

Green public procurement for accelerating the transition towards sustainable freight transport

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Summary

Emissions from the transport sector shall be reduced in the coming years and a large share of the emissions come from freight transport. To reduce transport related emissions transporter must invest in new vehicles in the coming years. This paper examine how Green public procurement (GPP) can be used to push the market in a sustainable direction. The results shows that GPP is a useful tool to both force and share the costs, related to new vehicles, with freight service providers. However, our study shows that there are huge differences between small and large municipalities.

Keywords: Freight, Green public procurement, Transport.

1 Introduction

Transforming entire mobility systems in more sustainable directions requires attention to the many different domains that transport systems comprise. Transitioning personal mobility has already been well explored by scholars tending to electric cars [1]–[3]), while the hard-to-abate shipping sector is increasingly recognized as a paramount research objective [4]–[6]. One transport domain still insufficiently recognized in research on sustainability transitions is road-based freight transport. Despite accelerated technological innovation within freight transport [7]–[9], it has yet to be explored as a transition site. This paper seeks to fill this gap by turning to the Norwegian freight transport sector.

The freight transport sector is characterized by a wide range of companies and operators, both international and domestic, targeting wider or more niche parts of the logistics market, and applying a variety of business models and contracts. On a national level in Norway, road transport in 2020 represented 17 % of GHG emissions. Heavy vehicles and vans are accounted for 49 % of these emissions. Other negative side effects of freight transport are traffic noise, congestion, air pollution and traffic accidents, which is closely related to vehicle mileage travelled [10]. However, freight service providers are aware of their own emission, and several larger actors have incorporated own goals for low or zero emissions operations in the near future. Thus, freight transport poses a series of climate and environmental challenges, particularly in cities, that have increasingly compelled local authorities to incorporate freight into climate and planning strategies [11]. The EU's White paper [12] and the

following EU's working document titled *A call to action on Urban logistics* [13] highlight's the need to be aware of logistics and freight transport, thus being a part of the public planning processes [14].

In the European context, public procurements have increased the last 20 years, and now constitute 14 % of the EU's GDP [15]. Green public procurement (GPP) is an instrument used by public actors to purchase goods and services with a lower environmental impact in their lifetime than goods and services otherwise bought. Green public procurement is one of several strategic instrument for achieving Norway's goals and obligations in the climate area [16].

Green public procurement in the EU is not mandatory, but with several policies, EU seek to stimulate for the use of green procurement. In 2016, they launched the Handbook of GPP, which may be applied as a guide for buying green [17]. Green public procurement has been shown to stimulate to pro-environmental purchasing strategies and is contributing to develop the markets more green [18]. Green public procurement is driven by political forces and policy makers but is also affected by the user practices and cultural practices in the municipality.

In Norway, public authorities spend approximately 600 million NOK on public procurements every year, and the products and services procured by public authorities represent 16 % of the national total emissions [16]. Norwegian green public procurement is anchored in national legislation (e.g., [19]) that obliges public administrations to establish procurement practices that enhance sustainability, for instance by requiring specific technological solutions or setting specific emission limits for the products or services that are procured.

This study is conducted within the framework of the research centres FME MoZEEES (Mobility Zero Emission Energy Systems) and FME NTrans research centre (Norwegian Centre for Energy Transition Strategies). The paper delves into the governance of sustainability transitions in freight transport by studying practices with green public procurement. Specifically, this paper *explores preliminary experiences with green public procurement in freight transport and discusses how such practices should be developed to accelerate sustainability transitions in freight transport*. The study focuses on procurements where freight transport is a result of the procurement, but not the main purpose.

To do so, we study practices and perspectives among Norwegian freight service procurers as well as freight service providers through qualitative interviews and nation-wide surveys. In the following section we introduce our understanding of green public procurement as a governance instrument for progressing sustainable technologies in freight and provide an overview of existing knowledge about green public procurement in sustainability transitions. We then account for the methods and data used to explore the research questions. Finally, main results and findings are summarised and discussed.

