ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2025 Volume 13 Number 1 (September)
http://doi.org/10.9770/p9685553439

Publisher
http://jssidoi.org/esc/home

SUSTAINABILITY AS PART OF STRATEGIC MANAGEMENT IN THE MANUFACTURING INDUSTRY*

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Received 11 May 2025; accepted 6 August 2025; published 30 September 2025

Abstract. The manufacturing industry is a fundamental pillar of the economy in many developed countries. It is also a key sector in the Czech Republic, significantly contributing to macroeconomic aggregates such as gross domestic product, employment, and exports. The current business environment increases the requirements for companies not only in terms of maintaining competitiveness, but also in terms of a responsible approach to production resources and the environment. Company managers who want to keep their company on the market for a long time should always adapt their corporate and production strategies to current trends and challenges. Sustainability goals should be an integral part of corporate strategies today, as well as measuring and monitoring the carbon footprint and systematically reducing it. The article examines approaches to sustainability and ESG in the Czech Republic's manufacturing industry, especially in the context of large companies. The article is based on the results of a nationwide survey. These results show a statistically significant dependence between the size of the company and the sustainability strategy. It is also confirmed that companies that have implemented the environmental management system standard have a sustainability strategy in place. The results contribute to understanding how large companies in the manufacturing industry approach sustainable development and where SMEs lag.

Keywords: carbon footprint; ESG; manufacturing industry; sustainability; strategy

Reference to this paper should be made as follows: Hoke, E., Heinzová, R., Pospíšil, R., Molková, K. 2025. Sustainability as Part of Strategic Management in the Manufacturing Industry. *Entrepreneurship and Sustainability Issues*, 13(1), 426-436. http://doi.org/10.9770/p9685553439

JEL Classifications: M11, M21

1. Introduction

Sustainability and ESG (Environmental, Social, and Governance) are becoming increasingly important for large companies worldwide, including the manufacturing industry. The manufacturing industry in Europe plays a significant role in economic growth and development (Mousa & Bouraoui, 2024). The manufacturing industry is one of the pillars of the Czech economy and contributes significantly to the primary macroeconomic aggregates such as GDP and unemployment. The manufacturing industry includes production activities and operations that transform raw materials and materials into finished products. It plays a key role in resource depletion, the rational use of resources, the circular economy, and sustainability. In general, economic progress should be considered a key factor for success, but today, in addition to it, it is necessary to fulfil social responsibility and comply with environmental regulations through sustainable development (Mayamurugan,

* *This paper is co-financed by FSR 2024 FLCM/003 Increasing the scientific qualification of the staff of the Faculty of Logistics and Crisis Management and GA/FLCM/2025/003 Use of modern methods and tools in logistics process management.*

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2016; Zairi & Peters, 2002). As part of industry transformation in several European countries, Industry 4.0 and Industry 5.0 are merging. These new stages include, in particular, elements of resilience, sustainability, and safety. Recently, the manufacturing sector has had a vital influence on environmental, social, and economic aspects of sustainability, owing to its substantial demands on energy, water, materials, and other resources (Harikannan & Vinodh, 2025). Today, mainly large companies already include a sustainable approach and management in their corporate strategies. This article focuses on examining these connections in the manufacturing industry of the Czech Republic, with particular emphasis on the role of company size and the use of environmental management tools, such as the ISO 14001 standard or carbon footprint measurement. The research aims to identify key factors that facilitate the implementation of sustainable strategies, thereby contributing to a deeper understanding of environmentally responsible management processes in large companies.

2. Theoretical Background

Strategic management and a correctly set strategy are essential for any company's long-term growth and competitiveness. One of the most critical business capabilities determining a firm's ability to develop effectively is the competitive business strategy (Taranenko et al., 2024). Working with the strategy, its updating for individual business areas and processes is essential for achieving the organisation's goals. The timing of the update and its rapid integration into business processes is key, as this is the only way to cover current challenges, trends, and threats in the business environment. Strategic management is still relevant for researchers, as it intersects with various fields of thought, including economics, sociology, political science, etc. (Hou & Li, 2024).

