Sustainability Initiatives in the Spanish Road Freight Transport Companies

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Abstract:

Purpose: The objective of this study is to examine the status of implementation of 13 sustainability initiatives that impact road freight performance.

Design/methodology/approach: Through an empirical analysis with information collected from surveys carried out on 368 Spanish road transport companies, the researchers have identified the benchmark sustainability initiatives in Spain. On the one hand, those currently implemented are known, and on the other hand, those planned to be implemented in the future.

Findings: Our research reveals a clear disconnect between initiatives considered crucial in the academic literature, such as fleet modernization and decarbonization goals, and those that are prioritized in practice. This gap highlights the need to realign the approach to management with evidence-based priorities.

Research limitations/implications: Although this study provides valuable information, it is not without limitations, mainly due to its specific scope in Spain. The research opens the doors to potential future research, such as expanding the study sample with European companies. Moreover, in order to analyse the correlation between the implementation of initiatives and social, environmental and economic indicators, it is proposed to expand the study by asking the companies themselves about their use of these TBL indicators.

Practical implications: Supply chain management in road freight transport has acquired strategic importance within the Spanish economy, emerging as a critical factor driving its development. The results of the study suggest areas where specific interventions could bridge the gap between theory and practice. Professionals are encouraged to adopt high impact, widely implemented strategies to improve both environmental performance and operational efficiency.

Originality/value: Companies operating in the sector have prioritized the economic optimization of their operations. However, the growing importance of road transport goes beyond economic concerns, increasingly influencing environmental and social sustainability. This document underlines the critical role of implementing or planning initiatives to improve road freight performance.

Keywords: sustainability, supply chain management, road transport, initiatives, best practices, surveys

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1. Introduction

Road freight transport is an essential driver of the European market, both economically and in terms of infrastructure. The volume of tonnes transported IN Europe continues to increase year on year, reaching 1,869 trillion tonne-kilometres in 2024, 0.6% more than in 2023 (Eurostat, 2025). These data make it the main mode of land transport, accounting for 75% of the total volume transported.

Specifically in Spain, industrial, commercial, and service activities linked to the logistics and transport sector accounted for 10% of GDP in 2022 (Fundación Corell, 2025). At the national level, road freight transport accounts for 96% of the total volume of tonnes transported (OTLE, 2024). This sector contributed almost one million jobs and generated a turnover of approximately one hundred billion euros in 2024. In addition, the latest data so far in 2025 indicate that in the first quarter the volume of tonnes transported grew by 6.6% and in the second quarter by 2.6% compared to the same periods in 2024 (Cadena de suministro, 2025). Therefore, it is a major driver in the economic sphere, although the costs associated with these activities continue to rise, representing a year-on-year increase of 2.5% (Interempresas, 2025).

It is also important to note the significant impact it has on the concepts of environmental and social sustainability. In 2024, road freight transport in Europe was responsible for 25% of CO_2 emissions and in Spain it was responsible for almost 30% of the country's total emissions, which contributed significantly to air pollution. When social impacts such as traffic jams, pollution and accidents are taken into account, road freight transport reported for 2% of annual national GDP. In addition, the sector is still very fragmented because there are many small companies with a small number of vehicles per operator. Some studies pointed out that the top five companies according to the national ranking control 15% of the market and that there is a high participation of self-employed workers (DBK, 2024).

Consequently, looking at the three pillars of sustainability justifies the proliferation of studies focused on measuring transport performance in recent years. Research by Treitl et al. (2014) identified the main factors affecting truck performance, including vehicle occupancy and loading, route design, and reverse logistics. However, the analysis of transport should not be limited only to economic aspects, as the environmental and social sustainability of transport processes has a significant impact on the overall context (De-Gruyter et al., 2016; Kolosz & Grant-Muller, 2016). Since then, numerous studies have explored the measurement of transport performance, integrating sustainability indicators and initiatives in the environmental and social domains (Kumar & Anbanandam, 2022).

Despite the relevance of sustainability initiatives in road transport, the literature lacks empirical studies that identify the most implemented or planned initiatives. Therefore, the objective of this study is to determine the sustainable initiatives of reference in road transport in Spain. To this end, an exploratory study is carried out based on empirical data obtained through a survey applied to Spanish transport companies.

The document is structured in 6 main sections, in addition to the introduction. In the second section, the authors conduct a comprehensive review of the literature on the main initiatives to improve road freight transport performance. The third section provides an insight into the research methodology used in the study. The fourth section presents the results observed in the empirical analysis. The fifth section discusses the results obtained with the previous literature in this field. Finally, in the conclusion section, the authors summarize the main contributions of the article from academic and managerial perspectives and propose a future research agenda.

2. Literature Review

The importance of the road freight transport sector is evident given its status as one of the drivers of the European economy. In this context and bearing in mind the continuous increase in transport costs, best practices focused on improving the performance of these activities have proliferated in recent years.

An examination of the state of the art reveals that one of the main initiatives proposed in road freight transport is to share shipments with companies as it promoted economic, social, and environmental results (Morali & Searcy, 2013). This type of collaboration sometimes occurs between non-competing companies, and to a lesser extent, between competing companies. Nevertheless, this strategic approach makes it possible to exploit underutilized capacity and increase flexibility, leading to reduced downtime, costs, and environmental impact (Häberle, 2025).