2 Green public procurement as strategy for transition governance

The governance of sustainability transitions is an increasingly important research topic, as the pace of transition is considered to depend on degrees to which transitions are managed or incentivized [20]. Within the field of sustainability transitions, Transition Management has been particularly prominent in devising governance strategies for steering and accelerating transitions in different sectors [21], [22]. Transition Management is considered to be a "prescriptive framework" that allows for creating "space for short-term innovation and develop long-term sustainability visions linked to desired societal transitions" [23]. Specifically, Transition Management points to particular governance activities (i.e., strategic, tactical, operational, reflexive) that allow for dealing with the complexity of sustainability problems and the societies that they are enmeshed in. Within the framework of Transition Management, green public procurement could be an example of tactical governance activities, which intervene into established structures such as rules and regulations, routines, and institutions.

Within the scholarly field of sustainability transitions, green public procurement could also be considered an expression of Strategic Niche Management. This field of research tends two ways in which emerging technologies and innovations can diffuse and become competitive in existing markets or become dominant in new niche markets. Scholars of Strategic Niche Management are thus concerned with how emergent innovations

could be nurtured and matured in protective spaces that shield them from market competition until they are sufficiently competitive [24]. Thus, green public procurement could also be a fruitful strategy for accelerating transitions when following ideas of Strategic Niche Management. Green public procurement could nurture niche innovations by creating markets for specific technologies or for any technologies that reduces emissions.

Green public procurement is therefore an example on how sustainable transitions could be steered on low-level governance.

2.1 How can Green public procurement accelerate transition?

The potential for stimulating sustainable innovations and technological changes by public procurement is high in the transport and logistics sector, which is undergoing rapid changes due to digitalization in the supply chain and forcing changes in the individual behavioral pattern such as increased online shopping, home delivery services, and new consumer patterns. It is therefore a golden opportunity to link green public procurement to this sector and identify its possibilities and challenges as a tool towards achieving CO₂-free city logistics by 2030 [13], [25], [26].

How to succeed with GPP has been investigated by [27]. They identified four criteria to success with the implementation of GPP: 1) consistent and operational policy goals; 2) nation-wide campaigns for GPP; 3) ethics, professionalism, capacity, and knowledge among employers; 4) systems for checks and balances among actors in the entire purchasing process. Bjørklund and Gustafsson [28] have examined GPP in Swedish municipalities and observed that most previous measures to curb emissions from transport in urban areas focussed on passenger transport, and that urban freight has almost been forgotten. [28] also mention that there are exceptions, and that knowledge from those few municipalities should to be transferred to other municipalities to accelerate the transition towards more sustainable freight transport. [29] shows significant differences in GPP uptake between countries and national levels: The countries working most with GPP are characterized by a large governmental sector, and municipalities and local administrations are more prone to work with GPP than authorities on EU and national levels.

[18] developed a method for GPP, which was tested on public procurers of transport in Sweden. This method is a participatory method, seeking to enhance the procurer's understanding and knowledge about practical needs. Their results emphasize that the participatory method and greater insight for the procurer's contribute to broad environmental assessments, enhancing green procurements and to more fairly assess alternative technologies. With Rotterdam and The Hague as examples, [30] studied public procurement as a driver for more sustainable freight transport. They state that it is hard to determine the exact number of trips that is generated from procurements, and that procurements are first applied as an administrative activity, and not as an activity to meet policy.

As procurers of large volumes of goods and services, public authorities are in a position to move the priorities of commercial freight service providers in a greener and more sustainable direction. While ambitions have been defined at both international and national level, procurement processes on regional and local levels play an important role in fulfilling the ambitions for sustainability transitions. Along Oslo's Climate strategy [26] the municipality has developed a procurement strategy as they want to use public procurement as a powerful tool to accelerate the green shift, climate goals and circular economic thinking in accordance with ambitions of being an emission free city [31]. This requires procurement processes that strengthen the competitiveness of climate- and environment-friendly solutions with a small environmental footprint, high expected quality, long service life and good recycling opportunities [32].

