

# A passenger vision for the future of the electric aviation 9-seater services: a case study on the Førde - Bergen route in Norway

Graduation report, August 2025

Seamless Personal Mobility Lab

Ines Peeters - MSc SPD

# COLOPHON

# Colophon

Delft University of Technology / IDE / SPD

This report is part of the Seamless Personal Mobility Lab

August 2025

Author

Master student Strategic Product Design

Ines Peeters

Academic supervisors

Dr. Ir. Suzanne Hiemstra-van Mastrigt

Dr. Ir. Sylvia Mooij

Company mentor

Embraer-X

Luciana Monteiro

# PREFACE

# Preface

This graduation thesis marks the final step of my master's in Strategic Product Design at TU Delft. Writing this report has been an intense but rewarding journey, shaped by many people who supported me along the way.

First, I would like to sincerely thank my supervisors, Sylvia and Suzanne. Their guidance helped me structure my thoughts, zoom out when I got lost in the details, and stay grounded in the bigger picture. Their feedback, listening and supporting me, especially during more stressful moments, made a big difference in staying focused and moving forward to the end of the project.

I also want to thank Luciana from Embraer-X for her role in initiating this project. Her openness, guidance, and the conversations we had, both on the topic and during our lunches in Rotterdam, gave me the freedom to shape this research in a way that felt meaningful and personal.

To my parents, Tim and Yvonne, I owe many thanks for their constant encouragement and support. I am especially grateful for our trip to Norway in January, which gave me the opportunity to conduct field research while exploring the country together.

A special thanks to everyone in Norway who made this journey possible. I was welcomed with open arms and am incredibly grateful for their hospitality and willingness to help. In particular, I would like to thank Trond in Førde for making my family feel so welcome in the fjord area in Norway, and Niclas in Bergen for connecting me with local contacts. I also want to thank Marit and Andreas in Oslo for their help in broadening my network.

To my friends, thank you for your patience, support, and for checking in, even when I wasn't always as present. Your encouragement carried me through the moments I needed it most.

This thesis is the result of both an academic and personal journey, and I am grateful for everyone who helped shape it.

Warm regards,

Inès Peeters



# EXECUTIVE SUMMARY

# Executive summary

This project was conducted in collaboration with Embraer-X, the strategic innovation department of aircraft manufacturer Embraer. The project addresses the challenge for OEMs: aircraft are not built until there is clear interest from airlines supported by a human desirability to enter the 9-seater market. Therefore, this study explores the research question: who are the passengers in the electric 9-seater and what kind of services should airlines offer to meet the passenger needs?

The 9-seater electric aircraft introduces a new travel experience to passengers. It is designed for short-haul rural–hub connections of up to 400 km and offers a low-emission, time-efficient alternative to ground transport. Its small size allows operation from underused regional airports, and it produces less noise while flying at lower altitudes. The aircraft is especially relevant in regions with low passenger volumes, limited public transport, and geographic barriers. These conditions informed the selection criteria for a suitable use case, which led to the exploration of the Førde–Bergen route in Western Norway.

This route connects a rural area (Førde) to a regional hub (Bergen) and is currently underserved by fast and seamless transport options. It includes several existing travel alternatives: driving with a ferry (≈3 hours), a 7.5-hour detour by car, bus-ferry combinations (≈3.5 hours), a passenger boat (≈3.5 hours), and an illogical and unsustainable flight via Oslo (≈4 hours). Previously, a direct 39-seater flight operated on the route but was discontinued in 2020 due to low passenger demand and misaligned scheduling. Local governments have expressed interest in reintroducing the route using a 9-seater aircraft (Ydersbond, 2023). Given the route's geographical

complexity, public transport limitations, and business travel potential, it serves as a relevant test case for studying 9-seater implementation.

A two-week qualitative field study was conducted in January 2025 to explore who the potential passengers of the 9-seater are and what services they would expect. The research question was: who are the passengers in the 9-seater market and what kind of services should airlines offer to meet the passenger needs? Three sub-questions guided the research: (1) What factors determine a passenger's choice of travel mode? (2) How do passengers experience current travel options on the Førde–Bergen route? (3) How is the 9-seater service concept evaluated by potential users?

To answer these questions, three qualitative methods were applied: in-depth interviews, on-street interviews, and auto-ethnographic research. Thirty interviews were conducted with passengers across the route, and the researcher traveled the existing travel options to validate and deepen the findings. The in-depth interview method served as the main analytical base, while the other two methods provided context and revealed additional themes.

