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Environmental Considerations Regarding Freight Transport among Buyers of Transport Services in Sweden

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Abstract: Freight transport has substantial negative environmental and health impacts, and buyers of transport services can make these impacts 'greener'. This article aims at improving our understanding of transport buyers' environmental considerations. The study was based on interviews with 11 buyers of transport services in Sweden, dealing with the motives behind their sustainability work and specific environmental requirements for freight transport, including requirements for renewable fuels. In line with previous studies, we found service reliability to be a top priority. Branding appears to be a central driver motivating companies' environmental strategies, along with pressure from both internal and external stakeholders. The relationship between transport buyers and transport providers (carriers or freight forwarders) was found to be a potential barrier to environmental developments. Several interviewees stressed difficulties in influencing certain transport providers, and some of the buyers turned to smaller carriers to achieve more notable improvements. All participants had goals of reducing emissions of greenhouse gases, but without more specific frames, this has led to the use of biodiesel. Specific requirements are needed if another energy carrier should be used, such as biomethane or electricity. Long-term contracts may be a way for transport buyers to enable the transport providers to make the necessary investments.

Keywords: green logistics; freight transport; environmental requirements; renewable fuels

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1. Introduction

Although the pollution from large industrial point sources in several countries and sectors has been regulated and significantly reduced, important environmental impacts in other parts of the supply chain or life cycle of products and services have received less attention. However, growing environmental concerns have accelerated the interest in green supply chain management [1], which integrates corporate environmental and supply chain management. Ideally, supply chain management should comprise all actors, but for practical reasons, companies commonly focus on strategic suppliers and customers [2]. Manufacturing is also emphasized, while there is less focus on the service industry, and least of all the logistics sector, such as providers of freight transport such as carriers or freight forwarders [3].

Earlier reviews of green supply chain management and logistics found freight transport to be considered an ancillary activity to business management, and reported low interest in environmental improvements [4,5]. The freight transport sector is also lagging behind, e.g., electricity and personal cars, regarding climate change mitigation policies [6]. However, freight transport is associated with a wide array of environmental impacts, including emissions of greenhouse gases [7], so transport with less environmental impact can be an indispensable component of 'greener' supply chain management [8]. Lately, environmental issues connected to freight transport seems to have received more attention [4], but Multaharju et al. [9] still called for more studies to understand the importance of the logistics function in the sustainability strategy of a company.

On the general industrial level, some commonly used environmental sustainability strategies can be identified: such as compliance, risk management, improved resource efficiency, and green marketing [10,11]. These are also relevant regarding freight transport, and the strategies are influential and implemented to different degrees within the sector. Considerable development has occurred the last decades, with many examples of green freight transport solutions in specific contexts. However, actual green practices widely vary, ranging from the implementation of generic tools to much more specific and clearly transport-related measures. This is, for example, driven by customer demand, regulations, and attempts to strengthen company image [8,12,13], although the research results are mixed on what factors are influential and their relevance [14]. Despite the many examples, the transport sector is still largely using fossil fuels and lagging behind in the transformation to renewable fuels in the combat against climate change and many other environmental and health issues, e.g., [15–19]. Only a limited share of the existing potential environmental improvements seems to be implemented by transport providers, partly due to lacking capabilities and tools [5].

The role of transport buyers is important for reducing the environmental impacts of freight transport, as they may demand services with better environmental performance [14,20]. The demands from transport buyers can be vital to triggering green initiatives among freight transports [21]. They can foster eco-efficiency innovations connected to logistic services [5]. Although environmental issues are commonly involved in the relationships between transport buyers and providers, many questions remain regarding what is and can be required [1,22]. Environmental aspects are often less prioritized than, for example, costs, and may even be omitted from requirements of transport services [23]. Requirements regarding environmental management systems seem common, whereas specific requirements regarding particular vehicles or fuels are less so [9]. Sallnäs and Huge-Brodin [24] concluded that the relationships between transport buyers and providers can be substantially improved.

The choice of fuel is one part of freight transport that can be crucial regarding environmental performance, as a shift to efficiently produced and distributed renewable fuels can markedly reduce environmental impacts [25–27]. In many parts of the Nordic countries, renewable fuels, such as biomethane, biodiesel, ethanol, and green electricity, can be used. Sweden, Norway, and Finland are the three countries with the highest shares of renewable energy used in transport in Europe [28]. However, the use of fossil fuels is still considerable [29–32]. The existence of these fuels in parallel provides opportunities to learn about possibilities regarding renewable fuels in the Nordic context. Although several studies have been conducted on the choice of fuels for buses operating in public transport, e.g., [33–35], there seem to be fewer studies on freight transport. Pålsson och Kovács [14] studied drivers and motives for Swedish industrial companies to reduce carbon dioxide emissions from freight transportation emissions, but they applied a more quantitative approach and did not focus on the selection of fuels in detail.

The aim of this qualitative study was to learn more about environmental considerations regarding freight transport among buyers of transport services, based on the following research questions:

1. Do the buyers of transport services have any freight-transport-related environmental requirements? If so, what kinds of requirements are applied?
2. What are the reasons behind the requirements and practices, and can these be linked to company environmental strategies and/or the interaction with the transport providers or other stakeholders?
3. How do buyers of transport services consider the possibility of using renewable fuels? What are their views on different alternatives?

The study was based on interviews with Swedish companies that buy transport services. The Introduction is followed by background information on the freight transport sector and the Swedish context. The background also includes some more information on studies dealing with environmental considerations, including renewable fuels. Section 3

deals with our methods: how the interviewed companies were selected and how the interviews and analysis were carried out. Section 4 presents the findings from the interviews. The paper then ends with a discussion on the findings and conclusions.

2. Freight Transports and Renewable Fuels in the Swedish Context

If a company needs transport services, there are two main options: buying or leasing vehicles and transporting the goods itself, or buying the service from a transport provider that is external to the organization. It is often preferable to externally buy the service if it cannot be achieved faster, cheaper, and better within the company [36]. Freight transport providers in Sweden are primarily small companies, and 75% of the yearly revenues of the industry come from carriers with fewer than 100 employees [37]. Several of these carriers work together with freight forwarders—companies contracted with multiple carriers that organize freight transport and assign freight transport to the carriers working with them [37]. A freight forwarder deals with the organization of the transportation process and can help carriers by acquiring new customers [38]. A transport buyer can buy the service either directly from a carrier or indirectly from a freight forwarder, who then gives the assignment to one of the contracted carriers.