Although green public procurement is increasingly emphasized as a climate measure, The Office of the Auditor General in Norway has established that current public procurement practices are not contributing enough to diminish GHG emissions and to provide the use of climate friendly solutions. They also point to lack of holistic approaches to procurement, which are needed to take sufficient environmental concerns [16].

3 Methods

The purpose of this study has been to examine practices and perspectives with green public procurement at the side of public procurer as well as freight service providers to accelerate sustainability transitions in freight transport.

This study is based on a combination of qualitative (interviews) and quantitative (survey) methods. Qualitative methods were used to gain knowledge about the topic and insight into whether and how environmental criteria are used in public procurements within the municipalities today. Interviews were chosen because it opens for interaction with the informant and allows exploration of different paths of the answers. Quantitative methods, here represented by the surveys, allow us to examine if specific findings from the interviews also are viable in a broader context.

Table 1: Overview of data collection

	Public procurers	Freight service providers
Interviews	N=4	N=3
Survey	N=71	N=220

3.1 Interviews

We conducted interviews with representatives from four municipalities and three freight service providers. Two of the municipalities are regional centres and two are smaller municipalities. These interviews involved staff responsible for procurement processes in the respective municipality. Two of the three freight service providers operate in the business-to-business market, while the third also delivers to private households. The informants were persons with responsible for vehicle fleets, daily businesses, and public procurements.

Interview guides have been developed based on national documents [33], [34] and the Public Procurement Act [35]. The interview guide for municipalities revolves around the following topics: 1) strategy and collaboration, 2) experience with public procurements, 3) public support schemes and national goals. The interviews with freight service providers highlighted the following themes to explore drivers and barriers impacting the freight operators in the transition of urban freight: 1) technology, 2) logistic solutions and 3) policy.

The interviews were conducted in digital meetings and. results have been used for documentation, survey design and input to the analysis.

3.2 Surveys

Municipal survey

The survey for municipalities is structured according to the same three main topics as in the interviews, while the questions are reformulated to fit into the context of a survey. Findings from the interviews were used to create response categories. The survey was distributed via e-mail to all 356 Norwegian municipalities with a request to forward it to a person in the municipality administration responsible for or with experience with procurements. A reminder was sent out to non-response municipalities after two weeks. In total we received 71 individual responses from 61 different municipalities, implying that the request had been forwarded to more than one person in some municipalities, and both have answered it. However, as the role and the answers from the same-municipality respondents are not identical, all responses are included in the data analysis. There is not recorded more than two answers on any municipality. 46 respondents completed all the questions in the survey.

Using the classification of municipalities by population size from Statistic Norway [36], and comparing to national statistics for 2022, we find that the smallest municipalities are somewhat underrepresented, and the largest somewhat overrepresented in the survey sample, while the remaining categories are proportionally represented (Table 2). The informants represent a range of roles related to public procurement (Table 3).

Table 2: Categorization of included municipalities

	Survey sample		Norwegian municipalities, 2022 [37]
Population size	N	%	%
Under 2 000 inhabitants	8	12 %	22 %
2 000 – 4 999 inhabitants	18	26 %	27 %
5 000 - 9 999 inhabitants	13	19 %	20 %
10 000 - 19 999 inhabitants	10	15 %	13 %
20 000 - 49 999 inhabitants	11	16 %	12 %
50 000 or more inhabitants	9	13 %	6 %
Missing	2		
Total	71	100 %	100 %

Table 3: Respondent's role in municipality

Role in municipality	N	%
Responsible for procurement strategies	27	38 %
Advisor to procurers	20	28 %
Procurer	19	27 %
Other role related to procurement	5	7 %
Total	71	100 %

Freight service provider survey

The survey among freight service providers was distributed to the members of the Norwegian association for lorry owners (NLF), targeting freight service providers doing different kinds of transport. In the survey we ask if they are involved with public procurements, together with other question about public procurements, their relationship to it, and the effect it can have on sustainable transitions. The survey was initially distributed to over 3000 members of the NLF, of which 220 responded.

