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Green Logistics Practices Seeking Development of Sustainability: Evidence from Lithuanian Transportation and Logistics Companies

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Abstract: Reducing the harmful effects on the environment and increasing the expression of sustainable development principles is one of the most topical challenges all around the world. Given the importance of logistics for the economy and the growing concern for the environment, the purpose of this article was to reveal a green logistics (GL) practice framework for sustainable development. Based on a systematic and comparative analysis of the scientific literature, the authors present a theoretical conceptual model for applying GL practices to sustainable development. In order to assess the expression of GL practices and their determinants in Lithuanian transport and logistics services companies, a quantitative questionnaire survey was conducted. Descriptive statistics, correlation, and regression analyses were used to analyze the data. The results made it possible to identify GL areas such as green transportation, green warehousing, green management, sustainable waste management, and the prevailing GL practices in Lithuania: "Eco-driving", "Optimization of transport routes", and "Optimization of transport cargo distribution". The factors that most encouraged the application of GL practices in the studied companies were: legal regulation and policies, requirements of business partners, service users, customers and society, awareness of the company's top management, and corporate culture focused on environmental conservation and sustainable development.

Keywords: sustainability; green logistics; green logistics practices; driving factors; Lithuania

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1. Introduction

Reducing harmful effects on the environment is not only one of the major challenges in the world, but also a priority objective to implement the provisions of the sustainable development strategy. These objectives and challenges are relevant for businesses in all sectors of the economy, including logistics. Logistics, on the one hand, is vital for the economy and everyday life of countries, and on the other hand, it is one of the main sources of pollution and users of resources [1–4]. The logistics sector is facing increasingly stringent environmental requirements. This is largely due to two reasons. First, in recent years, the growth of freight transport services has had a significant impact on congestion, safety, and environmental pollution. Second, the need for more sustainable logistics services is growing in the countries concerned. As a result, there is a growing diversification of the application of GL initiatives in businesses. With an increase in globalization and the complexity of supplier networks, there is an increased business interest in managing these networks' sustainable performance. However, the ability to do so is still inadequate [5]. Authors [5] highlighted that implementation of sustainable decisions and contribution to truly sustainable business management, in general, is a transformative task. Change must cover all activities of businesses, including management, learning, and corporate culture.

The application of GL practices in business activities is an important prerequisite for reducing a negative environmental impact of logistics processes. "Green practices in logistics operations are the only solution to control air pollution, climate change and global warming problems" [1] (p. 15). The studies of Aldakhil et al. [1] have shown that green practices in logistics operations are positively correlated with sustainable economic and environmental growth. The achievement of the objectives of economic and environmental sustainability depends on the viability and effectiveness of green practices in logistics operations [6]. According to Karaman et al. [7] and Seroka-Stolka et al. [8], green logistics activities promote the circular economy and the overall economic development of countries. The activity of GL in implementing the circular economy of enterprises is the use of environmentally friendly green packaging, green transportation, storage, and processing flow [8].

Most scientists [2,3,9] emphasize that sustainable development can be ensured by the active application of GL practices in business activities, transport, storage, and packaging. Studies on GL practices have been carried out in Germany, Italy, G. Britain [10], Sweden [11], Slovakia [12], China [13], Morocco [14], and Thailand [15]. The results of studies in different countries showed a wide variety of GL practices. Based on scientific research analysis, the case of the investigated party, the duration of the company's activities, the basket of logistical services, the country and business culture, etc. can significantly differentiate the application of its practices across countries. From a research point of view, most studies of GL practices have focused on manufacturing sectors and relatively little attention has been paid to the transportation and logistics service. Furthermore, there is a great deal of variability about the implementation of green practices by logistics enterprises and factors that encourage and/or limit their application. Although the scientific community widely analyze GL practices and their implementation, there is a research gap in conceiving a GL practice framework for sustainable development.

The increasing demand for the application of GL practices encouraged the authors of this article to carry out a comprehensive analysis into the theory of GL practices and the factors influencing their application. It also motivated us to test empirically the situation regarding the application of GL practices in Lithuanian transport and logistics service companies. Lithuania, located in the center of the Baltic Sea region between the markets of Western Europe and Eastern countries, has become an important transit and logistics service country. The territory of the country is crossed by two international transport corridors and their branches. This enables Lithuania to become an important link in the global transport logistics chain, serving east–west and north–south trade flows, maximizing the benefits of individual modes of transport and their effective interaction. According to the data of analytics company "Scorify", transport and logistics services companies in Lithuania generate more than 12% of the country's GDP, which is why the state pays great attention to this area, encouraging its continuous development, reduction in environmental pollution, and investment in roads, ports, public logistics centers, urban logistics, and state-of-the-art infrastructure. Despite the advantages of the logistics sector, there is considerable concern about the country's strong growth in freight traffic, which is due to the increasing environmental impact of logistics operations, increasing CO_2 emissions, noise, consumption of natural resources, waste generation, etc. There is an urgent need to take into account emerging environmental challenges, with an increasing focus on sustainability issues and a stronger use of GL practices.

The purpose of the article is to reveal a GL practice framework for sustainable development.

The article consists of the following structural parts. The first part of the article highlights the principles of green logistics and their links to sustainable development. The second part identifies and comments more widely on green logistics practices and the factors and the benefits of their application in enterprises. The theoretical model of the application of green logistic practices developed by the authors is presented as a result of theoretical insights. The third part presents the methodology of empirical research.

The last part presents the results of a quantitative study conducted in Lithuanian logistics companies, as well as a discussion and conclusions.

2. Theoretical Background

2.1. Green Logistics as a Condition for Sustainable Development

In recent decades, world scientists, politicians, and civil society have developed a universal concept that combines social, economic, and environmental objectives, which has been identified as a concept of sustainable development. Bajdor et al. [16] noted that the sustainable development concept changed modern enterprise's business perspective and strategies, which moved away from achieving economic and financial profit towards social and ecological order.

