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Governance in transitioning maritime passenger transport towards sustainability

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Summary

Governance is central for sustainability transitions in maritime transport. Norwegian authorities can directly influence developments in maritime transport through green public procurement, implementing low or zero emission technologies on more than 250 operational ferry and high-speed vessel connections is facilitated by public procurement. This study explores the role of green public procurement and investigates procurers' and operators' perspectives on the efficiency of green public procurement in accelerating sustainability transitions. Through review of calls for tender and interviews with procurers and operators, the study identifies critical issues for green public procurement to accelerate maritime passenger transport towards sustainability.

Keywords: governance, sustainability, maritime transport, public procurement

1 Introduction

Norwegian authorities have high ambitions of moving maritime transport towards sustainability. They have launched a variety of tools and strategies to facilitate transitions among ship owners, ports and authorities on local and national levels. This array of incentives and policies is an example of how governance can be actively applied to steer and manage sustainability transitions [1, 2].

Governance can be defined as "the totality of interaction, in which public as well as private actors participate, aimed at solving societal problems or creating societal opportunities; attending to the institutions as contexts for the governing interactions, and establishing a normative foundation for all those activities" [3]. The role of governance in accelerating transition in maritime transport, however, has historically been limited by the marginal influence of national authorities, the relative power of the shipping industry and the international character of this industry. The potential of governance is therefore greater in progressing sustainability transitions in purely domestic segments. Hence, green public procurement of ferry services has emerged as a promising approach for governing maritime passenger transport towards sustainability in Norway.

This study is conducted within the frame of the MoZEES research centre (Mobility Zero Emission Energy Systems[1]) and explores and describes the role of governance in transitioning domestic maritime passenger

[1] www.mozees.no

transport towards sustainability. It particularly focuses on the role of green public procurement and how procurers and operators experience the efficiency of green public procurement in accelerating sustainability transitions. The paper thus revolves around two research questions:

1. What characterises green public procurement of maritime passenger transport in Norway?

2. What issues are critical for green public procurement to accelerate sustainable transitions in maritime passenger transport?

The research questions are investigated through review of eleven tenders for maritime passenger transport services, as well as interviews with procurers and contractors associated with these tenders.

The next section of this papers introduces understandings of governance and its role in progressing sustainable technologies through for instance green public procurement. Thereafter, methods and data used to explore the research questions are presented, followed by a review of nine critical issues for accelerating sustainable transitions through green public procurement. Finally, the paper summarises main findings and discuss the results' implications for the practice field.

2 Theoretical background

2.1 Governance and sustainability

The concept of governance has evolved over the last century, from being a theory of *how to rule* (planning) to becoming a theory of *how to implement* [4]. As such, governance pursues the same goals and achievements as government, but is distinguished by the processes that underlie the achievement of these goals [5]. Unlike government, governance includes the actions of the state as well as non-public actors such as communities, businesses and NGOs [6]. Neo-institutionalist approaches to governance especially emphasize the importance of private markets in governance, and the freedom of actors to enter into contracts to fulfil necessary functions and access resources [7]. Economic approaches to governance, exemplified through New Public Management, have introduced market-oriented policies aimed at facilitating for instance exit options, competition, accountability and monitoring [8].

There is a growing body of literature on governance of sustainable technologies. In proposing a framework for analysing governance of sustainable technology innovation, Hillman and colleagues [9] refer to four mechanisms in governance which can be directed at the demand side or supply side; regulatory mechanisms (absolute policies through control and hierarchy), market mechanisms (market design, taxes, subsidies, investment support), cognitive mechanisms (consensual knowledge, problem framing) and normative mechanisms (values and beliefs of what is 'good'). Inspired by cultural theory, Tukker and Butter [10] claim governance of sustainable transitions is largely fatalist, hierarchist, individualist or egalitarian, whereas Kemp and colleagues [11] refer to policy integration, shared perspectives, information and incentives and system innovation programs as key components in governing sustainability. Transforming technologies in a sustainable direction depends on governance which succeeds in pressuring existing technologies as well as providing and coordinating resources which allow markets and technologies to change and adapt [12].