In accordance with the Introduction, the shift to renewable fuels has been slow, despite the potential to significantly improve the environmental performance of the transport industry. For example, the greenhouse gas (GHG) emissions from heavy trucks in Sweden were reduced by 15% between 1999 and 2019 [39], while the emissions from light trucks increased by 45% [39]. In comparison, the GHG emissions from buses in Sweden decreased by 85% during this period [39], which also involved a 40% reduction in fossil fuel use in the industrial sector and in electricity production by 75% [40].

However, there are some signs of managers increasingly considering environmental performance when buying transport services [41]. Lammgård and Andersson [13] found, in a survey of Swedish professional goods transport buyers that 70% of them considered environmental aspects. For example, they demanded that the transport provider had environmental certifications, prioritized reduced environmental impacts in their selection, or included written agreements regarding measuring environmental performance, see e.g., [8,41]. Some transport buyers specifically demand that the vehicles use alternative fuels or have specific environmental classifications [13]. A recent study on public transport authorities in Sweden and their transport (such as buses) found that specific requirements are needed if the organization wants a renewable fuel other than biodiesel to be used, commonly considered the most straightforward to use [42].

The share of renewable fuels in the transport sector in Sweden has increased in the last decade, from around 5% in 2011 to 22% in 2019 [43] (Regarding the use of different renewable fuels, statistics can only be found on an overall general level for the entire transport sector. We thus could not find reliable statistics for renewable fuel use in only freight transport in Sweden). All diesel sold in Sweden is blended with low shares of biodiesels, but the share is growing due to increasingly strict requirements on greenhouse gas emission reductions. Regarding high blends, primarily four types of renewable fuels have been used: E85 (85% ethanol; ethanol with a small share of gasoline), FAME100 (fatty acid methyl ester; a biodiesel based on mainly rapeseed, then called rape methyl ester (RME)), HVO100 (hydrotreated vegetable oil; a biodiesel based on a mix of, e.g., slaughterhouse waste and palm fatty acid distillate (PFAD; a byproduct from the palm oil industry)), and methane gas (primarily based on biomethane, produced from, e.g., manure, wastewater sludge, and organic waste). For heavier vehicles, such as trucks and buses, ED95 (95% ethanol; a higher blend of ethanol with no gasoline; the other 5% is a mix of ignition improvements, lubricants, and corrosion protection) can be used in vehicles dedicated to ED95. E85 used to be the most popular alternative a decade ago, but its use has since decreased (Figure 1). The use of HVO100 rapidly increased in 2016 and 2017, but then declined. The use of FAME increased until 2016, but then decreased with the rise in HVO100, and increased again with the decreased use of HVO100 in 2018. Renewable fuels

seem to have an internal competition, rather than a parallel growth that would minimize the use of fossil fuels. However, Figure 1 focuses on high blends and does not show the development of low blends (to which HVO has been transferred, for example).

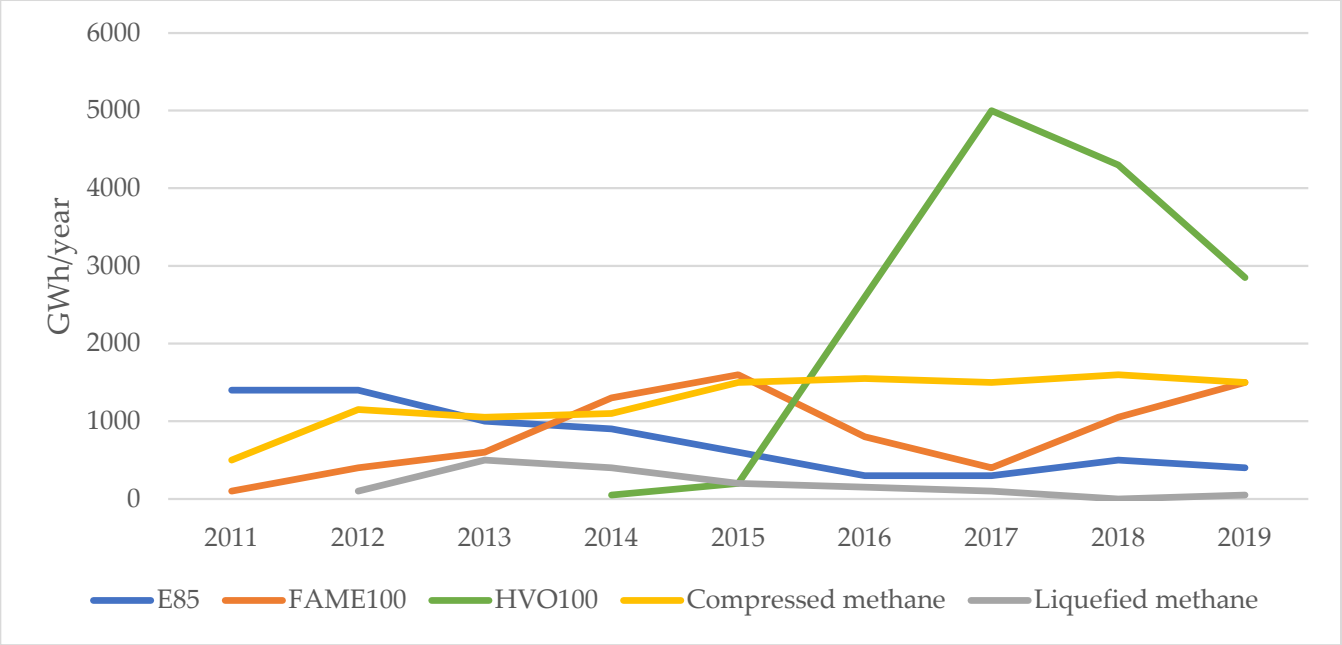

Figure 1. The use of high blends of renewable fuels in the transport sector in Sweden, based on data from the Swedish Energy Agency [43].

Regarding policies that might affect transport buyers and providers, several policies in Sweden are connected to renewable fuels for freight transport. Among the commonly mentioned influential policies is the tax exemption for high blends of renewable fuels, which ensures that the renewable part of high-blended fuels for transports is exempt from the entire energy and carbon dioxide tax. However, this subsidy requires permission from the European Commission, which is usually only granted for a short period. For example, permission to continue the tax exemption in 2021 was granted in the autumn of 2020 [44]. The tax exemption for biomethane, however, has been granted for ten years, although only granted for non-food-based biomethane [45]. Regarding low blends, a new policy was introduced in 2018 that forces fuel suppliers to reduce their emissions of greenhouse gases—in the beginning by 21% for diesel, and then with increasingly stricter quotas until 2030, when the reduced emissions for diesel should be at least 66% (Swedish Code of Statutes 2017:1201 5§). Furthermore, it is possible to apply for monetary aid for buying environmental trucks, i.e., trucks that are fueled by ethanol, methane, or electricity via a battery or fuel cells (or a combination of these alternatives) [46]. The monetary aid may not exceed 40% of the difference between the truck and the closest comparable diesel vehicle to a maximum of 20% of the purchase price of the truck [46].