The findings of this fieldwork led to the identification of 20 passenger needs. Ten passenger needs were synthesized into the Time-Savvy Business Traveler persona: time efficiency, reliability, flexibility, productivity, having an overview, convenience, seamless transitions, financial freedom, lowering emissions, and work-life balance. These were translated into design criteria guiding the design phase.

The design phase started with a co-creation session which designed the door-to-door journey using the Time Savvy persona. Along this journey 37 service touchpoints were developed. A passenger selection session was held online with six Norwegian Time Savvy personas to reduce the number of services to 21. A stakeholder evaluation was held to 15 touchpoints after stakeholder evaluation. The five most important passenger needs were prioritized by passengers and stakeholders as: time efficiency, reliability, having an overview, productivity, and flexibility. Stakeholders confirmed to focus on these five needs, but noted that time efficiency is the most important needs and flexibility is the most difficult since it impacts operational viability.

The final set of touchpoints includes services such as: a system to benchmark the full door-to-door trip in terms of cost, time, and emissions; real-time updates across all travel segments; a trip summary at the end of the journey; and clear information about the new electric 9-passenger flying experience. It also includes flexible flight rebooking, rush-hour-aligned departure schedules, baggage delivery options, self-handled luggage, integrated parking, and backup ground transport. Security procedures were simplified through separate security streams, while pre-ordering catering and comfortable workspaces help maintain productivity. Connections to international flights and integrated ground transport services further complete the eShuttle journey.

To support implementation, the project concludes with a roadmap that spreads the development of the eShuttle service over four strategic horizons, from now until 2040. The roadmap is based on the “wheel of responsibility,” outlining how airlines, airports, governments, and OEMs should collaborate. While the airline owns the passenger experience, airports must enable physical services, governments provide regulatory and funding support, and OEMs ensure the aircraft enables the onboard services.

The roadmap is structured over four horizons. Horizon 0 (2025–2031) focuses on building a time-efficient foundation and preparing operations before the aircraft’s expected release in 2030. Horizon 1 (2031–2034) launches the eShuttle by targeting the Time-Savvy business traveler with a focus on reliability and time savings. Horizon 2 (2034–2037) adds control and overview through real-time updates and trip summaries to enhance informed decision-making. Horizon 3 (2037–2040) expands the eShuttle service into a full door-to-door network, implementing all touchpoints and broadening accessibility with increased governmental support.

# TABLE OF CONTENTS

# Table of contents

<b>Chapter 01 - Introduction</b>	12	<b>Chapter 04 - Passenger results</b>	38
1.1 Introduction	13	4.1 Introduction	39
1.2 Why electric aviation matters?	14	4.2 Factors for choosing a transport mode	40
1.3 What is the small electric 9-seater aircraft?	15	4.3 Passenger transport mode experiences	42
1.4 The 9-seater stakeholders	16	4.4 Motivations for 9-seater adoption	46
1.5 Project brief	18	4.5 Derived passenger needs	47
1.6 Project goal and scope	18	4.6 Conclusion	48
1.7 Project approach	19		
1.8 Methods overview	20	<b>DEFINE</b>	
<b>DISCOVER</b>		<b>Chapter 05 - Persona development</b>	50
<b>Chapter 02 - 9-seater aircraft</b>	22	5.1 Introduction	51
2.1 Introduction	23	5.2 9-seater competes with car journey	52
2.2 Embraer	24	5.3 The Time Savvy persona needs	54
2.3 Embraer-X	26	5.4 Conclusion	55
2.4 The 9-seater aircraft	25		
2.5 The 9-seater market	26	<b>Chapter 06 - Design brief</b>	56
2.6 Conclusion	27	6.1 The design problem	57
<b>Chapter 3 - The use case</b>	28	6.2 The design goal	57
3.1 Use-case selection approach	29	6.3 Out of scope	57
3.2 Norway's 9-seater context	30	6.4 The design criteria	58
3.3 The Førde–Bergen route	31		
3.4 Field study in Norway	32		
3.5 Reflection on field study	36		
3.6 Conclusion	36		

## **DEVELOP**

<b>Chapter 7 - Ideation &amp; passenger concept selection</b>	60
7.1 Design approach for 9-seater ideation	61
7.2 Co-creating the eShuttle services	62
7.3 Participant selection service touchpoints	64
7.4 The selected passenger touchpoints	66
7.5 Conclusion	70
<b>Chapter 8 - Stakeholder iteration of eShuttle concept</b>	72
8.1 Design approach for stakeholder iteration	73
8.2 Touchpoint iteration with stakeholders	74
8.3 The iterated eShuttle service touchpoints	79
8.4 Conclusion	83