An expanding field of theory and research addresses sustainability governance under the branch of transition management. Transition management devises a prescriptive framework for shaping transitions through strategic, tactical, operational and reflexive activities [13:9]. These activities allow for developing systemic instruments and process strategies for enabling transitions [14]. As such, transition management is a governance approach [2] and a practice-oriented model for influencing ongoing transitions in more sustainable directions [15]. As with other governance approaches, transition management focuses on processes as much as objectives [16]. The orientation towards market instruments (e.g. ecotaxes, subsidies, tradeable permits, certification) derives from difficulties with implementing more conventional, regulatory instruments [6]. For instance, it has proved difficult to regulate sea transport due to its international character, which requires regulation on supranational levels.

2.2 Governing sustainability in transport

Although Van Leeuwen [17] argues that regionalization of maritime governance has produced stricter environmental standards and increased enforcement, the transnational nature and long history of self-regulation in maritime transport have caused it to lag behind environmental governance in other sectors [18]. Roe [19] refers to several reasons for governance failure in the maritime sector: national maritime policies have little impact, institutions which develop and implement maritime policies are not able to define necessary policies, lack of involvement from stakeholder groups outside maritime value chains (media, politicians, interest groups etc.), overwhelming power of shipowners and lack of dynamic policy design.

Hoogma and colleagues [20] give a thorough description of eight groups of barriers which obstruct sustainable technologies from gaining ground in the transport sector, whereof many relate to the role and potential influence of governance and policy making. For instance, they refer to the lack of direction of policy makers and inadequate regulation as barriers towards developing, investing in and planning for use of particular technologies. Insecurity in turn allows manufacturers to justify the status quo as there is no secure market with predictable consumer demand. As such, they argue, lack of legislation and lack of financial support for marketing of new technologies reduce willingness to invest in new technologies. Governance can further reduce barriers in providing or adapting infrastructure which reduces hesitations to invest.

This is reflected in other studies. Nilsson & Nykvist [21] call for several governance strategies to accelerate sustainability transitions in road transport, which could be equally relevant to maritime transport. They suggest that such governance relies on strong and clear political objectives and strategies with explicit technology prioritization and substantial integration of policies relating to climate, environment and transport. They further promote public-private partnerships and fleet procurement to increase familiarity with new technologies.

On an international level, there are several examples of market-based incentives for ships to improve environmental footprints, such as green port dues and indexes for clean shipping, energy and environmental performance [22-24]. Given the (semi-) public ownership of many ports [25] these represent one aspect of sustainability governance in maritime transport. Another prominent aspect is green, public procurement.

2.3 Green public procurement

The Organisation for Economic Co-operation and Development [26] defines public procurement as the "purchase by governments and state-owned enterprises of goods, services and works [carried out] efficiently and with high standards of conduct (…)". Within the EU, green public procurement (GPP) is voluntary, but there is a wide range of EU policies supporting green public procurement [27] and that underlie their handbook on green public procurement [28]. Public procurement has the potential to stimulate innovation [29] and to promote emerging technological niches [30]. A substantial literature examines the impact of public procurement on innovation [e.g. 31, 32-34]. As realising potential benefits of innovation relies on the expertise and efficiency of actors in the relevant value chain [35], green public procurement is closely related to private-public partnerships [36-38].

Public procurement can rest on a number of procedures, which are discussed in several studies [e.g. 39, 40, 41]: *open tendering* allows any actor to make a bid on a public tender with set and determined requirements, whereas *restricted tendering* involves a stage of pre-qualification. *Tenders with negotiations* allow pre-qualified bidders to negotiated with the procurer on any aspect of the tender, including technology, price and contractual features [42]. Similarly, *competitive dialogue* gives the procurer an opportunity to maintain a dialogue with a number of pre-qualified contractors to discuss how the procurer's needs can be fulfilled in a possible offer [43] involve dialogue with pre-qualified bidders, which enable the procurer the modify and tune criteria and requirements. Finally, in a *development procedure*, a research project makes up the basis for the procurement process with the aim to build knowledge and find new solutions [44].

Although not explicitly focussing on maritime transport, existing research does to some degree refer to specific criteria and assessments included in green public procurement. In a recent review of scientific literature on green public procurement, Cheng and colleagues [45] identify prominent environmental assessment criteria, including technical requirement and eco-labelling. Although price and quality typically receive higher weight than environmental criteria, green criteria and standards could also be used for

screening bidders and reduce the number of available bidders. Alhola [46] gives an overview of 31 environmental award criteria used in calls for tender in Finland, Sweden and Demark, where criteria on environmental policy, environmental management systems and other, less specific, environmental criteria are most prominent. A Finnish study [47] further investigates environmental criteria in transport-related procurement contracts, and find criteria in procurement related to eco-driving, age and emissions standards of vehicle fleets, oil leaks and hull bottom paint.

