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## Naar duurzaam en naadloos geïntegreerde eilandverbindingen.

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# **Naar duurzaam en naadloos geïntegreerde eilandverbindingen. Toekomstscenario's voor de Waddeneilanden.**

Towards sustainable and seamless island connections:  
Scenarios for the Dutch Wadden islands

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## **Samenvatting**

Natuur-beschadigende en kostbare baggeractiviteiten in de Waddenzee zijn momenteel noodzakelijk om de veerverbindingen tussen Holwerd en Ameland en Lauwersoog en Schiermonnikoog in stand te houden. Om deze redenen zijn voor de concessieperiode vanaf 2030 duurzaamheid en betrouwbaarheid op de lange termijn belangrijke elementen in de herziening van het vervoersconcept. Deelvervoer biedt kansen voor een duurzame en kostenefficiënte exploitatie van de veerdiensten. Dit vraagt echter om een zorgvuldige afweging van belangen van onder meer de rederij, bewoners, vervoerders, ondernemers, bezoekers en overheden. In dit onderzoek verkenden we het potentieel van delen in de keten van personen- en goederenvervoer naar Ameland en Schiermonnikoog. Eerst analyseerden we het vigerend beleid op verschillende schaalniveaus en de trends in het vervoer naar de Waddeneilanden. Daarnaast voerden we interviews uit met stakeholders (n=18). Op basis van deze analyse hebben we vier toekomstscenario's geschetst met verschillende maten van delen en ketenintegratie: 1) Heft in eigen hand; 2) Samen eigen verantwoordelijkheid; 3) Samen zorgeloos op pad; en 4) Comfort op maat. Vervolgens hebben we in twee focusgroepen gereflecteerd op de betekenis van deze scenario's in de praktijk. We concluderen dat deelconcepten kansrijk zijn voor het vervoer naar de Schiermonnikoog en Ameland, mits de rederij proactief maatschappelijke actoren betreft, de veerdienst als integraal onderdeel van de keten wordt benaderd en de vloot wordt opgebouwd uit kleinere schepen.

## **Trefwoorden**

Deelvervoer; ketenintegratie; Waddeneilanden; toekomstscenario's

## 1. Introduction

Wagenborg Passagiersdiensten (in English: Wagenborg Passenger Transport) has enabled water transport to the Wadden islands Ameland and Schiermonnikoog for more than a century. Now, environmental challenges on a global and regional scale



ask for sustainable redevelopment (see *Figure 1: Location Ameland and Schiermonnikoog* Leendertse et al. 2022) to reduce greenhouse gas emissions and protect and revitalise the natural conditions and livelihood of the Wadden Sea World Heritage Site (I&W, 2020).

Currently costly and damaging dredging activities on the Wadden Sea are necessary to allow the continuation of water transport for people and goods to the Wadden islands. In the long-term, these activities are unsustainable, posing the most urgent threat to the connection between Holwerd and Ameland (RWS, 2019; Stigter, 2019). The upcoming concession period, starting in 2030, presents an opportunity to rethink the traditional (ferry) transport concept for both islands. Long-term reliability and sustainability are likely critical elements of the following concession framework. Thus, smart and innovative ferry transport that addresses seamless and sustainable connection is vital beyond 2030.

Shared mobility may be the key to a sustainable future transport concept for the island connections. Sharing implies that people or companies allow the use of their excess capacity for others. For instance, wholesale businesses could combine their loads into fewer trucks, and ferry terminals could facilitate storage facilities for island businesses and space for car-sharing. Such activities are more environmentally friendly as combining space and services would result in less total required resources. However, the process toward a shared economy is complex. There are different kinds of transport flows (people and freight), the supply chain is intricate (first mile on landside, ferry transport and last mile on the islands; vice versa), and a wide stakeholder variety (in transport, in government, in commerce, in users etc.).