Research by Treitl et al. (2014) identified the main factors influencing performance, including route design, truck loading, truck occupancy, and reverse logistics. Subsequently, some authors focused on certain concepts related to logistics costs and customer service (Piotrowicz & Cuthbertson, 2015). However, the analysis of transport should not be limited only to economic aspects, as the environmental and social sustainability of transport processes has a significant impact on the overall context (De-Gruyter et al., 2016; Kolosz & Grant-Muller, 2016).

In addition, one of the main initiatives that revolutionized the management of order loading and unloading was the allocation of time slots, which promoted the importance of route planning to optimize processes (Sedghi et al., 2016). The authors in this article analyse the results in three different distribution networks.

For this reason, a year later Domínguez-Caamaño et al. (2017) analysed the evolution of transport metrics in the context of supply chain management. In particular, in the field of road transport, García-Arca et al. (2018) designed a scorecard to measure performance.

One of the main strategies of companies that transported large volumes was the use of mega-trucks. This type of vehicle is characterized by having a length of 15-25 meters and up to 60 tons of MMA. The use of this type of vehicle reduces intermediate consumption, labour, and taxes in the sector by 2-7%, while increasing its gross value added by 2% and business profits by 10% (Zofío et al., 2023). Although some studies highlight that the use of this type of truck is not possible in all regions and that in many cases it is associated with high mortality rates along with other risk factors (Castillo-Manzano et al., 2021; Jakobsen et al., 2023).

Rather than questioning the purchase or rental of mega-trucks, many companies directly manage their own fleet renewal plan design. This involves evaluating different vehicle alternatives based on maintenance, operational and greenhouse gas emission costs, as well as compatibility with infrastructure, energy and autonomy (Gouveia et al., 2025).

In the domain of sustainability, the Spanish association AECOC has formulated a series of recommendations with the objective of enhancing logistics efficiency. These recommendations were originally formulated in 2000, with subsequent updates being implemented by the Association to enhance delivery and reception, optimise efficient loading units, ensure supply quality is consistent with agreed standards, and operationalise the principles of pallet pools. Their ubiquity has prompted the formulation of recommendations for diverse sectors, channels, and product types (AECOC, 2026). In recent years, there has been an expansion of the concept to encompass digitisation practices and efficient urban transport.

Other authors have focused their studies on measuring transport performance through indicators and best practices in economic, social and environmental dimensions (Kumar & Anbanandam, 2022).

When addressing the environmental aspect of sustainability, studies mainly revolve around the calculation and reduction of the carbon footprint (González-Boubeta et al., 2018; Romano et al., 2022). Responses have included the adoption of multimodal transport, such as rail and inland waterways (McKinnon, 2018). Many companies have also chosen to implement or develop software for route optimization and fleet management (Vázquez-Noguerol et al., 2018).

Another line of research related to improving the environmental aspect is the use of biofuels or other alternative fuels, since greenhouse gas emissions can be decreased by reducing fuel consumption by different means and mixing biofuels with fossil fuels. However, for it to be profitable, all the characteristics of the demand for fuel, emissions derived from producing that raw material and the production costs of the raw material must be taken into account (Nordin et al., 2024).

In the social field, which has been little studied to date, Stefaniec et al. (2021) introduced a set of initiatives on the social impact of road transport in Europe, emphasizing the need for this measurement to occur independently of other economic or environmental branches.

Another notable trend in measuring the sustainability of road freight transport is the development of supervised machine learning algorithms and advanced analysis techniques (Mangina et al., 2020; Castaneda et al., 2021). Furthermore, Magazzino et al. (2022) utilise neural networks to formulate recommendations with the objective of enhancing transport sustainability, with a particular emphasis on environmental considerations.

Despite these advances in data processing techniques, researchers express the need for a greater volume of accurate and reliable data to extract valuable information (Rincon-Garcia et al., 2018). Initiatives focused on data sharing, including blockchain, have emerged to improve data accuracy and security (Jia et al., 2022). Moreover, according to 2023 data, the fleet management software market is estimated to have a compound annual growth rate of 19.8% through 2032 (Fortune, 2025).

The objective of this study is to establish a connection between the academic and professional spheres with the aim of identifying sustainable initiatives that have been implemented in Spanish companies or are in the planning stage for their long-term implementation.

3. Research Methodology

The objective of the present study is to assess the degree of implementation of the 13 sustainability initiatives identified in the literature review, with a particular emphasis on their impact on road transport performance and efficiency. In the Appendix I the 13 selected initiatives and their link to the environmental, economic and social pillars of sustainability can be consulted.

The study was conducted using a methodology previously validated by Bell et al. (2022). Following a comprehensive evaluation of extant methodological approaches, it was determined that web surveys would be the optimal choice, a decision that was made based on their proven effectiveness in the rapid acquisition and processing of collected data (Grant et al., 2005).