3. Methods

3.1. Selection of the Interviewed Companies

This qualitative study was based on interviews with the representatives of 11 companies (A–K) buying transport services. These companies were selected to include a wide variety of different companies with only two basic guidelines: first, that the interviewed company had a large amount of goods being transported but the transportation of goods was not the main business; second, that the company seemed to work with environmental issues to at least some extent, for example, based on the information on their webpages, to increase the chance that they had considered different renewable fuels. In addition

to these two basic guidelines, a wide variety of companies was chosen considering the following parameters:

- the sector in which the company worked,
- how the company works with products (manufacturer, grocer etc.),
- how they sell their products,
- size of the company, and
- whether the company is only active in Sweden or also internationally.

In total, companies from eight different sectors were included in the interviews: daily goods, building materials, pharmacy goods, pulp and paper, machines, second-hand products, furnishings, and commercial kitchen goods. The interviewed companies were a mix of manufacturers, grocers, wholesalers, retailers, a purchasing and logistics company, and a company that organized the sale and transportation of their customers' goods. The interviewed companies sold their products in different ways: via retailers, their own stores, internet stores, or directly to other companies. The companies represented a mix of Swedish companies, international companies with their main base in Sweden, international companies originating from Sweden, and international companies with part of their activities in Sweden. For the international companies, the focus was primarily on the part of the company that was active in Sweden. The companies had yearly revenues of EUR 10 million to 50 billion.

Almost all of the companies organized their sustainability work in similar ways: they either had part of the management or a particularly assigned sustainability division that directed the sustainability work. The rest of the organization took part in developing new ideas and implementing set goals, often with particular responsibilities, such as the logistics divisions working with transport-related sustainability issues. The major exception to this structure with a central management of the sustainability work was Company A, an owner cooperative with local co-owners that each had their own businesses. In the company, there was a sustainability manager, but each co-owner had veto rights for the manager's suggestions. Each co-owner had their own designated key-person and was free to develop individual ways of dealing with sustainability in their business.

Apart from the interviewed companies, we also contacted sixteen other companies: seven that declined participation and nine that did not respond to our inquiries.

3.2. Interviews and Subsequent Analysis

The companies themselves chose the employee who would be interviewed based on an initial contact that outlined the focus of the study. One company chose two representatives. A variety of positions were represented: sustainability manager, sustainability developer, project manager within sustainability team, transport manager, logistics manager, logistics purchasing manager, logistics optimization specialist, environmental and quality assurance manager, assistant to chief executive officer, and chief financial officer. In some cases, the interviews focused on the entire company. In other cases, the interviews focused on particular parts of the transports, e.g., distribution of freight and outgoing deliveries. This was due to how the company was organized. Due to the COVID-19 pandemic restrictions, all interviews were conducted either via telephone or video call.

The interviews were semistructured, based on an interview guide, but with the possibility of adding and specifying questions based on the answers. This ensured that all the predefined focus areas were covered and that the formulation of the major questions was similar in all the interviews, but allowed for a flexible interview process that allowed room to further pursue relevant topics that arose in the particular interview, cf. [47].

Three main topics were pursued: how the companies worked with sustainability; how they dealt with the purchase of freight transport; and what knowledge, views, and experiences they had regarding renewable fuels. Further questions were asked, depending on the answers to those three broad and general questions. We also asked questions related to the company's general sustainability work: how the sustainability work was organized, why the company worked with sustainability, and if the company concentrated

their sustainability work on certain parts of the business. The focus was primarily on environmental sustainability, in line with the study aim, but the broader term sustainability was used in the beginning of the interviews in order to broaden the perspectives. Connected to the topic of how the company deals with the purchase of freight transport were additional questions, for example, regarding the length of contracts, if and to what extent they could influence the technology used by the transport provider, and what particular requirements were set for the freight transports. Further questions on renewable fuels were used to obtain information on whether some renewable fuels were used and if and to what extent such use could affect their businesses, and to collect specific views on each of the renewable fuels available on the market.

The interviews varied in length from 30 to 60 min. They were all recorded and completely transcribed to allow for more thorough examination and analysis, cf. [47]. The interviewees were offered the opportunity to review the transcripts and ensure that everything was correct, and those interviewees who desired also read the parts in the manuscript that related to their company to ensure that everything was correctly understood.

The transcribed interviews were analyzed using thematics [47], meaning that we searched for patterns and themes in the interviews. When searching for patterns and themes, our focus was primarily the research questions of the study.

4. Results

4.1. Sustainability Work, Drivers, and Organization

Almost all of the companies organized their sustainability work in similar ways: they either had part of the management or a particularly assigned sustainability division that directed the sustainability work. The rest of the organization participated in developing new ideas and implementing set goals, often with particular responsibilities, such as the logistics divisions working with transport related sustainability issues. The major exception to the structure with a central management of the sustainability work is Company A, an owner cooperative with local co-owners that each have their own businesses. In the company, there is a sustainability manager, but each co-owner has veto right for the manager's suggestions. Each co-owner can have their own designated key-person and is free to develop individual ways of dealing with sustainability in their business.

The participating companies mentioned several main drivers of their general sustainability work (Table 1). Most of them connected in some way to public relations and improving the public opinion of the company, for example, to create an overall picture of a sustainable company, to improve the brand, to sell more or increase business, to be known as a more sustainable option than competitors, or to be a sought-after employer. Other recurrent drivers were demands from customers or management. It was also stated to be part of the company's business model to work with sustainability. Almost all the respondents expressed similar motives: that it is important to improve the environmental performance for the sake of the environment, or that it is important to be a company that is acting responsibly. However, Respondent J stressed that the company's sustainability work is not based on an idealistic foundation:

> "*To be credible when it comes to our core business, we also have to deal with this type of issue. It is not idealistic, but it is basically that we think it is best for the company. Because J is a company, and if you go to the board and ask what we should do, they would say that we should grow. We think that dealing with sustainability and working hard on those issues is the best way forward given the business model that we have.*"

The sustainability work is thus motivated as a part of the growth strategy of the company.

Table 1. Drivers of the sustainability work mentioned in the company interviews with transport buyers. If the box is grey, the driver was mentioned in the interview with that company.