## **DELIVER**

<b>Chapter 9 - eShuttle concept design</b>	84
9.1 Introduction	85
9.2 The eShuttle concept	86
9.3 eShuttle benefits for airlines and OEMs	87
9.4 eShuttle services along the journey	88
9.5 Conclusion	90
<b>Chapter 10 - Roadmap for implementation</b>	92
10.1 Approach for eShuttle implementation	93
10.2 Wheel of responsibilities for stakeholders	94
10.3 The eShuttle door-to-door journey	98
10.4 The roadmap	99
10.5 Conclusion	105
<b>Chapter 11 - Conclusion</b>	106
11.1 Discussion	107
11.2 Recommendations	108
11.3 Limitations	109
11.4 Conclusion	110
<b>References</b>	112
<b>Appendices</b>	118
A.	
B.	
C.	
D.	
E.	
F.	
G.	
H.	
I.	

# Introduction

# 01

This chapter introduces the graduation project. Section 1.2 explains why electric aviation is needed to address the environmental impact of the aviation sector. Section 1.3 introduces the small electric 9-seater aircraft and explains how it fits within Regional Air Mobility (RAM), in contrast to Urban Air Mobility (UAM). Section 1.4 presents the stakeholders involved in delivering 9-seater services and their roles. Section 1.5 outlines the project brief, developed in collaboration with Embraer-X. Section 1.6 defines the project goal and scope. Section 1.7 explains the design approach, followed by Section 1.8, which gives an overview of the methods used throughout the project.

- 1.1 Introduction**
- 1.2 Why electric aviation matters?**
- 1.3 What is the small electric 9-seater aircraft?**
- 1.4 The 9-seater stakeholders**
- 1.5 Project brief**
- 1.6 Project goal and scope**
- 1.7 Project approach**
- 1.8 Methods overview**

## 1.1 Introduction

This chapter introduces the small electric 9-seater aircraft. It begins by explaining why electric aviation is relevant in addressing the environmental challenges of the aviation sector. The chapter then introduces the 9-seater aircraft as the first fully electric aircraft expected to be commercially viable by 2030, and explains how it fits within the broader shift toward Regional Air Mobility (RAM). The difference between RAM and Urban Air Mobility (UAM) clarifies the operating context of the 9-seater.

Following this, the stakeholders involved in delivering 9-seater services are introduced, including their roles and relationships in enabling a passenger-centered service. The chapter ends with the project brief, the research goal and scope, the chosen design approach, and an overview of the methods used in this graduation project.



*Figure 1: front picture of a 9-seater aircraft (Vearidion, 2025).*

## 1.2 Why electric aviation matters?

The aviation industry is facing environmental challenges. The sector currently makes up 2% of global greenhouse gas emission (Wang et al., 2024). The aviation air travel volumes are back to pre-pandemic levels and keep growing, with a yearly growth of 6%, while the pace of current sustainable initiatives only reduce emissions by 1% per year (Notenboom, 2025). This means emissions are expected to keep rising and in order to meet the goal of the Paris Agreement to achieve net-zero carbon emission by 2050, the sector needs to change (Ansell, 2023).

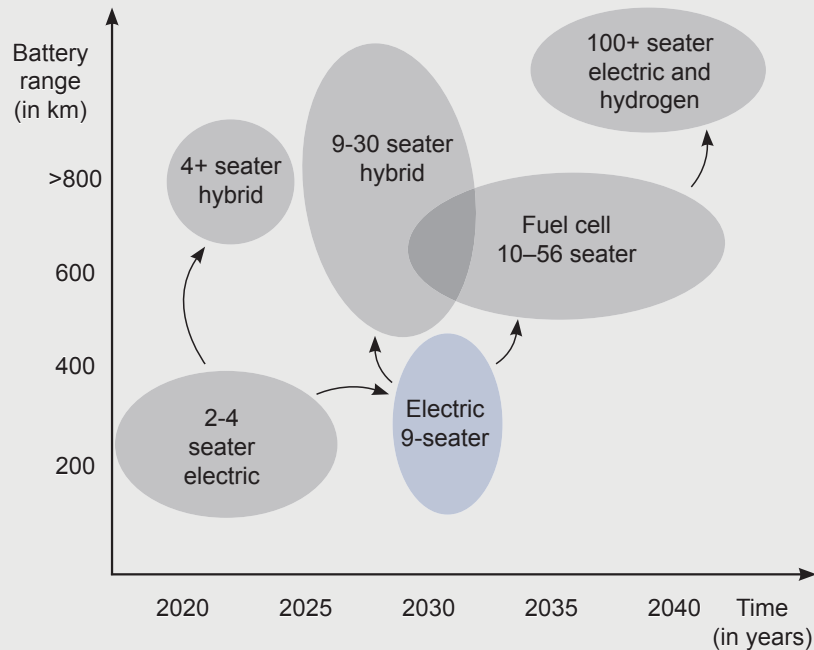


Figure 2: the technology readiness (Ydersbond, 2023).