Knott's study (2024) presents research on strategic management that considers the conditions resulting from the expected impacts of climate change. As the economy is advancing by leaps and bounds, the top priority has been given to managing a green-oriented enterprise due to its significance in the lasting ability and sustainability of the organisation (Le et al., 2024). Companies struggle to integrate sustainability into their corporate strategy and implement it into business activities (Beush et al., 2022). Although several articles take or promise a strategic approach to sustainability, few clearly define their understanding of strategy regarding sustainability (Farkas & Matolay, 2024).

Companies should strive to integrate different aspects of sustainability, even if they seem to be in conflict. Sustainability should encompass economic, environmental, and social dimensions, and accepting the tensions between them is crucial (Hahn et al., 2015). Sustainability should be embedded within the company's strategy, with specific, measurable objectives set (Sabauri & Kvatashidze, 2023). Sustainability strategy in industrial manufacturing should include both ways to ensure the company's competitiveness and a socially responsible approach to the environment. However, they may also be conflicting objectives. Adolph and Beckmann (2024) state that the corporate sustainability strategy (CSS) concept suffers from considerable definitional ambiguity. Understanding the role of corporate strategies in sustainability has become a hot topic for scholarly research (Zameer et al., 2024; Koe et al., 2024).

Incorporating ESG factors into corporate strategies enhances overall performance. It contributes to sustainable development while revealing various implementation challenges, such as difficulties in quantifying ESG factors and navigating different ESG criteria and rating systems (Liang et al., 2022). Measuring ESG performance has become a key factor for investment decision-making, especially for publicly traded companies. High ESG scores indicate that companies are economically, socially, and environmentally sustainable, which increases their attractiveness to investors (Tsang et al., 2023).

Large companies in the manufacturing industry can play a key role in sustainability by integrating different dimensions of sustainability, focusing on ESG, and actively engaging stakeholders. These approaches improve their economic performance and contribute to the company's sustainability (Tsang et al., 2023; Sedlák & Veber, 2024). According to Calabrese (2021), companies also embed ESG in their strategies to increase commercial attractiveness to investors. Environmental management systems can be a tool to ensure the sustainability of large companies.

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ISO 14001 is an international standard for environmental management that helps organisations develop and implement policies and objectives concerning legal requirements and significant environmental aspects (Mayamurugan, 2016). This standard has become a widely accepted tool for sustainability management in enterprises, with its implementation becoming necessary for large companies (Pakulska & Rutkowska-Podolowska, 2017). There are different views on implementing ISO 14001, with some seeing it as a process with limited value, while others see its potential as a competitive advantage in the supply chain (Curkovic & Sroufe, 2011). Implementing ISO 14001 positively impacts environmental sustainability, although it may not have the same impact on economic and social sustainability. Organisations that apply Total Quality Management (TQM) and ISO 14001 achieve better sustainability performance (Tasleem, 2018). A study by Zimon et al. (2022) shows that implementing ISO 14000 contributes significantly to improving the environmental performance of companies.

Companies adopting this standard show better identification and quantification of costs and benefits associated with environmental issues, leading to better decision-making processes (Zimon et al., 2022). Environmental management systems, which include ISO 14001, are considered a key tool for achieving sustainability in companies. These systems help companies meet legislative requirements and improve their environmental policy (Basovníková et al., 2016). Implementing ISO 14001 can lead to energy savings and cost reductions, contributing to higher profitability for companies. Studies also suggest that these systems promote efficient use of resources and ensure customer satisfaction (Zoubek et al., 2021; Zimon et al., 2022). Any human production activity and product cycle within the life cycle leaves a carbon footprint. The carbon footprint can also be the leading indicator of the environmental friendliness of production. Monitoring the carbon footprint, i.e., the amount of greenhouse gases that escape into the air, is fundamental in identifying sources of emissions and inefficient activities. The quality of business processes in a low-carbon economy is key to achieving sustainability. This includes strategic management and calculation of the carbon footprint, which can affect the reputation of companies as socially responsible entities (Straková & Kostiuk, 2023). As part of the effort to achieve carbon neutrality, companies are trying to integrate the green aspects of Industry 4.0 (Benešová et al., 2021).