Given the mixed economy of Scandinavian countries and the heavy reliance on the public sector's ability to engage private actors to deliver their services, public procurement represents a major activity and responsibility on all administrative levels in Norway [48]. As local and regional authorities enjoy substantial autonomy they are fairly free to control and shape their own procurement ambitions and procedures. In an empirical study of environmental criteria in the public procurement of Norwegian counties and municipalities, Michelsen and de Boer [49] found that 3 of 4 include environmental performance criteria in public procurement, and that these requirements are typically related to environmental management systems. Another study [50] found that approximately 70 % of public tenders included some sort of environmental requirements, and that emissions, fuels and energy are prominent requirements in tenders for local and regional transport services [51].

The ability of green public procurement to produce environmentally benign outcomes relies, however, on a range of factors other than the mere inclusion of environmental criteria in awarding contracts. This includes the cost-benefit of the greener option and budgeting, the presence of or lack of supporting policies and legislation on all political levels and in the procuring organisation itself, support from management and defined strategies, knowledge about market opportunities and the dynamics between internal pressure and market resistance, as well as the quality and availability of green solutions [29, 30, 52].

The success of sustainable public procurement is further determined by the degree to which the behaviour of procurers themselves is sustainable [53].The procurer, however, can hold many different traits. Gelderman and colleagues [54] emphasise three actor groups as particularly central in shaping public procurement,; the institutional top management, procurement professionals and budget owners. Testa and colleagues [27, 55] therefore call for a determined public administration with sufficient awareness and competence of procurement on all levels and greater awareness and (legal, economic, technical) training throughout procuring organisations. They further emphasise the value of dedicated personnel with defined roles, functions and responsibilities in procurement, and claim the resources of individual procurers are more important than procedures.

3 Norwegian policies for sustainable maritime transport

Norway has an ambition of being a frontrunner in sustainable transport, and the national transport plan for 2018-2029 [56] states that 40 % of all local shipping shall run on low- or zero emission solutions by 2030. Most recently, the national government banned all carbon emissions in UNESCO world heritage fjords. Green shipping is therefore a priority area for the Norwegian government, and the government's maritime strategy [57] launches comprehensive policy instruments.

Use of more environmentally friendly fuels is a core element, and the *maritime strategy* considers gas (LNG), biofuels, and electricity (including onshore power and hybridization) to have the greatest potential. Particularly prominent are onshore power and renewal of the short distance fleet, further supported by the national port strategy which includes tax discounts for environmentally friendly vessels. The maritime strategy aims to further develop instruments supporting R&D, piloting, and commercialization of solutions for more environmentally friendly shipping. It emphasises the importance of cost-effective instruments to support investments in environmentally and climate-friendly maritime transport, of developing an overall plan for increased use of onshore power, and of making requirements for low- and zero emission technology in ferry tenders when technology warrants it. It also holds ambitions to further develop international regulations on climate and environmentally friendly shipping, both through the International Maritime Organisation (IMO) and the EU .

The objectives of the maritime strategy are supported by a range of instruments and support schemes, some of which are presented in Table 1. Particularly prominent are the support schemes administered by Enova. Enova is fully owned by the Ministry of Climate and Environment and supports public and private projects for improving energy efficiency and reducing climatic emission through innovation and technology development.

Among other instruments that indirectly may accelerate sustainable technologies in maritime passenger transport are the national emission taxes. As per 2018, the Norwegian general tax rate for CO2 emissions is approximately EUR 50 per ton CO2-equivalent. The parallel sulphur tax has also been substantially increased recent years [58]. Other relevant schemes include *Support for renewal in local shipping* and *Risk loans for financing new construction in local shipping*. Furthermore, the Norwegian Export Credit Guarantee Agency (GIEK) mitigates risk for banks and other finance institutions through a Domestic ship guarantee scheme.