Of the freight service providers participating in the online survey, roughly one third (39 %) provide services for the public sector, and one of four (27 %) are personally involved in tenders for the public sector (Table 4). Results presented in this paper are based on responses from companies which do provide services to the public sector.

Table 4. Respondent's role in freight company

Are you involved in tenders for public procurement?	N	%
Yes, I respond to procurement tenders	60	27
Yes, but someone else in our company is responsible	27	12
No, we do not provide services to the public sector	133	60
Total	220	100

4 Results

The results are presented in three sub sections: the first gives an overview of perspectives on public procurements and requirements from the municipalities point of view. The second section describes perspectives on public procurements and requirements from the freight service providers point of view, while the final section presents existing requirements and how they are used.

4.1 Existing low and zero emission requirements in freight transport

The in-depth interviews and comments in the survey show that there are differences both in types of requirements and how requirements are used in practice in the municipalities' procurement process. The most common requirement related to transport in Norwegian public procurements for goods and service is for type of propulsion technology in the vehicles used. One reason to this is because it is both easy to require and control, compared to using a specific emission level, which is the second most common requirement. Some municipalities also put restrictions on specific types of deliveries, for example by demanding small vehicles, consolidation, or deliveries outside of rush hour. However, all such requirements are more demanding both for the public buyer to monitor and the freight service provider to document.

There are also differences for which part of the transport such requirements apply. However, also here there is tendencies indicating requirements that are easier to monitor is favourable. A lot of goods are produced abroad and therefore also generate freight transport from those countries, but requirements related to transport is most often only applied for the last mile. The main reason was that transport outside of Norway is out of control of the Norwegian distributor and there is limited with low or zero emissions options in the market.

The third difference is when requirements are included, the results are shown in Table 5.

Table 5: Municipalities practice in terms of limit values for use of requirements

Are environmental requirements for transport included in your procurement processes?	Municipalities by population size						Total
	Under 2 000 inhabitants	2 000 - 4 999 inhabitants	5 000 - 9 999 inhabitants	10 000 - 19 999 inhabitants	20 000 - 49 999 inhabitants	50 000 + inhabitants	
Yes, always	13 %	6 %	31 %	40 %	36 %	33 %	25 %
Yes, for purchases over 100 000	0 %	17 %	15 %	30 %	18 %	44 %	20 %
Yes, for purchases over 500 000	13 %	22 %	15 %	0 %	9 %	11 %	13 %
Yes, for purchases over 1 million	0 %	6 %	0 %	10 %	18 %	11 %	7 %
No, never	75 %	50 %	38 %	20 %	18 %	0 %	35 %
N of respondents	8	18	13	10	11	9	71

The values NOK 100 000 and NOK 500 000 are based on answers in the interviews. Although these limits also are viable for other municipalities, the majority using requirements, always include them (Table 5). The motivation for applying value limits for when to include requirements is related both to the possibilities to monitoring of what is delivered, and how large the emissions from the transport in that particular procurement is. The Public Procurement Acts says requirements should be in proportion to both costs and emissions.

4.2 The perspective of municipalities

The results are cross tabulated with the size of municipalities to see if there are any differences that may depend on the number of inhabitants in each municipality.

Table 6: Which municipalities has a strategy and why.

	Municipalities by population size						Total
	Under 2 000 inhabitants	2 000 - 4 999 inhabitants	5 000 - 9 999 inhabitants	10 000 - 19 999 inhabitants	20 000 - 49 999 inhabitants	≥ 50 000 inhabitants	
Does your organisation have a strategy to increase share of environmentally friendly transport in procurement?							
Yes, as a result of a political decision	25 %	18 %	46 %	50 %	36 %	78 %	40 %
Yes, according to the legislation for Public Procurements from 2017	13 %	24 %	15 %	30 %	27 %	11 %	21 %
Yes, of other reasons	13 %	12 %	8 %	20 %	27 %	11 %	15 %
No, the organisations missing such a strategy	50 %	41 %	23 %	0 %	9 %	0 %	22 %
Don't know	0 %	6 %	8 %	0 %	0 %	0 %	3 %
N of respondents	8	17	13	10	11	9	68

Table 6 shows there is a relationship between adoption of strategies and number of inhabitants in the municipality. Municipalities with a large population more often has an implemented strategy to promote GPP. Political decisions seem to be more important than the Public Procurement Act from 2017. An important insight from the interviews is that in smaller municipalities both political will and personal interest in the administrations plays a more important role to success with GPP for freight transport.

