

Article

Meeting Sustainable Development Challenges at the Enterprise Level

Beata Starzyńska ^{1,*}  and Mariusz Bryke ² ¹ Faculty of Mechanical Engineering, Poznan University of Technology, 60-965 Poznań, Poland² Kaizen Institute Poland, 52-121 Wrocław, Poland; mbryke@kaizen.com

* Correspondence: beata.starzynska@put.poznan.pl

Abstract

Enterprises play a key role in achieving sustainable development goals because they affect them to a greater or lesser extent, both in a positive and negative way. The aim of the study presented in the article is to answer the question concerning the level of application of the best practices in enterprises related to the implementation of sustainable development strategy. As recognized means of operational activities in organizations, they are a guarantee of the effective achievement of their goals. The method employed in the research procedure was the Human Lean Green method. Thus, best practices applied in the enterprises analyzed became the basis for measuring their organizational maturity in three areas of sustainable development, i.e., social (Human), economic (Lean) and environmental (Green). The study was conducted in 20 enterprises (manufacturing or service enterprises). The results of the research show, among others, that the popularity of using practices from the Human area is greater than Lean Green practices.

Keywords: sustainable development; sustainable development of enterprises; Lean Manufacturing; Green Manufacturing; Human Lean Green method; best practices



Academic Editors: Grigorios L. Kyriakopoulos and Camelia Delcea

Received: 20 August 2025

Revised: 31 October 2025

Accepted: 8 November 2025

Published: 17 November 2025

Citation: Starzyńska, B.; Bryke, M. Meeting Sustainable Development Challenges at the Enterprise Level. *Sustainability* **2025**, *17*, 10275. <https://doi.org/10.3390/su172210275>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

In response to the growing environmental crisis and social inequalities, modern society has adopted sustainable development as the leading model of transformation [1]. The term sustainable development was introduced in 1987 by the World Commission on Environment and Development in a report entitled *Our Common Future*. Sustainable development was defined in the following way: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Report).

Starting from the classic definition, the literature on sustainable development provides many interpretations of this term, emphasizing its interdisciplinarity and multiple meanings [2,3]. The analysis of the definition allows us to notice a common element, which is the inclusion of three dimensions of human activity: economic, environmental and social. This approach was proposed by John Elkington [4] and is often referred to as the Triple Bottom Line. The economic dimension of sustainable development refers to a system that meets current consumption needs without compromising future generations. At the social level, sustainable development means supporting the development of people, communities and cultures to ensure decent living conditions—with adequate health care, education, gender equality, peace, and stability in the world. In turn, the environmental dimension of sustainability refers to the state of the natural environment and its ability to remain

productive and resilient so that it can further support human life. This includes the integrity of ecosystems and the ability of the environment to self-regenerate.

The concept of sustainable development refers mainly to macro-level systems—such as countries, economies or international communities—but its practical application requires implementation in management processes at the enterprise level. Organizations play a key role in achieving sustainable development goals, because they all—to varying degrees—affect them both positively and negatively [5].

Investigating sustainable development from the perspective of the enterprise level is important for two main reasons. Firstly, companies must account for the resources they use and the impact they have on the environment [6]. Secondly, they are obliged to act in a responsible and prudent manner, taking care of the health and safety of their employees and the quality of life of local communities. In addition, enterprises remain in constant interaction with their physical, biological and social environments; they influence them and are shaped by them [7,8]. For this reason, it is natural that they play an important role in the sustainable development of regions and countries and thus are obliged—by offering their products and services—to take action for the sake of environment and society [9].

The aim of the study presented in the article is to answer the question concerning the level of application of the best practices in enterprises related to the implementation of sustainable development strategy. The review part of the article discusses: directions of integrating the management concept with the idea of sustainable development; the significance of standardized management systems as an organizational framework for meeting sustainable development challenges; the synthesis of methods for assessing the level of sustainable development of enterprises.

2. Literature Review

2.1. Integration of Modern Management Concepts for Sustainable Development

The strategy which revolutionized the approach to the functioning of both manufacturing and service enterprises is the concept of Lean Manufacturing [10]. Its essence is to minimize any forms of waste and eliminate unnecessary operations and procedures in the production process, while providing products and services that meet customers' quality expectations, maintaining low production costs and the use of raw materials at the indispensable level.

From the perspective of challenges arising from the paradigm of sustainable production, the degree of advancement of the implementation of Lean Manufacturing practices in an organization may affect (both positively and negatively) one or more pillars of the Triple Bottom Line (TBL). Examples of positive effects are given below:

- In the economic dimension—reduction in waste and overproduction, reduction in costs, shortening the time of execution of orders and commissioned work, improvement of product quality, reduction in inventory [11–13];
- In the environmental dimension—reduction in resource consumption, pollution control, energy efficiency, increase in employee environmental awareness [14–16];
- In the social dimension—interdisciplinary teams, occupational health and safety, continuous improvement, employee satisfaction [16,17].

Yet, the literature studies also indicate possible negative effects of the implementation of Lean Manufacturing practices [18]. Examples of negative effects include the following:

- In the economic dimension—long time needed to implement the concept itself, inadequate resource allocation, administrative costs;
- In the environmental dimension—problematic waste disposal, pollution;

- In the social dimension—routine activities, lack of trust on the part of employees, compromises in the range of operational efficiency.

Both the positive and negative impacts of Lean Manufacturing practices on each of the pillars of sustainable development result from the need to make compromises between these pillars in order to continue to achieve benefits in a specific area. Observations of business practice show that many enterprises implement social and environmental practices “as long as they are profitable”, abandoning them in a situation when financial results worsen.

According to [19], another key strategy for meeting sustainable development goals by enterprises is the concept of Green Manufacturing. It involves taking into account the natural environment in the process of making organizational decisions. It includes practices enabling the creation of environmentally friendly products and minimizing the impact of an organization’s activities on the environment through ecological manufacturing, research and development and marketing. The positive relationship between “green” practices and financial results (economic aspect of sustainable development) was demonstrated, among others, by Bour et al. [20]. According to the authors, best practices of sustainable development significantly improve the image and profitability of enterprises. In turn, according to [19,21], the implementation of green practices also positively affects the social reputation of an organization. Thanks to them, companies can achieve zero waste, improve working conditions for employees and respond to the expectations of local communities.

Lean Manufacturing and Green Manufacturing have a common goal—the elimination of waste—but the understanding of the term “waste” in both approaches is different [22,23]. Lean defines it mainly through the prism of cost and time, while Green focuses on environmental aspects, recognizing waste as excessive consumption of resources, pollutant emissions to the atmosphere, water contamination, etc., which may endanger human health and the environment. In connection with growing interest in the integration of Lean and Green, many authors have drawn attention to the need to combine them. The Lean Green approach is defined as an integrated concept geared not only towards operational improvements and financial benefits, but also environmental ones [24]. The integration of Lean and Green can be viewed as a new opportunity for organizations to improve performance regarding sustainable development [25]. It was observed that although Lean and Green originate from different contexts, they are complementary and synergistic strategies, as both focus on limiting losses and efficient use of resources [26,27]. As a consequence, their principles and operational tools have been combined under a unified streamlining approach, known as Lean Green.

A novelty in the research is the integration of the Lean Green approach with the concept of sustainable development [26]. Research indicates that it is possible to achieve long-term improvement of environmental processes and results while, at the same time, maintaining the principles of sustainable development. In recent years, with an increase in expectations towards enterprises in terms of environmental and social effects of their operation and products and services offered, Lean Green and sustainable development began to be perceived as a strategic requirement [27]. Both approaches complement each other through common and individual elements [28].

The literature also includes attempts to analyze the concepts of Lean and Green in conjunction with other approaches implemented in enterprises, such as Six Sigma [29]. The author of publication [30] notes that the integration of Lean and Green approaches can inherit the same limitations as each of them separately, but it is possible to overcome them by combining them with the Six Sigma methodology. There were also similarities identified between some of the main features of Lean, Green, and Six Sigma (LGSS). The authors of refs. [31,32] indicate that the LGSS approach has a positive impact on economic, social and environmental results in the context of sustainable development in an organization. The

authors of paper [33] proposed an integrated LGSS model, enabling the execution of this balanced approach regardless of the size, culture or business line of an enterprise.