The questionnaire was meticulously designed and comprised both open-ended and closed-ended questions to facilitate the analysis of the data collected. The survey, administered via the JotForm platform, was structured into two primary sections. The initial set of open-ended inquiries was meticulously crafted to delineate the profile of the respondent and the company. The ensuing discourse centred on closed questions, with the objective of evaluating the implementation of the 13 initiatives identified within the domain of road freight transport. The questionnaire employed is documented in Appendix II.

Subsequent to the selection of the study sample, the study is conducted and the results are analysed according to the respondents' answers. The following sections present this information.

4. Data Collection and Analysis

In this section, the selection of the sample for the study is explained, and then the data collection model is presented. In the subsequent subsection, the results of the aforementioned profiles of companies and interviewees are analysed.

4.1. Source Acquisition

The sample universe was defined based on information provided by the Spanish Ministry of Transport in 2023, which covers a total of 166,132 companies of many sizes. It was deemed necessary to exclude self-employed drivers from the sample in order to avoid the potential distortion of the data. In order to identify and establish contact with the selected companies, a range of sources were consulted, including commercial databases. The objective of this research was to obtain a reference email address. The filtering process was based on the classification of companies whose primary or secondary CNAE code corresponded to activities 4941 (road freight transport) and 5221 (transport-related activities). This process ultimately yielded a comprehensive list comprising 45,433 email addresses. The survey, administered via the JotForm platform, was disseminated primarily via email throughout the 2023 period. However, a total of 9,743 emails were returned due to errors in addresses or inaccuracies in contact details.

The protracted nature of the survey, which was conducted over the course of 2023, enabled a comprehensive analysis of the response rate. This analysis facilitated the identification of the most opportune times for the dissemination of electronic communications. The period of time during which the highest response rates were recorded, as well as the days of the week during which these rates were highest, were determined. The implementation of this provisional strategy resulted in a consistent escalation in responses, from 0.7% in January to

a maximum of 2% in December. Conversely, the questionnaire's duration, estimated at approximately 15 minutes, and its methodological design, which necessitated obligatory responses to all questions to proceed, resulted in a substantial rate of participant attrition, averaging 90%. As the data was incomplete, it was necessary to remove it from the sample.

The remaining correctly collected data was then subjected to a process of purification and analysis using the R software to guarantee the quality of the data. In conclusion, upon consideration of the sample universe and the responses obtained, a margin of error of 5.1% was calculated with a confidence level of 95%.

It is imperative to acknowledge that, in accordance with the provisions stipulated within the Organic Law on the Protection of Personal Data, the anonymity of the interviewees was scrupulously upheld at all times. The study was approved by the Ethics Committee of the University of Vigo, which oversaw the entire research process. All procedures were carried out in accordance with the ethical standards of the institutional and national research committee, and with the Declaration of Helsinki of 1964 and its subsequent amendments or comparable ethical standards. Consequently, the principles of informed consent were adhered to, and all individual participants included in the study provided written consent.

4.2. Participant and Company Overview

The final sample was composed of 368 participating companies, with a wide geographical distribution throughout Spain, highlighting a significant concentration of responses in the regions of Galicia, Barcelona, and Madrid. The summary of the characteristics of the interviewees and the companies under study can be found in Table 1.

Category	Characteristic	Detail	Percentage
Interviewee	Role	CEO Logistics Administrators Logistics/Transportation Director Traffic Manager Others	43.21% 19.02% 13.32% 5.43% 19.02%
	Work Experience	0-5 years 6-10 years >11 years	11.68% 16.58% 71.74%
Company	Number of employees	<10 employees 11-50 employees 51-250 employees >251 employees	45.11% 37.50% 12.50% 4.89%
	Revenue	€0-2M €3-10M €11-50M > € 51M	51.63% 30.16% 13.59% 4.62%

Table 1. Profile of the interviewees and participating companies

The robustness of the data is supported by the considerable experience of the participants, with over 70% of them having been employed by the company under study for over 11 years. Furthermore, it is imperative to emphasise the significance of the interviewed profile, as all participants are regarded as professionals within their respective fields of study. This ensures the enhancement of the data collected, contributing to the richness of the findings. As illustrated in Table 1, approximately 60% of the interviewees have held the position of CEO or logistics director. The comprehension of the 13 initiatives proposed in the questionnaire was facilitated by the interviewees' professional knowledge and experience in the sector.

With regard to the nature of the companies in question, the analysis of their size reflected a significant predominance of micro-enterprises (almost 52%). This data underscores the fragmentation of the sector, which is

predominantly composed of small companies. It is imperative to acknowledge the exclusion of the self-employed population from the study sample.

Moreover, in the preliminary questions, in addition to enquiries regarding the profile of the interviewee and the size of the company, specific questions were posed concerning transport management. The size of the fleet was inquired about, with the results indicating that 50% of the companies owned less than 5 vehicles, 27.5% between 6 and 20 vehicles, and the remainder possessed more than 21 vehicles. With regard to the composition of the fleet, 68% of respondents reported ownership of their own fleet, while the remaining 32% disclosed subcontracting arrangements for fleet management. In conclusion, with regard to the nature of the goods conveyed, it is important to note that a significant proportion of the transported goods are palletised, accounting for over 53% of the total, while a substantial percentage of these goods are food-related, constituting approximately 32% of the total.