One of the possible solutions is electric aviation, which is expected to reduce emissions by up to 88% (Nordic Innovation, 2024). Battery technology is developing rapidly and is expected to enable operations of small electric aircraft by 2030. These aircraft open up new possibilities for short-distance air travel (EFC, 2025).

Electric aviation is expected to scale in phases. Hybrid and fuel cell aircraft may enter the market from 2025 onward, while battery-electric 9 seaters are expected per 2030. This makes the 9-seater the first fully electric aircraft ready for commercial use and a stepping stone toward larger electric aviation (Ydersbond, 2023). The expected technology timeline is shown in Figure 2.

The first small electric aircraft to operate commercially is the 9-seater by 2030. This 9-seater aircraft introduces new flying experiences for passengers with reduced noise and zero emissions (EFC, 2025).

### 1.3 What is the small electric 9-seater aircraft?

New modes of electric air travel are emerging under the umbrella of Advanced Air Mobility (AAM). Within this, two main categories are often mentioned: Urban Air Mobility (UAM) and Regional Air Mobility (RAM). UAM focuses on short flights within cities, using electric Vertical Take-Off and Landing (eVTOL) aircraft that depart from vertiports. RAM, on the other hand, connects rural areas to urban hubs over longer distances, using small aircraft that operate from existing airport infrastructure. Table 1 summarizes the differences between UAM and RAM (Advanced Air Mobility Expo, 2025).

The 9-seater aircraft falls under the category of RAM, which focuses on short-haul flights up to 400km (Baur et al., 2024). The 9-seater carries up to nine passengers and is operated by two pilots (FAIR, 2024).

The 9-seater market is not expected to contribute significantly to reduction of global greenhouse gas emissions, but it will serve as a stepping stone for upscaling electric aviation to larger aircraft (Aircontact group, 2024) (see figure 2).

*Table 1: Differences UAM and RAM (Advanced Air Mobility Expo, 2025).*

Aspect	UAM	RAM
<b>Geographical focus</b>	Air transport within and around dense urban environments	Intercity, rural to urban and remote connectivity
<b>Distances</b>	Less than 100km	Between 100 km and 400km
<b>Infrastructure</b>	Vertiports	Existing airport infrastructure
<b>Main use-cases</b>	Air taxis, last mile delivery and intra-city travel	Regional business travel, healthcare and logistics

### 1.4 The 9-seater stakeholders

The introduction of 9-seater depends on collaboration between stakeholders. Table 2 below outlines the main stakeholders involved and their roles in delivering 9-seater services to the passengers.

Passengers are the end-users whose needs ultimately determine the 9-seater service success. Currently, it is unclear who these passengers are and what desirable and viable 9-seater services should be offered (Embraer, 2024).

The airline holds the most central role: it decides whether to operate the 9-seater services based on a viable business case. The airline has the ‘power’ to decide to step into this 9-seater market and buy an aircraft from an OEM, such as Embraer. The airline is responsible in offering the passenger services (Skypal, 2024).

Airports provide the physical infrastructure for 9-seaters to land and take-off. The airports co-operate with airlines to support passenger services at airports (Avinor, 2025).

The government plays an enabling role through funding and regulation. In many regions, 9-seater routes may not be commercially viable at first, especially in low-demand or remote areas. Public support, such as subsidies or Public Service Obligation (PSO)-like contracts, help ensure continuity and access to those remote regions (Norwegian Ministry of Transport, 2024).