Another example of combining different concepts is presented in paper [34], in which an integrated model of Lean and Agile manufacturing was developed. Lean practices can be used to eliminate activities that do not bring added value and causes of losses in enterprises. In turn, the Agile approach can be used to flexibly respond to dynamically changing customer requirements and maintain market position. According to ref. [35], the combination of these two strategies supports the sustainable development of the system.

The literature on management in the Lean and Green approaches unanimously emphasizes the importance of integration with the human factor. Issues regarding the necessary protection of employee interests were raised, among others, by Shah and Ward [11,36]. Among the proposed practical activities, the authors list projects increasing the level of safety at work, developing employee multitasking competencies, supporting the creation of independent teams, investing in human capital, engaging employees, etc. [37,38]. The implementation of the activities described in practice significantly affects the operating results of an enterprise. Moreover, it is possible to assess the impact of a comprehensive approach to the protection of employee rights on operational, environmental and social activities, as well as in the context of the perception of an organization by its employees.

Management concepts and related strategies must be “armed” with appropriate operational tools [39]. The mere declaration that an enterprise uses the concept of Lean Manufacturing or Lean Green does not mean much. The best practices give strategies their driving force [40,41]. The literature features many different definitions and classifications of best practices [36,42,43]. Most of them define best practices as the best, practice-proven way of doing something that also guarantees the achievement of the assumed goals. It is also an action that can be used under similar conditions by other economic entities. The use of best practices serves not only to improve the processes in a firm and increase the efficiency of operations, but also to strengthen the position of an organization on the market and stand out in the local, national and global environment [44].

2.2. Standardized Management Systems

Enterprises, facing the challenge of developing sustainable management strategies and analyzing their effects from the perspective of the Triple Bottom Line (TBL), are increasingly implementing various types of standardized management systems [45], developed by the International Organization for Standardization (ISO). These systems have a significant impact on meeting sustainable development goals, offering a framework that supports organizations in integrating sustainable development practices in their operational activities. The most frequently cited in the literature and used in the studied area are systems that meet the requirements of the following standards: ISO 9001, ISO 14001 and ISO 45001 (formerly OHSAS 18001) [46–48].

According to ref. [49], the ISO 9001 standard focuses on the economic dimension of sustainable development, and its use can contribute to improving the quality of products and services offered, higher efficiency and greater customer satisfaction, which in turn translates into profit for an enterprise. On the other hand, the implementation of the Quality Management System (QMS) allows to reduce the waste of resources and thus minimize the impact of their disposal on the environment. In addition, the standardization achieved thanks to the QMS can also help reduce potential risks to employees’ health and environmental pollution.

The ISO 14001 standard can support enterprises in managing their environmental footprint and contribute to increased environmental efficiency, creation of more environmentally friendly products and greater transparency of activities and acceptance by external

stakeholders. According to ref. [50], the environmental management system has a positive impact on environmental results, and its implementation reduces waste and promotes the principle of Reduce, Reuse, Recycle, which can improve financial results and stimulate sustainable development.

In turn, the ISO 45001 standard allows us to design and maintain a safe working environment and care for employees' health. It focuses on the social dimension of sustainable development and contributes to more effective work processes, a better perception of the working environment by employees and can increase the attractiveness of an enterprise in recruitment processes [51].

According to ref. [52], the best way for business to contribute to sustainable development is to integrate different standards. As ref. [53] notes, integration can be an opportunity to increase the competitiveness, development and long-term success of an organization, achieve higher quality, productivity, customer satisfaction and profit, and can also contribute to the increased competitive advantage and durability of an organization. An organization can implement many standardized management systems and manage them separately or in an integrated way [54]. Integration of management systems is not a new concept. Research in this area has so far been carried out, among others, by Asif et al. [55], Merlin et al. [56], Rebelo et al. [53] and Poltronieri et al. [57]. The basic objective of the integration of management systems is to improve and optimize the processes implemented in an organization and to ensure cooperation between individual systems, taking into account external processes carried out by suppliers and subcontractors.

The authors of ref. [58] proposed a conceptual model of sustainable development of enterprises through the integration of management systems. Integrating sustainable development with business processes requires it to be an integral part of an organization's business strategy, as well as assuming continuous interaction with stakeholders and innovative ways of designing, reviewing and updating processes. According to this approach, the sustainability integration process should start with the identification of key stakeholders and their requirements.

In order to facilitate the implementation, application and improvement of integrated management systems, the International Organization for Standardization ensures a high level of consistency in the structure of individual standards in the area of system management. This consistency applies both to the terminology used and the layout of the content of the published standards [59]. In addition, the Guide 84 document "Guidelines for addressing sustainability in standards" published in 2019 clearly indicates that if a standard did not refer to sustainable development before, it can be considered an argument for its revision. The introduction of the Annex SL by the ISO brought changes and additional issues, including a unified structure of management standards.

Significant changes introduced by the ISO include, among others, the obligation to analyze the context of an organization, thinking based on risk, making decisions based on data, greater emphasis on measuring and evaluating processes and results, as well as a culture of integration. In the case of risk analyses related to management systems (ISO 9001, ISO 14001, ISO 45001), they contribute to the sustainable development of an organization, as they include requirements for the identification, analysis and reduction in economic, environmental and social risks [60]. Thus, some of the changes in the recently published ISO standards have a lot in common with the key elements of the sustainable development management model, which proves the proximity of both areas.

However, according to ref. [61], there is still little evidence regarding the impact that the integration of standardized management systems has on results connected with sustainable development. The authors of refs. [62,63] note similarities and synergies between integrated management systems and sustainable management, such as orientation

on stakeholders, complexity, and innovation. Nevertheless, they emphasize that sustainable development must first be managed within the system and only then measured in order to assess its effectiveness.

2.3. Sustainable Development Assessment Methods at the Enterprise Level

The term sustainable development assessment was created as a combination of environmental assessment and sustainable development [64]. Currently, it is a commonly used term covering a wide range of approaches to the operationalization of the concept of sustainable development. These approaches can be formal or informal, can be a legal or voluntary requirement, can be based on science or policy, etc., and come under different names such as sustainable development assessment, sustainable development impact assessment or integrated assessment [65].

The authors of ref. [65] distinguished two basic approaches to devising sustainable development assessment: a criteria-based approach and a model-based approach. Despite the apparent balance of strengths and weaknesses of both approaches, the model-based approach seems to be more appropriate for sustainable development assessment [65]. Describing the interrelationships between different business processes in different organizations, it can serve as a general assessment model, while allowing it to be applied to the specific conditions of a particular organization.

Sustainable development is in fact an integrating term. It seems justified to design sustainable development assessment as a process integrating the areas of pro-social, pro-ecological and pro-economic solutions, creating a framework for making decisions that bring lasting results to an enterprise. Attempts to conduct separate analyses in these areas and integrate them as late as at the stage of ready-made conclusions from individual analyses may lead to ignoring interrelationships occurring in the studied areas [66].

With regard to the three areas of sustainable development, ref. [67] proposes an in-depth analysis covering seven issues (natural resources, pollution, health and safety, satisfaction and professional development, equal opportunities, finance and development), using the specific assessment areas assigned to them. A different view of the areas of sustainable development assessment was presented by the authors of ref. [68]. They dealt with the area of the natural environment and showed the assessment components of this sustainable development dimension. However, in the social area, the authors of ref. [69] propose taking into account the following areas of assessment: human rights, work practice and decent work, fair operational practice, society, product responsibility / consumer issues, health and safety, social involvement and development.

The authors of ref. [70] undertook to review and evaluate existing solutions in the area of sustainable development assessment, called tools. In their paper, they explain the basic differences between the tools, as well as their strengths and weaknesses.

According to ref. [71], sustainable development assessment tools have a hierarchical structure. In this hierarchy, the tools cover specific areas, and within them, themes and sub-themes. At the lowest level of the hierarchy, there are indicators. The author recommends distinguishing two groups of indicators: having a positive and negative impact on sustainable development, and on their basis maximizing activities conducive to sustainable development and minimizing negative practices.