Driver	Company										
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
Legislative requirements. *Obligation to work with sustainability issues.*							■				
Risk management. *To avoid economic risks if improved sustainability performance is postponed.*			■								
Improved resource efficiency. *Reducing costs via efficient logistics or transportation.*			■				■				■
Sustainability branding and long-term profitability. *The sustainability work is important for the brand.*		■	■	■	■	■	■	■		■	■
Shareholder or management pressure. *Management or owners encouraged or demanded sustainability work.*		■				■	■	■			■
Customer demands. *Needs to work with sustainability to meet customer requirements, wants, or expectations.*	■	■	■	■		■					
Customer profitability. *Better sustainability performance makes it more profitable for the company's customers.*	■										
Employee expectations. *Many employees think that it is important that the company works toward sustainability.*		■					■	■			
Social responsibility. *Sustainability work is understood as an indirect requirement for a large company.*				■		■					
Part of business model. *It is part of the business model to focus on sustainability.*			■	■	■	■		■			■
Entire business model. *The business model is entirely based on the company being more sustainable.*									■	■	

4.2. The Choice of Transport Providers, Relations

All the interviewed companies purchased transport services from transport providers in some way, but five of them also owned some trucks (A, B, C, J, and K). Most of the companies used both freight forwarders and specific carriers in some capacity (B–K). However, the share between freight forwarders and carriers varied between the companies. Respondents G and H specified that they primarily use carriers for more local freight transport. Company E was moving toward using primarily freight forwarders, and company F was already primarily using freight forwarders. Conversely, companies I and K were trying to move away from using freight forwarders. According to Respondent I, "*It is not that I don't like the freight forwarders—because they are good at what they are doing—but I would rather have a direct contact with the carrier and the drivers working for us.*" Company A was the only company that only used one option, carriers.

Most of the companies had been customers of the same transport providers for many years (B, C, D, E, H, and K). In one case, this was due to only a few transport providers in Sweden dealing with that kind of transport (B). Two respondents explained that they preferred to stay with the same transport providers due to the long process of starting relationships with new ones, trying them out in smaller capacities at first and making the collaboration work (C and E). Company K had a tendency toward long collaborations with the transport providers to enable the companies to develop together and allow for better local knowledge and customer relationships. This was also the main reason why Company K was moving toward carriers instead of freight forwarders. However, not all

the companies had long-term relationships with their transport providers. During the last couple of years, Companies F and J had regularly increased their use of primarily new, smaller, and innovative transport providers. Company I had recently changed strategy regarding buying transport services and was moving more toward using only carriers but had not yet had the time to form long-term partnerships.

Some companies had contracts of one year (F), three years (B, I, and K), or one to three years (H); other companies had indefinite agreements with a few months' notice (D, E, and J), or a mix of the two for different aspects of their transport needs (C). Respondent C explained its mix as "*When it comes to distribution, we usually have three-year contracts, but it can differ if there are special trucks and such. For supplier transports, the contracts are shorter with three months notices or something like that.*" Company C thus had different contract lengths for different types of transport.

Several respondents stated that they had longer contracts and relationships in connection with special trucks (such as specially built vehicles, biomethane trucks, and test vehicles) (C, D, and E). Respondent E explained that:

> "*the times we have had a slightly longer contract, it's more about us wanting a better environmental solution where we want the carrier to make an investment with us in a new type of equipment, new trucks. Instead of giving them pure money, we have them sign a five-year contract so that they can write off that investment and have safe volumes.*"

Company E, along with Companies C and D, thus had longer contracts in cases involving trucks that might require larger investments.

4.3. Requirements, Goals, and Priorities Regarding Transportation

Some respondents explained that service reliability is among their top priorities for freight transport (C, D, E, and I). Additionally, environmental and social impacts (E, D, and J) and costs (D, I, and J) were also considered important. According to Respondent D, "*Firstly, our task is to ensure the delivery of goods, so we cannot prioritize either cost or sustainability or similar factors beyond service reliability. We need stable parties who we know can run the basic task in a good way.*" According to Respondent I, "*In the first round of a procurement, we do not look so much at price—we look more or less only at quality of the service, environment and sustainability*". Respondent J also mentioned that the speed of delivery was important, along with the cost:

> "*Transport is expensive, so of course it must be an affordable service, but otherwise it is a lot about finding a good one. [. . .] It is to some extent about price, but also speed above all—to get the product out as quickly as possible. And also, of course, to have reasonable environmental alternatives.*"

Respondent F said that the shift toward using renewable fuels in freight transport is primarily the transport providers' problem; the company thinks that the transport providers should bear the costs of such a shift, and it tries not to pay extra for working toward its goals or its requirements.

All the interviewed companies worked in some way toward reducing the amount of fossil fuels in their transports, although two of them were just starting and currently working on describing their aims (A and G). They were all primarily focused on fossil versus renewable fuels and greenhouse gas emissions (Figure 2). Company E used a pyramid that indicated their preferences by ranking the different energy carriers. It was then up to the carriers to decide which alternative to use. The formulations and level of the goals and requirements differed between the companies. For example, Company D had set a goal to be completely fossil-free by 2025 and required all new contracts for freight transports to only use fossil-free solutions. Company E had a goal to be completely fossil-free by 2030, Company I had a goal to reduce the carbon dioxide emissions by 20% during 2020 and Company G was considering setting a goal of reducing the greenhouse gas emissions by somewhere around 10% to 35% by 2025.