The current literature on sustainability and ESG practices in the Czech Republic's manufacturing industry highlights the need for further exploration into various aspects, including the distinct strategies of large companies versus SMEs, the specific effects of environmental management systems, the challenges faced by different manufacturing sectors, and the impact of regional factors. In particular, there is a lack of research examining the direct relationship between ISO 14001 implementation and adopting an ESG strategy. This gap underscores the need to better understand how environmental management systems such as ISO 14001 can influence or support broader ESG initiatives within the specific context of the Czech manufacturing sector. Therefore, this study addresses this research gap and contributes novel empirical evidence that advances theoretical knowledge and offers practical implications for environmental management and sustainable corporate development.

3. Research methodology

Initially, the authors created a theoretical basis based on analysing and synthesising domestic and foreign publications and articles. This theoretical background served as a platform for the determination of hypotheses and the design of questions for the survey. Hypotheses to make further theoretical and practical contributions in strategy, sustainability, and manufacturing were constructed as follows.

H1: Large companies have a sustainability or ESG strategy in place.

H2: Companies that have implemented ISO 14000 have developed a sustainability strategy or ESG.

H3: Companies with a sustainability strategy or ESG have a calculated carbon footprint.

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A quantitative questionnaire survey verified the hypotheses. The questions for the questionnaire survey were constructed to help test the hypotheses and extend the problem under study to include theoretical and practical insights. The questionnaire survey was conducted in January 2025. The contacts of the manufacturing companies were obtained from the database available with the Faculty of Logistics and Crisis Management. Further contacts were then supplemented from the Chamber of Commerce of the Olomouc Region. The questionnaire was created using the software Survio. One thousand one hundred twenty-four (1124) enterprises were contacted, and 170 questionnaires were correctly filled out and returned. The return rate was 15%.

The responding companies represent a cross-section of the Czech manufacturing industry, an essential part of the national economy. The largest sectors covered include the production of metals and metal products, electrical and optical equipment, means of transport, and the food industry. Of the total respondents, 30 were small enterprises, 32 were medium-sized enterprises, and 108 were large enterprises. It is evident that most of the responses came from large companies, indicating that ESG and sustainability issues currently attract greater attention among larger manufacturing firms. As a limitation, it should be noted that the sample covers the manufacturing industry as a whole and does not focus in detail on specific sub-sectors or industries with unique environmental or social impacts. Therefore, the results should be interpreted as generalisable primarily to the Czech manufacturing sector overall, and future research could examine selected industries in more depth. General descriptive statistics, contingency table, and chi-square test of independence were used for data processing.

4. Research results and discussion

This chapter summarises the results of the nationwide survey based on the verification of the hypotheses. The first hypothesis was established as follows:

H1: Large companies have a sustainability or ESG strategy in place.
H_0: There is no relationship between company size and the existence of a sustainability or ESG strategy.
H_A: There is a relationship between company size and the existence of a sustainability or ESG strategy.

Table 1. Relationship between company size and the existence of a sustainability strategy or ESG

	Does your company have a sustainability or ESG strategy in place?				Total
Company size	Yes, we have a CSR strategy (Corporate Social Responsibility)	Yes, we have an ESG strategy	We don't have	We are preparing the strategy	
Small enterprise	0	3	19	8	30
Medium-sized enterprise	4	6	10	12	32
Large enterprise	15	42	14	37	108
Total	19	51	43	57	170

Source: Authors‘ own research, 2025

The chi-square test was used to verify the hypothesis. Of the large enterprises (250 or more employees), 42 out of 108, or 38.9%, have an ESG strategy; for medium-sized enterprises (50-249 employees), 6 out of 32, or 18.8%, have an ESG strategy; and for small enterprises (up to 49 employees), only 3 out of 30, or 10%, have an ESG strategy. These results confirm that larger companies are more likely to have formal ESG strategies ($p < 0.001$). ***H_A was confirmed***. The results show a statistically significant association between company size and the existence of a sustainability or ESG strategy.