In the scientific debate, it is recognized that green logistics, as a practice implementing the principles of sustainable development, is particularly important in its potential to address environmental, economic, and social issues. This is illustrated by the interpretations of the GL concept, in which GL is defined as management practices and measures that are employed to reduce environmental impact not only by reducing CO_2 emissions, but also by limiting other air pollutants that are emitted while burning fossil fuels, misusing other natural resources, and inappropriately disposing waste [10]. According to other authors, this is sustainable production and distribution of goods, taking into account environmental and social factors [8,17–19], which focuses on material handling, waste management, packaging, and transport. Hutomo et al. [20] state that it is an economic activity aimed at serving customers and social development, linking suppliers and customers, overcoming space and time barriers, and achieving efficient and rapid movement of goods and services. Khan [2] notes that the concept of GL has evolved to reduce the harmful effects of logistics on social and environmental sustainability without compromising the profitability and efficiency of logistics operations. Mesjasz-Lech [21] emphasizes not only the integration of the environmental goals with the decision-making processes of the economic entities, but also the commitment of all partners toward the economic and environmental efficiency. Seroka-Stolka et al. [8] highlight that activities of GL are related to the ecologically efficient management of the flow of products and information in order to create an added value for customers and satisfy their needs.

In discussions of the scientific community [4,7–9,12,17,18,22,23], it is agreed that the concept of sustainable development, which combines three main interrelated and complementary aspects—economic, environmental, and social—can also be implemented in logistic processes.

The economic aspect includes the use of the cost-effective routes, combined transport, the provision of a fair price for services and a quality assurance to the consumer, the enhancement of the competitiveness of the company, and the pursuit of the higher added value. This aspect also leads to a better overall of the business environment, lower taxes, and fiscal policy. The environmental aspect includes the use of the renewable energy sources, energy saving of fossil fuels, a reduction in emissions into the atmosphere, and the use of clean vehicles. In this aspect, companies not only reduce the environmental impact, but they also achieve financial benefits (fuel, time) in order to use the energy sources more efficiently. The social aspect includes a social responsibility of the companies, employee competence, ensuring occupational safety, as well as providing a good and ergonomic working condition for the workers, reducing road accidents. The social aspect determines the motivation of the company's employees and their interest in the well-being of the society and the state. Based on Bajdor et al. [16], an enterprise's financial results are indeed a vital success factor, but next to them, social and ecological responsibility has also become the critical success factor. According to Broman and Robèrt [24], an ecological, social, and financial capital is essential for the sustainable society and for the transition to a such society.

The clear link between the GL and sustainable development can be realized in areas such as green transportation, green warehousing, green packaging, green management, green logistics data collection and management, and waste management [12,15,17,18,25]. According to Karia and Asaari [26], green packaging is associated with economically, environmentally, and socially sustainable material use, packaging processes, and packaging recycling and reuse; green storage is understood as storage space, layout, and energy consumption optimization; green transportation includes green vehicles, contributing to the economic, environmental, and social sustainable development, the use of green management–GL strategic planning, control, monitoring, and evaluation in order to ensure coherence between economic, environmental, and social aspects; and GL collection and processing of data carried out using technologies such as management systems, software, and advanced information systems, allowing not only to improve the management but to reduce paper documents as well.

In summary, the contribution of GL to sustainable development is clear, and the promotion of GL practices is essential for achieving sustainable development goals.

2.2. Application of Green Logistics Practices in Logistics Companies

GL is becoming important in the path leading to the development of sustainability. According to Karia and Asaari [26], GL is a way to improve ecologically, economically, and socially sustainable development by reducing the operating costs of enterprises and saving energy without harming the natural environment and society, while increasing the quality of life of society.

Scientists and practitioners in the field of GL are actively exploring the application of practices, methods, and technologies related to sustainable development. Results of retrospective analysis of scientific literature [13–15,18,27,28] revealed the abundance of GL practices and the diversity of their classification.

The ten most applicable GL practices identified by Zowada and Niestrój [24]: use of alternative fuels and recyclable packaging; fleet renewal; route optimization; use of intermodal transport; "Eco-driving"; upgrading of warehouse equipment and technology for energy efficiency; optimization of warehouse space; reduction in paper documents (digitisation); and use of "green" criteria for selecting suppliers and business partners. Similar GL practices are also identified in the works of Evangelista et al. [9], Baz and Laguir [14], and Pieters et al. [27].

Zhang et al. [13], in a study of Chinese truck fleets, found that GL is related to logistics management strategy development, green warehousing and packaging, green transportation, vehicle fleet management, innovation such as alternative fuels, etc. Baz et al. [14], while researching the expression of GL in 3PL Moroccan companies, found that most practices are related to transport and vehicle use, such as fleet modernization, route optimization, and efficient vehicle loading. In the field of storage, this is mainly achieved through waste reduction and the use of organic packaging. The authors also found that the lack of a clear environmental strategy, weak cooperation, and the absence of partners limit the expression of green practices. The results of the study by Sureeyatanap et al. [15] conducted in Thailand logistics companies showed that green driving, vehicle route optimization, use of alternative energy, and model shift are the most common green practices. In addition, the company's size, financial situation, "service areas", customer pressure and organizational support were found to be statistically significant for the level of implementation of GL practices. The study revealed that companies with more than 200 employees and higher profits have a higher level of GL practice than smaller companies. The reason for this could be the limited resources available, which could potentially reduce environmental initiatives.

Among the studies on this topic, one of the most notable works was conducted by Centobelli et al. [10] and provided a systematic classification (taxonomy) of GL practices. After a thorough analysis of scientific literature, the authors purified 14 practices of GL, on which the focus of the majority of researchers and practitioners is: usage of alternative fuels,

transportation modes and vehicles, eco-driving, avoidance of empty running, full-vehicle loading, routing techniques to minimize travel distances, energy-efficient warehousing and usage of alternative energy sources in it, materials and packaging recycling, certification (ISO 14001), employee training, and environmental performance measurement and monitoring. In addition, by the empirical study, the authors explained the level of application of these practices among logistics providers in Germany, Italy, and Great Britain. The study found that German companies are more likely to use green practices than Italian and British ones.

The external and internal factors affecting the application of GL practices are widely analyzed in the scientific literature. In Zimon et al. [29], external factors were organized into two more groups: one of them is consumers/suppliers, and the other is third parties, such as regulatory pressure, institutional pressures, international environmental regulation, competition, reputation, and social responsibility. Government policy and legal regulation are considered dominant forces [9,13–15,30]. Baah et al. [23] identify pressures from organizational and regulatory stakeholders as another factor that affects the implementation of GL practices, which enhances environmental reputation and financial performance.