This paper aims to explore sharing possibilities in the logistics and personal mobility chain that help to enable sustainable and low-emission transport to Ameland and Schiermonnikoog. Engagement with stakeholders and the development of four future mobility scenarios form the core of the research. To this end, we have conducted: an analysis of the relevant policy documents (of local, provincial and national governments); a data analysis (of ferry bookings, public transport use, and freight transport data) to understand the current transport volumes and flows to and on the islands for freight transport and personal mobility, including travel by car, bus and bike; a review of tourism trends in the Dutch holiday market and sustainable travel; a series of interviews (18) with stakeholders to understand the various perspectives on potential future mobility outcomes; finally, based on these analyses, four future mobility scenarios were developed for the transport to Ameland and Schiermonnikoog - see Kask et al., 2021.

## 2. On-going developments and challenges

Before developing the future mobility scenarios for the islands, several steps were taken to understand the current situation, context, and different perspectives in this complex

system. The analysis included a review of policy documents, a tourism trend review, data analysis of transport flows and interviews with stakeholders (18), which helped identify the key challenges for developing the scenarios. This section offers an overview of the main findings. For more detailed information, see Kask et al., 2021.

## *2.1 Policy analysis*

The Wadden Sea is the largest tidal flat system worldwide, with one of the most important bird migration and breeding areas. The area, compassing around 500 km along the Dutch, German and Danish coast, has been listed as a World Heritage Site since 2009. The three countries have agreed to "achieve, as far as possible, a natural and sustainable ecosystem in which natural processes proceed in an undisturbed way" in the Wadden Sea area. (I&W, 2020, p.25). Nature protection and development are critical goals for the area.

Protecting the natural conditions of the Wadden Sea has been on the agenda for years. However, until now, the area's health has not been restored to the desired level (I&W, 2020)). Building dikes and reclaiming land in the past have decreased the size of the Wadden Sea, meaning less water flows from the North Sea into the Zuiderzee and Lauwerszee. This has led to increased sedimentation growth along the coastline and an increased risk of navigation channels filling up during storms (Ameland et al., 2019).

The navigation channel between Holwerd and Ameland is most heavily affected by this sedimentation, leading to increasingly more dredging efforts to maintain timely ferry transport between the island and mainland. Dredging itself increases sedimentation further due to the enlargement of the natural channels, resulting in reduced flow velocities (Ameland et al., 2019, Stigter, 2019). It is estimated that the sedimentation trends will continue for at least the coming 20-30 years, and predictions for sea-level rise will not be able to combat the sedimentation volumes (Ameland et al., 2019). However, keeping up with current dredging activities is unsustainable in the long term due to physical, technical, and financial limitations and its destructive effect on biodiversity.

In 2023, the Dutch government will decide on the preferred long-term mobility concept for access to Ameland, which will shape the ferry concession for the upcoming period. In 2021, two solutions were chosen, which are further researched leading up to 2023. The first solution – optimising the current situation – accommodates large ferries with cars and freight only with high tide and allows for high-frequency smaller ferries on low tide. A strong limitation of vehicles would be needed. The second solution – replacing the location of ferry terminals – sees the relocation of the ferry terminal from Holwerd to Ferwerd where the transport volumes would remain similar to the current flows (Ameland et al., 2019).

Meanwhile, the islands desire fewer cars and less (car) traffic movements. On Ameland, there are discussions about reducing the number of cars arriving to the island by 20%. However, the final development direction is yet to be decided. Schiermonnikoog wants people on the island to be able to experience a 'car-free' island since visitor cars are not allowed, but this is currently undermined by traffic primarily caused by vehicles of delivery and construction companies and island inhabitants (Ameland, 2020; Schiermonnikoog, 2020; 2018). This shows a consensus between policy goals on local, regional, national, and international levels. Limiting the transport of cars and trucks is considered not only to benefit tourism and liveability on the islands but also to facilitate a different mobility concept with smaller ferries, contributing to the overall sustainable development goals of the entire Wadden region.