The combination of a geographically diverse sample and the representation of a range of company sizes reinforces the multi-sector approach of the study, in line with the objective of obtaining a global and representative view of the transport landscape in Spain.

5. Findings Evaluation and Interpretation

This section presents and analyses the results obtained from interviews carried out with 368 companies in the road freight transport sector. The primary objective of this study is to identify the sustainability initiatives that have been defined in the extant literature and that are currently being implemented by companies, as well as the initiatives that are planned to be implemented in the future. The initial subsection provides a presentation of the initiatives that have already been implemented. In the second subsection, the results are grouped according to the size of the companies. Finally, thirdly, the results of those initiatives planned to be implemented in the future are presented.

5.1. Implementation Results by Initiative

The results of this section demonstrate the degree of implementation of the 13 initiatives in the companies under study. The selected initiatives have been those defined by Fernández-Vázquez-Noguerol et al. (2018), with the exception of the best practice that they defined as *'Use of computer tools for route optimisation'*, which was integrated into the *'Use of fleet management software'*. Each interviewee was asked individually whether they had implemented each practice. Figure 1 shows the results.
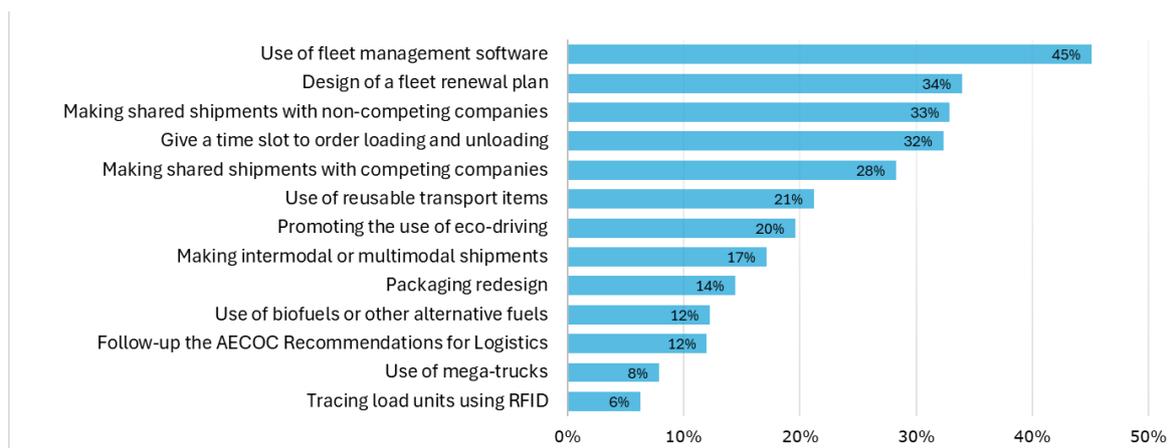

Figure 1. Exploratory results about the sustainability initiatives done

The most implemented initiative is the *'Use of fleet management software'* (45%). These data are surprising because a 2018 study highlighted that only 39% of companies had this type of software in their companies (Fernández-Vázquez-Noguerol et al., 2018).

The next three most widely used initiatives produced similar results (32–34%) and were: *'Design of a fleet renewal plan'*, *'Making shared shipments with non-competing companies'*, and *'Give a time slot to order loading and unloading'*. Studies focusing on these initiatives aim to develop models that can be used to compare different alternatives in terms of their economic and environmental impact (Gouveia et al., 2025; Häberle, 2025).

The fifth most prevalent practice is *'Making shared shipments with competing companies'* which accounts for 28%. It is noteworthy that there is a substantial discrepancy in the implementation of sharing with non-competing companies, with that practice accounting for 33%.

Least used practices, below 10%, include *'Tracking load units using RFID'* and *'Use of mega-trucks'*. Both practices involve large economic investments, which may justify their low implementation (Castillo-Manzano et al., 2021). Nevertheless, the European Commission is acutely aware of the necessity to promote a more efficient and safer transport logistics chain.

In conclusion, a salient finding of this survey is the intricacy of ascertaining the fundamental principles for sustainable freight transport, as evidenced by the fact that none of these initiatives have been implemented in half of the surveyed companies. However, the study enabled the identification of reference initiatives from theoretical and practical perspectives.

5.2. Clustering of Results by Company Characteristics

The implementation of introductory questions regarding the interviewee and the company facilitates the subsequent analysis of the most implemented initiatives, which are filtered both by number of employees and by turnover. Heatmaps have been utilised to visualise the outcomes, as this method facilitates the immediate detection of patterns or outliers (Slomska-Przech et al., 2021). The intensity or variation in tonality is directly proportional to the magnitude of the value.

Initially, the outcomes of the implementation of the initiatives were analysed by categorising the results according to the number of employees of the companies interviewed. As illustrated in Table 2, a heatmap has been developed based on the number of employees in the companies.