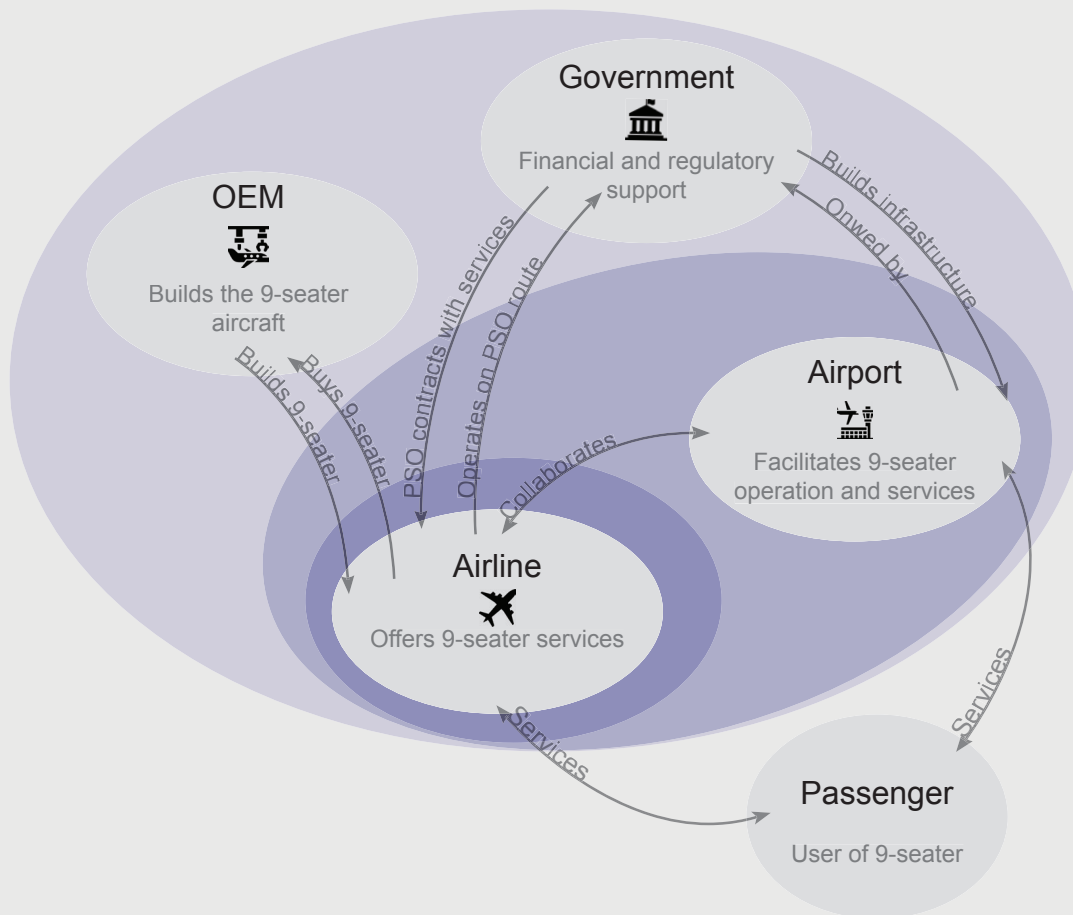
The OEM supplies the 9-seater aircraft based on market supply and demand. The OEM has little to no influence on the passenger service design, since the airline is leading in this (Embraer, 2024).

Table 2: Stakeholders and their roles in offering the 9-seater services.

Stakeholder	Customer	Role in 9-seater journey	Notes/context
<b>Passenger</b>	-	End-user of the 9-seater service, but unclear who the target group is of the 9-seater services.	Businesses show high interest in fast air transport (Embraer, 2025)
<b>Airline</b>	Passengers (9-seater services)	Main service provider. Owns the passenger experience. Decides to operate the route based on business case. Coordinates with OEMs, airports, and government (Skypal, 2024).	Enters the market when services and business model are defined (Embraer, 2025).
<b>Airport</b>	Airlines (time slot and services) and passengers	Provides infrastructure for take-off, landing, and ground services. Collaborates with airlines for passenger services at the airports (Avinor, 2025).	Most airports are government owned to maintain national connectivity (Avinor, 2025).
<b>Government</b>	Airline and airports (PSO contracts)	Supports through ticket funding and services through PSO contracts and owns most national airports (Norwegian Ministry of Transport, 2024)	-
<b>OEM</b> (E.g. Embraer)	Airline (builds aircraft for airline)	Passive role; responsible for aircraft production. Operates on supply-demand logic (Embraer, 2024).	Starts the production of 9-seater aircraft when airlines buy an aircraft from OEM (Embraer, 2025)

## The stakeholder network

This paragraph shows how the relationships between the stakeholders work. Figure 3 shows how the stakeholder network for the 9-seater service is structured across three layers: responsible, supports and enables. The network focuses on how to collaboratively deliver a passenger-centered 9-seater service, with each stakeholder contributing in different ways.



In Figure 3, the passenger is placed outside the stakeholder network. The passenger does not directly shape the system but is the end-user of the 9-seater services and plays a passive role in providing 9-seater services.

### Responsible for 9-seater services

This layer includes the airline. The airline is responsible for delivering the 9-seater passenger experience. Airlines co-operate with airports when the 9-seater services are at airport locations. The airline must comply with the regulatory Public Service Obligation (PSO) contracts in how they offer the 9-seater services to passengers.