Table 1: Selection of instruments for sustainable maritime transport in Norway

Enova	A parastatal organ owned by the Ministry of Climate and Environment. Administers a range of relevant support schemes.
Pilot-E	Grant scheme provided by Enova, the Norwegian Research Council and Innovation Norway. Supports development and implementation of environment-friendly technology, with grants equivalent to more than 10 mill EUR in 2018. Maritime transport has so far been a key target area
Klimasats	Support scheme for local and regional authorities which grant support initiatives which reduce climate emissions or facilitate transitions to sustainable societies.
Chart for green coastal traffic	Forum for co-creation of knowledge and innovative solutions in the maritime industry.
Environmental technology scheme	Targets companies in all sectors with the aim to stimulate innovation and reduce the financial risk associated with promising solutions at an earlier stage of development (TRL 5-7).
Support for climate and environmentally friendly shipping	Encourages collaboration between private actors in development of zero and low emission ships.
NOx fund	Enterprises may join by making payments per kg NOx emitted, at a lower rate than the national NOx-tax. Support is paid back to the industry through the NOx Fund's support scheme.
Emission taxes	Taxes on NOx, CO2, sulphur

Norwegian authorities consider public procurement a useful tool to become a "zero-emission nation" [59]. Since January 2017, state, county and municipal administrations are obliged to develop their procurement practice in order to contribute to reduce environmental impacts and promote climate-friendly solutions whenever relevant. Correspondingly, a new paragraph added to the Regulation on Public Procurement, emphasises that environmental requirements and criteria may be applied in all steps of the procurement process, and that, where applied, they should be weighted minimum 30 %. Through requirements and incentives in the procurement of ferry services, national authorities expect to stimulate technology implementation to reduce CO2 emission from the ferry sector (Norwegian Government, 2016). Furthermore, a parliament resolution (no. 873, 2016) specifically encourages the use of development contracts for hydrogen ferries. The Norwegian Public Roads Administration and more recently Trøndelag county have deployed strategic procurement of innovation in this area.

A parliament proposition from 2017 suggested that low- or zero-emission solutions for maritime passenger transport services should be a requirement in public procurement processes whenever possible. Although green public procurement might be picking up for local ferries and passenger vessels, an overview of public tender competitions in Norway indicated that there is a considerable potential for improvement in including environmental criteria [51]. In 2017, 15 million NOK were allocated to the Agency for Public Management and eGovernment (Difi) to develop an improved scheme for green public procurement. Further, the Confederation of Norwegian Entreprise (NHO) recently published guidelines for public procurement of

passenger transport. Although not obligatory for tenders for regional roads, there is an available template that procurers can confer with.

4 Methods

The purpose of this paper is to explore the role of governance in transitioning maritime transport towards sustainability, with a particular focus on green public procurement of maritime passenger transport services. The research questions have been studied through application of two different qualitative methods: document studies and interviews. Qualitative methods are particularly useful for accentuating processes and meaning [60] and allow the researcher to understand how individuals understand and interpret their surroundings [61].

The characteristics of green public procurement is explored through document studies of calls for tender for maritime passenger transport services. More specifically, eleven calls for operation of 19 ferry services throughout Norway have been investigated. All calls were published between 2015 and 2018, and were identified through the Norwegian national database for public procurement[2]. When available, tender documents were downloaded from the database, but were also requested directly from the procurer's contact person. The procurer of ferry services for national roads is the Norwegian Public Roads Administration (NPRA) Directorate of Public Roads, while ferry services for sub-national roads are procured by county authorities represented by a designated public transport administration company or regional representatives of the NPRA. The calls for tender included here were examined with respect to directions for quays and infrastructure, vessel requirements, other environmental criteria, and award criteria.

Interviews have been conducted with procuring bodies and operators in order to better understand what issues are critical for accelerating sustainability transitions in the ferry segment of maritime transport. Interviews are approved by the Norwegian centre for research data and are performed in accordance with their guidelines. All interviewees have been sent information about the study ahead of the interviews and been asked for consent to participate. In total, three procurers and two operators were interviewed during the second half of 2018. Both operators represent actors with large market coverage, whereas the three procurers represent a region within the NPRA (two interviewees), and a public transport administration company (one interviewee). The main difference between procurers is that ferry services connecting national roads, and procured by the NPRA, are required to facilitate zero emission solutions, whereas county roads administered by county authorities or public transport administration companies are merely encouraged to do the same. In many cases, however, the NPRA assists county authorities in procuring ferry services for county roads, and the NPRA interviewees included in this study therefore have experiences from procurement processes which do and do not follow national zero emission requirements.