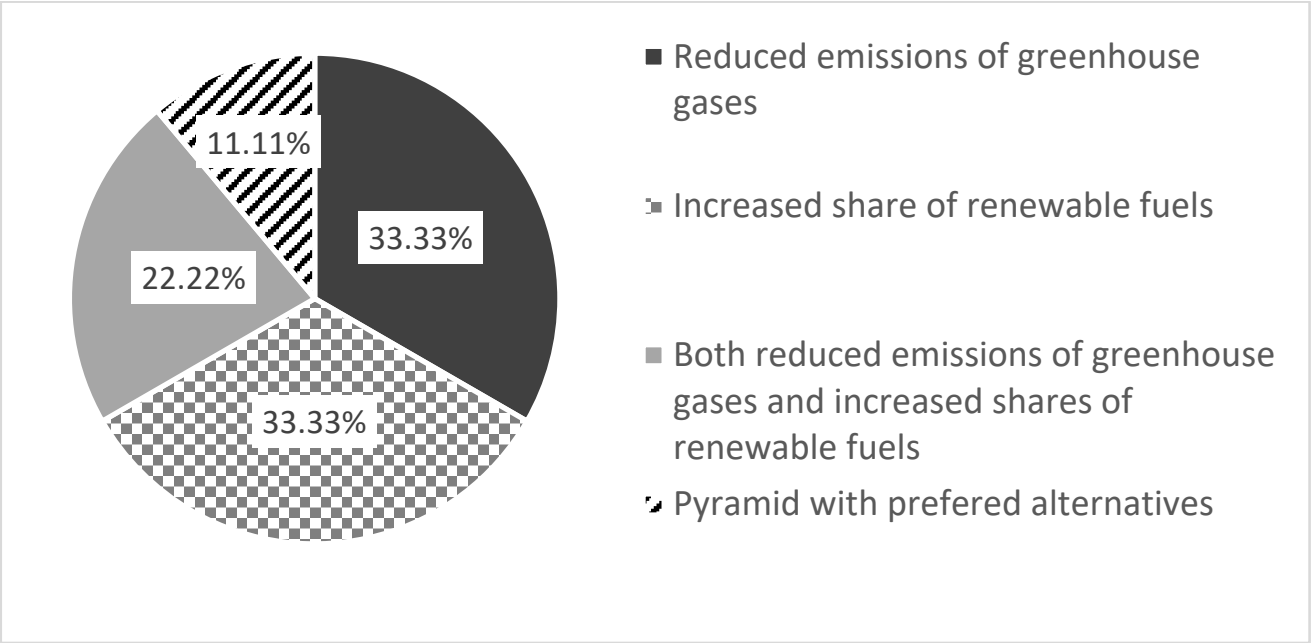

Figure 2. How the goals and requirements connected to fossil fuel use in freight transport were set for the different companies.

Some companies stressed air pollution, primarily in relation to the requirements for trucks to follow specific Euro classifications. The Euro classifications regulate the maximum emissions of pollutants such as particulate matter, hydrocarbons, nitrogen oxides, and carbon monoxide. All new trucks must follow the latest requirements, which is currently Euro VI, and when a new level is implemented, it becomes illegal to sell new trucks that do not fulfill the requirements (in 2020, 48% of the trucks in Sweden complied with the Euro VI regulations [48]). Respondent F stated, "*in order to drive into our warehouse facility, you have to use a Euro VI truck, which we check*". Companies E and I had both introduced requirements that all trucks should be either Euro V or Euro VI. The Respondent D did not mention any specific air pollution requirements but stated that:

> "*there will be more and more demands that the companies we work with are even more at the forefront—it is no longer enough to just start to refuel with biodiesel, but greater demands will be placed on the transport providers. Those who drive around with Euro IV will not have much work*".

Requirements regarding air pollution may become more common and tougher in the future.

Noise was also mentioned by a few companies, but not necessarily that they had any requirements. Respondent C said: "*Regarding noise, we take a closer look at different developments. We might not have any specific requirements with max decibels or such, but we look more generally at how we can reduce the noise*". For Company D, more silent trucks are needed for parts of their transport, which might especially become more important for them in the future. Respondent F stated:

> "*Changing to an environmental zone at our warehouse provides better air for our employees. It is even better if you can be completely fossil-free or switch to electricity, mainly for the environment but also since electric trucks make less noise so that they are less noisy when they pass homes and such—which is also a health perspective.*"

Noise is thus something that can be important, especially for deliveries at certain times or places, but had no strict demands at the time from the transport buyers.

Many of the companies did not have the same requirements for all their freight transport types. For example, Company B had requirements on specific alternative fuels when

buying trucks but more general requirements when purchasing transport services. Others, such as Company K, worked with each transport provider to decrease environmental impacts, but without a strict overall policy specifying the desirable reduction in greenhouse gases, increased use of renewable fuels, or other issues.

The importance of the interviewed companies in relation to the transport providers differed, for example, if they were large or small customers. Several of the respondents saw that this had an important effect on their ability to influence the environmentally relevant choices of the transport providers. For example, Company F found it easier make transport more sustainable with new, small, and innovative transport providers than with larger transport providers, the "big dragons", which they found much harder to affect.

4.4. Renewable Fuels

The primary reasons for the use of renewable fuels were to decrease the greenhouse gas emissions and/or contribute to the goals of higher shares of renewable fuels. However, the companies had different methods of working on this. Some respondents, such as Respondent F, stated that the transport provider is solely responsible for deciding how to deal with what fuels to use, as long as they are renewable. Other companies had more specific requirements, and some of them worked toward phasing out diesel trucks. All new trucks bought by Company B were required to be not diesel trucks, and Companies C, D, and K had requirements for biomethane trucks in some contracts. Table 2 shows what renewable fuels were used by the interviewed companies and indicates the level of use.

Table 2. The renewable fuels used by each of the participating companies, and the share of the total amount (black = a large share of the fleet uses renewable fuel, grey = the renewable fuel is used in one or a few trucks, or they are only testing the fuel in a smaller share of the trucks).

	A	B	C	D	E	F	G	H	I	J	K
HVO											
RME											
Biomethane											
Ethanol											
Electric hybrids											
Electric vehicles											

Company I chose a few routes for the regular transport of goods that were "given" to a transport provider in a long-term partnership. The provider received the task to provide this service as environmentally friendly as possible, without trying to minimize the cost. The pyramid used by company E, with preferred alternatives, was based on the following premise:

> "*At the top of the pyramid, we have intermodal solutions, not only due to environmental reasons, but also based on social aspects connected to the hard conditions for truck drivers. Biomethane is preferred over electric vehicles. After that come HVO, RME and those fuels. Then liquefied natural gas and compressed natural gas—even though we know that there are no carbon dioxide savings, we still promote natural gas in some parts of the world since it will be an easier step later if one is to switch to biomethane when it comes to the market. And then, at the bottom, we have diesel.*"

Motives to use renewable fuels to achieve reduced air pollution or noise were only mentioned for vehicles driven on electricity (including hydrogen).

According to Respondent C, uncertainties connected to policies and availability made it necessary to have a wide portfolio of technologies. They were unwilling to specify that a specific fuel should be used in procurements, to decrease the risk for the haulage contractors. Respondent B agreed, "*Our goal is not to have one engine type. We want diversity in our vehicle fleet—not only gas trucks or electric trucks, but always have a width.*" Company D found that a major problem is knowing what fuels and infrastructure will be available in

the future and saw no clear path for exactly how the goals for sustainable transport should be reached.