## *2.2 Trend analysis*

For an overview of current trends in island travel, a tourism trend review and data analysis of ferry booking data (both personal and freight transport) and public transport data were carried out. The results show that reaching Ameland or Schiermonnikoog is not easy without a car, especially if travelling farther than Groningen or Leeuwarden. Consequently, public transport is currently a relatively unattractive choice for travellers (mode choice for 5% of travellers reaching Ameland, 14% for Schiermonnikoog in 2019). However, with increasing numbers of visitors and cars reaching ferry terminals, and Ameland, improvements in public transport in the long-term may be desired to move towards a more sustainable travel concept where cars are of smaller importance. This is also supported by tourism trends, where travellers look for more sustainable trips and, on the other, expect a seamless journey (Hartman et al., 2019).

Ameland and Schiermonnikoog are islands with permanent residents and important tourism destinations with many restaurants, hotels, shops and grocery stores. The supply of these businesses is organised daily from the mainland. With the number of visitors on the islands growing, much more goods are transported to the islands. This can be seen from the data analysis of freight and passenger transport that show a steady increase in both. The trend can be caused by the simple fact that more people need more food and other goods, but e-commerce purchases are a contributing source. Everything flexible and easy is attractive for the islands' businesses, travellers, and inhabitants.

The question remains if the new transport solutions proposed for Ameland will be able to facilitate the growing demand for freight transport if cutting the number of personal cars is already on the agenda. According to stakeholders, continuing the current set-up in the long-term is less likely and undesired as lighter and smaller ferries become the norm. At the same time, it seems that transporters use specific ferry times and are more likely to travel in the first part of the day. Thus, the limited number of ferries sailing at high tide should not be limiting.

## *2.3 Stakeholder perspectives: sharing and chain integration as key concepts*

For further analysis of the issues and potential development directions for the transport to Ameland and Schiermonnikoog, 18 interviews with different stakeholders were conducted (see Kask et al., 2021). This sub-section concludes the main take-aways.

First, the interviewees expect fewer personal cars to travel towards the ferry terminals in the future. Overall, car ownership may decline, and Ameland is considering limiting access by car for visitors. However, with these trends and potential decisions in mind, it is important to facilitate future travellers in a way that still enables them to travel easily and comfortably. Many interviewees addressed the need for a sound luggage transport system. Suggested solutions for an improved system could vary – luggage could be picked up from home by postal service, checked in at a train station, or the ferry terminal – but could always be delivered to the accommodation on the island. Public transport companies would prefer if luggage transport were arranged in the different transport stream, avoiding time loss for arranging the luggage on the bus. In addition to luggage, the transport on the islands should be well facilitated, especially on Ameland, if cars are no longer welcome on the islands.

Second, many interviewees highlighted the growing importance of experiences in tourism in the future. This is in line with the findings of our tourism trend review. The journey from home to one of the islands could become an experience on its own, before stepping on the ferry itself – the holiday would start from their doorstep. Convenient luggage transport is one of the key elements to facilitating this. In addition, being able to plan the journey through a MaaS application was mentioned by many as an essential component. The benefits of using such an integrated system could ensure that people can arrange a parking spot for their car and book luggage transport in advance. A ticket reservation system in which travellers book for specific journeys would also be seen as a positive development. This way, the ferry company could sell tickets based on fluctuating demand, using variable pricing, which would also help disperse travellers during the day and the season.

Third, according to various interviewees, separating people and goods in ferry transport would be a positive. According to those stakeholders, it would help disperse the different flows toward the islands. However, it could also enable less dredging – people would travel on smaller ferries throughout the day and freight on larger ships only during high tide. Specifically, for Schiermonnikoog, deliveries via a hub and consolidation of goods are of relevance. On Ameland, there is already a certain degree of bundling of goods through one company, but on Schiermonnikoog, many companies deliver with their own vehicles.