Interviewees were recruited through purposive sampling [62, 63]: Interviewees representing procurers were recruited based on the review of tenders described above, and winning tenders were in turn used to identify and recruit interviewees representing operators. The interviews were conducted in person and as telephone meetings. They were based on a semi-structured interview guide, which is useful when the researcher holds some knowledge of the main topic (here: sustainability in maritime passenger transport) but has less knowledge of what relevant sub-topics might be (here: for instance contract duration, fuel supply infrastructure) [64]. The interview guide included five topics: 1) background information about the informant and her/his organisation, 2) knowledge and implementation of low and zero emission technology in own organisation, 3) joint ventures and cooperation regarding emerging technologies, 4) procurement and tender processes, and 5) incentives and support mechanisms for sustainable maritime transport.

Data from the interviews were analysed with the software program Nvivo in order to sort and categorise the data and therein to allow mapping critical issues for accelerating sustainability transitions. In step 1, all interviews were reviewed and their content coded with reference to background of the topics in the interview guide. In step 2, positive, neutral or negative value was added to the interviewees' statements. In step 3 the coded text was analysed, using the codes to compare the statements about one topic across all interviewees,

[2] www.doffin.no

and to see how frequent the topic is mentioned. When juxtaposed with coded statement values, this might indicate if a particular topic or issue is considered a barrier or accelerator for sustainability transitions.

The interviewees provided valuable reflections on green public procurement in transitioning maritime passenger transport towards sustainability. However, in interpretation of the results, one should bear in mind that the operators represent businesses where a sound company economy is a prerogative and where sustainability transition in the maritime passenger sector are secondary (or tertiary) objectives. Further, these operators represent two of the largest ferry service providers in Norway, and their perspectives are not necessarily representative of the view of smaller operators or operators less successful in winning tenders.

5 Results

5.1 Characteristics of procurement of ferry services

The following sections present the analysis of eleven calls for tender for ferry operations in Norway, with respect to directions for quays and infrastructure, vessel requirements, other environmental criteria, and award criteria. All but two calls include requirements about reduction of the emission *characteristics of the vessel* . These can relate to use of specific technologies, such as electric propulsion, or they can relate to specified limits on emissions (see Table 2). Some calls also require low-, zero- or none-fossil technologies without referring to a specified technology or fuel. Some of the calls include exceptions from these requirements for reserve vessels or temporary vessels, but should these be used for longer periods they must comply with the general requirements.

Table 2: Vessel requirements on propulsion and emission-restrictions

Type of vessel requirements	Number of calls for tenders
Fully electric vessel	4
Partly electric vessel	1
LNG or non-fossil fuels	2
Limits on emissions and/or energy use	4

Some calls also require a minimum operation time without needing to recharge or refuel, which could potentially restrict the opportunities for electric solutions. One call, for instance, requires a fully electric vessel to continue operating at least 3 hours if charging is unavailable and that other zero- or low-emissions solutions must be able to maintain operation for minimum 12 hours without refuel or recharge.

Quay infrastructure also determines the possibility for using electric solutions. Calls for tender usually specify the available quays and their characteristics, and nine of the reviewed calls specify that on-shore power supply will be available to the operator. A majority of the calls also allows modifications of the quays to comply with the operator's needs. In most cases, the operator will be responsible for planning, making and financing the modifications, and must also adhere to relevant plans and regulations. In one call, however, the procurer itself assumes the responsibility for providing onshore infrastructure.

Some calls for tender allow *financial support for environmental upgrading* to be subtracted from the bid price. For instance, a few calls request information about possible funding from Enova and several calls ask the tenderers to specify whether they are eligible for funding from the NOx fund. By subtracting support for emission-reducing measures from the tender price, tenderers with lower emissions are indirectly rewarded.

Mandatory monitoring and reporting on environmental performance are included in a handful of the calls. These require tenderers to report on fuel consumption, for example by implementing a Ship Energy Efficiency Management Plan, a monitoring tool developed by the International Maritime Organisation. Yet other calls demand ISO 14001 certification or similar standards for environmental management and control. Several calls also open for sanctions if the operator does not comply with contracted emission-limits.