The authors of ref. [72] presented solutions based on the TBL (Triple Bottom Line) approach, which helps organizations not only to assess the economic value created by a company, but also to take into account environmental and social values in the assessment of activities. In a narrower sense, the TBL can serve as a basis for measuring and reporting enterprise performance in economic, social and environmental areas. In a broader sense, the term encompasses the entire set of values, problems and processes that a company

needs to address in order to minimize the negative impacts of its operations and create economic, social and environmental value. “This means a clear vision of a company’s goals and taking into account the needs and expectations of stakeholders” [73].

The practical approach to the assessment of an enterprise’s sustainable development is presented in paper [74], in which the Corporate Sustainability Self-Assessment Questionnaire (CSQ) was developed for Kelly Services Inc. headquartered in Troy, MI, USA. CSQ is an integrated tool whose task is to collect and centralize qualitative and quantitative information related to corporate social responsibility and sustainable development. CSQ can be adapted to any type of company, regardless of its size or type of product made. Kelly Services Inc. performance indicators were also used in the proposed methodology.

A review of sustainable development assessment tools also points to a tool called Social Return On Investment (SROI). It is a tool used to analyze the mechanisms of formation and duration of an organization’s impact on society, environment and economy, measuring the value of this impact and reporting it. SROI combines the advantages of a cost–benefit analysis with a social audit, understood as an audit carried out by an external entity. A unique feature of this tool is the monetary presentation of all significant investments and activity effects, i.e., the conversion of social impact into monetary value [75].

The authors of ref. [76] believe that “there is a sufficient number of tools and methods to measure, evaluate and effect improvement in the areas of quality, productivity and production efficiency, while the number of tools and methods to evaluate environmental initiatives on the production floor is rather low”. The environmental assessment methods used in these areas according to the authors are: Green Performance Map (GPM), Environmental Value Stream Mapping (EVSM), Waste Flow Mapping (WFM) and Life Cycle Assessment (LCA).

Another approach to sustainable development assessment of an organization is presented in a method based on aggregated indicators relating to three basic aspects of sustainable development. According to ref. [77], the introduction of the aggregate sustainable development indicator makes it possible to study the relationship between the component indicators, facilitates communication between social development stakeholders in an organization, opens the way to sustainable development monitoring and reporting, and allows for comparison of progress in different sections and years. Such a systemic approach helps to clearly identify links between indicators and to understand the system’s behavior over time [78]. A three-dimensional model is proposed, which evaluates three dimensions of sustainable development at all levels of a manufacturing organization, throughout the entire product life cycle. Each axis of the model reflects an indicator or measure based on a reporting standard called the Global Reporting Initiative (GRI). The first axis describes the levels of sustainable development that can be attained in an organization. The second one refers to the three pillars of sustainable development, which are “interdependent and mutually reinforcing” [79]. Sustainable development can occur throughout the entire product life cycle, which is why the last axis is devoted to this cycle. The model allows for visualization and standardization of the relationship between activities performed throughout the entire product life cycle.

The method of choosing indicators, their selection, weighting and aggregation adopted in Eslami’s method [80] makes it possible to calculate the aggregate sustainability index in three aspects (environmental, social and economic) at each stage of the product life cycle and at three levels: product, process and system. The method also allows for monitoring the indicator over time and affords the possibility of improvement in selected areas.

A comparative summary of the discussed methods is presented in Table 1. The proposed methods and tools for assessing sustainable development were compared with regard

to the possibility of their application in an enterprise, the criterion of comprehensiveness and the possibility of conducting a quick assessment.

Table 1. Comparison of methods.

No.	Method/Tool for Assessing the Sustainability of an Enterprise	Useful for Companies?	Comprehensive?	Quick Assessment?
1	Barometer of Sustainability	–	–	+
2	Dow Jones Sustainability Index	+	o	–
3	Global Reporting Initiative Framework (GRI)	+	+	–
4	IChemE Sustainability Metrics	+	+	–
5	Rapid Plant Assessment Tool	+	–	+
6	Sustainability Assessment in Mining and Minerals Industry)	o	+	–
7	Composite Sustainable Development Index)	+	+	+
8	ITT Flygt Sustainability Index	+	+	+
9	Ford of Europe’s Product Sustainability Index	–	+	–
10	GM Metrics for Sustainable Manufacturing	+	+	+
11	Sustainable Development Framework (SDF)	–	+	–
12	Rapid Basin-wide Hydropower Sustainability Assessment Tool	–	+	+

+ yes, – no, o—partly.

In recent years, the term sustainable development has increasingly been replaced by the acronym “ESG” (E—environmental, S—social, G—governance).

ESG refers to a set of factors on the basis of which non-financial assessments of enterprises are created, which makes it possible to evaluate and quantify business activities [81]. Research shows that incorporating ESG into business strategies—in the long run—leads to better financial results [82–84], among others, by increasing employee efficiency [85,86].

The “G” pillar is for “corporate governance”, i.e., good corporate management practice. This area is associated with ISO 37000 standard [87] concerning “good” governance of an organization. The implementation of good governance is based on leadership, values and structures and mechanisms adapted to the internal and external context of an organization. That is why its role in revitalizing the approach to management system standards is so important (ESG reporting guidelines) [88].

ESG is derived from the concept of CSR (“Corporate Social Responsibility”) CSR, defined by the ISO 26000 standard [89], is understood as the impact of decisions and actions taken by organizations through transparent and ethical behavior in seven areas: organizational governance, human rights, work practices, environment, fair operating practices, consumer issues, social involvement and development of the local community. Despite being similar in scope to ESG, CSR is defined as a voluntary set of activities. Another difference introduced by ESG is the obligation for enterprises to report sustainable development [90,91].

The presented literature review shows that despite numerous studies on the assessment of an enterprise’s sustainable development, there are no comprehensive assessment methods—covering all dimensions of sustainable development—that would enable the measurement of the effectiveness (level of implementation) of best practices employed in an enterprise in the context of sustainable development and at the same time indicate areas for improvement in an organization.

3. Methodology

The method used in the research procedure was the Human Lean Green (HLG) method [92]. Conducting assessment using the method consists in measuring the indicators obtained from the analysis of answers given by representatives of the analyzed enterprises to questions regarding the scope and degree of employing best practices.

The development of the HLG method for the assessment of enterprises' sustainable development covered the following stages: development of assumptions for the method; determination of perspectives, criteria and specific issues that are the subject of the assessment; appropriate development of the method in each of the perspectives, and the method of obtaining adequate data and information from enterprises. The proposed method meets the following assumptions: it integrates three areas of sustainable development; it is based on measuring the degree of implementation of best practices, which are the confirmed activity for sustainable development; it offers results to managers in an easy form to interpret. Best practices are treated here as a set of benchmarks, i.e., reference points for improvement activities which an organization implements after conducting the study using the method presented in the article.

The proper development of the method for assessing the sustainable development of enterprises required the determination of: the assessment perspective; assessment criteria and specific issues, which are the subject of the assessment of each of the criteria (called assessment elements: management, materials, machines, employees, working methods). The general model of the Human Lean Green (HLG) assessment method is shown in Figure 1.

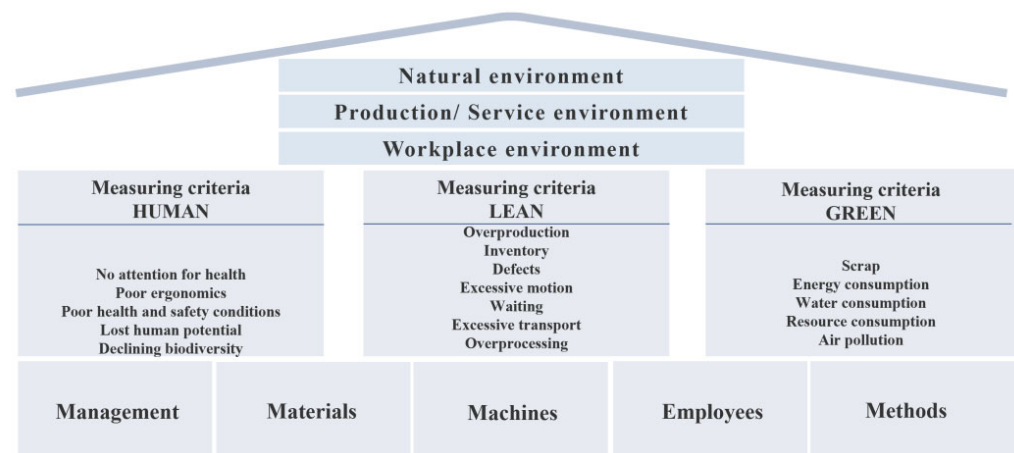


Figure 1. The general model of the Human Lean Green method. Source: [92].