To conclude, the key concepts that were found are sharing and chain integration. These concepts are sometimes referred to in the logistics literature as horizontal and vertical cooperation, respectively (e.g., see Cruijssen et al. 2007). Horizontal cooperation relates to how service operators in the same transport segment or level of the supply chain share information, capacity, and orders. For instance, wholesale businesses could combine their loads into fewer trucks, and ferry terminals could facilitate storage facilities for island businesses and space for car-sharing. Such activities are more environmentally friendly as combining space and services would decrease resource consumption (Shaheen & Chan, 2016). Vertical integration of transport services relates to how consecutive parts of a multimodal transport or supply chain are interconnected. The main advantage lies in cost reduction, emission reduction and reliability improvements resulting from non-competitive behaviour. Vertical integration is essential for facilitating a seamless transport of people and goods. The more integration there is in the trip or delivery chain, the more fluent the different parts of the trip chain connect. Current governance arrangements and issues in the hub programme.

### **3. Results: Scenarios for sustainable and seamless transport concept**

#### *3.1 The scenario approach*

How a future transport concept of a ferry company looks depends on various developments and choices made by different stakeholders in the coming years. It is intrinsically difficult to predict which decisions will be made and how they may impact the travel and transport to Ameland and Schiermonnikoog. However, by applying a scenario analysis – following recent examples of KiM (2015) and PBL (2019) – it was possible to envision different types of developments and their impact on future mobility in the Wadden Sea region. We sketched the future from a user perspective – i.e., travellers and goods transporters / logistic operators.

Four future mobility scenarios were developed through internal discussion with the research team, based on the policy document analysis and data analysis and semi-structured interviews with various stakeholders (see discussion in the previous section). For each scenario, an extreme image was sketched to evoke discussion about the potential futures. Next, the scenarios were tested with stakeholders in an online workshop where



Figure 2: Four future mobility scenarios for transport to Ameland and Schiermonnikoog.

representatives of various public and private organisations and island inhabitants could reflect on the scenarios. The results of the workshop were then used to clarify the scenarios further. The overall recommendations from the workshop were used to reflect on the scenarios and to draw up advice for a ferry company to develop a sustainable future mobility concept for Ameland and Schiermonnikoog.

Within our research (Kask et al., 2021), developments related to sharing economies, mobility, and other societal sectors as well as other mobility innovations such as chain integration (Storme et al., 2021) were identified as key uncertainties. 'Sharing' and 'chain integration' were selected as the key uncertainties in the scenario analysis. However, we also include related uncertainties and development directions highlighted during the interviews with stakeholders in the storylines of our scenario analysis.

For the four scenarios presented, sharing considers the extent to which physical space and things are shared among travellers and companies ('horizontal integration'). Increased sharing may limit the environmental and spatial footprint of transport and transport-related developments (both people and freight), which is essential for a vulnerable yet protected area such as the Wadden Sea.

For the scenarios, chain integration considers the extent to which various parties and companies within the chain collaborate with each other and with the ferry operator. This is also sometimes referred to as vertical integration (Crujssen et al. 2007) and relates to how consecutive parties of a multimodal transport chain are interconnected. Chain integration may deliver more comfort and a higher service level for the users in the personal mobility and logistics chain.

Sharing and chain integration can be stimulated when governments, transport companies, the ferry company, businesses, and other parties align their goals to achieve sustainable and seamless transportation to the Wadden islands.

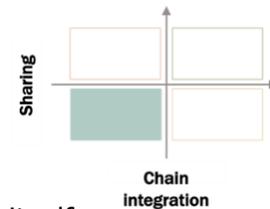
### 3.2 The four scenarios for Ameland and Schiermonnikoog

Based on the extent to which sharing and chain integration are achieved, the four scenarios depicted in Figure 2 have been built for the future accessibility of Ameland and

Schiermonnikoog. The scenarios depart from the user's perspective (traveller / delivery company / island businesses / island residents) and combine the insights gained from the policies, trends and contextual developments, and the findings of the stakeholder interviews, coupled with brainstorming sessions within the university research team. Moreover, the feedback from the stakeholder workshop, where the draft version of the scenarios was presented, was integrated as well.