There are two main methods for *evaluating tenders* in a public procurement process. The Lowest Price approach evaluates the bids that are subject to a set of minimum requirements based on price only. The Most Economic Advantageous Tender (MEAT) approach, on the other hand, allows for a variety of quality aspects

to be considered when evaluating the bids, such as environmental impact [65]. While both approaches are in use, the latter has gained popularity in recent years and is also recommended by the European Commission [66]. Among the call for tenders reviewed here, four calls apply the Lowest Price approach and do not apply any environmental criteria in the evaluation. However, the same four calls require either fully electric vessels or places restrictions on emissions and fuel consumption. The other seven calls in the review apply the MEAT approach, combining price and other, primarily environmental, award criteria. The weight given to price varies between 70-85 % and the environmental criteria are given a weight between 15-20 %. One of the calls includes *quality* as a criterion instead of environmental aspects. The content of the environmental criterion varies from case to case and includes indicators such as energy use, CO_2 emissions, NOx emissions and environmental efficiency.

5.2 Critical issues for success

Interviews with three procurers and two operators allow for identifying a set of critical issues that influence the ability to transition to zero-emission solutions. They can be categorised into *procedural issues* and *service delivery issues.* The former category relates to characteristics of the public procurement process, while the latter refers to issues that concern the ability to deliver a zero-emission service (see Table 3). The following section presents the critical issues that are identified.

Table 3: Critical issues for successful GPP in maritime passenger transport

	Critical issues
Procedural	Timelines
	Contract duration
	Standardisation
	Requirements
	Environmental weights
Service delivery	Technology lock-in
	Technology costs
	Infrastructure and charging/refuelling
	Energy capacity and cost

5.2.1 Procedural issues

The interviewees provided their perspectives on procurement procedures typically applied for maritime passenger transport: negotiated procedure, development procedure, and competitive dialogue procedure. Although the negotiated procedure approach demands a large administrative capacity and risks exposing conflictual issues, the operators appear positive to this approach and some would like it to be used more often. They describe it as useful for clarifying uncertainties and avoiding misunderstandings. Further, they suggest that the competitive dialogue approach allows operators to give input to and shape the content of the tender, and both procurers and operators recall positive experiences with the development procedure. Although it is considered an expensive approach, it provides both procurers and operators with valuable knowledge and learning opportunities when testing new solutions.

Timelines. Tight timelines are a key challenge presented by the interviewees. Frequently, multiple calls for tender coincide, and the operators therefore struggle to participate in all relevant tenders. The uneven temporal distribution of calls also has a negative impact on work flow, access to capital and available expertise. This affects the operators as well as dockyards and design offices. In addition, delivering new technological solutions or installing vessels with existing zero or low emission technology within a limited timeframe comes with a risk of elevating final costs, delivery problems or delays. In consequence, it might in some cases only be feasible for the existing operator with available vessels to submit realistic offers. This may limit competition in the public procurement processes to a few large operators.

Contract Duration. Procurers and operators have different opinions regarding the ideal duration of contracts. Long contracts imply that the same technological solution is used for a long period of time, without the possibility to implement new technology and update existing vessels if improved solutions should emerge.

Procurers experience this as inflexible, as they strive to continuously upgrade the energy performance of ferry connections. With the current system, a new procurement process is needed in order to update or change outdated technology, which is both costly and time-consuming for the procurer. However, operators prefer longer contracts to ensure predictability in own operations and that they capitalise on sunk investments as vessels remain in use.

Standardisation. Several interviewees ask for more standardisation in the public procurement process, particularly regarding requirements, sanctions and weights in the evaluation process. This could make the process more resource-efficient. The public procurement process is to some extent already standardised and must comply with the standard procedure for public procurement.

Requirements. Interviewees consider technical requirements a significant influence on the implemented solution. One operator claims cheaper diesel solutions will continue to be the standard unless calls include zero-emission technology as a specific requirement. In addition to specified propulsion technology, other technical specifications can indirectly influence the feasibility of zero-emission solutions. For example, speed requirements can obstruct zero-emission solutions because fully-electric solutions are currently unsuited for high speeds. Operators further suggest that anchoring zero-emission ambitions in their organisation produces low-emission solutions even though they are not required in calls: internal policy strengthens the operator's environmental focus and justifies time spent on developing low-emission solutions.

Weighting. The use of weights in the award process is criticised by several interviewees. Firstly, they argue that weighting environmental aspects instead of applying minimum environmental criteria weakens the environmental standard. Successful use of environmental weighting assumes generally high environmental ambitions among operators. Interviewees considers it more likely, however, that environmental weighting lowers the bar for operators as they simply need to be better than their competitors – whose environmental ambitions are not necessarily high. Thus, the tender with the highest environmental weights might not have a large environmental impact. Instead, by using minimum environmental criteria, the procurer can determine and raise the operators' ambitions.