Denisa et al. [31] conducted a study on the application of GL in Slovak SMEs and found that customer pressure and top management decisions are the most important factors. By adopting GL initiatives for SMEs, companies try to maintain existing ones and attract new customers. In addition, the authors add that the involvement of top management has a direct impact on how green logistics initiatives will be adopted by employees. Sureeyatanap et al. [15] and Chu et al. [32] also note the importance of customer pressure, which contributes significantly to the financial performance of the company. As a result, managers should give employees more autonomy and flexibility in their activities. This demonstrates that addressing the needs of legislation, government policy, business partners, or clients is not the only factor driving the application of GL practices, but there are other important factors such as managers' understanding of the environment, awareness, and human resources. According to the survey of Swedish logistics companies conducted by Pålsson and Kovacs [11], the following companies' objectives were identified as important factors: the need to improve company's image, save costs in the long term, improve competitiveness, and respond to the needs of society. Ibrahim et al. [3] conducted a survey in Malaysian logistics companies to examine the impact of technological, organizational, and environmental awareness factors on the intention to adapt green practices. The study found that technological and environmental awareness factors have a small impact on the willingness to use green practices, while organizational factors have a significant impact.

Not only can the above factors influence the application of GL practices, but so can the socio-economic characteristics of the company itself, such as ownership, size, financial situation [13,15,33], turnaround, and operating period [7,9,14,15,17].

The analysis carried out in the scientific papers suggests that the application of GL practices is determined by both internal and external environmental factors of logistics companies. It is also important to note that the influence of factors is not the same; some promote more, others can also have the opposite effect, i.e., to discourage or limit the application of GL practices.

In conclusion, it can be noted that the main factors of the external environment that promote the application of GL practices are the legal regulation and policies of national governments, the requirements of business partners, service users, customers, and society. The most distinguishing factors of the internal environment are the following: the awareness of the company's top management and the corporate culture oriented towards the preservation and sustainable development of the environment.

The review of the literature allowed the authors of the article to develop a theoretical model revealing GL practices seeking development of sustainability (see Figure 1).

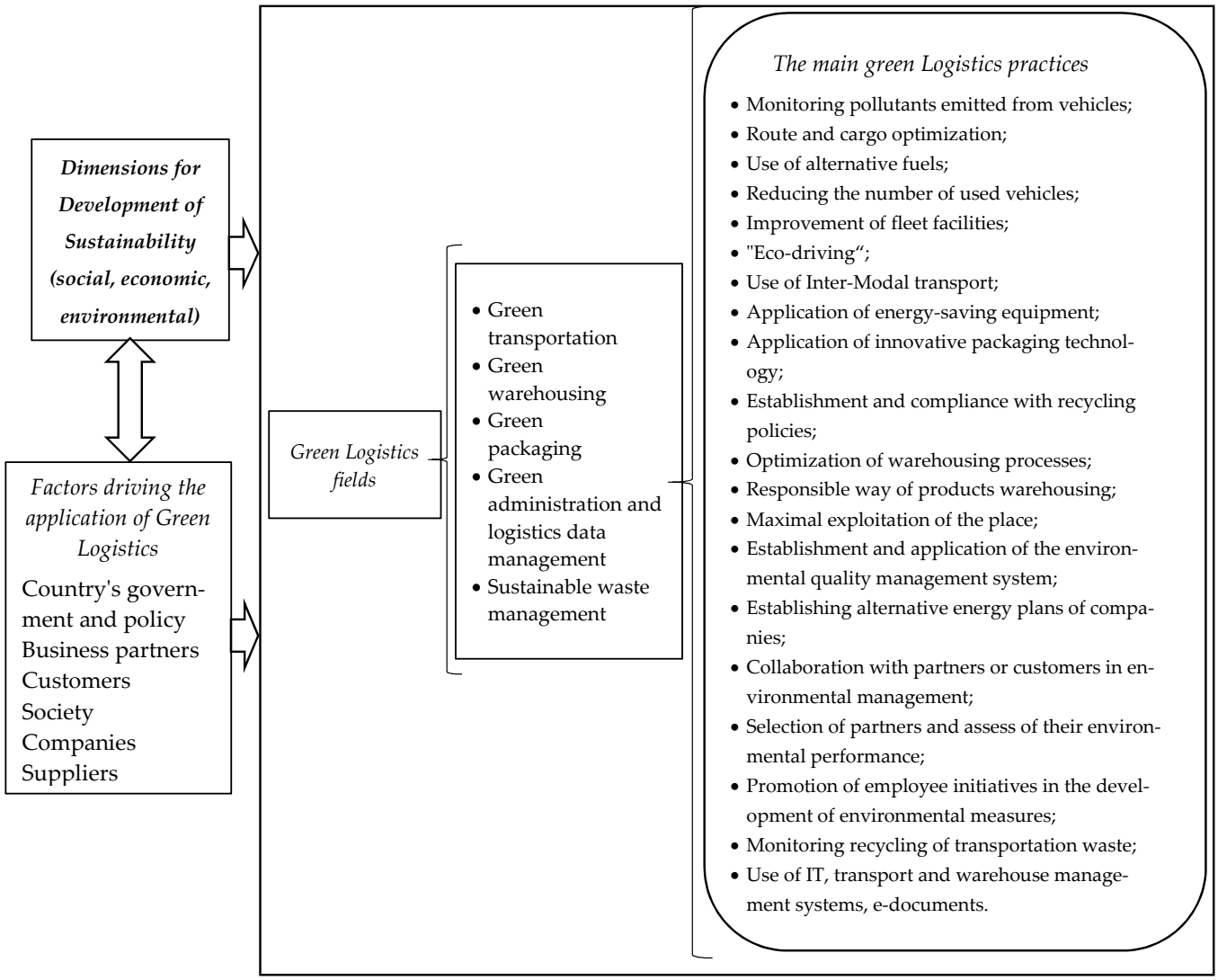

Figure 1. Theoretical conceptual model of green logistics practices seeking development of sustainability.

The model presented reveals the links between factors, fields of GL, and their practices with sustainable development. The application of green practices is influenced by government policies, business partners, consumers, society, etc. The objectives and initiatives of businesses themselves are one of the factors. The fields of GL can be defined in detail by GL practices, which are very diverse.

2.3. The Benefits of Applying Green Logistics Practices

Stream of studies has revealed that there are numerous benefits associated with GL practices. Researchers evaluate the benefits of applying GL practices at the company level from different points of view. Khan [2], Richnák et al. [12], Maas et al. [30], Azevedo et al. [34], and Sureeyatanap et al. [15] state that GL practices in logistics operations improve the economic performance of the company, increase customer satisfaction and confidence, increase operational efficiency, and improve environmental sustainability. As stated by Chu et al. [32], although, at the beginning, the GL application increases the costs of investment, operation, training, and purchase of environmentally friendly materials, in the long term, it reduces storage, stockpiling, transportation, and energy costs. Others [7,33,35] state that it improves the institutional image of business and their competitive position in the market, leads to consumer satisfaction, and contributes to reducing waste and environmental costs [34–36]. As Tüzün et al. [37] state, "green logistics helps improve a business, commercial performance along with its environmental image, and

provide for more efficient uses of resources, while also enabling recycling and improving market shares" (p. 604). From the point of view of Patra [35] and Evangelista [38] there are four main benefits of companies practicing GL, i.e., reduction of carbon emissions; cost reduction in the long term; control of air, noise, and environmental pollution; and business diversification and management of additional directions (reverse logistics).