Matrices of questions and statements regarding best practices, which are the operationalization of sustainable development goals were prepared for the needs of the developed method and IT tool supporting data collection. The idea of building a set of questions about best practices in each of the HLG areas is presented in Table 2.

Table 2. Question matrix in the HLG method.

Evaluation Criteria	Evaluation Elements				
	Mgt.	Material	Machine	Man	Method
HUMAN	Question 1	Question 1	Question 1	Question 1	Question 1
	Question 2	Question 2	Question 2	Question 2	Question 2
	...	...	...	...	...
	Question k	Question k	Question k	Question k	Question k
LEAN	Question 1	Question 1	Question 1	Question 1	Question 1
	Question 2	Question 2	Question 2	Question 2	Question 2
	...	...	...	...	...
	Question l	Question l	Question l	Question l	Question l
GREEN	Question 1	Question 1	Question 1	Question 1	Question 1
	Question 2	Question 2	Question 2	Question 2	Question 2
	...	...	...	...	...
	Question m	Question m	Question m	Question m	Question m

The Human Lean Green method contains a set of 181 questions and statements related to best practices—87 from the Lean area, 35 from the Human area, 59 from the Green area—which integrate two methods of assessment: qualitative and quantitative.

The computational model, included in the IT tool, generates three main assessment indicators—for each of the Human, Lean and Green areas, i.e., the average indicators of the use of best practices in the listed areas. The process of summing up the answers indicating the number of best practices used in the analyzed organization is effected by means of conversion factors which were applied to determine the degree of “intensity” of use of each of them (e.g., yes; partly to a small extent; etc.). In a model situation in which all answers to diagnostic questions are affirmative, the values of averaged indicators in the H, L and G areas assume a value of 100%.

In the case of Lean, two sets of questions were prepared: one referring to a manufacturing enterprise, the other—to a service enterprise. In addition, the method includes questions regarding the organizational and legal aspects of an enterprise.

The culmination of each study is a report—a document presenting a comprehensive picture of the current situation in an enterprise and containing recommendations for tools and solutions aimed at supporting an organization in achieving the expected results. A report has an instructional function because it includes suggestions for improving best practices which are crucial for the sustainable development of an organization.

The stage of the method verification consisted in: assessing the unambiguity and usefulness of the assessment criteria and detailed issues describing them; confirming the possibility of using the method in real conditions and confirming the usefulness of the method in real conditions.

Thus, best practices applied in the enterprises analyzed became the basis for measuring their organizational maturity in three areas of sustainable development, i.e., social (Human), economic (Lean) and environmental (Green). In order to improve the process of collecting data in the enterprises studied and conducting their analyses, an IT tool of the same name was created.

4. Results

The subject of the study presented in this article are practices employed in enterprises, which are dedicated to the implementation of sustainable development goals.

The aim of an enterprise’s sustainable development assessment, carried out using the Human Lean Green method, is to furnish decision-makers with information on the scope and degree of the implementation of best practices in the above-mentioned areas and to support decision-makers in the decision-making process regarding future directions of activity.

The key to the selection of firms to be analyzed was diversification in terms of the type of activity (manufacturing or service enterprises), company size (large-sized, medium-sized, small-sized, micro-sized enterprises) and management support systems present in an organization which are based on ISO standards and other systems functioning on the market. However, not all firms agreed to participate in the study. In the end, the study was conducted in 20 enterprises (further studies are underway). The aim in the measurement was the value of the averaged indicator of the use of best practices set at 75% in each of the areas. The results obtained by the analyzed organizations also refer to this value. They are presented in Table 3.

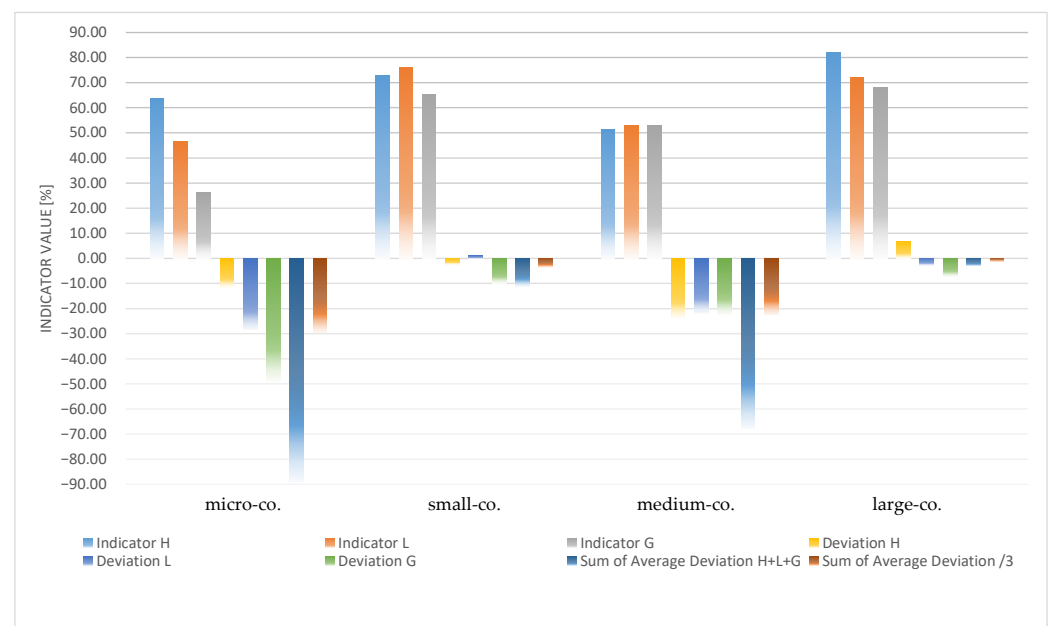
Table 3. Summary of average values of H, L and G indicators of research in the context of achieving the assumed goal (75%).

Company Name	Human Indicator [%]	Lean Indicator [%]	Green Indicator [%]	Human Indicator Deviation [%]	Lean Indicator Deviation [%]	Green Indicator Deviation [%]	Total Deviation [%]	Average Deviation/3 [%]
Company 1	82.95	70.00	71.74	7.95	−5.00	−3.26	−0.31	−0.10
Company 2	73.00	73.57	53.00	−2.00	−1.43	−22.00	−25.43	−8.48
Company 3	57.00	57.86	65.00	−18.00	−17.14	−10.00	−45.14	−15.05
Company 4	53.00	44.52	19.00	−22.00	−30.48	−56.00	−108.48	−36.16
Company 5	64.13	61.43	53.75	−10.87	−13.57	−21.25	−45.69	−15.23
Company 6	74.00	48.57	33.33	−1.00	−26.43	−41.67	−69.10	−23.03
Company 7	83.00	86.43	64.00	8.00	11.43	−11.00	8.43	2.81
Company 8	93.00	85.29	77.00	18.00	10.29	2.00	30.29	10.10
Company 9	76.00	46.43	59.21	1.00	−28.57	−15.79	−43.36	−14.45
Company 10	28.00	44.29	35.87	−47.00	−30.71	−39.13	−116.84	−38.95
Company 11	62.50	65.63	66.30	−12.50	−9.37	−8.70	−30.57	−10.19
Company 12	24.00	29.29	23.91	−51.00	−45.71	−51.09	−147.80	−49.27
Company 13	73.00	60.00	45.65	−2.00	−15.00	−29.35	−46.35	−15.45
Company 14	87.50	74.29	84.38	12.50	−0.71	9.38	21.17	7.06
Company 15	85.00	70.59	69.00	10.00	−4.41	−6.00	−0.41	−0.14
Company 16	75.00	78.57	54.35	0.00	3.57	−20.65	−17.08	−5.69
Company 17	34.00	43.57	29.35	−41.00	−31.43	−45.65	−118.08	−39.36
Company 18	59.38	65.44	65.63	−15.62	−9.56	−9.37	−34.55	−11.52
Company 19	93.00	69.29	96.74	18.00	−5.71	21.74	34.03	11.34
Company 20	92.00	90.71	97.00	17.00	15.71	22.00	54.71	18.24

As for the nature of business activity, 17 of the analyzed firms conduct manufacturing activity; 3 of them—service activity. Regarding the size of an enterprise, the sample covered 9 enterprises representing a group of large-sized enterprises; 7—medium-sized enterprises; 2—small-sized enterprises; 2—micro-sized enterprises. The third criterion for being selected for the sample was the use of management support systems used in an enterprise and based mainly on ISO standards. 13 enterprises confirmed the use of these in their activity.