Secondly, interviewees argue that large environmental weights could allow the operator to set unreasonably high prices, resulting in unrealistic tenders. Some of the interviewees further emphasise that price declines in low- or zero emission solutions levels the playing field for environmental-friendly technology and traditional solutions, rendering environmental criteria less necessary.

5.2.2 Service delivery issues

Technology lock-in. Closely related to the issue of contract duration, is the fear of lock-in among both procurers and operators. As seen above, procurers call for more flexibility to upgrade during the contract period to keep up with the technological development and environmental standards, whereas operators are afraid to lose their competitive edge due to an outdated fleet. Currently, contracts are already shorter than the lifetime of vessels, and considering the fast technology development the operators risk ending up with a fleet that is no longer competitive in subsequent procurement process. The risk of losing competitivity can be mitigated through contract options which allow flexibility in transition phases between contract periods. This could allow the operator to use the existing fleet for 1-2 years after the original contract has expired, thus giving time to replace their or adapt them to stricter environmental requirements.

Technology costs. The opinions on technology costs are somewhat divided among the interviewees. Some note that diesel solutions are still cheaper than zero-emission solutions and hence argue that calls for tender should require zero-emission technology. Others underline that the price of zero-emission technology has declined significantly in recent years, to the extent that zero-emission solutions in several cases are competitive with traditional diesel propulsion technologies.

Energy capacity and cost. Although zero-emission propulsion technology is ready to be put into use, the infrastructure to support electricity-powered maritime transport remains underdeveloped. Interviewees address problems related to energy access as a main challenge. The current "first come, first served" principle regulating the electricity distribution makes it impossible to guarantee energy access unless it is pre-ordered.

To avoid energy-shortage, operators sometimes overestimate the energy needed for their vessels, which can result increase the tender price. Increasing the grid capacity causes a non-linear increase in costs. One procurer notes that while establishing solutions 0.7 MW charging may cost 10 million NOK, required infrastructural adjustments causes an energy increase to 1MW to cost as much as 200 million NOK. The fluctuating grid tariff also presents uncertainty and extra costs to the operators, and one interviewee calls for a specific grid tariff for electric ferries in order to provide more stability and predictability.

Infrastructure and charging/refuelling. As seen above, the infrastructure to support zero-emission transport remains costly and the operators' technology choices partly depend on whether their projects are eligible for financial support to cover infrastructure costs. The lack of standards in charging infrastructure and the multitude of solutions make fleets less flexible and less interchangeable. The installations also need to comply with existing zoning plans. The interviews show that long-lasting planning processes may delay implementation of land-based infrastructure. Moreover, limited power effect and capacity, minimum operation time requirements and route schedules that do not incorporate charging make operators choose hybrid solutions over fully-electric vessels.

6 Conclusion

The purpose of this paper has been to explore the role of governance in transitioning maritime transport towards sustainability, with a particular focus on green public procurement of maritime passenger transport services.

Calls for tender for ferry services typically place environmental requirements on vessels through requiring specific technologies or specific emission limits. In most cases, the operators themselves are responsible for financing modification of quays and infrastructure if this is necessary for them to comply with emission or technology requirements. Although these costs area added to the operator's tender price, other costs can be reduced if the operator implements solutions that release financial support from Enova or the NOx Fund. Tenders are typically evaluated according to both economic and environmental criteria, although their definitions and weights differ from one call to another. A handful of calls further warn that successful bidders will be subject to monitoring and reporting to ensure sufficiently low emission levels.

Through interviews with procurers and operators of ferry services this study also identifies issues that are critical for accelerating sustainability transitions in maritime passenger transport. These issues are placed in two categories: procedural issues relate to timelines, contract length, standardisation, requirements and environmental weight, whereas service delivery issues relate to technology lock-in, technology costs, energy capacity and costs and infrastructure. The service providers raise some issues for procurers to consider for future calls for tender, such as standardisation of requirements, sanctions and weights in the evaluation process, and applying emission criteria instead of technological criteria for environmental aspects. Timetables not allowing sufficient time for charging, lack of standards in charging infrastructure and associated division of responsibility for investments, costs and maintenance associated with this, as well as capacity restriction in the power grid, are also pointed to as obstacles towards accelerated uptake of zero-emission propulsion solutions.