*Taking matters into your own hands  
(‘Heft in Eigen Hand’)*

With a low level of chain integration and a low level of sharing (figure 2), this scenario builds upon the current situation regarding transport to Ameland and Schiermonnikoog where developments in sharing and chain integration remain minimal. It distinguishes itself from other scenarios and the current situation by emphasising privacy, freedom of choice and personal responsibility. Privacy concerns have increased through time due to cyber security and cybercrime issues.

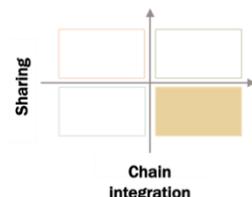


In this scenario, the car is the preferred transport mode for reaching the ferry terminals on the land side. Travelling by public transport is time-consuming and inconvenient. While some people opt to travel to the terminal with a shared car, using such initiatives has proven unpopular due to privacy and data sharing concerns. People are unwilling to share personal data in return for tailored mobility services. Luggage travels conveniently in the back of the car, from home to the accommodation on the island. When the car is left behind at the mainland terminal, people can drop their luggage on the ferry company's luggage cart. However, people are increasingly less willing to do so and keep their luggage with them on the ferry. On the islands, luggage is transported on taxis waiting for travellers on arrival.

Freight transport on the islands is offered by various delivery companies that use their vehicles that drive from mainland distribution centres to the businesses on the islands. Even though the costs of shipping the trucks and vans are high, the companies are willing to pay this to offer their customers the best service and remain and improve their market share. In an extreme scenario and if sufficiently cost-efficient, delivery companies may decide to arrange water transport to ensure even more flexibility and the possibility of offering last-minute deliveries on the islands.

*Together, but own responsibility  
(‘Samen Eigen Verantwoordelijkheid’)*

With a low level of chain integration but a high level of sharing (figure 2), this scenario expands significantly on the sharing dimension. It can be distinguished from the other scenarios by focusing primarily on shared transport.



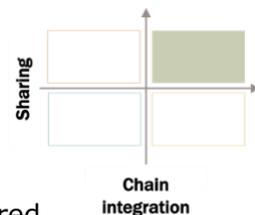
In this scenario, visitors travel to the islands primarily by public transport. Travelling by public transport is simply the most affordable – costs of parking at the terminal are high and taking the car to the island is unaffordable for many due to the high taxes imposed by the local government. The public transport offer has generally been improved; however, a low chain integration level means intermodal transport is often a burden. Mobility providers are not keen on sharing data, so MaaS apps only offer travel information for a few mobility

providers. This might mean that waiting times at ferry terminals have become longer and more uncertain. However, the new, comfortable ferry terminals offer plenty of facilities to make waiting pleasurable. Luggage travels with people in public transport, but in separate, designated areas on the trains and buses.

A strong sustainability focus has led the islands to put limits on freight travel coming to the islands. Goods delivery on the islands is now offered by one / few companies with a dominant position. All goods are brought to distribution centres at the ferry terminals, where goods are consolidated and brought to the islands in zero-emission delivery trucks and vans that then deliver to each address once a day to avoid unnecessary delivery kilometres. While delivery companies may save on the costs of shipping their trucks across the Wadden Sea, the service level that delivery companies use to offer decreases.

*Together carefree on the road*  
 ('Samen Zorgeloos op Pad')

With a high level of chain integration and a high level of sharing (figure 2), this scenario focuses especially on sustainability and low environmental footprint.



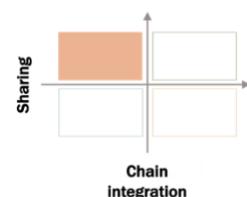
In this scenario, visitors choose to travel to the ferry terminals by shared transport – either by public transport or with a shared car. Travelling with shared transport offers a seamless and worry-free journey from door to door, and it is the most attractive and cost-effective way to reach the islands. Travelling by personal car is discouraged, expensive and frowned upon. A MaaS platform provides all the relevant information one might need to plan, book, and pay for the journey from origin to destination. The platform offers a variety of possibilities to travel and helps travellers to choose a trip that fits best their travel needs.