Municipalities were also asked for what kind of commodities and services they included requirements related to sustainable transport. The responses show that requirements apply for all kind of goods, but are more common for office supplies, furniture, consumables, and food.

As shown in Table 7, dialogue with freight service providers is the most common way to gain knowledge about low emission solutions or delivery alternatives. Responses summarized in Table 7 are based on a question allowing multiple responses, therefore the total number of responses is higher than actual respondents of the survey. Percentages show share of respondents choosing each of the alternative responses.

Table 7: How municipalities gain knowledge

	Municipalities by population size						Total
	Under 2 000 inhabitants	2 000 - 4 999 inhabitants	5 000 - 9 999 inhabitants	10 000 - 19 999 inhabitants	20 000 - 49 999 inhabitants	50 000 + inhabitants	
Do you acquire information about low emission solutions or delivery alternatives? (Multiple responses possible)							
Yes, have employees who are constantly working to map the market	0 %	0 %	0 %	0 %	27 %	56 %	12 %
Yes, in dialogue with freight service providers/vehicle manufactures	50 %	33 %	54 %	80 %	91 %	56 %	58 %
Yes, participate in networks at local level (neighbouring municipalities)	13 %	17 %	31 %	40 %	18 %	0 %	20 %
Yes, participate in networks at regional level	38 %	17 %	38 %	40 %	18 %	33 %	29 %
Yes, participate in networks at national level	0 %	6 %	0 %	10 %	9 %	33 %	9 %
Yes, in other ways	13 %	11 %	8 %	0 %	0 %	0 %	6 %
No, do not actively seek knowledge	13 %	39 %	23 %	0 %	9 %	0 %	17 %
N of respondents	8	18	13	10	11	9	69

The technological maturity in the market for low and zero emission vehicles varies between large and small vehicles [38]. For small vehicles the characteristics regarding range and payload is similar, but low or zero emissions heavy goods vehicles are only competitive for urban transport for the moment. Also, the price is significant higher when compared to vehicles with internal combustion engines. With this backdrop, it is reasonable to expect that requirements for low or zero emission vehicles affect the offered price of transport services in a negative way. Results presented in Table 8 only partly supports this. A large share of the respondent's state that they do not know the effect on prices, and the share stating that the price remains unchanged matches the share stating that the price increases due to environmental requirements in tenders.

Table 8: Procurers' assessment of consequences for offered price in procurements.

Is the offered price affected by a requirement for low emission transport?	N	%
Yes, the price will be higher	8	17
Yes, the price will be lower	1	2
No, the price remains unchanged	10	22
Don't know	27	59
Total	46	100

Table 9: Procurers' assessment of bidders' knowledge about legislation and public support schemes

How do you experience level of knowledge of legislation and support schemes among bidders?	N	%
Overall good	5	11
Good among larger freight service providers	10	22
Bad	10	22
Don't know	21	46
Total	46	100

Because the difference in price for fossil fuelled vehicles and low or zero emission vehicles and that the new Public Procurements Act tries to speed up the transition in sustainable solutions, different public support schemes to cover extra costs have been launched. For such support schemes to be useful, they must be communicated to potential users, e.g., freight service providers. According to the responding procurers, there is a job to be done to inform the freight sector, especially among the smaller actors (Table 9).

25 respondents answer that they do not include requirements for low or zero emission transport in their procurements. Therefore, the number of respondents included in Table 8 and Table 9 are lower.

4.3 The perspective of freight service providers

When it comes to what affects the freight industry's acquisition of vehicles running on alternative fuels, environmental requirements in public procurement are assessed to be of significant importance, although not the most important factor (Table 10).

