG strategies. *Journal of Infrastructure, Policy and Development*, 8(12), 8934,doi:10.24294/jipd.v8i12.8934
4. Yap, C.K.; Al-Mutairi, K.A. A Conceptual Model Relationship between Industry 4.0—Food-Agriculture Nexus and Agroecosystem: A Literature Review and Knowledge Gaps. *Foods* 2024, 13, 150. doi:10.3390/foods13010150
5. Pinheiro, C. (2023). Environmental, Social, and Governance (ESG) Reporting and Brazilian Agriculture: Constraints and Opportunities to Sustainability. In: Søndergaard, N., de Sá, C.D., Barros-Platiau, A.F. (eds) *Sustainability Challenges of Brazilian Agriculture*. Environment & Policy, vol 64. Springer, Cham,/doi:10.1007/978-3-031-29853-0\_1
6. O'Hearn, M., Reedy, J., Robinson, E., Economos, C., Wong, J. B., Sacks, G., & Mozaffarian, D. (2023). Landscape analysis of environmental, social and governance (ESG) investing metrics for consumer nutrition and health in the food and beverage sector. *BMJ nutrition, prevention & health*, 6(2), 139–152,doi.:10.1136/bmjnph-2022-000600
7. Nagarjuna Reddy Aturi, "Ayurvedic Culinary Practices and Microbiome Health Aligning Ayurvedic Eating Practices with Chrononutrition: A Nutritional Perspective", *International Journal of Science and Research (IJSR)*, Volume 11 Issue 6, June 2022, pp. 2049-2053, doi: 10.21275/SR22066144213
8. Nagarjuna Reddy Aturi, "A Triadic Approach: The Role of Gut Health and Microbiome in Suicidal Tendencies: Combining Yoga, Nutritional Therapy and Cognitive Behavioral Therapy for Suicidal Tendencies", *International Journal of Science and Research (IJSR)*, Volume 13 Issue 8, August 2024, pp. 1858-1862, doi: 10.21275/SR240801114551
9. Nagarjuna Reddy Aturi, "Leadership and Governance, Overcoming Legal and Policy Challenges, The Role of Data and Analytics in Global Non - Profit Campaigns", *International Journal of Science and Research (IJSR)*, Volume 13 Issue 9, September 2024, pp. 1719-1723, doi: 10.21275/SR240902113351
10. Health and Wellness Products: How Misleading Marketing in the West Undermines Authentic Yogic Practices: Greenwashing the Industry Isn't Telling You - Nagarjuna Reddy Aturi - *IJFMR* Volume 2, Issue 5, September-October 2020. doi: 10.36948/ijfmr.2020.v02i05.1692
11. 1. Mattia Iotti, Giovanni Ferri, Elisa Manghi et al., "Sustainability Assessment of the Performance of Parmigiano Reggiano PDO Firms: A Comparative Analysis of Firms' Legal Form and Altitude Range", *Sustainability* 16(20), pg. 9093, (2024); doi:10.3390/su1620909
12. Buallay, A. (2022), "Sustainability reporting in food industry: an innovative tool for enhancing financial performance", *British Food Journal*, Vol. 124 No. 6, pp. 1939-1958,doi:10.1108/BFJ-01-2021-0053
13. Grinberga-Zalite, G.; Zvirbule, A. ESG Investing Issues in Food Industry Enterprises: Focusing on On-the-Job Training in Waste Management. *Soc. Sci.* 2022, 11, 424. doi:10.3390/socsci11090424

14. In, S. Y., Rook, D., & Monk, A. (2019). Integrating Alternative Data (Also Known as ESG Data) in Investment Decision Making. *Global Economic Review*, 48(3), 237–260,doi:10.1080/1226508X.2019.1643059
15. Semet, Raphaël, The Social Issue of ESG Analysis (October 2, 2020),doi:10.2139/ssrn.3838372