The results contained in Table 3 for service enterprises (Company 7, Company 19 and Company 20) indicate the relatively lowest potential for improvement in the area of implementing best practices in organizations. Only two of the surveyed manufacturing firms show a similar status.

Differences in the results in the achievement of the aim defined as 75% for enterprises divided into groups of enterprises regarding their size are presented in Figure 2.

**Figure 2.** Summary of average values of H, L and G indicators of research in the context of achieving the assumed goal (75%) divided into groups of enterprises according to their size.

Averaging the results from Table 3 across the selected enterprise groups indicates that the assumed goal of 75% adherence to recommended practices is achieved by the largest companies (Human area only; 81.94%). The aggregate difference in the levels of best practices adherence across all areas studied shows the lowest value, meaning that the potential for change in these organizations is the lowest.

In the SME group, small enterprises achieved the target level of applying best practices in their Lean operations (76.03%). In none of the areas studied were the medium-sized enterprises achieving the target values. The obtained average values of the Lean, Green, and Human indicators (all at approximately 50%) indicate the potential for tool support in management for sustainable development.

Microenterprises achieved the lowest results in the study. It should be noted, however, that the untapped benefits of implementing best practices for sustainable development stem from the nature of the operations conducted by microenterprises. By agreeing to participate, these companies simultaneously confirmed their interest in the issue and their readiness to implement change.

In turn, the differences in the results in the achievement of the aim defined as 75% for enterprises—using and not using management support systems are illustrated in Figure 3.

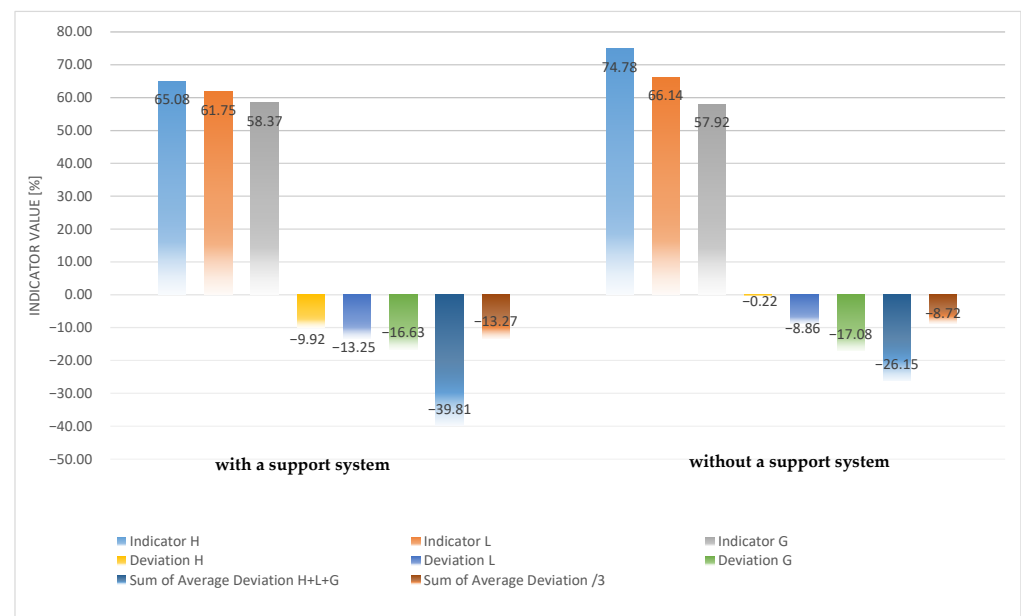


Figure 3. Summary of average values of H, L and G indicators of research in the context of achieving the assumed goal (75%) in companies with/without a support management system.

The values presented in the chart (Figure 3) indicate that in both groups of companies considered, the highest level of best practice implementation corresponds to the Human area, followed by Lean and Green. Interestingly, companies that did not declare having a formal management support system achieved higher average values of the average best practice indicator. Thus, the potential for implementing changes in this direction is lower in these companies.

5. Discussion

The aim of the research presented in the article was to answer the question about the level of application of best practices in enterprises for the implementation of sustainable development strategies.

The literature review presented in the article also shows that despite numerous studies on the methods of assessing the sustainable development of an enterprise, there are no comprehensive assessment methods—covering all the dimensions of sustainable development—that would enable the measurement of the effectiveness (level of implementation) of best practices used in the enterprise in the context of sustainable development and at the same time indicate areas for improvement in the organization.

As mentioned earlier, best practices are a driving force in the implementation of contemporary management strategies in enterprises [40,41], including sustainable development strategies.

Regardless of their nature (organizational, technical, educational, other), they can be described as the best, practice-proven way to do something while guaranteeing the achievement of the assumed goals. Best practices are also actions that can be applied, in similar conditions, by other entities.

Emphasizing the huge role of the human factor within the Lean Green concept and the growing popularity of the idea of Corporate Social Responsibility (CSR) prompted the Authors of this article to propose the Human Lean Green approach, on which the developed method of assessing enterprises of the same name was based.

Innovative elements of the method, compared to those proposed so far, are: isolating the HUMAN module, paying attention to best practices guaranteeing the effectiveness of operations and the possibility of assessing both production and service enterprises.

Questions in the method, formulated to reflect the identified perspectives, criteria, and assessment elements (Figure 1), directed respondents' attention to the scope and degree of application of best practices in the three identified research areas. The aggregated research results confirmed their broader application in large enterprises. Among SMEs, it may be surprising that small companies are more adept at implementing them than medium-sized enterprises. For representatives of microenterprises, the study became a valuable source of knowledge about sustainable development.

Research also indicates that many companies have difficulty implementing and maintaining Lean Green practices [3,28,93]. Additionally, the results of the presented research show (Figure 2) that the popularity of using practices from the Human area is greater than the mentioned Lean Green practices.

The desire to build integrated systems as an organizational framework for meeting the challenges of sustainable development cannot be overestimated. At the same time, the functioning of enterprises in accordance with the procedural order becomes a source of developing and applying the best practices (these include, among others, the previously mentioned “green” practices; fair practices or Lean practices).

The research results presented in this article do not support this thesis (Figure 3). It turns out that companies that do not rely on any formal management support systems can achieve better results (here measured by the level of application of recognized practices in the areas of Human, Lean, and Green).

In the context of the conducted study, it can be concluded that the enterprise diagnosis in terms of sustainable development, conducted using the Human Lean Green method, highlighted the importance of obtaining data and information from various sources within the enterprise.

A significant limitation of the conducted study is the number of surveyed enterprises; therefore, there is a need to conduct the study in a larger number of enterprises (including service enterprises).

6. Conclusions

In this article, the research process utilized the Human Lean Green method. Supplemented by the social dimension and developed into a method, HLG is a practically verified tool for assessing the sustainable development of enterprises, which is in line with current and future research directions on models, methods and tools for assessing companies' activities related to sustainable development. Thus, best practices applied in the enterprises analyzed became the basis for measuring their organizational maturity in three areas of sustainable development, i.e., social (Human), economic (Lean) and environmental (Green).

Conducting an SD assessment using the Human Lean Green method allows decision-makers to be provided with information on the scope and degree of application of best practices implemented in the surveyed enterprises and to support the decision-making process regarding future directions of action towards improving the organization.

The research conducted confirmed the method's usefulness in real-world conditions and provided an answer to the question of whether the method meets its goals and functions as intended.