Based on the experiences of the interviewees in this study, green public procurement can be considered a representation of the different governance mechanisms described earlier [9]. Green public procurement of ferry services on national roads holds clear *regulatory* traits through national requirements for zero emissions solutions. These national requirements, along with their influence on all public procurement, can be expected to install meaning and value concerning what is a good ferry service and can strengthen the *normative* competitiveness of operators who deliver sufficiently sustainable solutions. To a certain degree, green public procurement of ferry services also serves to align *cognitive* orientations, as they appear to create a common acceptance and acknowledgement of the need for transitioning maritime passenger transport. Although green public procurement does not necessarily favour a specific technology, it seems to facilitate a fair consensus about objectives and ambitions, therein unifying perceptions and understandings of the future. Overall, however, green public procurement of ferry services is an obvious example of *market* mechanisms being used to progress sustainable technologies, which in addition to the procurement itself includes the

incorporation of other support schemes and (dis)incentives (e.g. Enova, NOx-tax/fund). As such, green public procurement of ferry services has in itself created a market for sustainable maritime passenger transport in Norway.

Norwegian authorities take an active role in promoting low- and zero emission solutions in maritime transport. In the passenger segment, national and regional authorities have explicit ambitions of facilitating transitions through green public procurement of ferry services. As such, they contribute to overcome barriers towards sustainable technologies in transport described earlier in this paper [19-21]. For one, the green public procurement strategies in the ferry segment install service and technology providers with *direction*, albeit for a definite period, which increases willingness to invest and reduces risk perceptions. Secondly, in providing a *market for emerging technologies* green public procurement also ensures predictability and encourages ambition among tenderers. It is also important to note the *heavy political and corporate anchoring* within which these procurement strategies are moulded and the fruitful *private-public cooperation* that they appear to produce. Green public procurement therefore holds particular promise for progressing sustainability transitions in maritime transport because it targets a segment (i.e. domestic ferry services) falling entirely under the *jurisdiction of Norwegian authorities*. As such, barriers associated with lack of common policies enforced by strong institutions that hamper transitions in international maritime transport are rendered irrelevant.

Hoogma et al [20] pointed to inadequate regulations as a barrier for sustainable technologies. One example of that highlighted by interviewees in this study are regulations in the energy market. The rapid technology development makes it difficult to predict expected energy demand in advance before final technology solution is developed and implemented, but because of the first come-first served principle operators must predict and pre-order the energy in order to secure operation of future zero-emission vessels.

An interesting issue for securing predictability and reducing risks for operators are the different practices for distributing responsibility and costs associated with establishing or modifying quays and infrastructure. Without common directions and guidelines for technological solutions, there is a risk that different operators establish a variety of solutions. This would move infrastructure even further away from *standardisation*, reduce fleet flexibility and increase costs as infrastructure must be rebuilt or modified when contracts expire and new operators, whose vessels are not compatible with infrastructure solutions, are to operate the connection.

The operators interviewed in this study represent a substantial share of the market they engage in and do, with two other operators, win most tenders for ferry services in Norway. As such, they can be expected to hold particular sway over governance approaches to sustainable transitions [19]. Still, there are still a number of operators on other maritime passenger transport services (school routes, city ferries, high-speed vessels) that subject to public procurement that are not included in this study. This implies that the study does not include valuable perspectives of smaller ferry operators nor the perspectives of operators of other maritime passenger transport services than car-and-passenger ferries. As these can be expected to hold other resources and potentially orient towards other markets they might have diverging perceptions of critical issues in green public procurement.

Further, the study does not explicitly focus on operators' perspectives on calls for tender where they have been unsuccessful. This, in combinations with interviewing operators who do not succeed in accessing the ferry market through public procurement, could provide valuable insight into green public procurement as a potential *barrier* towards competition and stronger environmental reorientation in larger parts of the ferry segment.

It should also be noted that the potential of governance in progressing sustainability transitions in maritime passenger transport goes beyond green public procurement. As mentioned introductorily, Norwegian authorities have launched a range of instruments to facilitate emerging technologies, and these should also be included under the umbrella of green public procurement. For instance has Enova in the period 2015-2017 allocated nearly 70 million euros between 17 projects in maritime passenger transport [67]. Future research should also investigate the potential of development contracts in more detail, as these are gaining ground and are currently being used to develop solutions for hydrogen high-speed vessels on coastal routes in central Norway.

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