Multiple options are also available for luggage transport, from handing the luggage off to a delivery company at home to checking in the luggage at the ferry terminal with delivery to the island destination. People who are travelling to the islands value nature, which has increasingly translated into being more considerable and sustainable on the journey to and from the islands.

A joint venture has been established to deliver goods to the island to meet customer demands most efficiently and sustainably. The ferry company and various delivery companies have joined forces and share resources to provide the islands with the most sustainable and customer-friendly delivery service. The ferry company coordinates the shipping of goods in containers over the Wadden Sea, and bundled, zero-emission deliveries are carried out on the islands. Also, crowdsourcing is widely used among the island inhabitants who arrange delivery of products from the mainland through each other via digital platforms.

*Tailor-made comfort*  
 ('Comfort op Maat')

With a high level of chain integration and a low level of sharing (figure 2), this scenario emphasises developments in transport and mobility that are steered by diversity, price, and competition.



In this scenario, people prefer to travel privately with their travel group or companions, and the personal car is the primary transportation mode for reaching the ferry

terminals. Car parking is available directly at the terminal and at various locations nearby where shuttle bus services operate towards the terminal. This way, traffic congestion towards the terminal can be avoided. It is also possible to take the car to the islands, but that only applies to zero-emission cars and comes with high costs. However, thanks to the high-service level provided by the ferry company, the car is not necessary anymore as the carrier of luggage. An all-in-one MaaS platform enables people to book everything they need for their journey in one place – their parking spot, luggage transport and ferry tickets. The price for the ferry tickets fluctuates based on travel time and demand, which helps disperse travel throughout the day. More people may also combine their trip with a visit to the Wadden coast as they arrive a day earlier or have some time to spare before having to drive back home at the end of the day.

The ferry company collects luggage at the terminals and arranges its delivery to the accommodation on the island. When arriving by car, a designated luggage cart waits for travellers at their parking spot, which they can fill with their luggage. The cart is then collected and taken on the ferry. For a few suitcases, luggage check-in is possible at a drop-off desk at the terminal.

The ferry company plays a central role in facilitating sustainable and efficient transport of goods to the islands thanks to the real-time information the different delivery companies provide. In this way, the company knows in advance how many goods will be on the ferries, where to place them and if they can take on last-time extra deliveries. A variable pricing system could also be offered for transporters. Hubs are located at terminals on both ends of the journey, where only containers are loaded on the ferries. On the islands, companies deliver individually to continue offering their customers a high level of service.

### *3.3 Testing the scenarios with stakeholders*

The four future transport scenarios were presented to and tested with stakeholders in an online workshop. The scenarios enabled a lively discussion where the barriers and enablers for each scenario were discussed. Although scenarios are not about choosing one preferred, the question of which scenario stakeholders like the most was still posed in the workshop.

The response showed that there was not one scenario that is unanimously preferred, especially when considering the desired outcome for personal and freight transport. At the same time, none of the scenarios was regarded as unrealistic. Generally, scenarios focused on sharing seemed less favourable than those focused on chain integration. For personal transport, sharing could stimulate mass tourism that is not desired on the islands. Since Schiermonnikoog is already car-free for visitors, sharing would lead to a smaller impact than Ameland in personal transport.

For freight transport, sharing would imply undesired consequences, such as loss of market share on the island or lost time when having to unload and reload the goods at hubs. On Ameland, sharing goods delivery is already applied as much of the deliveries are carried out by a single company. On Schiermonnikoog, however, increased sharing in the delivery chain would be desired to limit vehicle movements.

Sustainability policies were expected to be implemented in the coming years, which would make the scenario most like the current situation – 'Heft in Eigen Hand' – potentially limited in the long term. This scenario was also least preferred by the stakeholders. Regarding the role of a ferry company, the scenarios have different implications. The scenarios on the

bottom (low level of chain integration) suggest a more passive company that primarily focuses on transporting people and goods from shore to shore. Scenarios on the top (high level of chain integration) imply a company that has a more (pro-)active role in the journey from door to door.