The respondents had different attitudes toward their own knowledge on renewable fuels. For example, Respondent B did not find that there were any issues connected to knowledge and understanding the alternatives, while Respondent I found it difficult to understand the available renewable fuels:

> "*It is definitely not easy to understand the different fuel alternatives that exist. You have to read extremely much to understand it all. Everything is so difficult to understand.*"

The relatively low number of trucks produced that are driven on renewable fuels, such as biomethane or electricity, may limit development. According to Respondent B: "*We could have bought many more gas trucks in recent years, but there were not many to buy because they did not produce more than a certain number*". This is a clear example of how factors external to the transport buyers may be hindering their work toward sustainability.

4.4.1. HVO

The respondents (A, B, D, and F) that addressed HVO all expressed that it is not the best long-term option because there might be difficulties with availability if the demand increases. Respondent B said, "*I'm pretty sure there won't be enough HVO when the whole world starts asking for it in a different way*". Respondent A also mentioned the risk where increased production might lead to other negative environmental effects: "*I believe that largely increased production capacity will have other negative effects, similar to what you hear about soy beans—that you devastate something else to get HVO*". The interviewed transport buyers were thus uncertain about both the availability and environmental performance of HVO in the future, related to how the demand will develop and how this will influence what raw materials will be used.

Nevertheless, HVO was considered a convenient way to change from diesel to renewable fuel, although Company I did not want to market its use of HVO to avoid questions concerning its origin. Because there was not full traceability of the resources used to produce HVO, it was not possible to prove that it did not contain PFAD, a by-product of palm oil production. Respondent A stated that HVO is more expensive than using common low-blended diesel. Respondent C thought that new regulations regarding increasing the share of renewable fuels in low-blended diesel have worsened the environmental impacts of high-blended HVO: "*The fine HVO with low climate impact goes into the low-blends for the reduction, because then you get the most value for the money. The regulation connected to low-blended fuels stipulates that there have to be a certain reduction of greenhouse gas emissions. If the renewable fuel has lower greenhouse gas emissions, less fuel is needed to comply with the regulation. And then the inferior qualities of HVO are sold as pure fossil-free.*" Respondent K indicated that the availability of pure HVO dramatically decreased due to the mentioned regulations.

4.4.2. RME

RME was used for some of the freight transport of five companies. Four of them described problems with using RME. Respondent B talked about the challenge of using arable land to grow plants for fuel, but also that it can enable arable land to be kept open: "*With RME comes the discussion of food farming and fuels. But at the same time, we want to keep our open landscapes and not plant forests on them or such.*" Respondent D also mentioned the problem of using arable land for fuel. A challenge with RME, as this respondent explained, is that RME might not be the best alternative considering a slightly longer time horizon: "*We have a lot of RME in the fleet at present, but a truck has a lifetime of about five years. If we look at that time horizon, I doubt that RME will be considered the best solution.*" Company E had tried using RME, but found that their fuel consumption increased compared with HVO or diesel: "*The trucks needed around one liter more per ten kilometers than with HVO. Otherwise, it is a good product. But one liter more per ten kilometers for a truck that usually uses around three to four per ten kilometers is a pretty big cost increase.*" Respondent C referred to needs of extra maintenance as a drawback.

4.4.3. Biomethane

Several respondents were positive about the use of biomethane (B, C, D, I, J, and K). According to Respondent D, biomethane is one of the few alternatives that they think will work in the long term; and Respondents D, E, and I mentioned that the resources used to produce biomethane are good, better than those of many other renewable fuels. According to Respondent J, biomethane trucks also have a satisfactory range and are easy to refuel. Respondent K mentioned the current expansion of the biomethane infrastructure as something positive, and thought that actors in Sweden have relatively good access to biomethane and that the future looks promising with the further development of distribution networks. In addition, Respondent B saw it as advantageous that some older biomethane trucks are exported to other countries and may run on natural gas, which results in lower emissions compared with diesel.

However, several respondents also mentioned problems with using biomethane. According to Respondent B, there are still challenges with the availability of liquefied biomethane, which can be used for longer and heavier transport, meaning that they sometimes they actually use liquid natural gas while the corresponding amount of biomethane is used by someone else in the system (a similar system exists in Sweden connected to renewable electricity). Both Respondents B and C mentioned limited refueling infrastructure. Respondent H agreed, but primarily for transport outside of Sweden. According to Respondent D, large investments at the state level to ensure the availability of biomethane are somewhat lacking. Company E had experienced problems with heavier transport:

> "*If you have a regular European trailer that has a maximum gross weight of 40 tons, it works and has a good fuel consumption. If you go up to the Swedish-approved dimensions of 67 tons or 74 tons, the truck engine is not strong enough to run on gas and maintain a fair fuel consumption.*"

The respondent of Company A, which was not using biomethane, stated that the producers and sellers of trucks seem to focus on selling diesel trucks, not really any of the alternatives:

> "*It does not seem like the truck manufacturers are at all interested in selling the alternatives. If you look at their websites and so on, there is very little information on any of the alternatives. They show a front picture of several alternatives, but then when you want concrete facts about the price difference and such, it falls flat.*"

4.4.4. Ethanol

The respondents of Companies B and C, which used ethanol in some of their trucks, said that ethanol works well for local distribution but was not the best option for heavier transport. Respondent D also said thatethanol is a good fuel. However, both Respondents B and D mentioned that ethanol had low availability, with no signs of large investments in vehicles or infrastructure in Sweden. Likewise, Respondent D stated that nothing indicated growing ethanol production or use, because there were no investments connected to ethanol. Respondent B also added that the only producer of ethanol (ED95) trucks was about to stop producing them.

4.4.5. Electricity and Hydrogen

Many of the companies found that electricity or hydrogen were interesting options for the future and that they will likely be important parts of the "final solution" for road transport, to transition away from combustion engines (A, B, C, D, H, and I). Company K was also positive, but primarily toward hydrogen because hydrogen refueling is more time-efficient than recharging. Respondent D stated that electric vehicles were the only option other than biomethane that they felt sure about for a five-year perspective. Furthermore, it was mentioned that, in contrast to the other alternatives, electrified vehicles can reduce the emissions and noise in cities and enable night deliveries without needing to build special silent vehicles. However, several respondents stated that electric vehicles need to

be more developed and mature before they are suitable (B, D, and E). Respondents F and H explained that electric vehicles were not an option for them at the moment because they needed really big trucks that can drive long distances. According to Respondent E, "*If we look at electricity, it can be interesting, but in today's situation they have a short range. There are no really good trucks on the market*." Company J had previously tried electric vehicles, but they did not provide the needed range. Both Respondents B and D mentioned that there were uncertainties with electrical vehicles in terms of infrastructure, availability of enough power, and balancing the power.

4.4.6. Summary

To summarize, the companies found biomethane and electricity to be the best options, but transitioning to HVO was the easiest (Table 3). Ethanol was not really considered an option because there were no developments toward more ethanol use.