To summarize the theoretical insights, the application of GL practices is clearly necessary to reduce the negative environmental impact of the logistics sector, taking into account the needs and interests of stakeholders, using advanced technologies and equipment, and reflecting global trends in sustainable development strategies.

3. Methods

A review of the literature has shown that the factors influencing green logistics practices in transport and logistics services in order to achieve sustainability are very diverse and vary from country to country. Thus, it has been suggested that the green practices of Lithuanian transport and logistics companies may also differ, and their application may be influenced by different factors. The aim of an empirical study was to determine the applicable GL practices in Lithuanian transport and logistics service companies and the factors that promote their application. To achieve this aim, the following tasks of empirical research were outlined:

1. To identify the prevailing fields and practices of GL.
2. To identify the factors most conducive to the application of GL practices.

A questionnaire survey method was used to conduct the study. The scientists [39] recommend this method for a variety of reasons, but one of the most important is that, in a short time and with a low cost of funds, a fairly large number of respondents can be interviewed. Transport and logistics services companies are distributed quite widely in the territory of Lithuania, which was one of the reasons for the choice of this method. As a result of the COVID-19 pandemic, intra-country movement was restricted, and an e-survey was carried out.

Lithuanian transport and logistics companies were chosen as the target respondents. A questionnaire was placed on the website www.apklausa.lt (from 1 April until 31 December 2020). In order to interview as many target respondents as possible, two different strategies for disseminating the questionnaire were used. One of them was a snowball, where target respondents were found through the channels of researchers and their colleagues and acquaintances. On the other hand, a link to the questionnaire was sent to the transport and logistics companies' e-mails published on the website of Business News catalogue (Business News) (https://rekvizitai.vz.lt/) (from 1 April until 31 December 2020).

The questionnaire consisted of three groups of questions and statements.

- The first group of questions were designed to identify socio-economic characteristics of enterprises such as enterprise's activity duration, size, and average turnover per year (sources: [7,9,13–15,25,33]).
- The second group of questions examined green practices in transport and logistics companies. This group consisted of 29 items: monitoring of emissions from vehicles, use of biofuels, use of alternative or new energy vehicles, reduction of the number of used vehicles, route optimization, cargo distribution optimization, eco-driving, use of intermodal transport, the maximum warehouse space exploitation of improved or innovative handling systems, responsible products storage mode selection, storage space optimization, innovative packaging technology, the application of greener packaging type of the choice of recyclable packaging materials and logistics containers, transport packaging reduction, the company's quality, environmental management system, collaboration with partners or clients in environmental management, environmental management certification, advanced information system development/installation of plant, environmental effectiveness of the audit, the partner selection and their environmental measures effectiveness assessment conducted staff of the environmental

management knowledge training, employee initiatives promoting the development of environmental measures environmental management strategies for the identification, storage and transport of waste recycling, waste recycling monitoring, containers and other logistics packaging materials recycling, and responsibility for waste sorting (sources: [10,13–15,27,28,38]).

- The third group of questions consisted of 17 items, which were used to identify factors contributing to the application of GL: legal and regulatory requirements, recommendations and regulations of logistics industry associations, customer recommendations and requirements, recommendations and requirements of logistics company partner, public requirements, customer environmental management requirements, the need to improve the image of the company, the behavior of the company's shareholders, employees environmental management requirements, the need to improve the competitiveness of the company, needs to receive subsidies and other benefits, the desire to reduce costs, facilitate the disposal of hazardous waste, implement its environmental mission, marketing needs, part of the corporate culture, and needs to improve the environmental performance of the company (sources: [9,11,13,14,23,30–32]).

The five-point Likert scale was used to assess green practices and factors, where 1 is completely disagreeable, and 5 is entirely in agreement. The questionnaire survey was conducted in 2020 in quarters III to IV. In total, 292 completed questionnaires were received.

The SPSS 17 program package was used to analyze and statistically evaluate the data.

To determine the internal reliability (validity) of the scales, the Cronbach alpha coefficient (see Table 1) was calculated.

Table 1. Cronbach Alpha coefficients of reliability of the green logistic fields and practices questionnaire.

Fields of Green Logistics	Number of Statements of Green Practitioners	Cronbach Alpha Coefficients
Green transportation	8	0.86
Green warehousing	4	0.84
Green packaging	4	0.78
Green management	9	0.95
Sustainable waste management	4	0.84

Cronbach alpha coefficient describes a psychometric relevance of the test variables, the internal consistency of the test. The test theory indicates that when Cronbach alpha value comes closer to 1, internal consistency of the test is high. Cronbach's alpha value equal to or greater than 0.7 is considered reliable [40,41]. All calculated Cronbach alpha coefficients (see Table 1) exceed 0.7, indicating a high psychometric relevance of the study variables.

As the study was also aimed at identifying the factors most conducive to the application of GL practices in Lithuanian transport and logistics services, it was appropriate to determine, before carrying out the impact analysis, whether there were statistically significant links between the driving factors and the individual variables of the green logistics fields; therefore, Spearman's correlation analysis was chosen. There are statistically significant relationships where the *p*-value (sig.) is less than the set significance level (0.01 and 0.05). The magnitude of the correlation coefficient allowed us to judge the influence of the dependent variable on the independent variable. According to the Chedoke scale, the link's strength characteristic (R) 0.1–0.3 is weak, 0.3–0.5 average, 0.5–0.7 noticeable, 0.7–0.9 strong, and 0.9–0.99 very strong [42].

Further calculations have eliminated the statistically insignificant links between factors and green logistics. Additionally, subsequent calculations made it possible to determine which factors had the greatest impact on the fields of GL applied in Lithuanian transport and logistics services companies.