These results are to be expected as larger companies usually have more resources, both financial and personnel. There is more pressure on large companies from the public, investors, and stakeholders. Large companies are more likely to be part of international supply chains, which motivates them to implement sustainable strategies. Smaller companies often deal with day-to-day operational issues, and ESG strategies may not be a priority for

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them. This fact is also supported by the study of Hou & Xie (2024), who report that ESG strategy is prevalent among large enterprises, significantly impacting the quantity of green innovation in the Chinese economy. Large companies that integrate ESG strategies report higher financial performance than those that do not (Das, 2024). Balogh et al. (2022) examined the 100 largest Czech firms and showed that stakeholders, including investors and customers, play a key role in pressuring large enterprises to implement sustainable strategies. Decker Ure et al. (2024) add that corporate sustainability measures for large corporations have become part of corporate environmental, social and governance (ESG) programs in recent years. However, ESG strategies and their impacts are only beginning to be understood by large corporations. There are few definitions for how to apply, measure and evaluate the effectiveness of ESG practices. The results of Nováková (2025) study show that there is currently a significant difference in the level of ESG implementation not only between large and medium-sized construction companies, but also between Czech and foreign companies. The research confirms that ESG awareness or activity in this area decreases with company size. Other studies that demonstrate a link with firm size and sustainability strategy are (Ren & Ren, 2024; Xu, 2024; Wang, 2023).

Based on the empirical results, it was also possible to identify other significant relationships between sustainability-related variables. In addition to the company's size, implementing an environmental management system according to ISO 14001 proved to be an important factor. This standard represents a formal commitment to improving the company's environmental performance, and its presence may reflect its overall readiness to integrate sustainability at the strategic management level. For this reason, the author's team formulated the following hypothesis:

H2: Companies that have implemented ISO 14000 have developed a sustainability strategy or ESG.
H_0: There is no relationship between the implementation of the ISO 14001 standard and the existence of a sustainability or ESG strategy.
H_A: There is a relationship between the implementation of the ISO 14001 standard and whether the company has a sustainability or ESG strategy.

Table 2. Link between ISO 14001 certification and a sustainability or ESG strategy.

		ISO 14001:2015 - Environmental Management System (EMS)	ISO 26000:2010 - (Corporate Social Responsibility)	ISO 50001:2018 and 50004:2020 - Energy management systems	ISO 45001:2018 - Occupational Health and Safety Management System (OHES)	SA8000:2014 - Social Accountability Standard	ISO 45001:2018 - Occupational Health and Safety Management System (OHES)	Total
Company size	Small enterprise	3	4	3	6	4	7	30
	Medium-sized enterprise	19	2	6	14	2	12	32
	Large enterprise	83	17	45	57	12	58	108
Total		105	23	54	77	18	77	170

Source: Authors' own research, 2025

The contingency table converted into row percentages looks like this.

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Table 3. The contingency table.

		ISO 14001:2015 - Environmental Management System (EMS)	ISO 26000:2010 - (Corporate Social Responsibility)	ISO 50001:2018 and 50004:2020 - Energy management systems	ISO 45001:2018 - Occupational Health and Safety Management System (OHES)	SA8000:2014 - Social Accountability Standard	ISO 45001:2018 - Occupational Health and Safety Management System (OHES)	Total
Company size	Small enterprise	10,0%	13,3%	10,0%	20,0%	13,3%	23,3%	100,0%
	Medium-sized enterprise	59,4%	6,3%	18,8%	43,8%	6,3%	37,5%	100,0%
	Large enterprise	76,9%	15,7%	41,7%	52,8%	11,1%	53,7%	100,0%
Total		61,8%	13,5%	31,8%	45,3%	10,6%	45,3%	100,0%