Table 3. A summary of respondents' thoughts about different renewable fuels that can be used for freight transports.

HVO	+	Convenient to change to from diesel	–	Risk of lack of availability
			–	Can use questionable raw materials
			–	More expensive than diesel
			–	High climate impact in high blends
RME			–	Arable land is used for fuels
			–	Not a good long-term solution
			–	Higher fuel consumption than HVO
			–	More maintenance required than diesel/HVO
Biomethane	+	A good long-term solution	–	Lack of liquefied biomethane
	+	Use good raw materials	–	Limited refueling infrastructure nationally and internationally
	+	Satisfactory range	–	Lack of large investments from the state
	+	Easy to refuel	–	Not strong enough for the heaviest transports
	+	Good expansion of infrastructure	–	Hard to find more detailed information from producers of trucks
	+	Old trucks are still forced to run on natural gas when exported		
Ethanol	+	Works well for local distribution	–	Not best option for heavier transports
			–	Low availability
			–	No investments are done
			–	Lack of production of trucks
Electricity (and hydrogen)	+	Seen as "final solution"	–	Recharging takes time
	+	A good long-term solution	–	Need to be more developed and mature
	+	Can reduce noise and air pollution in cities and enable night deliveries	–	Not yet good enough for big trucks that drive long distances
			–	Uncertainties connected to infrastructure, availability of power and balancing the power

5. Discussion

5.1. Priority, Drivers and Strategies

In line with the findings of Björklund and Forslund [41], Navarro et al. [23] and Jazairy [21], the interviewed transport buyers pay most attention to service reliability when choosing the suppliers of freight transport services and deciding on requirements for such services. Costs were important, while the transport buyers had different views on environmental issues, including whether to pay extra for improved environmental sustainability.

A large variety of drivers were stated to motivate the presented environmental strategies and measures, with clear links to the general strategies mentioned in the Introduction: such as compliance, risk management, improved resource efficiency, and green marketing. Transport with superior environmental performance can create competitive advantages in relation to them [9,13,49,50].

Evidently, legislative requirements play a central role concerning freight transport in Sweden and the EU. This was most obvious regarding air pollution, where the Euro classification system ensures a stepwise development toward lower pollution and negative health impacts. Air-pollution-related policies such as congestion charges can be an effective method to increase the use of electric (or hydrogen) vehicles [51]. The situation is similar concerning noise, although this was not mentioned by the interviewees. However, this type of legislation is mainly directed toward truck manufacturers, and more indirectly influences what types of trucks are available on the market. In comparison, climate-related legislation may be more directly relevant for the choices of transport buyers concerning the mentioned shifts to renewable fuels.

Several of the respondents referred to different kinds of risk management: environmental considerations were important for acceptable risk levels and a wide portfolio of technologies and fuels made them more resilient. Additionally, regarding transportation and logistics, a key purpose was to strive toward resource-efficient solutions, which was also mentioned by the respondents. However, there are different kinds of efficiency, and logistics efforts may reduce costs and environmental impacts within a certain frame. However, the frame may importantly restrict the possible efficiency levels that can be reached, for example, if a company works with instant delivery (just-in-time, etc.). If the diesel trucks used for instant delivery are changed to those using biomethane or electricity, the environmental impacts may be significantly reduced; shifting to another delivery policy (new frame) may further reduce these impacts.

Stakeholder pressure is obviously influential. In addition to policymakers, the participants mentioned internal considerations related to employee expectations and directives from top management. Externally, customers were commonly emphasized, which corresponds well with the findings of Wolf and Seuring [8], Khidir et al. [12], and Lammgård and Andersson [13]: demands from customers can be an important reason for environmental considerations in transport requirements. In several cases, environmental efforts were encouraged or demanded by the owners or shareholders. A few respondents also mentioned a kind of social responsibility: to be a responsible organization that can serve several stakeholder groups. Pålsson and Kovács [14] found customer or owner requirements to be less influential on reducing emissions from freight transport than motives such as showing social responsibility or being viewed as an environmentally responsible employer.

Branding, related to the organizations and their products and services, appears to be a central driver. In different ways, several of the mentioned environmental initiatives were used for green marketing or profiling. However, some of the organizations were a bit careful or hesitant regarding renewable fuels such as biodiesel (RME and HVO), as it may be problematic to market a company as green if it, for example, is associated with the use of PFAD. This challenge can grow due to the low-blend regulations, because the biodiesel with the best climate performance is used for low blends, which leads to deteriorating climate performance of the high blends. Pålsson and Kovács [14] found branding of different types to be a strong driver for reducing greenhouse gas emissions from freight transport, and that ambitions and achievements can widely vary, which may be difficult for stakeholders to notice for different reasons. For example, consider a case where a few trucks that are commonly visible on busy roads are shifted to biomethane and branded with a company name and a message such as "We run on biomethane" (or similar): the message is true, but it is not at all clear if this shift applies for all trucks or a small share, and most stakeholders probably do not know.

Finally, two companies were clearly motivated to shift toward renewable fuels in relation to their business model, for which it was not considered reasonable to be associated

with linear and polluting fossil fuel systems. However, several of the other companies also seemed to work toward more sustainable business models, which may involve strengthened efforts to use renewable fuels.

5.2. Relationship between Transport Buyers, Carriers and Transport Providers

The participating organizations were responsible for a large amount of freight transport together, but relatively few of the total were interviewed. The study was not designed to be able to generalize the findings. Nevertheless, our impression is that most of the environmental initiatives, including shifts to renewable fuels, were taken by the transport buyers, rather than being driven by large transport provider or carrier marketing or encouraging such efforts. This supports the finding of Sallnäs and Huge-Brodin [24] that transport providers can be reactive in their relationships with transport buyers concerning environmental issues. Several interviewees stressed difficulties with influencing certain transport providers regarding the environmental performance of their freight transport, which appeared to be particularly difficult for some of the largest transport providers, in relation to which the transport buyers may be small. The interviewees thus appeared to feel that they could not necessarily reach the environmental performance they wanted due to their inability to influence the transport providers. These findings are also in line with those of Sallnäs and Huge-Brodin [24], who found that the relationship between transport buyers and providers can function as barriers to environmental developments when the ambitions and solutions of these actors are not well-aligned. Interestingly, several of the participants that were smaller carriers have achieved more significant improvements. Some of these were described as more flexible and innovative in terms of environmentally adapted solutions.