Table 10: FSP's assessment of what affects the company's acquisition of alternative fuel-vehicles

How important are these issues for your company's choice of vehicles with alternative fuels?	Of very little importance	Of little importance	Important	Very important	N
Support for purchase of vehicles	16 %	2 %	10 %	72 %	83
Improved infrastructure for alternative fuels	27 %	2 %	13 %	58 %	83
Reduced road tolls	20 %	6 %	22 %	52 %	83
Requirements in public procurement	30 %	10 %	22 %	39 %	83
Priority at loading bays	51 %	8 %	12 %	29 %	83
Requirements from the private market	51 %	11 %	16 %	23 %	83
Access to streets/areas otherwise off limits for vehicles	53 %	18 %	10 %	19 %	83
Access to public transport lanes	49 %	20 %	11 %	19 %	83
Other	73 %	14 %	7 %	5 %	83

As shown in Table 11, findings from interviews with freight service providers indicate that an orientation towards public clients seems to both affect their experiences with procurements processes and their internal goals for low- and zero emission vehicles. Further findings from the interviews are embedded in discussions where it is appropriate.

Table 11: Findings from interviews with freight service providers

FSP	Experience with Public procurement	Goal
A	Experience a growing interest for FSP opinion/knowledge regarding requirements. Poor evaluation and monitoring of requirements.	Zero emission city logistics in 2026
B	PP is time-consuming; therefore, they concentrate on the private market.	Euro VI fleet
C	Experience a growing interest for FSP opinion/knowledge regarding requirements. Poor evaluation and monitoring of requirements.	Fossil free vehicles and buildings in 2025

Table 12: FSP's assessment of consequences of environmental requirements in public procurements

How do you consider the following statements about environmental requirements included in public procurement processes?	Strongly disagree	Disagree	Agree	Strongly agree	N
The tenders include requirements which support sustainable transition	20 %	20 %	49 %	11 %	45
The requirements have a negative effect on price and quality of services	7 %	18 %	29 %	47 %	45
It is challenging for freight operators to meet the requirements	7 %	4 %	36 %	53 %	45

Respondents directly involved in providing bids for GPP tend to consider the environmental requirements to represent a challenge for the industry with negative effects on price and quality of services offered, although they also tend to agree that such requirements have a positive effect on sustainable transition (Table 12).

Findings from the in-depth interviews with freight service providers indicate that the largest drawback with requirements for low or zero emission vehicles is that it affects the operational routines, which in turn affect the price and quality of deliveries. Therefore, freight service providers are positive to be invited to share knowledge about possibilities and barriers in the market and say they experience a growing interest for market dialogues.

The interviews also include statements from the industry about the importance of follow-up routines after a tender has been awarded. Since offered solutions are part of the competitive basis in the procurement, it is important to make sure that the winner actually delivers on what has been offered. If not, other bidders could have been able to deliver a more cost-effective solution. From the experience of the interviewees, today's follow-up practice is something which can be improved.

5 Discussion & Conclusion

As findings from the surveys indicate, a large proportion of Norwegian municipalities are already working with GPP. Today's practices of GPP involving freight services have been presented above and the results indicate potential for further refining of the practices. Part two of our research question is «*how should GPP practices be developed further to accelerate sustainability transitions in freight transport?*» This chapter starts with a brief overview of the most important issues recognised through the analyses, as a basis for the following discussion, which also relates to other studies within the same field.

The most prominent issues for accelerating the transition to more sustainable freight transport in public procurements of goods and services revealed in this study are:

- Political decisions
- Strategies
- Requirements
- Capacity/Budget
- Competence
- Methods for monitoring/follow-up

These issues are important for both public procurers and freight service providers, but in different ways.