The Human Lean Green study allows for the comparison of obtained results with those obtained during subsequent studies, allowing for the development of improvement actions in three defined areas. In this way, an important attribute of the method is the ability to conduct comparative studies over a specific period of time.

A further distinguishing feature of the Human Lean Green study is the ability to generate a report that allows for the determination of the current level of implementation of good practices in three areas of sustainable development and the planning of improvement actions based on this.

As part of the cognitive direction of the development of the proposed method, an in-depth analysis of the essence of interaction and mutual influence between individual areas of sustainable development, studied in the method and recorded in the generated reports is being carried out.

One of the recommended directions for the development of the method is the enhancement of the functionality contained in the IT tool enabling a wider spectrum of the aforementioned quantitative analyses.

In connection with the obligation that companies have to report activities related to sustainable development, conceptual work began on the possibility of developing the Human Lean Green method towards its compatibility with the current reporting standards.

It should be emphasized that an additional challenge for entrepreneurs is the requirement to report on sustainable development. The mentioned ESG reporting is a process where enterprises publish information about their activities in environmental areas (e.g., CO₂ emissions, energy consumption), social areas (e.g., employee rights, engagement in community life) and corporate governance (e.g., business ethics, transparency). The CSRD—Corporate Sustainability Reporting Directive—extends the scope of ESG reporting to more and more enterprises.

Author Contributions: Conceptualization, M.B. and B.S.; methodology, B.S. and M.B.; formal analysis, B.S.; resources, M.B.; writing—original draft preparation, M.B. and B.S.; writing—review and editing, B.S.; visualization, B.S. and M.B.; supervision, B.S.; funding acquisition, B.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by statutory activity financed by the Polish Ministry of Science and Higher Education, grant number (0613/SBAD/4940).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Waas, T.; Hugé, J.; Block, T.; Wright, T.; Benitez-Capistros, F.; Verbruggen, A. Sustainability assessment and indicators: Tools in a decision-making strategy for sustainable development. *Sustainability* **2014**, *6*, 5512–5534. [\[CrossRef\]](#)
2. Marczak, Ł. Problem wieloznaczności pojęcia “zrównoważony rozwój”. *Stud. Gdańskie* **2015**, *36*, 167–180.
3. Czaja, S.; Becla, A. Wybrane informacyjne problemy definiowania zrównoważonego i trwałego rozwoju—ujęcie teoretyczne. *Optim. Stud. Ekon.* **2016**, *1*, 14–35. [\[CrossRef\]](#)
4. Elkington, J. The triple bottom line. *Environ. Manag. Read. Cases* **1997**, *2*, 49–66.
5. GRI Standards. Available online: <https://www.globalreporting.org/standards> (accessed on 24 November 2024).
6. Liu, H.; Zhao, H. Upgrading models, evolutionary mechanisms and vertical cases of service-oriented manufacturing in SVC leading enterprises: Product-development and service-innovation for industry 4.0. *Humanit. Soc. Sci. Commun.* **2022**, *9*, 387. [\[CrossRef\]](#)
7. Arvidsson, S.; Dumay, J. Corporate ESG reporting quantity, quality and performance: Where to now for environmental policy and practice? *Bus. Strategy Environ.* **2022**, *31*, 1091–1110. [\[CrossRef\]](#)
8. Sun, Y. The real effect of innovation in environmental, social, and governance (ESG) disclosures on ESG performance: An integrated reporting perspective. *J. Clean. Prod.* **2024**, *460*, 142592. [\[CrossRef\]](#)
9. Imperiale, F.; Pizzi, S.; Lippolis, S. Sustainability reporting and ESG performance in the utilities sector. *Util. Policy* **2023**, *80*, 101468. [\[CrossRef\]](#)
10. Hamrol, A. *Strategie i Praktyki Sprawnego Działania*; Wydawnictwo Naukowe PWN: Warszawa, Poland, 2015.
11. Shah, R.; Ward, P.T. Defining and developing measures of lean production. *J. Oper. Manag.* **2007**, *25*, 785–805. [\[CrossRef\]](#)
12. Bortolotti, T.; Boscari, S.; Danese, P. Successful lean implementation: Organizational culture and soft lean practices. *Int. J. Prod. Econ.* **2015**, *160*, 182–201. [\[CrossRef\]](#)
13. Negrão, L.L.L.; Godinho Filho, M.; Marodin, G. Lean practices and their effect on performance: A literature review. *Prod. Plan. Control* **2017**, *28*, 33–56. [\[CrossRef\]](#)
14. Jabbour, C.J.C.; Santos, F.C.A.; Fonseca, S.A.; Nagano, M.S. Green teams: Understanding their roles in the environmental management of companies located in Brazil. *J. Clean. Prod.* **2013**, *46*, 58–66. [\[CrossRef\]](#)
15. Piercy, N.; Rich, N. The relationship between lean operations and sustainable operations. *Int. J. Oper. Prod. Manag.* **2015**, *35*, 282–315. [\[CrossRef\]](#)
16. Resta, B.; Dotti, S.; Gaiardelli, P.; Boffelli, A. How lean manufacturing affects the creation of sustainable value: An integrated model. *Int. J. Autom. Technol.* **2017**, *11*, 542–551. [\[CrossRef\]](#)
17. Resta, B.; Dotti, S.; Gaiardelli, P.; Boffelli, A. Lean manufacturing and sustainability: An integrated view. In *Advances in Production Management Systems. Initiatives for a Sustainable World: IFIP WG 5.7 International Conference, APMS 2016, Iguassu Falls, Brazil, 3–7 September 2016, Revised Selected Papers*; Springer International Publishing: Cham, Switzerland, 2016; pp. 659–666.
18. Jasiulewicz-Kaczmarek, M.; Gola, A. Maintenance 4.0 technologies for sustainable manufacturing—An overview. *IFAC-PapersOnLine* **2019**, *52*, 91–96. [\[CrossRef\]](#)
19. Afum, E.; Agyabeng-Mensah, Y.; Sun, Z.; Frimpong, B.; Kusi, L.Y.; Acquah, I.S.K. Exploring the link between green manufacturing, operational competitiveness, firm reputation and sustainable performance dimensions: A mediated approach. *J. Manuf. Technol. Manag.* **2020**, *31*, 1417–1438. [\[CrossRef\]](#)
20. Bour, K.B.; Asafo, A.J.; Kwarteng, B.O. Study on the effects of sustainability practices on the growth of manufacturing companies in urban Ghana. *Heliyon* **2019**, *5*, e01903. [\[CrossRef\]](#)
21. Baah, C.; Jin, Z.; Tang, L. Organizational and regulatory stakeholder pressures—Friends or foes to green logistics practices and financial performance: Investigating corporate reputation as a missing link. *J. Clean. Prod.* **2020**, *247*, 119125. [\[CrossRef\]](#)
22. Cherrafi, A.; Elfezazi, S.; Hurley, B.; Garza-Reyes, J.A.; Kumar, V.; Anosike, A.; Batista, L. Green and lean: A Gemba–Kaizen model for sustainability enhancement. *Prod. Plan. Control* **2019**, *30*, 385–399. [\[CrossRef\]](#)
23. Teixeira, P.; Coelho, A.; Fontoura, P.; Sá, J.C.; Silva, F.J.; Santos, G.; Ferreira, L.P. Combining lean and green practices to achieve a superior performance: The contribution for a sustainable development and competitiveness—An empirical study on the Portuguese context. *Corp. Soc. Responsib. Environ. Manag.* **2022**, *29*, 887–903. [\[CrossRef\]](#)
24. Leong, W.D.; Lam, H.L.; Ng, W.P.Q.; Lim, C.H.; Tan, C.P.; Ponnambalam, S.G. Lean and green manufacturing—A review on its applications and impacts. *Process Integr. Optim. Sustain.* **2019**, *3*, 5–23. [\[CrossRef\]](#)
25. Teixeira, P.; Sá, J.C.; Silva, F.J.G.; Ferreira, L.P.; Santos, G.; Fontoura, P. Connecting lean and green with sustainability towards a conceptual model. *J. Clean. Prod.* **2021**, *322*, 129047. [\[CrossRef\]](#)