### Supports the 9-seater services

The airport supports the services. The airports co-operate with airlines to manage 9-seater ground services. In this the government supports infrastructure development to realise the 9-seater operations at airports.

### Enables the 9-seater services

The government and the OEM enable the 9-seater services. They are not directly involved in delivering passenger-centered services. The government plays a role by owning most airports and issuing PSO contracts to airlines in how they should provide services. The OEM operates on a demand-supply basis, by building the 9-seater aircraft for airlines.

Figure 3: the mapped stakeholder network.

## 1.5 Project brief

This project was initiated by Embraer-X, the strategy department of the original equipment manufacturer (OEM) Embraer (Embraer is the third leading aircraft OEM worldwide). Embraer-X acts as a market accelerator within Embraer, aiming to explore new business models. They do this by identifying market needs and industry trends to step into new markets (Embraer, 2024).

The goal of this project is to analyse the 9-seater market and uncover what services airlines should offer to passengers to enable a successful commercial introduction of the 9-seater. The role of the airline is crucial in this, since the airline must first see a viable business case before entering the 9-seater market and purchasing an aircraft from an OEM. An OEM does not start building an aircraft before an airline commits to buying it, as the production costs are too high. Therefore, the power to enter the 9-seater market lies with the airline, not with the OEM. The airline is also responsible for offering the 9-seater services to passengers. This brings us to the research question:

**Who are the passengers in the 9-seater market and what kind of services should airlines offer to meet the passenger needs?**

## 1.6 Project goal and scope

The goal of this report is to uncover the service touchpoints that airlines should offer to passengers in the 9-seater door-to-door journey. This helps Embraer convince airlines to enter the 9-seater market by showing, from a passenger point of view, which services are needed to create a viable business case.

This research focuses on uncovering passenger needs through a qualitative research approach. It explores what the passenger needs are in order to understand how airlines should offer the 9-seater services. The focus is specifically on the airline–passenger relationship in the door-to-door travel journey.

This project does not focus on the development of the aircraft itself. The technological feasibility and technical ‘know-how’ of the OEM are left out of scope. Instead, the report focuses on the desirability of the 9-seater services (who are the passengers?) and the viability (what services should airlines offer?).

## 1.7 Project approach

The project is structured through the Double Diamond approach, which contains four different phases (Design Council, 2005). Figure 4 shows the four phases of the Double Diamond and how the report outline is structured.

### Discover phase

In this phase, the project research question is explored. In Chapter 2 the 9-seater aircraft and in Chapter 3 the use-case and passenger methods are explained. Chapter 4 presents the passenger results to discover the passenger needs for 9-seater services.

### Define phase

In this phase, the results from Chapter 4 are discussed in Chapter 5 to develop the needs-based target group of the 9-seater service. The define phase ends in Chapter 6 with a design brief that concludes the research phase of the first diamond. In this design brief, the design criteria are listed. These criteria guide the second diamond.

### Develop phase

The develop phase was used to explore different options to answer the design brief from Chapter 6. This phase included the desirability development of the 9-seater services through co-creation and passenger concept selection in Chapter 7. Chapter 8 focuses on stakeholder iterations to explore the viability of the services. These desirability and viability iterations helped to define the deliver phase.

### Deliver phase

The deliver phase was the final phase of the project. It includes the presentation of the 9-seater service concept in Chapter 9, followed by the implementation approach of the 9-seater services in Chapter 10. The last diamond ends with the conclusion in Chapter 11. This chapter summarizes the final outcomes of the project.

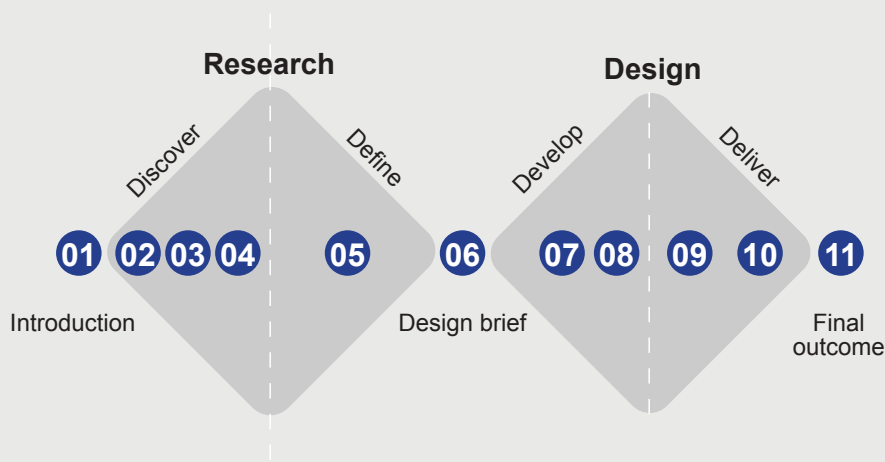


Figure 4: the report approach with chapter numbers (Design Council, 2005).