Political decisions and strategies are identified as the most prominent reasons for municipalities to work with GPP in this sample. However, there is a divide between the larger and smaller municipalities, where the smaller tend to be lagging behind the larger regarding implementation of GPP. Capacity in the municipality administration along with personal interest are mentioned as reasons for not working with GPP in the smaller municipalities. Statements point to personal interest as often being essential when prioritizing different tasks if public procurements just is one of several areas of responsibility in your job. For the smaller municipalities to enhance their involvement in GPP, increased access to resources or more efficient use of existing resources could be an enabler, e.g., through inter-municipal collaboration in procurement processes. Quite a few of the municipalities already use networks on local and/or regional level as a source for acquiring information about low emission solutions and delivery alternatives. Enhanced collaboration through such networks could be an enabler for GPP in the smaller municipalities. Increased use of value-based inclusion of environmental requirements, as a large number of municipalities already apply, can also be a measure to accelerate more sustainable transport solutions associated with the larger purchases of goods and services. The larger municipalities are able to work with GPP in a more professional way since they often have designated procurement departments, professionalism and knowledge are mentioned as success criterions in GPP by [27]. Dialogue with the freight industry is identified as the most important source for procurers to gain knowledge about new solutions and alternatives. At the same time, the procurers indicate that there is room for improvement when it comes to the freight service providers' knowledge of legislation and support schemes. Utilising the dialogue between procurers and freight industry to provide suppliers with information about legislation and support schemes, could be worth exploring. It is important to remember there are exceptions that shows that a large administration is not mandatory to success with GPP. But, knowledge and transfer of knowledge between actors, as also underscored in [18], [28] is important especially in smaller municipalities. Easy access to or already acquired competence about GPP probably lower the bar for including it in daily routines.

An active strategy is not only important for municipalities. Strategies and focus generate requirements that both encourage and force freight service providers to think new and offer solutions that meet the requirements. Even if the results here have shown that economic incentives are the most important parameter for freight service providers, findings from the in-depth interviews also show that the freight service providers working for the public sector, have the most ambitious goals for delivering low or zero emission solutions. This may not only be due to the orientation in the market affecting internal strategies here, but also internal budgets and fleet sizes which reflect the capacity of the companies in terms of both financial and administrational capacity. To become an early adopter freight service provider, they need financial resources, just as municipalities. Requirements for low or zero emission vehicles may therefore favour larger freight service providers already in possession of adequate vehicles. They don't have to calculate for new investments or deal with the risks involved with ordering new vehicles in a market that experience huge delays these days.

Therefore, the characteristic of the Norwegian context where use of public support schemes in combination with GPP is of great importance. Public support schemes covering some of the extra expenses often associated with introduction of new technologies are examples of strategic niche management, which has proved to be a useful tool in transition management based on both our and previous findings [21], [24]. However, many small municipalities state that they consider the funding from public support schemes to be scarce and that it often

includes cumbersome application processes. So, to accelerate the transition, and reduce the bias for larger actors, easier applications processes, and more financial support to cover for both risks and extra work would be beneficial. Otherwise, less competitions may contribute to a negative effect on price and quality when fewer bids are delivered, something freight service providers already have stated is the situation.

Capacity can also be related to access of vehicles running on alternative fuels. This is mentioned by both freight service providers and small municipalities. Access to appropriate vehicles and corresponding fuelling/charging stations is crucial for success with transitioning of the freight transport.

To ensure fair competition, methodologies for monitoring the compliance of requirements is needed. It is important from a competitive point of view, that the winning freight service provider deliver what is promised. Development of standardised monitoring methodologies may contribute to lower the bar for smaller enterprises and municipalities to contribute when the resources needed to follow-up is reduced.

This study shows Norwegian municipalities in all sizes have started to implement requirements for low and zero emission transport in their procurement of goods and services. However, there are still some barriers to overcome, especially in the smaller municipalities. Several barriers are directly or indirectly related to financial resources, therefore extended public support schemes adapted to the need of the smaller actors, both private and public, should be considered to avoid that only larger freight service providers can compete on procurements including requirements for low or zero emission solutions. Other relevant measures include simplifying application routines, to reduce the work related to the process of applying for financial support for extra expenses related to low or zero emission transport. Building and utilising networks to enhance and disseminate knowledge and resources between municipalities and between municipalities and the freight service operators should be further explored.

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