Number of employees	<10	10-50	50-250	>250
Tracing load units using RFID	1,97%	2,25%	1,13%	0,85%
Use of mega-trucks	1,97%	3,10%	1,97%	0,85%
Follow-up the AECOC Recommendations for Logistics	3,94%	3,38%	2,82%	2,25%
Use of biofuels or other alternative fuels	3,10%	5,35%	2,25%	1,97%
Packaging redesign	6,20%	4,79%	1,41%	1,13%
Making intermodal or multimodal shipments	5,35%	6,20%	3,10%	2,25%
Promoting the use of eco-driving	5,92%	7,61%	4,79%	1,69%
Use of reusable transport items	9,58%	7,04%	3,10%	1,69%
Making shared shipments with competing companies	12,39%	12,11%	2,82%	1,13%
Give a time slot to order loading and unloading	11,55%	12,96%	4,23%	3,10%
Making shared shipments with non-competing companies	13,80%	14,08%	3,66%	2,25%
Design of a fleet renewal plan	9,86%	16,06%	5,92%	2,54%
Use of fleet management software	15,21%	19,72%	8,45%	2,54%

Table 2. Results of the implementation of the initiatives according to the number of employees of the companies

Table 2 illustrates the potential areas for focus: shared shipping initiatives, the definition of time windows, fleet renewal design, and software use in small businesses. The practice of shared shipments is typically observed in corporate entities that seek to attain economies of scale by achieving substantial scale through collaboration with other companies. Conversely, initiatives such as the utilisation of mega-trucks or RFID are seldom implemented in such enterprises, presumably due to the typically substantial investments required. In medium-sized companies (50 to 250 employees) the use of fleet management software stands out, while in large companies no initiative stands out from the rest.

Secondly, the results of the implementation of the initiatives were analysed, grouping the results according to the turnover of the interviewed companies. As illustrated in Table 3, a heatmap has been developed based on the companies' turnover.

Revenue	<2	2-10	10-50	50-200	>200
Tracing load units using RFID	1,97%	2,54%	0,85%	0,28%	0,56%
Use of mega-trucks	2,25%	2,82%	2,25%	0,56%	0,00%
Follow-up the AECOC Recommendations for Logistics	4,51%	3,66%	2,25%	0,85%	1,13%
Use of biofuels or other alternative fuels	4,79%	3,66%	2,25%	0,85%	1,13%
Packaging redesign	5,92%	5,07%	1,69%	0,28%	0,56%
Making intermodal or multimodal shipments	5,35%	6,20%	3,10%	1,13%	1,13%
Promoting the use of eco-driving	7,61%	7,04%	3,94%	0,56%	0,85%
Use of reusable transport items	10,42%	6,76%	2,82%	0,56%	0,85%
Making shared shipments with competing companies	16,06%	9,01%	2,25%	0,85%	0,28%
Give a time slot to order loading and unloading	14,08%	10,14%	5,07%	1,41%	1,13%
Making shared shipments with non-competing companies	16,34%	10,14%	5,35%	1,13%	0,85%
Design of a fleet renewal plan	13,80%	12,68%	5,63%	1,41%	0,85%
Use of fleet management software	20,28%	15,49%	7,89%	1,13%	1,13%

Table 3. Results of the implementation of the initiatives according to turnover

In companies with a turnover of less than 10 million euros, the last five practices continue to stand out. However, within companies with a turnover between 10 and 50 million, the exclusive utilisation of fleet management software emerges as a distinguishing factor. With regard to large companies with a turnover in excess of 50 million euros, no particular practices are found to be significantly superior to others. Indeed, the absence of implementation of initiatives within this category of company is particularly salient. This outcome is noteworthy given the assumption that such enterprises possess greater resources to implement initiatives.

5.3. Results of Initiatives Being Planned for Future Implementation

In addition to the present level of implementation of the 13 initiatives, the surveys incorporated a second set of questions with the objective of ascertaining whether each of them had been planned for future implementation. Figure 2 presents the results of the study.
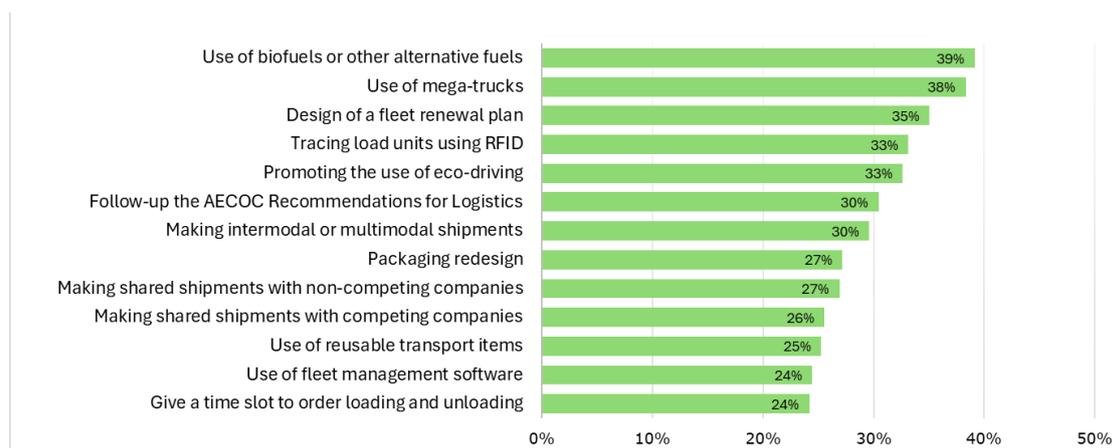

Figure 2. Exploratory results about the initiatives in the planning stage

The primary outcome of this study is the identification of the key principles for sustainable freight transport. The analysis revealed that none of the aforementioned initiatives are expected to be implemented in the short term by half of the surveyed companies.