## 1.8 Methods overview

The methods used in the research and design phase are described down below.



### Desk research

Chapter 1-11

Desk research was done by gathering insights into the existing literature and documents available regarding the 9-seater topic.



### Stakeholder interviews

Chapter 2, 3

Semi-structured and unstructured interviews were held with electric aviation stakeholders. The stakeholders were sampled through convenience and random sampling. During these interviews, the goal was to help guide the research or design process through the expert lens.



### Indepth / on-street interviews

Chapter 4, 5

Semi-structured in-depth and on-street passenger interviews were held to gain insights into their travel behavior, mode experiences and how they evaluate the 9-seater concept. Visual tools were designed to help guide the interviews. These visual tools can be found in Appendix A.



### Auto-ethnographic research

Chapter 4, 5

Auto-ethnographic research was conducted to familiarize as researcher with the passengers and to understand how current travel modes are experienced. A two week visit was done in January 2025 to experience different travel modes and sample passengers for the on-street passenger interviews.



### Co-creations

Chapter 7, 8

Co-creations sessions were held with IDE master students and stakeholder experts to ideate 9-seater services.



### Evaluation sessions

Chapter 7, 8

Evaluation sessions were held with passengers and stakeholders. The evaluation sessions focused on the design criteria which guided the design process. The evaluation sessions gave insights into the prioritization of the design criteria.



### Selection sessions

Chapter 7

Selection sessions were held with passengers to select ideas that were most desired. The selection sessions helped to gather insights into reducing ideas into the development of concepts.



### Feedback sessions

Chapter 8

Feedback sessions were held with stakeholders to gather insights on the viability of the concept development. The feedback sessions helped to reduce the amount of concepts into 'final' concepts for the final phase of this report.



Figure 5: own picture from auto-ethnographic research.

# The 9-seater aircraft

# 02

This chapter introduces the context behind the 9-seater aircraft. Section 2.2 outlines Embraer's position as an aircraft manufacturer, followed by Section 2.3 on Embraer-X and its role in exploring new markets. Section 2.4 presents the characteristics and applications of the 9-seater aircraft. Section 2.5 highlights the market potential and outlines the conditions for selecting suitable use cases. Section 2.6 concludes the chapter.

## **2.1 Introduction**

## **2.2 Embraer**

## **2.3 Embraer-X**

## **2.4 The 9-seater aircraft**

## **2.5 The 9-seater market**

## **2.6 Conclusion**

## 2.1 Introduction

This chapter introduces Embraer and its strategy department Embraer-X, which explores new market opportunities like the 9-seater. It then outlines the characteristics of the 9-seater electric aircraft and the new flying experience for passengers. The chapter shows the market potential of the aircraft in regions with limited public transport, geographical constraints, and thin business travel demands, where the 9-seater could offer a time-efficient alternative compared to other modes of transport.



*Figure 6: a flying 9-seater (Vearidion, 2025).*

## 2.2 Embraer

Embraer is a Brazilian aircraft manufacturer and Original Equipment Manufacturer (OEM). It is the third-largest aircraft builder worldwide, after Airbus and Boeing. Unlike Airbus and Boeing, which primarily produce larger aircraft, Embraer’s product portfolio includes aircrafts with up to 150 seats (Embraer, 2025).

As an OEM, Embraer is responsible for the design, certification, and production of aircraft. Production only begins once an airline places an order. Due to the high development and certification costs, OEMs do not build aircraft without a buyer. This differs from the automotive industry, where vehicles are often built before they are sold. In aviation, the aircraft must first be sold to an airline, which means that the airline must see a viable business case before they step into a new market (Embraer, 2025).

Airlines only purchase a new aircraft type when they see market potential. For OEMs, this means they must demonstrate that the aircraft fits within a viable service model. One way to support this is by showing passenger desirability in the services airlines would need to offer (Embraer, 2025).

## 2.3 Embraer-X

Embraer-X is the strategy department within Embraer (see figure 7). It explores new markets and emerging technologies. Embraer-X has supported initiatives such as the eVTOL spin-off EVE. For the 9-seater market, Embraer-X looks at partnerships to invest in smaller OEMs, such as start-ups or scale-ups, that are developing electric 9-seater aircraft. The goal is to explore business opportunities by convincing airlines of a viable business case to buy a 9-seater aircraft from an OEM (Embraer, 2025).