A regression analysis was carried out to determine which factors had the greatest impact on green logistics. Several key indicators were taken into account for the regression analysis. The regression factor (R^2) represents the extent to which the independent variable explains the dispersion of the dependent variable [43]. According to the author, based on

the determinant coefficient alone, it is not possible to say whether the linear regression model is suitable for the available data, but the higher the determinant coefficient (its maximum value is 1), the more accurately the dependent variable from the independent is calculated. Čekanavičius and Murauskas [41] also point out that a regression model with $R^2 < 0.20$ is considered inappropriate. During the regression analysis, an ANOVA test (p) was also performed, which indicates the statistical significance of the relationship. According to S. Bekešienė [43] and Čekanavičius and Murauskas [41], regression model is statistically significant with ANOVA criterion value $p < 0.05$. In addition, the authors point out that the reported regression equation coefficient Beta of standardized data makes it possible to determine which regressor is more influential in the model. The distribution of the respondents according to the socio-economic characteristics is presented in Table 2.

Table 2. Socio-economic characteristics of respondents (n = 292).

Socio-Economic Characteristics of an Enterprise	Variant of Responses	Number of Respondents	Structure, %
Duration of enterprise's activity, in years	1–5	56	19
	6–10	56	19
	11–20	100	35
	21 and longer	80	27
Size of the enterprise by the average annual number of employees	Micro (0–9)	32	11
	Small (10–49)	76	26
	Average (50–250)	68	23
	Large (>250)	116	40
Average annual turnover in million EUR	up to 1	36	12
	1–4	80	28
	5–10	48	17
	11–50	52	18
	51 and above	76	26

The information collected during the study and presented in Table 2 only confirms the importance of the logistics sector in Lithuania. More than half the respondents (62%) were the companies active for more than 10 years. Additionally, 40% of the respondents indicated that the number of employees of the company exceeds 250. A quarter of transport and logistics companies surveyed have an average annual turnover of more than EUR 51 million.

4. Results

4.1. Prevailing Green Logistics Practices and Fields in Lithuanian Companies Providing Transport and Logistics Services

The results of the study (Table 3) suggest that the goals of sustainable development are relevant for Lithuanian transport and logistics companies, since the GL practices covered all the fields of GL activities, and the range of GL practices is wide enough. The resulting calculations show that the standard deviation varies in the range from 0.88 to 1.36. This shows that GL practices, such as the "Optimization of transport routes", "Optimization of transport freight distribution", and "Eco-driving", according to the standard deviation, are less than 1, which indicates that the answers of the respondents are more undivided/unanimous. Other green practices and their application in companies, according to the standard deviation, show that the answers of the respondents are very scattered (standard deviation > 1). It is assumed that the predominant practices in the companies studied are "Eco-driving", "Optimisation of transport routes", and "Optimisation of transport cargo distribution" (assessment standard deviation < 1). It is worth noting that, according to the respondents, the average rating of green practices, according to the importance of their application in companies, is not high and ranges from 2.10 to 2.89. It would also be possible to distinguish more GL practices, which are sufficiently widely applied in the studied transport and logistics service companies in Lithuania: "Reducing the number of vehicles used", "Maximizing the use of warehouse space", "Using improved or innovative loading systems", "Optimising storage space", "Using recyclable packaging materials

and logistics containers", "Reducing the use of transport packaging", " Environmental management certification", and "Recycling of packaging materials".

Table 3. GL fields and practices in Lithuanian transport and logistics companies (n = 292).

Green Logistics Fields and Practices	Average	SD
Green transportation	2.39	1.11
Monitoring of emissions from vehicles	2.36	1.22
Use of biofuels in vehicles	2.89	1.35
Use of alternative or new energy vehicles	2.71	1.36
Reduction of used vehicles	2.16	1.01
Optimization of transport routes	2.25	0.98
Optimization of transport cargo distribution	2.10	0.88
Eco-driving	2.26	0.98
Use of intermodal transport	2.41	1.11
Green warehousing	2.46	1.07
Maximum use of warehouse space	2.55	1.05
Use of improved or innovative loading systems	2.51	1.05
Responsibly chosen method of product storage	2.33	1.09
Optimization of storage space	2.48	1.04
Green packaging	2.63	1.10
Application of innovative packaging technologies.	2.81	1.11
Choosing a greener type of packaging	2.59	1.12
Use of recyclable packaging materials and logistics containers	2.53	1.06
Reduction of the use of transport packaging	2.59	1.05
Green management	2.65	1.18
Establishment of an enterprise quality environmental management system	2.63	1.28
Cooperation with partners or clients in the field of environmental management	2.42	1.20
Environmental management certification such as ISO 14000 series	2.52	1.09
Intelligent information system development/installation in enterprise	2.60	1.23
Audit of the effectiveness of environmental measures	2.75	1.15
Selection of partners and assessment of the effectiveness of their environmental measures	2.86	1.23
Ongoing training of employees in environmental management knowledge	2.81	1.15
Promoting employees' initiatives in the development of environmental measures	2.51	1.15
Identification of environmental management strategies	2.78	1.14
Sustainable waste management	2.61	1.11
Recycling of transport and storage waste	2.60	1.17
Monitoring of recycling of transport waste	2.37	1.12
Recycling of containers and other logistics packaging materials	2.59	1.05
Responsible waste sorting	2.89	1.11

The implementation of these practices is important in order to make more rational use of the limited resources available, to reduce operating costs and to increase the competitiveness of enterprises in the market, especially in the face of strong competition not only in domestic but also in foreign markets.

Transport and logistics companies operate in a very dynamic environment. Environmental factors directly or indirectly influence decisions made. It was, therefore, important to find out which factors had the most influence on the application of GL practices.

4.2. Factors Contributing to the Application of Green Logistics Practices

Theoretical analysis has shown that the application of green logistics practices can be influenced by many and very diverse environmental factors. The research conducted by scientists not only revealed differences between different countries, but even within the same country, the same environmental factors affect different businesses differently. One of the main reasons for this is the different internal environment of businesses—company's objectives, basket of services, duration of operations, number of employees, etc. All this leads to different reactions of transport and logistics companies to changes in the business environment.

This study aimed at general diagnosis of the situation in the country; however, which factors had the most influence on the application of GL practices in Lithuanian transport and logistics service companies? The evaluation was carried out in two stages. First, the aim was to identify the existence of statistically significant links (p) between factors and individual variables in the field of green logistics and the strength of the link (R). There were calculated coefficients of correlation analysis between 17 factors distinguished (see Table 1) and the five GL fields.

Factors and the field "Green transport" of GL. A statistically significant relationship has been found between the factors and green transport in the GL area, as the p-value (sig.) is below the defined significance level (0.01 and 0.05) and in the study, $p = 0.000$. In addition, the correlation coefficient (R) varies in the range from 0.180 to 0.550. This indicates weak to moderate links between factors and green transport but is statistically significant.