In this sense, the initial implementation of future measures, despite its present low level of implementation, is the 'Use of biofuels or other alternative fuels'. This alternative to fossil fuels offers significant potential to reduce greenhouse

gas emissions and contribute to global decarbonisation goals. However, the adoption of these technologies is constrained by several challenges, including the initial costs of implementation, the availability of adequate infrastructure, and the need to ensure that the production of these fuels does not conflict with other environmental or social priorities.

'Use of mega-trucks' has been ranked second, with a percentage of 38%. At the implementation level, it was positioned in second-to-last place, with a percentage of 8%. The same phenomenon is observed in the *'Design of a fleet renewal plan'*. It appears that this plan will be implemented to a greater extent in the future than it is at present.

With regard to prospective implementations, initiatives pertaining to shared shipments with both competing and non-competing companies (26-27%) are also noteworthy. This initiative typically engenders numerous advantages, including the reduction of expenses, emissions, and the enhancement of working conditions. However, companies often encounter challenges in determining whether another company should be regarded as a competitor.

6. Discussion

In this section, the results obtained by comparing the current implementation with the future one are discussed, as well as the results obtained with those previously known in the literature review. Initially, Figure 3 compares the results of the 13 initiatives to improve road freight performance from both current and future implementations.
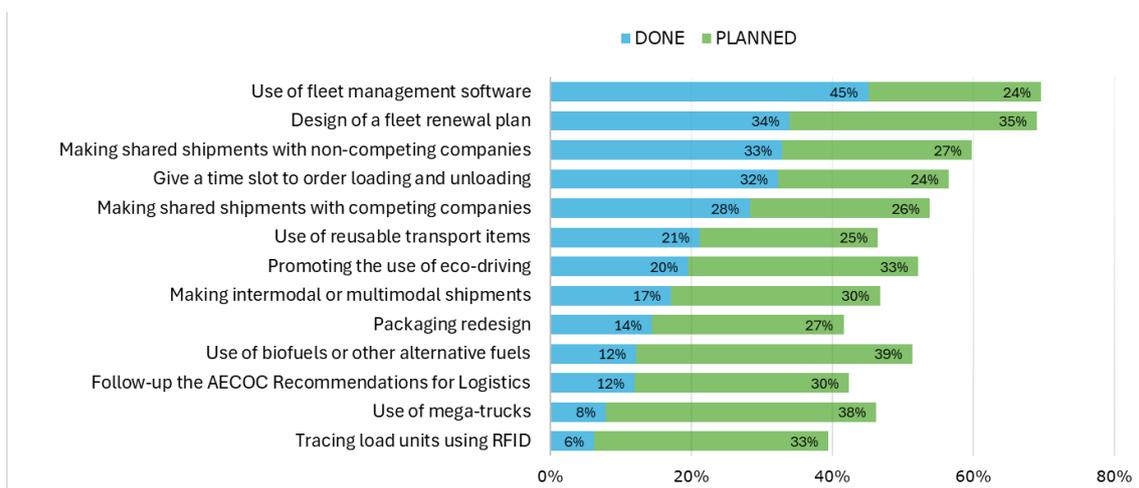

Figure 3. Exploratory results about the sustainability initiatives done or planned

The graph demonstrates that there is no direct correlation between the initiatives that are currently most implemented and those that are planned to be implemented in the future. It is only in the *'Design of a fleet renewal plan'* that equivalent results are achieved (34-35%). In the remaining cases, it is noteworthy that the most widely implemented practice today, *'Use of fleet management software'*, is the one with the lowest level of implementation in the future. In other studies (Fortune, 2025), it was predicted that the compound annual growth rate of this software's adoption would reach 20% by 2032.

The other salient alternative that is worthy of note, in this case in the opposite direction, is that *'Use of biofuels or other alternative fuels'* and *'Use of mega-trucks'* are especially important in terms of their future implementation, but they have hardly been implemented at present. The underlying reasons for this phenomenon may be attributable to their heightened association with environmental enhancements as opposed to economic or social improvements (Zofío et al., 2023; Nordin et al., 2024).

The most implemented initiative was identified as the *'Use of fleet management software'* (45%). These data are surprising because a 2018 study highlighted that only 39% of companies had this type of software in their companies (Fernández-Vázquez-Noguerol et al., 2018). Furthermore, the results of the stratified analysis indicated that this practice is more prevalent in SMEs.