### *3.4 Gamechangers: the impact of contextual developments*

The outcomes of the different scenarios may vary depending on the choices that different government levels may make. In some cases, scenarios may not even be attainable.

#### *Dredging*

Dredging is currently necessary to continue reliable ferry transport in the Wadden Sea. However, dredging not only comes with very high costs (for taxpayers) and detrimental environmental impact but may also not be technically achievable due to the increasing dredging volumes. Therefore, several reasons support a potential decision to either reduce or stop dredging in the future. In such a case, the scenario 'Taking matters into your own hands' would not be achievable as smaller ferries would have to be used for the transport over water which would not be able to accommodate many vehicles. Sailing on high tide could be an option. However, undesired by delivery companies due to potential work hours during the night.

#### *Zero-emission zones*

In urban transport, zero-emission zones are being implemented in the coming years. In line with the environmental protection goals for the Wadden region, zero-emission zones might also be put in place in the region. A zero-emission zone might have the most significant impact on Ameland, which welcomes 100.000 passenger cars annually. With a zero-emission zone, this would no longer be possible unless the cars were fully electric. However, suppose ferries operating on the Wadden sea also have to be zero-emission. In that case, these ferries are likely smaller and unable to carry many vehicles across the water. On the Wadden islands, bus transport is already fully electric, yet other forms of transport lag behind. At the same time, some delivery companies are already preparing themselves for the urban zero-emission zones to be able to continue their business beyond 2030. Such companies may also benefit from the Wadden Sea transport as they have the vehicles needed to continue their deliveries while others may not be prepared.

#### *Tourism developments*

Neither Ameland nor Schiermonnikoog are planning to increase their annual visitor numbers but instead wish to avoid peak moments and spread visitors more over the year. As highlighted in the scenario descriptions, increased sharing may lead to mass tourism as the islands become more accessible to more people. This would be an issue for Schiermonnikoog, where day tourists are already causing heavy traffic congestion yet bringing little economic benefits to the island. Thus, opting for more sharing without effective dispersion measures (such as in scenario 'Together, but own responsibility') might be undesired.

### *Concession*

The current ferry concession targets the transport of people rather than the transport of goods. According to several participants in the workshop, this concession set-up is considered not best suited for the islands since the arrival of people and freight at the same time causes undesired congestion on the islands. Furthermore, the delivery companies that deliver on the islands do not all fit on the one early morning ferry, meaning that they cannot deliver their goods before the times when it gets busy with tourists on the islands. Instead, additional ferries in the morning could be desired. Therefore, participants indicated that the option for a concession that either caters separately for the transport of people and transport of goods, or where the concession only covers the transport of people, might be on the cards. Such a set-up could allow a more effective way of transporting passengers and goods and help to disperse not only the travellers but also help to separate the stream of people from the stream of goods. The benefits of this may go further than just dispersion. If delivery companies were free to operate their ferry services across the sea, various participants indicated that additional possibilities might also arise for the reduction of dredging. In this case, delivery companies might operate their ships that are also smaller and zero-emission.

## **4. Conclusions and policy recommendations**

This paper explored possible futures for island transport for the Dutch Wadden islands Ameland and Schiermonnikoog. The islands are part of the UNESCO World Heritage Site that aims to be "a natural and sustainable ecosystem where natural processes proceed in an undisturbed way". However, transport to the islands is currently operated by ferries that not only run on fossil fuels but also ask for constant dredging of the channels to navigate between the islands and the mainland. The potential mobility futures of the island transport were explored through scenario development. Four scenarios were developed based on combining different levels of chain integration and sharing concepts. Testing these scenarios with the stakeholders in an (online) workshop helped further to highlight the perspectives for the future transport concept:

- (Only) Focus on chain integration may lead to more benefits than (only focus on) sharing.
- In personal transport, sharing may stimulate mass tourism which is an undesired outcome for the islands.
- With increased sharing, mass tourism at peak hours could be avoided when using effective dispersion measures, such as a ferry booking system, smaller ferries with more departures and a demand-responsive ticket pricing system.
- A practical, seamless luggage transport concept must be developed to encourage public transport to reduce car travel to Ameland and the mainland terminals.
- In freight transport, sharing would help transition towards more sustainable ferries and help to reduce vehicle movements on the island. However, delivery companies may lose market share on the islands or deal with other negative financial consequences.
- Depending on the desired future, a ferry company can take different roles and carry out different actions to transfer towards an outcome that is robust, sustainable and considers the different stakeholder perspectives.