Factors and the field "Green warehousing" of GL. The correlation analysis showed that, between two variables, p-value (sig.) is higher than the set significance level "Recommendations and requirements of the logistics partner" ($p = 0.073$) and "Marketing needs" ($p = 0.154$). There is no statistically significant correlation; the correlation coefficients (R) are 0.100 and 0.080, respectively. Among the remaining 15 variables of the driving factors, there are statistically significant links with this field of GL, since among the variables, p-value (sig.) is less than the set significance level (0.01 and 0.05), and in the study, $p = 0.000$, and the correlation coefficient (R) ranges from 0.140 to 0.390. This shows very weak and weak links between the driving factors and green storage, but they are statistically reliable.

Factors and the field "Green package" of GL. The calculations made showed that there are no statistically reliable links even with 16 variables, because between variables, p-value (sig.) is higher than the set significance level (0.01 and 0.05) and ranges from $p = 0.06$ to $p = 0.352$. Additionally, only one factor, "Needs to facilitate the disposal of hazardous waste", is statistically reliable, $p = 0.01$, and its correlation coefficient (R) is 0.310.

Factors and field "Green management" of GL. The results showed that there is no statistically reliable relationship with the following variables: "Recommendations and regulation by logistics industry associations" ($p = 0.091$), "Employee's behaviour requirements" ($p = 0.064$), "Achieving cost savings" ($p = 0.083$), "Needs to improve the environmental performance of the enterprise" ($p = 0.121$), and the correlation coefficient (R) ranges from 0.112 to 0.209. It has been found that there are statistically significant links between the thirteen driving factors and this field of logistics, as between the variables, p-value (sig.) is less than the set significance level (0.01 and 0.05), and in the study, $p = 0.000$, and the correlation coefficient (R) ranges from 0.170 to 0.450. This shows weak links between factors and green management but is statistically significant.

"Customer recommendations and requirements" ($p = 0.139$) and "Logistics partner recommendations and requirements" ($p = 0.384$), because $p <$ (0.01 and 0.05), respectively, the correlation coefficients (R) are (0.079 and 0.112). Among the remaining 15 variables of the driving factors, there are statistically significant links with this field of GL, since among the variables, p-value (sig.) is less than the set significance level (0.01 and 0.05), and in the study, $p = 0.000$, and the correlation coefficient (R) ranges from 0.140 to 0.390. This shows very weak and weak links between factors and this field of logistics, but they are statistically reliable.

Factors and the field "Sustainable waste management" of GL. The correlation between the variables showed that there are statistically significant relationships between the factors and this field of GL, as the p-value (sig.) between the variables is less than the set significance level (0.01 and 0.05), and in the study, $p = 0.000$, and the correlation coefficient (R) ranges from 0.120 to 0.260. This indicates very weak and weak links between factors and waste, but statistically significant.

Summarizing the analysis of correlation variables, it can be concluded that there are statistically significant weak strength relationships between the factors and individual fields of the GL. Statistically insignificant relationships between variables were eliminated, and further impact measurement was limited to statistically significant relationships for

regression analysis. One such field of GL was identified during the calculations as "Green packaging". The calculations made showed that the regression model is not suitable in this case ($R^2 = 0.15$), which does not satisfy the regression model condition $R^2 < 0.20$. The results obtained suggest that the green packaging field of GL was not relevant in the companies investigated, and the factors were not investigated and analyzed.

Further, the regression analysis assesses the factors that have had the greatest impact on GL fields. The regression model for the driving factors and green transport is appropriate, since $R^2 = 0.32$, and the regression factor is moderate R = 0.56 (see Table 4).

Table 4. Factors influencing the application of green transport.

Independent Variable	Standardized Beta Coefficient	*p*-Value	t	Dependent Variable
Legal and regulatory requirements	0.140	0.049	1.98	Green transportation
Customer recommendations and requirements	0.170	0.020	2.34	
Public requirements	0.220	0.008	2.68	
Needs for subsidies and other benefits	0.320	0.000	4.00	

The results of the studies presented in Table 4 show which factors had the greatest impact on the implementation of the GL practice "Green transport". The *p* value of the ANOVA criterion is less than 0.05, which leads to the conclusion that there is a significant linear dependence between the variables. The Beta coefficient of standardized data ranges from 0.140 to 0.320. In the analysis of the results based on of the impact of individual factors, the factor "Needs for subsidies and other benefits" (0.320) was the major influence on this field of GL. This shows that subsidies and other benefits are a significant promotion for transport and logistics companies to apply GL practices. The results of the study revealed that the factor "Public requirements" also strongly influenced transport and logistics companies to apply green transport practices in the field of GL (Beta coefficient 0.220). In addition, other factors such as "Legal and regulatory requirements "and "Customer recommendations", although weak in impact, encourage the use of GL practices.

The results of the study suggest that Lithuanian transport and logistics services companies are, however, most likely to apply green transport practices, driven by the company's desire to receive subsidies and other benefits. For companies operating in a climate of increasing uncertainty, this is a very important ambition. Of the factors of the external business environment, the growing demands of society have been the most influential. In recent years, both as a result of climate change and as a result of globalized markets, civil society has become more open and increasingly demanding and exerting considerable pressure on businesses to implement sustainable development solutions.

A regression analysis has been carried out with contributing factor variables, and the field "Green warehousing" of GL (see Table 5) indicates that the regression model is suitable, because $R^2 = 0.28$, and the regression factor is strong at R = 0.53.

Table 5. Factors influencing the application of green warehousing.

Independent Variable	Standardized Beta Coefficient	*p*-Value	t	Dependent Variable
Public requirements	0.210	0.013	2.49	Green warehousing
Customer environmental management requirements	0.130	0.038	2.08	
Requirements for employee behavior	−0.150	0.031	−2.17	
Needs to improve the enterprise's competitiveness	0.140	0.049	1.98	
Need to save on costs	−0.170	0.041	−2.05	
Needs to facilitate the disposal of hazardous waste	−0.330	0.000	−3.97	
Needs to fulfil own environmental mission	0.260	0.004	2.88	

The factors that have encouraged transport and logistics companies to apply green warehousing in Lithuania cannot be assessed unambiguously, because negative and positive Beta coefficients are obtained. The analysis of the results of the survey found that, although weak, the companies studied were encouraged by "Needs to fulfil own environ-

mental mission", "Needs to improve the competitiveness of the company", "Customer environmental management requirements", and "Public requirements". It is worth noting that the strongest impact was due to two factors: "Needs to implement own environmental mission" (Beta coefficient is 0.260) and "Public requirements" (0.210). As a result, we can assume that initiatives arise from the internal incentives of companies to adopt green practices in this area of green logistics. Of external factors, again, the greatest influence was the growing pressure of society. Increasing public awareness, good practices, and the power of social networks have a very strong impact on the company's decisions, especially concerning the achievement of environmental and social objectives.