26. Garza-Reyes, J.A. Lean and green—A systematic review of the state of the art literature. *J. Clean. Prod.* **2015**, *102*, 18–29. [[CrossRef](#)]
27. Larinina, T.; Djoldosheva, T.; Mottaeva, A. A study on the convergence of lean and green management goals. *BIO Web Conf.* **2024**, *145*, 04035. [[CrossRef](#)]
28. Siegel, R.; Antony, J.; Govindan, K.; Garza-Reyes, J.A.; Lameijer, B.; Samadhiya, A. A framework for the systematic implementation of Green-Lean and sustainability in SMEs. *Prod. Plan. Control* **2022**, *35*, 71–89. [[CrossRef](#)]
29. Cherrafi, A.; Elfezazi, S.; Govindan, K.; Garza-Reyes, J.A.; Benhida, K.; Mokhlis, A. A framework for the integration of Green and Lean Six Sigma for superior sustainability performance. *Int. J. Prod. Res.* **2017**, *55*, 4481–4515. [[CrossRef](#)]
30. Ghasemibojd, F.; Franchetti, M.J.; George, B. Green lean six sigma for sustainable development: A systematic review of evolution, challenges, and future pathways. *Clean Technol. Environ. Policy* **2025**, 1–24. [[CrossRef](#)]
31. Garza-Reyes, J.A. Green lean and the need for Six Sigma. *Int. J. Lean Six Sigma* **2015**, *6*, 226–248. [[CrossRef](#)]
32. Banawi, A.; Bilec, M.M. A framework to improve construction processes: Integrating Lean, Green and Six Sigma. *Int. J. Constr. Manag.* **2014**, *14*, 45–55. [[CrossRef](#)]
33. Gaikwad, L.M.; Sunnapwar, V.K. Integrated Lean-Green-Six Sigma Practices to Improve the Performance of the Manufacturing Industry. In *Concepts, Applications and Emerging Opportunities in Industrial Engineering*; IntechOpen: London, UK, 2021.
34. Venugopal, V.; Saleeshya, P.G. Manufacturing system sustainability through lean and agile initiatives. *Int. J. Sustain. Eng.* **2019**, *12*, 159–173. [[CrossRef](#)]
35. Singh, S.; Olugu, E.U.; Musa, S.N. Development of sustainable manufacturing performance evaluation expert system for small and medium enterprises. *Procedia CIRP* **2016**, *40*, 608–613. [[CrossRef](#)]
36. Shah, R.; Ward, P.T. Lean manufacturing: Context, practice bundles, and performance. *J. Oper. Manag.* **2003**, *21*, 129–149. [[CrossRef](#)]
37. Lawrence, E.; Andrews, D.; Ralph, B.; France, C. Applying organizational environmental tools and techniques. *Corp. Soc. Responsib. Environ. Manag.* **2002**, *9*, 116–125. [[CrossRef](#)]
38. Herrmann, C.; Schmidt, C.; Kurle, D.; Blume, S.; Thiede, S. Sustainability in manufacturing and factories of the future. *Int. J. Precis. Eng. Manuf.-Green Technol.* **2014**, *1*, 283–292. [[CrossRef](#)]
39. Salleh, N.A.M.; Kasolang, S.; Jaffar, A. Green lean total quality information management in Malaysian automotive companies. *Procedia Eng.* **2012**, *41*, 1708–1713. [[CrossRef](#)]
40. Sung, J.; Ashton, D.N. *High Performance Work Practices: Linking Strategy and Skills to Performance Outcomes*; Department of Trade and Industry: London, UK, 2005.
41. Höglund, L.; Holmgren Caicedo, M.; Mårtensson, M.; Svärdesten, F. Strategic management in the public sector: How tools enable and constrain strategy making. *Int. Public Manag. J.* **2018**, *21*, 822–849. [[CrossRef](#)]
42. Eswaramoorthi, M.; Kathiresan, G.R.; Prasad, P.S.S.; Mohanram, P.V. A survey on lean practices in Indian machine tool industries. *Int. J. Adv. Manuf. Technol.* **2011**, *52*, 1091–1101. [[CrossRef](#)]
43. Kovilage, M.P. Influence of lean–green practices on organizational sustainable performance. *J. Asian Bus. Econ. Stud.* **2021**, *28*, 121–142. [[CrossRef](#)]
44. Nunhes, T.V.; Bernardo, M.; Oliveira, O.J. Guiding principles of integrated management systems: Towards unifying a starting point for researchers and practitioners. *J. Clean. Prod.* **2019**, *210*, 977–993. [[CrossRef](#)]
45. Poltronieri, C.F.; Ganga, G.M.D.; Gerolamo, M.C. Maturity in management system integration and its relationship with sustainable performance. *J. Clean. Prod.* **2019**, *207*, 236–247. [[CrossRef](#)]
46. Nunhes, T.V.; Bernardo, M.; Oliveira, O.J. Rethinking the way of doing business: A reframe of management structures for developing corporate sustainability. *Sustainability* **2020**, *12*, 1177. [[CrossRef](#)]
47. Gueorguiev, T.; Kostadinova, I. ISO Standards Do Good: A New Perspective on Sustainable Development Goals. In *Proceedings of the 13th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management (IC3K 2021)—Volume 3: KMIS, Virtual Event, 25–27 October 2021*; pp. 133–137.
48. Martínez, S.; Ortiz, I.; Juan, J.; Lázaro, F. Using Certification as a Tool to Develop Sustainability in Project Management. *Sustainability* **2018**, *10*, 1408. [[CrossRef](#)]
49. Bravi, L.; Santos, G.; Pagano, A.; Murmura, F. Environmental management system according to ISO 14001:2015 as a driver to sustainable development. *Corp. Soc. Responsib. Environ. Manag.* **2020**, *27*, 2599–2614. [[CrossRef](#)]
50. Hassan, H.; Bushagour, A.; Layton, A. Resilient Circularity in Manufacturing: Synergies Between Circular Economy and Reconfigurable Manufacturing. *J. Manuf. Sci. Eng.* **2024**, *146*, 110902. [[CrossRef](#)]
51. Kornelius, H. Linking occupational health and safety management to sustainable competitive advantage of the firm. *J. Econ. Bus.* **2018**, *1*, 577–583. [[CrossRef](#)]
52. Siva, V.; Gremyr, I.; Bergquist, B.; Garvare, R.; Zobel, T.; Isaksson, R. The support of Quality Management to sustainable development: A literature review. *J. Clean. Prod.* **2016**, *138*, 148–157. [[CrossRef](#)]
53. Rebelo, M.F.; Santos, G.; Silva, R. A generic model for integration of quality, environment and safety management systems. *TQM J.* **2014**, *26*, 143–159. [[CrossRef](#)]