5.3. Renewable Fuels in Transport Services

All the participants had goals and requirements to shift toward renewable fuels or reduce emissions of greenhouse gases, but only few other environmental aspects. Some aspects, such as deforestation and noise, were mentioned later in the interviews when discussing the different alternative fuels, but they were not part of any specific requirements of the companies. Regarding the difference between having requirements for renewable fuels or reduced greenhouse gas emissions, the results offered no particular findings of whether the different requirements resulted in different usages of renewable fuels. However, previously similar differences at the policy level have had different impacts on renewable fuels. The Swedish policies connected to biofuels have changed in recent years: previously, a main policy was tax exemptions for any high-blended renewable fuel, but now there are policies that the greenhouse gas emissions per liter of common gasoline and diesel must be reduced. This change was mentioned by one of the interviewees as a cause for making it harder to find HVO, especially HVO with less greenhouse gas emissions, because the best HVO was used to blend with diesel to obtain more value per liter of fuel according to the policies. Similar observations were previously noted in Sweden, when the best ethanol produced in Sweden was exported to countries that rewarded greenhouse gas emissions rather than simply that the fuel being renewable, while Sweden imported ethanol from other countries. However, general goals and requirements for reduced greenhouse gas emissions of transport services does not necessitate a change to renewable fuels, because it might be possible to reduce some of the emissions via the optimization of packaging, driving, etc.

According to this study, the general requirements for renewable fuels or reduced emissions seem to lead to the use of HVO and/or RME, which are commonly judged to be most straightforward, being relatively cheap and easy to use in regular (or slightly modified) diesel trucks. The other alternatives (biomethane, ethanol, and electric vehicles) were only used when the transport buyers had introduced more specific requirements. These findings are similar to those of previous research on public bus transports and public procurement [42]. It thus seems as if both companies and public organizations need

specific requirements if a fuel other than biodiesel must be used by transport providers. However, specific requirements may be challenging for transport providers to have vehicle fleets that match the varying requirements and to establish efficient logistics [21]. Our findings indicated a shift in view on biodiesel, which may mean increased demand for biomethane and electricity: several respondents did not consider HVO or RME to be good long-term options due to issues mainly related to availability and other sustainability aspects. Biodiesel producers may thus need to improve aspects related to availability and feedstock sustainability to remain an attractive option. Biomethane, electricity, and, in some instances, hydrogen were seen as better long-term options. That biomethane (or biogas) is commonly produced from secondary resources (waste-based materials) was considered a particular strength by several of the interviewees [52]. However, as found by Breuer et al. [53], battery electric vehicles are not an optimal choice for most cases of long-distance heavy-duty transport today, and the interviews showed an agreement that electric vehicles need more development and maturity before they are a good alternative. Regarding biomethane, the results also showed similar findings as previous studies: there is still an issue with a lack of infrastructure [54].

As trucks driven on renewable fuels may be more expensive to buy, it may be particularly important for such vehicles that the contracts with the transport buyers are long enough. Our study showed that many services are carried out without long-term contracts, for example, based on indefinite agreements with a few months' notice required for cancellation. The contracts used varied in length from one to three years. This clearly differs from buses in public transport, where the contract periods commonly are about ten years in Sweden [34]. However, three of the companies stated that they had longer contracts for special technologies, including biomethane and electric vehicles. These seemed to assure profitability for the involved carriers, thus enabling investments in new trucks. Missing or short-term contracts were important possible reasons hindering the use of vehicles driven on biomethane and electricity. Long-term contracts have also been identified in previous research as a way for the transport buyer to enable investments in green technology for the transport provider, e.g., [21]. As found by Evangelista et al. [20], the transport buyer can be a barrier to the transport providers' development of green initiatives; to address this problem, the transport provider can, for example, pay extra for solutions with less environmental impacts or have more long-term commitments regarding the contract time frame.

A challenge with the less used alternatives is the so called "chicken and egg problem": if others are investing, it seems safer to invest themselves, but someone has to take the first step [55–57]. This can also be seen in the development of biomethane in Sweden in the last couple of years: researchers [58] found that actors were uncertain about the future. Since then, there have been large investments in infrastructure for biomethane, and the interviewees of this study, in contrast, considered biomethane as one of the best alternatives based on policy climate, recent developments, and long-term potential. Conversely, for ethanol, Respondent B referred to limited investments in technology as a reason to prioritize other alternatives. Uncertainties can also generally be a barrier to investments in renewable fuels, as found by Björner Brauer and Khan [54]: not only uncertainty of the future of the alternative, but also, for example, connected with knowing which alternative is best suited.

6. Conclusions

All the participating transport buyers used freight-transport-related environmental requirements to primarily reduce the share of fossil fuels and to lower greenhouse gas emissions. However, the level of ambition significantly varied. While one organization had the ambition to be fossil-free already by 2025 and did not accept any new transport-related contracts involving fossil fuels, others lacked specific long-term goals. The findings indicated that while some transport buyers are shifting toward a more general policy, others are rather adapting to some kind of minimum level, where the environmental

requirements seem to be adapted to different types of transports and customers, what presently is considered as sufficient and suitable.

In line with previous studies, we found service reliability to be a top priority for transport buyers. However, our findings indicated a relatively stronger focus on environmental issues over time, a development where freight transport seems to receive more attention. A large variety of drivers motivated the companies' environmental strategies and measures. Branding appears to be a central driver, along with pressure from both internal and external stakeholders. Legislative requirements were also influential. Business models, both existing and development toward improved sustainability, were additionally stated as motives for development. Most of the environmental initiatives were taken by the transport buyers rather than being driven by the transport providers, showing that transport providers can be reactive in their relationship with transport buyers. The relationship between transport buyers and providers can function as a barrier to environmental developments. Some large transport providers were described as resistant and/or less flexible, leading to several participants preferring smaller and newer carriers, which were described as more adaptable and innovative, to achieve more significant environmental improvements.

In the Nordic countries, there are unique possibilities to use renewable fuels and electricity for freight transport. This study adds insights regarding the views and choices in relation to fossil fuels and between different renewable alternatives. Renewable fuels were partly used by a majority of the participating companies. Commonly, the transport providers were responsible for choosing what renewable energy carrier to use (when there were such requirements), which generally seemed to result in the use of HVO or RME. However, our study indicates a shifted view, where biomethane and renewable electricity were seen as better long-term options due to their stronger sustainability performance, recent policy support, and the significant investments in production and infrastructure. However, vehicles powered by biomethane and electricity are more expensive. Thus, it may important for transport buyers to use long-term contracts that enable transport providers to make necessary investments in new trucks.

The study was mainly based on interviews with 11 large transport buyers operating in Sweden. The qualitative approach means that the results provide indications and contribute to deepened understanding, but the results cannot be generalized.

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