Source: Authors‘ own research, 2025

The chi-square test of independence was used to test the hypothesis. Of the companies implementing ISO 14001 (n = 105), 41 have an ESG strategy, representing 39%. On the other hand, among enterprises without this standard (n = 65), only 10 enterprises, or 15.4%, have an ESG strategy. This difference shows that firms implementing ISO 14001 are significantly more likely to implement a sustainability or ESG strategy. Statistical analysis showed a statistically significant association between ISO 14001 implementation and the existence of an ESG or sustainability strategy ($p < 0.001$). ***H_A was confirmed.***

ISO 14001 sets out the requirements for an environmental management system to reduce negative environmental impacts. Businesses that implement this standard have already demonstrated some commitment to environmental principles. Such companies are more likely to take a holistic approach to sustainability and develop an ESG strategy that includes social and governance aspects. This context shows that certification, such as ISO 14001, can indicate a company's overall sustainable direction. Pakulska & Rutkowska-Podolowska (2017) state that it is hard to imagine the functioning of a large company that does not include the management of environmental aspects. Tasleem et al. (2018) published on the ISO 14001 standard for environmental management system (EMS) and its usefulness for addressing sustainability issues in organisations. This study identifies TQM and ISO 14001 as important strategies for examining the impact on sustainable performance, including economic, social, and environmental sustainability. The author's team believes that to date, no foreign expert study has been identified that has analysed the relationship between the implementation of ISO 14001 and the adoption of an ESG strategy. Therefore, the results of this research contribute to the development of theoretical knowledge in the field and provide new insights that can serve as a basis for further academic research. The findings may also be helpful for practical application in environmental management and sustainable corporate development. A detailed search found studies that demonstrate that the implementation of ISO 14000 represents a reduction in the energy intensity of production (Goldar & Goldar, 2024), an increase in export opportunities (Goldar & Majumder, 2022), and has a positive impact on sustainable development (Alhamdi & Al-Kahtani, 2025). ISO 14001 helps companies to build legitimacy and credibility, which is important to meet institutional pressure for a proactive approach to environmental protection. This can be perceived positively in the long run, although the short-term financial benefits may be questionable (Riaz & Saeed, 2020).

While Hypothesis H2 focused on the relationship between the implementation of a certified environmental management system (ISO 14001) and the existence of a corporate sustainability strategy or ESG, Hypothesis H3 extends this perspective to include a specific environmental tool - the calculation of carbon footprint. Carbon footprint measurement is a concrete indicator of environmental performance and can be seen as a step towards systematic sustainability management. It is therefore relevant to examine whether the very companies that track this footprint also have a formal sustainability strategy or ESG in place.

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H3: Companies with a sustainability strategy or ESG have a calculated carbon footprint.
H_0: There is no relationship between whether a company measures its carbon footprint and the existence of a sustainability or ESG strategy.
H_A: There is a relationship between whether a company measures its carbon footprint and whether it has a sustainability or ESG strategy.

Table 4. Relationship between carbon footprint measurement and the existence of a sustainability or ESG strategy.

		Have you calculated your company's carbon footprint?			Total
		Yes	We are working on the calculation method	No	
Does your company have a sustainability or ESG strategy in place?	Yes, we have a CSR strategy	14	4	1	19
	Yes, we have an ESG strategy	41	6	4	51
	We don't have	1	4	38	43
	We are preparing the strategy	23	23	11	57
Total		79	37	54	170

Source: Authors‘ own research, 2025

The chi-square test of independence was again used to test the hypothesis. Of the companies with an ESG strategy, 41 out of 51, or 80.4%, have a calculated carbon footprint. On the other hand, only 1 out of 43 (2.3%) of the enterprises that do not have a strategy have a calculated carbon footprint. Of the enterprises preparing a strategy, 23 out of 57 (40.4%) have a calculated carbon footprint. These results confirm that companies strategically committed to sustainability are more likely to measure their carbon footprint actively. The results are statistically significant ($p < 0.001$), supporting the hypothesis of a link between strategic approaches to sustainability and specific environmental activities. ***H_A was confirmed.***

Carbon footprint measures environmental performance in terms of the amount of greenhouse gases generated (Shabir et al., 2023). Carbon neutrality is part of the sustainability strategy, and the tool to achieve it is to monitor and measure the carbon footprint actively. The relationship between carbon footprint measurement, sustainability strategy, and social responsibility is also illustrated in a study (Saeed et al., 2021).