The next three most widely used initiatives achieved equivalent results (32-34%) and were: *'Design of a fleet renewal plan'*, *'Making shared shipments with non-competing companies'*, and *'Give a time slot to order loading and unloading'*. Some studies through case studies demonstrate the potential of renewal plans to support rational, transparent, and sustainable decisions in fleet modernization (Gouveia et al., 2025). Its model evaluates and prioritizes different vehicle alternatives based on multiple criteria including total cost of operation, maintenance, CO_2 emissions, infrastructure compatibility, energy independence, and vehicle range. On the other hand, studies focused on analysing shared shipments focus on analysing how downtime, costs and environmental impact can be reduced (Häberle, 2025). Specifically, this book presents truck sharing as a new strategic approach to take advantage of underutilized capacity and increase operational flexibility from a practical point of view. Finally, the third initiative of this group highlights the current importance of route planning (Sedghi et al., 2016).

The fifth most prevalent practice is *'Making shared shipments with competing companies'* (28%), where it is observed that there is a notable difference in the implementation of shared use with non-competing companies (33%), but both practices contribute to increasing economic, social and environmental results (Morali & Searcy, 2013).

In a 2016 survey of 98 companies with a similar profile, *'Give a time slot to order loading and unloading'* and *'Packaging redesign'* occupied the podium, with almost 50% implementation (Fernández-Vázquez-Noguerol et al., 2018). Conversely, the values obtained in the present study indicate a decline to 32% and 14%, respectively. The 35% decrease in slot implementation may be attributed to companies' current prioritisation of flexibility to manage fluctuating demand and avoid delays. The decline in packaging redesign, which exceeds 70%, is particularly noteworthy, given the increasing regulatory oversight in the field. It is evident that the *'Use of reusable transport items'* has not yet been assigned the requisite level of importance. However, it appears that *'Use of fleet management software'* is currently being emphasised, a phenomenon that was not as prominent a few years ago. Conversely, the value of implementing a *'Design of a fleet renewal plan'* remains consistent, as the abundance of alternative vehicle types can lead to uncertainty among companies regarding the optimal course of action.

However, the initial implementation of future strategies, despite its present low implementation, is the *'Use of biofuels or other alternative fuels'*. It is evident that the reduction of greenhouse gas emissions can be achieved through the implementation of various strategies, including the reduction of fuel consumption and the incorporation of biofuels into existing energy mixes. However, for a venture to be profitable, all the characteristics of the demand for fuel, the emissions derived from producing that raw material, and the production costs of the raw material must be taken into account. The findings of a study by Nordin et al. (2024) demonstrate that the utilisation of biofuel is cost-effective solely when reduction targets are modest and prudently strict, as the substitution of the emissions target with a biofuel production target elevates the marginal cost of reducing emissions by up to 250%.

The utilisation of mega-trucks has been ranked second, with a percentage of 38%. At the implementation level, it was positioned in second-to-last place, with a percentage of 8%. This discrepancy can be attributed to the fact that the utilisation of this particular type of truck is not feasible in all regions, and that in many cases, it is associated with high mortality rates, along with other risk factors (Castillo-Manzano et al., 2021; Jakobsen et al., 2023). However, other studies have shown that the use of mega-trucks can lead to a reduction in intermediate consumption, labour, and taxes in the sector by 2-7%, while concurrently increasing its gross value added by 2% and business profits by 10% (Zofío et al., 2023).

This observation is equally applicable to *'Design of a fleet renewal plan'*, which appears to exhibit a higher level of short-term implementation in comparison to the current implementation. Gouveia et al. (2025) conducted research that demonstrates the potential of renewal plans to support rational, transparent and sustainable decisions in fleet modernisation. Their model assesses and prioritises different vehicle alternatives based on multiple criteria, including total cost of operation, maintenance, CO_2 emissions, infrastructure compatibility, energy independence and vehicle range.

Finally, with regard to future implementations, initiatives related to shared shipments with competing and non-competing companies (26-27%) are worthy of particular attention. These initiatives have been shown to engender improvements in economic outcomes through the distribution of costs, in social outcomes through the

enhancement of working conditions, and in environmental outcomes through the reduction of emissions (Morali & Searcy, 2013).

7. Conclusions and Future Directions

Road freight transport is of significant economic importance within Europe, accounting for 75% of the total land volume transported. For the year 2024, this amounted to 1,869 trillion tonne-kilometres. In Spain, the sector accounts for 10% of GDP, contributing to almost one million jobs and a turnover of approximately one hundred billion euros in the last year. It is also important to note its significant impact on the concepts of environmental and social sustainability. In 2024, road freight transport in Europe accounted for 25% of CO_2 emissions, with Spain responsible for almost 30% of the country's total emissions.

This necessitates the consideration of best practices and initiatives to facilitate economic, environmental, and social enhancement within the sector. A comprehensive review of the extant literature was conducted, leading to the establishment of 13 initiatives with the aim of enhancing the performance of road freight transport.

In order to ascertain the degree of implementation of these initiatives, an exploratory study was conducted with 368 Spanish companies selected according to the primary or secondary CNAE codes of activities 4941 (road freight transport) or 5221 (transport-related activities). The surveys inquired about the implementation status of each of these 13 initiatives, or the plans of companies to implement them in the future.