On the basis of the results shown in Table 6, the opposite effect of some factors on green warehousing can be seen, since Beta standard data has a negative factor (−0.150 and −0.330). We can treat these factors as inhibiting or limiting. This leads to the assumption that respondents see in this field of application some negative aspects as well, for example, an increase in costs for businesses, the growing need to change not only the values of companies, but also the attitude of employees, focusing on the development of sustainability. However, this is not so easily achieved in practice, as it requires a common approach and a consensus between the subsystems of corporate governance and management, and greater involvement of employees in decision-making. Additionally, the implementation of these GL practices takes time.

Table 6. Factors influencing the application of green management.

Independent Variable	Standardized Beta Coefficient	*p*-Value	t	Dependent Variable
Recommendations and requirements of the logistics partner	0.330	0.000	4.80	Green management
Public requirements	0.230	0.005	2.81	
Needs to improve the enterprise's competitiveness	0.150	0.028	2.21	
Needs to fulfil own environmental mission	0.440	0.000	5.04	

The most important factors of green management in the enterprises studied are detailed in Table 6.

The calculations carried out show that there is a significant linear relationship between the contributing factors and the green management variables, the *p*-value of the ANOVA criterion being less than 0.05.

The obtained results show that, in the Lithuanian companies surveyed, the GL field "Green Management" (the value of standardized coefficient Beta is positive and within the range from 0.150 to 0.440) is mostly stimulated by such factors as "Logistics Partner Recommendations and Requirements", "Public Requirements", "Needs to Improve Company Competitiveness", and "Needs to Implement own Environmental Mission". The results of the research allow us to state that the most applied practices in the field of "Green Management" are driven by external environmental factors, especially the recommendations and requirements of the partners. It can be assumed that these findings are mainly due to the fact that transport and logistics companies operate mainly on domestic and international markets. The internal market is limited and too small; therefore, it is necessary to apply GL practices in order to remain competitive and in demand on foreign markets. Therefore, there is a natural need to include an environmental dimension in the mission and, in this connection, to implement green management-related activities that are directly and indirectly linked to the achievement of the objectives and objectives of sustainable development.

A regression analysis of factors carried out with the GL field "Sustainable Waste Management" shows that the regression model is appropriate, since $R^2 = 0.22$ and the regression factor is moderate R = 0.47. The value of ANOVA criterion *p* is less than 0.05. The group of significant factors affecting sustainable waste management is shown in Table 7.

Table 7. Factors influencing the application of sustainable waste management.

Independent Variable	Standardized Beta Coefficient	*p*-Value	t	Dependent Variable
Public requirements	0.210	0.014	2.46	Sustainable waste management
Requirements for employee behavior	−0.160	0.030	−2.18	
Needs to fulfil own environmental mission	0.320	0.001	3.46	
Needs to improve the company's environmental performance	0.300	0.003	2.97	

The results of the calculations obtained show that the most encouraging factors were "Needs to implement own environmental mission" (Beta coefficient is 0.320) and "Needs to improve the environmental performance of the enterprise" (Beta coefficient 0.300). This shows that Lithuanian transport and logistics companies take a responsible approach to environmental requirements. On the other hand, the development of environmentally responsible business strengthens relations with partners, and businesses are focused on sustainability in order to strengthen their competitiveness.

Weaker was the influence of the factor "Public needs" on the application of this field of GL (Beta coefficient 0.210). The resulting standardized Beta (−0.160) of the "Employee behavior requirements" factor indicates that it does not encourage employees to take initiative in applying green waste management practices in enterprises. As a result, we can assume that, at the level of managers and managers of transport and logistics companies, green waste management practices are more effective than those of workers (drivers, warehouse workers, etc.), which do not additionally show initiative in their behavior towards waste management. Thus, sustainable waste management in enterprises is not encouraged by "Employee behaviour requirements", but factors such as "Public requirements", "Needs to fulfil own environmental mission" and "Needs to improve the environmental performance of the enterprise" have encouraged the application of green waste management practices in transport and logistics companies studied.

However, the results of the study suggest that more factors can be identified as encouraging the application of GL practices. Only a few factors could be identified from the internal initiatives of companies, indicating that the factors that are binding and derive most from the external environment are still more strongly influenced. The provisions of the green course strategy increase public awareness and pressure on businesses, increase resources, increase competition in the market, etc.; however, they force companies to seek and implement solutions that are adequate for the resources available and the external environment.

5. Discussion

The application of GL practices enables businesses to become cohesive and thus contribute to sustainable development. Transports and logistics companies tend to operate in more than one country and thus contribute to the achievement of sustainable development goals in different countries through green logistics practices. Studies of the scientific literature [10,15,28,44] have revealed that green logistics solutions can be implemented in a wide range of logistics areas and has enabled the identification of a wide range of GL practices in green transport, green warehousing, sustainable waste management, and green management. Retrospective analysis of the scientific literature allowed the authors of the article to form a theoretical model revealing green logistics practices seeking development of sustainability, which was tested in the case of transport and logistics service companies in Lithuania.

The results of the empirical study reflect the situation of the application of GL practices in Lithuania and allowed to identify the factors that have the greatest influence on the application of GL practices. Study variables such as the case of the investigated party, the duration of the company's activities, the basket of logistical services, etc. can significantly differentiate the application of its practices across countries. This is confirmed by Centobelli et al. [10] test results. The authors compared GL practices implemented in three

countries (Germany, Italy, and G. Britain) and found that there are both similarities and differences between these countries in the implementation of GL practices.

Researchers Zhang et al. [13] studied the application of green practices and driving factors in the transport industry in China. The results of their study showed that the three most popular green logistics practices found in transport companies were "Choosing the right mode of transport", "Optimisation of transport routes", and "Monitoring vehicle driving mileage". The results of the investigation carried out by Baz et al. [14] in Moroccan companies 3PL also confirmed that the majority of the practices used in GL relate to tour optimization, modernization of fleet and vehicle loading, and that a significant number of companies use alternative fuels and alternative energy. At the same time, the authors found that these practices are more applied to reduce costs than to protect the environment. However, there is no doubt that such actions also have a direct impact on reducing emissions and addressing environmental issues. The investigation revealed that Moroccan 3PL companies use the GL practices mainly in response to pressure from stakeholders such as customers, partners, and government and take into account the initiatives of competitors [14].