The main recommendations for a sustainable, future-proof mobility system and ferry connection include:

*Recommendation 1: The ferry company as a pro-active, societally engaged stakeholder in the process towards more sustainable transport to the islands*

The following concession period is the window of opportunity toward more sustainable transport over the Wadden Sea. A sustainable transport concept is urgent and crucial for a ferry company that wants to gain the next concession. The 2030 concession will likely come with a series of requirements, including more car-free transport, redesign of terminals and new concepts for luggage. At the same time, islands strive toward reducing car movements and electric vehicles in a shorter timeline. There is momentum toward a more sustainable mobility chain, linking up with the societal and mobility trends, on-going studies, pilot projects and developments. This way, small-scale solutions can be explored that show ways forward to 2030. The solutions can be facilitated in collaboration with local businesses, other transport providers and governmental organisations.

*Recommendation 2: Ferry trips as part of a seamless transport chain in personal mobility and freight transport alike*

With the need to reduce the transport of cars to the islands and car movements on the islands, it is essential to take steps that improve the convenience of travelling to the terminal by public transport or leaving the car behind at the mainland ferry terminal. To contribute to the experience of travelling, the whole journey from origin to destination could be part of a holiday, not just the ferry trip. Individually, the ferry company can only offer limited solutions. However, with other transport providers on the journey from door to door, a smooth trip can offer travellers the most benefits and comfort. The logistics chain needs to be viewed in the same way, wherein the best solutions will be found when transporters, ferry companies and island businesses work together.

*Recommendation 3: A ferry fleet and terminals that cater for sustainability and support the dispersion of traffic and travellers*

A new mobility concept for Ameland and Schiermonnikoog would not only require collaboration but also asks for physical changes that are essential in facilitating a ferry trip that respects the environment and is sustainable, comfortable, and seamless. Many stakeholders stress using smaller, less deep ferries as this would be important to reduce dredging activities on route to the islands. The smaller ferries would need to depart more frequently to handle the traveller demand. At the same time, these smaller, more frequent ferries would also help contribute towards the dispersion of travellers to avoid the feeling of mass tourism and help avoid traffic congestion on arrival to the islands/mainland. The ferries could be designed for different target groups – not only for islanders and travellers but also for a specific type of travellers, those willing to pay more for extra comfort and others happy to pay less for less comfort. As stressed by many stakeholders, different sizes of ferries could be used in combination for a departure-specific ferry booking system where the decision on the type of ferry to be used could be made based on the required capacity. The current large ferries could continue to serve the transport of large vehicles, building material and other large goods. However, such trips could only be facilitated during high tide when dredging will be reduced. The ferry terminals would also need to be redesigned to facilitate multimodal travel, the different types of travellers, luggage handling and freight consolidation. The terminals have an important place (hub) in the mobility chain

where people switch between different types of mobility and expect fluency and comfort in their transfer.

To conclude, the next concession period proves to be a window of opportunity for drawing a new mobility concept for the transport to Ameland and Schiermonnikoog. The urgent and crucial contextual developments ask for the various parties (ferry companies, freight transporters, authorities) to be proactive and design the transport concept based on the needs of the society. This would imply a change of perspective: instead of thinking from the inside-out (the ferry and then the context), zooming from the outside-in: by starting with the requirements given by the trends and the policy context, by studying the needs of different types of travellers and transporters and their travel chain, and finally, by designing the terminals and ferries.

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