5. Conclusions

The article focused on approaches to sustainability and ESG in the Czech Republic's manufacturing industry, primarily from the perspective of large companies. The results of the quantitative survey confirmed the expectations of the author team that there is a statistically significant connection between the size of the company and the existence of a sustainability or ESG strategy. This relationship suggests that larger companies have broader capacities for implementing sustainable strategies and stronger external pressure on transparency and social responsibility.

The novelty of this research lies in providing new empirical evidence on the relationship between company size and the adoption of ESG strategies in the Czech manufacturing sector, which has so far received limited attention in the domestic context. The results are in line with findings from other recent studies (e.g., Hou & Xie, 2024; Das, 2024; Balogh et al., 2022; Nováková, 2025) which also confirm that larger enterprises are more

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active in the field of ESG due to their greater resources and stakeholder expectations. By adding new data for the Czech manufacturing industry, this research complements existing knowledge and highlights the importance of supporting ESG adoption also among small and medium-sized enterprises.

Confirming the hypothesis about the connection between implementing the ISO 14001 environmental standard and the existence of a sustainability or ESG strategy can also be considered a key finding. The author team perceives this finding as theoretically significant, since no professional foreign study has been identified to date that would analyse this relationship. The research results thus represent not only a theoretical but also a practical benefit. The research was expanded to include a carbon footprint indicator in connection with environmental requirements. The hypothesis that a statistically significant relationship exists between whether a company has a calculated carbon footprint and whether it has a developed sustainability or ESG strategy was also confirmed. This finding highlights the importance of specific environmental tools for systematic sustainability management and underlines the role of measurable data in setting strategic ESG goals.

The novelty of this result lies in providing empirical evidence for this relationship in the context of the Czech manufacturing industry, where existing studies are still scarce. The limited available research (e.g., Saeed et al., 2021; Shabir et al., 2023) suggests that carbon footprint measurement is an integral part of sustainability strategies, but does not analyse this link in detail or for the Czech context. Therefore, this study contributes to filling this gap and confirms the expected connection between carbon footprint calculation and strategic ESG management.

Overall, the article provides important empirical findings on the factors influencing the adoption of sustainability strategies in the manufacturing industry in the Czech Republic. These results can serve as a basis for further research and support for decision-making by corporate and public actors in the field of ESG and environmental policy.

The limitation of the study is the regional limitation, as the research was conducted only in the Czech Republic. In the future, the author's team would like to extend their research abroad, e.g. to the V4. Another challenge is the interaction between different aspects of ESG. The research could further explore how different aspects of ESG (environmental, social and governance) interact and their impact on firm performance. Another limitation is that the sample represents the manufacturing industry as a whole and does not analyse specific sub-sectors. Therefore, the results apply mainly to the Czech manufacturing sector, and future research could focus more deeply on selected industries.

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Funding: This paper is co-financed by FSR 2024 FLCM/003 Increasing the scientific qualification of the staff of the Faculty of Logistics and Crisis Management and GA/FLCM/2025/003 Use of modern methods and tools in logistics process management.

Author Contributions: Conceptualisation: *Hoke*, *Heinzová*; methodology: *Pospíšil*; data analysis: *Heinzová*; writing—original draft preparation: *Hoke*; writing—review and editing: *Hoke*, *Heinzová, Molková*; visualisation: *Hoke*, *Heinzová*. All authors have read and agreed to the published version of the manuscript.

ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2025 Volume 13 Number 1 (September)
http://doi.org/10.9770/p9685553439

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