As demonstrated by the results of the empirical study conducted in Lithuania, "Eco-driving", "Route optimization" are also practices that are applied quite widely. The results of this study suggest that the application of these practices is very important for companies themselves, in order to make more rational use of available resources and to improve their competitiveness. To achieve private (enterprise) objectives, companies also serve public interests in the implementation of sustainable development goals.

Richnák and Gubová [12] studied the conditions for green and reverse logistics for sustainable development in Slovakia's dominant automotive industry. The results of the study show that green logistics practices are mainly used in storage, packaging processes, and stock management. In the Slovak market, the application of green practices to enterprises is mainly influenced by the strengthening of the company's image, the maintenance and strengthening of relations with partners, the need to improve environmental performance, and the lack of financial sources as a discouraging factor for green practices. Although the car industry was studied in Slovakia and the transport and logistics companies in Lithuania, the study shows many similarities. The results of this study can be based on the fact that most transport and logistics companies have very wide geography, located in different and often several countries. To be competitive in the international market, companies must adopt the values of their business partners, customers in different countries, and implement international requirements related to the achievement of sustainable development goals.

The study of researchers Sureeyatanap et al. [15] conducted in Thailand showed that, in companies operating in Thailand, GL practices are not widely applied. This suggests that this country is only taking "first steps" towards sustainability in the logistics sector. However, logistics companies have shown an interest in sustainability through green initiatives. Initiatives such as eco-driving, alternative energy, model shift, and vehicle routing are shown. According to the researchers, eco-driving, which has the most impact on cost savings and improves the environmental image, would be the most important. Practices such as alternative energy and modal shift show future opportunities for Thai logistics companies in strengthening their competitive edge. However, these authors have studied green initiatives in logistics companies, which are only the first step towards green practices. A similar application of GL practices was found in the study conducted in Zimbabwe [45]. The study by these authors showed that only a small number of companies in the country are trying to practice green logistics, optimizing transport routes and improving fuel efficiency, as well as optimizing packaging, warehousing, and stock management. Factors such as good image, ability to attract government support and cost savings, as well as improving profitability in the long term, are important for only a small part of the companies involved. In Sweden, the researchers Pålsson and Kovacs [11] identified three factors influencing green transport, namely the external requirements of stakeholders and economic and image considerations. Similar research results were

obtained in Lithuania, where the strongest application of GL practices is driven by legal regulation and policies of governments, the requirements of business partners, service users, customers, and society, and the desire to benefit from subsidies and other benefits.

Studies on green practice initiatives have been carried out in the EU and Asian and African countries. The results of the studies are published, but there is still a lack of systematic studies to provide more detailed information on the application of GL practices in transport and logistics companies in the EU countries.

In the case of Lithuania, the results of the empirical study showed that GL practices are applied in four fields of logistics: transportation, management, storage and waste management. The prevailing GL practices in Lithuania can be distinguished: "Eco-driving", "Transport route optimization", and "Transport cargo distribution optimization". In the empirical study conducted in Lithuania, we sought to identify the factors influencing and most encouraging the application of GL practices. The results of the study suggest that Lithuanian transport and service companies are, however, most strongly encouraged by the desire to obtain subsidies and other benefits, the requirements of society. As regards the application of green storage practices in the field of GL, the results obtained are not unambiguous. On one hand, the results obtained showed that the Lithuanian transport and service industries hide storage practices in their applications due to the disincentive of increase in costs, while staff do not show initiative in these practices for the application and do not show any additional desire to remove hazardous waste (limited to the compliance with the legal regulations); on the other hand, in Lithuanian transport companies, internally, there in an increase in the initiative to apply green practices in the warehousing field, and externally, the application of green storage practices in these companies is subject to public pressure.

The results of the empirical study conducted in Lithuania showed that the application of GL practices is not equally important for all companies. Initiatives to apply green practices with waste management from Lithuanian transport companies arise at the managerial level, the requirements of employee behavior on the contrary do not encourage their application. Of course, from the outside, companies' green practices in waste management are affected by public demands. The predominance of certain practices and different influencing factors suggest that companies primarily seek economic benefits from their business interests. However, the results obtained do not call into question the fact that the implementation of GL practices also contributes to the achievement of sustainable development goals both in Lithuania and in other countries.

One of the limitations of the study is that the study did not carry out a comparison analysis of the application of green logistic practices according to the socio-economic characteristics of enterprises, and it would have been appropriate to exclude the application of green practices according to the activities of enterprises, for example, wholesale trade, warehouse services, production and trade, freight services, forwarding services, etc. Another limitation could be that we did not seek to clarify the reasons for the non-application or low application of GL practices. This situation would explain the challenges facing Lithuanian Transport and logistics companies and provide recommendations and tools for wider application of practices. These studies can serve as a continuation of our research in the future.

6. Conclusions

Logistics plays an important role in the global economy, and it is, therefore, essential to apply GL practices in different business sectors in order to assess and take into account the negative environmental impact it has on the environment.

The application of GL practices is relevant for companies providing transport and logistics services. GL practices are not uniformly applied in different areas of logistics. As demonstrated by the results obtained, the need to apply GL practices was increasingly driven by factors from the external business environment. Such results can be based primarily on the fact that business interests are still more important. Priority is therefore

given primarily to the fulfilment of those decisions and requirements that ensure the smooth functioning of the company's activities. On the other hand, the application of GL practices requires additional investment and therefore does not benefit the companies, not immediately.

The originality and value of the article are based on the theoretical model developed and the results obtained, which reveal the expression of green practices in Lithuania and are relevant to transport and logistics service companies in developing strategies oriented towards sustainable development.

The analysis presented opens a space for debate and future research. Given that companies in the transport and logistics sector are among the major emitters of the environment, the use of GL practices should be more actively promoted. The results of the study on the application and drivers of GL practices can be useful to organizations' leaders, practitioners, and policy makers, as they make a clear contribution to sustainable development by addressing environmental concerns and addressing the needs of society as a whole. The findings can be of relevance to international readers and researchers working in the fields of sustainable development and GL through benchmarking across countries. This would reveal similarities and specificities between different countries and cultures.

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