54. Bernardo, M.; Gotzamani, K.; Vouzas, F.; Casadesus, M. A qualitative study on integrated management systems in a non-leading country in certifications. *Total Qual. Manag. Bus. Excell.* **2018**, *29*, 453–480. [\[CrossRef\]](#)
55. Asif, M.; Searcy, C.; Zutshi, A.; Ahmad, N. An integrated management systems approach to corporate sustainability. *Eur. Bus. Rev.* **2011**, *23*, 353–367. [\[CrossRef\]](#)
56. Merlin, F.K.; Pereira, V.L.D.V.; Pacheco, W. Sustainable development induction in organizations: A convergence analysis of ISO standards management tools' parameters. *Work* **2012**, *41* (Suppl. S1), 2736–2743. [\[CrossRef\]](#)
57. Poltronieri, C.F.; Gerolamo, M.C.; Dias, T.C.M.; Carpinetti, L.C.R. Instrument for evaluating IMS and sustainable performance. *Int. J. Qual. Reliab. Manag.* **2018**, *35*, 373–386. [\[CrossRef\]](#)
58. Cierpiol, A.; Wąsikiewicz-Rusnak, U. *Znormalizowane Systemy Zarządzania w Organizacjach Przemysłowych*; Wydawnictwo Naukowe Akademii WSB: Wrocław, Poland, 2021.
59. Nunhes, T.V.; Campos, T.L.R.; Francisco, F.E.; Oliveira, O.J.D. Contributions of Annex SL to Corporate Sustainability. *Front. Sustain.* **2021**, *2*, 745350. [\[CrossRef\]](#)
60. Silva, C.; Magano, J.; Moskalenko, A.; Nogueira, T.; Dinis, M.A.P.; Pedrosa e Sousa, H.F. Sustainable management systems standards (SMSS): Structures, roles, and practices in corporate sustainability. *Sustainability* **2020**, *12*, 5892. [\[CrossRef\]](#)
61. Gianni, M.; Gotzamani, K.; Tsiotras, G. Multiple perspectives on integrated management systems and corporate sustainability performance. *J. Clean. Prod.* **2017**, *168*, 1297–1311. [\[CrossRef\]](#)
62. de Nadae, J.; Carvalho, M.M.; Vieira, D.R. Integrated management systems as a driver of sustainability performance: Exploring evidence from multiple-case studies. *Int. J. Qual. Reliab. Manag.* **2021**, *38*, 800–821. [\[CrossRef\]](#)
63. Gibson, R.B.; Hassan, S.; Holtz, S.; Tansey, J.; Whitelaw, G. *Sustainability Assessment: Criteria and Processes*; Earthscan: London, UK, 2005.
64. Pope, J. What's so special about sustainability assessment? *J. Environ. Assess. Policy Manag.* **2006**, *8*, v–x. [\[CrossRef\]](#)
65. Sari, Y.; Hidayatno, A.; Suzianti, A.; Hartono, M. A systematic literature review for developing sustainability assessment tool: Formulating the state of the art and future direction. *IOP Conf. Ser. Mater. Sci. Eng.* **2019**, *703*, 012018. [\[CrossRef\]](#)
66. Gibson, R.B. Beyond the pillars: Sustainability assessment as a framework for effective integration of social, economic and ecological considerations in significant decision-making. *J. Environ. Assess. Policy Manag.* **2006**, *8*, 259–280. [\[CrossRef\]](#)
67. Madanchi, N. A Rapid Assessment Tool to Assess Factory Sustainability. Master's Thesis, University of Rhode Island, Kingston, RI, USA, 2013.
68. Subic, A.; Shabani, B.; Hedayati, M.; Crossin, E. Performance analysis of the capability assessment tool for sustainable manufacturing. *Sustainability* **2013**, *5*, 3543–3561. [\[CrossRef\]](#)
69. Popovic, T.; Barbosa-Póvoa, A.; Kraslawski, A.; Carvalho, A. Quantitative indicators for social sustainability assessment of supply chains. *J. Clean. Prod.* **2018**, *180*, 748–768. [\[CrossRef\]](#)
70. Chen, D.; Schudeleit, T.; Posselt, G.; Thiede, S. A state-of-the-art review and evaluation of tools for factory sustainability assessment. *Procedia CIRP* **2013**, *9*, 85–90. [\[CrossRef\]](#)
71. Steinkellner, H.; Domenik, K. Strengthen Social Sustainability in Parcel Hubs: A Theoretical Exploration and the Potential Role of Discrete Event Simulation. In Proceedings of the XXV International Conference MHCL, Vienna, Austria, 18–19 September 2024.
72. Wu, L.; Subramanian, N.; Abdulrahman, M.D.; Liu, C.; Lai, K.H.; Pawar, K.S. The impact of integrated practices of lean, green, and social management systems on firm sustainability performance—Evidence from Chinese fashion auto-parts suppliers. *Sustainability* **2015**, *7*, 3838–3858. [\[CrossRef\]](#)
73. Jonker, J.; Rudnicka, A.; Reichel, J. *Nowe Horyzonty. Przewodnik po Społecznej Odpowiedzialności i Rozwoju Zrównoważonym*; Centrum Strategii/Rozwoju Impact: Łódź, Poland, 2011.
74. Benitez, B. *Corporate Sustainability Self-Assessment*; Harvard Division of Continuing Education: Cambridge, MA, USA, 2018.
75. Nicholls, J.; Lawlor, E.; Neitzert, E.; Goodspeed, T. *A Guide to Social Return on Investment*; Office of the Third Sector, Cabinet Office: London, UK, 2009.
76. Shahbazi, S.; Kurdve, M.; Zackrisson, M.; Jönsson, C.; Kristinsdottir, A.R. Comparison of four environmental assessment tools in Swedish manufacturing: A case study. *Sustainability* **2019**, *11*, 2173. [\[CrossRef\]](#)
77. Karnib, A. A methodological approach for sustainability assessment: Application to the assessment of the sustainable water resources withdrawals. *Int. J. Sustain. Dev.* **2016**, *19*, 402–417. [\[CrossRef\]](#)
78. Moldavska, A.; Welo, T. Development of manufacturing sustainability assessment using systems thinking. *Sustainability* **2015**, *8*, 5. [\[CrossRef\]](#)
79. Jawahir, I.S.; Bradley, R. Technological elements of circular economy and the principles of 6R-based closed-loop material flow in sustainable manufacturing. *Procedia CIRP* **2016**, *40*, 103–108. [\[CrossRef\]](#)
80. Eslami, Y. A Modelling-Based Sustainability Assessment in Manufacturing Organizations. Ph.D. Dissertation, Politecnico di Bari, Bari, Italy, 2019.
81. Jing, W.; Alias, A.H. Key factors for BIM Implementation in the Context of ESG and SDGs Integration: A Systematic Literature Review. *Sustainability* **2024**, *16*, 9504. [\[CrossRef\]](#)

82. Tehrani, M.; Rathgeber, A.; Dougherty, E.; Fulton, L.; Fournier, J. Dow Jones Sustainability Indices and ESG Scores: Do They Tell the Same Story? *Sustainability* **2024**, *16*, 6110. [[CrossRef](#)]
83. Khamisu, M.S.; Paluri, R.A. Emerging trends of environmental social and governance (ESG) disclosure research. *Clean. Prod. Lett.* **2024**, *7*, 100079. [[CrossRef](#)]
84. Yang, S.; Zhao, W.; Liu, Y.; Cherubini, F.; Fu, B.; Pereira, P. Prioritizing sustainable development goals and linking them to ecosystem services: A global expert's knowledge evaluation. *Geogr. Sustain.* **2020**, *1*, 321–330. [[CrossRef](#)]
85. Chomać-Pierzecka, E.; Dyrka, S.; Kokieli, A.; Urbańczyk, E. Sustainable HR and employee psychological well-being in shaping the performance of a business. *Sustainability* **2024**, *16*, 10913. [[CrossRef](#)]
86. Peretz, H. Sustainable human resource management and employees' performance: The impact of national culture. *Sustainability* **2024**, *16*, 7281. [[CrossRef](#)]
87. ISO 37000:2021; Governance of Organizations—Guidance. International Organization for Standardization: Geneva, Switzerland, 2021.
88. Elidrisy, A. Comparative Review of ESG Reporting Standards: ESRS European Sustainability Reporting Standards “versus ISSB” International Sustainability Standards Board (Comparative Analysis of ESG Reporting Standards). *Int. Multiling J. Sci. Technol.* **2024**, *9*, 7191–7198.
89. ISO 26000:2010; Guidance on Social Responsibility. International Organization for Standardization: Geneva, Switzerland, 2010.
90. Du Toit, E. Thirty years of sustainability reporting: Insights, gaps and an agenda for future research through a systematic literature review. *Sustainability* **2024**, *16*, 10750. [[CrossRef](#)]
91. Leal Filho, W.; Wall, T.; Williams, K.; Dinis, M.A.P.; Martin, R.M.F.; Mazhar, M.; Gatto, A. European sustainability reporting standards: An assessment of requirements and preparedness of EU companies. *J. Environ. Manag.* **2025**, *380*, 125008. [[CrossRef](#)]
92. Starzyńska, B.; Bryke, M.; Diakun, J. Human lean green method—A new approach toward auditing manufacturing & service companies. *Sustainability* **2021**, *13*, 10789. [[CrossRef](#)]
93. Abualfaraa, W.; Salonitis, K.; Al-Ashaab, A.; Ala'raj, M. Lean-green manufacturing practices and their link with sustainability: A critical review. *Sustainability* **2020**, *12*, 981. [[CrossRef](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.