The findings of this study have both theoretical and practical implications. Firstly, they offer insight into the degree of implementation of the initiatives identified in the existing literature. Secondly, they facilitate the comprehension of industry trends by logistics managers, thereby enabling the prioritisation of relevant alternatives.

The policy implications of this study suggest that the digitisation of the sector should be encouraged to optimise the planning and traceability of transport routes, and that shared shipments and intermodality should be promoted. Moreover, the implementation of tax incentives has the potential to encourage companies to upgrade their fleets, thereby enhancing the sector's competitiveness.

It is evident that such initiatives engender a multitude of social implications, given their capacity to enhance working conditions, thereby promoting the safety and well-being of drivers. Moreover, should the ongoing digitisation of the sector continue, new roles will be created that focus on data analysis for fleet management.

7.1. Limitations and Future Research

Despite the extensive contributions of the study, which impact the theoretical, practical, political and social levels, it should be noted that limitations exist in the manuscript. The main limitation of our study is that it is a status quo based empirical paper. Once the use of the 13 initiatives in the companies under study has been identified, future lines of research could expand the study to ask companies about their social, economic and environmental indicators. With this information, it would be possible to establish a correlation between the use of these indicators and the initiatives that have been examined. Another limitation is that our study limits only to Spanish companies. Consequently, a new line of research could be associated with extending the study to European companies in order to generalise the data to a greater extent.

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Authors' contributions

Mar Vazquez-Noguerol: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing.

Iria Gonzalez-Romero: Formal analysis, Investigation, Methodology, Writing – original draft.

Jesús García-Arca: Conceptualization, Methodology, Supervision.

J. Carlos Prado-Prado: Project administration, Resources, Validation.

The authors confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Data availability

Data included in the article itself or supplementary material.

Use of Artificial Intelligence

The authors declare that the content of the article has not been developed using Artificial Intelligence.

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Appendix I
Linking Initiatives To Sustainability Goals

Initiative	Environmental Impact	Economic Impact	Social Impact
Tracing load units using RFID	Reduces unnecessary trips, lower fuel consumption and emissions	Reduce product losses and logistics costs. Encourage rescheduling of shipments	Increased cargo security and delivery transparency
Use of mega-trucks	Fewer emissions per ton transported	Reduces the number of trips, economies of scale	Less road congestion by reducing trucks on the road
Follow AECOC Recommendations for Logistics	Optimize routes and cargo units, reduce emissions by including reverse logistics	Reduce time and costs in transport, delivery and reception	Standardized and secure processes and facilitates collaborative agreements between companies
Use of biofuels or other alternatives fuels	Lower CO_2 emissions and pollutants	Potential long-term savings and regulatory compliance	Contributes to environmental and local health
Packaging redesign	Optimization of load occupancy. More products per trip and fewer emissions	Lower transport and storage costs	Better ergonomics in handling and reduction of waste movement
Making intermodal or multimodal shipments	Reduces emissions by achieving efficient combinations	Long-term optimised logistics costs	Reduced congestion and increased road safety
Promoting the use of eco-driving	Reduces spent fuel and emissions	Direct savings on fuel and maintenance	Safer driving and reduced driver fatigue

Initiative	Environmental Impact	Economic Impact	Social Impact
Use of reusable transport items	Less waste and production of new packaging	Savings in packaging and waste management	Foster a culture of sustainability in the company
Making shared shipments with competing companies	Reduces emissions by optimizing loads	Reduce the cost per trip when grouping	Reduced resource utilization, reduced fatigue
Give a time slot to order loading and unloading	Reduces emissions from idle trucks waiting	Time optimization and reduction of costs due to waiting	Improving working conditions and logistics coordination
Making shared shipments with non-competing companies	Lower fuel consumption and emissions	Reduced costs per ton transported	Collaboration and reduction of road congestion
Desing of a fleet renewal plan	Lower CO_2 emissions and local pollutants	Reduced maintenance and fuel consumption	Safer and more comfortable vehicles
Use of fleet management software	Reduce distances and emissions by optimizing routes	Savings in fuel, maintenance and uptime	Reduced stress for drivers and increased delivery reliability

Appendix II
Questionnaire

A. Introductory questions

(I) Interviewee information

1. What is your current designation?
2. How many years have you worked for this company?

(II) Company information

1. How many employees work for the company?
2. What is your company's turnover (in millions of euros)?
3. What is the size of your transport fleet?
4. What is the composition of the fleet?
5. What nature of goods do you transport?
6. What is the area of operation within Spain?

B. Indicate the level of implementation in your company (done, planned or unanswered) of the following 13 sustainability initiatives

1. Tracing load units using RFID
2. Use of mega-trucks
3. Follow-up the AECOC Recommendations for Logistics
4. Use of biofuels or other alternative fuels
5. Packaging redesign
6. Making intermodal or multimodal shipments
7. Promoting the use of eco-driving
8. Use of reusable transport items
9. Making shared shipments with competing companies
10. Give a time slot to order loading and unloading

11. Making shared shipments with non-competing companies

12. Design of a fleet renewal plan

13. Use of fleet management software