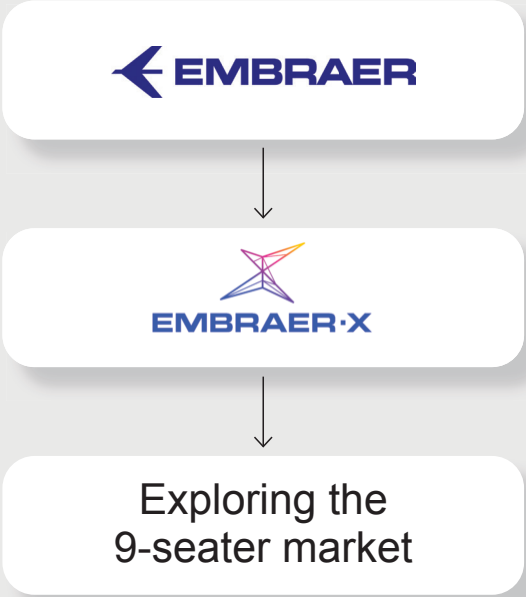


Figure 7: structure of Embraer and Embraer-X.

## 2.4 The 9-seater aircraft

The 9-seater electric aircraft carries up to nine passengers and is operated by two pilots (FAIR, 2024). It is designed for short-haul regional flights, with a range of up to 400 km (Schouten, 2025). The aircraft produces zero operational emissions and generates less noise due to its electric battery propulsion (Embraer, 2024).

The aircraft offers a new flying experience. It flies at lower altitudes, which reduces cabin pressure and allows for larger windows (EFC, 2025). The aircraft is smaller and passengers are seated directly next to each other as shown in figure 8 (Embraer, 2025).



Figure 8: interior design example from the electric Alice aircraft (Reed & Reed, 2021).

## 2.5 The 9-seater market

The 9-seater is suited for thin routes with low passenger volumes. These routes are often not commercially viable for larger aircraft to operate on due to the high costs (Baur et al., 2024). Especially the connection between rural and hub areas are suitable for 9-seaters (Embraer, 2024). The 9-seater aircraft enables new regional connections where demand is limited but connectivity is needed due to limited time efficient transport modes (Schouten, 2025).

The 9-seater focuses on short-distance routes using existing airport infrastructure (Baur et al., 2024). Europe has over 1,900 airports with runways suitable for 9-seater operations

(Schouten, 2025). Many of these airports are underused, which makes them attractive for 9-seaters (EFC, 2025). The 9-seater is relevant in rural areas, where public transport services are limited and travel times are long due to geographical constraints. In these areas, the car is often the default mode of transport (FAIR, 2023). The 9-seater could offer a time-efficient alternative in here (Embraer, 2024).

The 9-seater aircraft can be used for different purposes, including regional commercial flights, business aviation, cargo transport, and air ambulance services (Schouten, 2025). Business travellers are expected to be the first to adopt 9-seater services per 2030. This is due to the higher ticket prices expected in the market entry phase (Embraer, 2024).



Figure 9: Boarding a 9-seater aircraft at an airport (Vearidion, 2025).

## 2.6 Conclusion

The 9-seater aircraft gives a new flying experience to passengers, since it is a smaller aircraft, produces less noise and flies at lower heights.

The 9-seater aircraft is designed for short-haul rural-hub connections with distances up to 400km. The 9-seater offers a low-emission and time-efficient alternative to ground transport. It is most relevant in areas with limited public transport, geographical barriers, and low passenger volumes. In the market entry phase, the 9-seater ticket prices are expected to be higher. Business travellers are expected to adopt the service first due to a higher willingness to pay for their travel time.

These factors define the criteria for selecting relevant use cases: geographical constraints, a rural - hub connection, underused airport infrastructure, thin demand streams, no time efficient ground connectivity, and business travel.

# Førde–Bergen route use case

# 03

This chapter presents the rationale for selecting the Førde–Bergen route in Norway as a representative use case for exploring 9-seater electric aviation services. Section 3.2 outlines Norway’s policy, infrastructure, and potential passenger areas for 9-seaters. Section 3.3 introduces the Førde–Bergen route, including current travel options and travel times. Section 3.4 describes the field study conducted in Norway, including the research questions and qualitative data collection methods. Section 3.5 reflects on the methods applied in Norway. Section 3.6 concludes the chapter.

## **3.1 Introduction**

## **3.2 Norway’s 9-seater context**

## **3.3 The Førde–Bergen route**

## **3.4 Field study in Norway**

## **3.5 Reflection on field study**

## **3.6 Conclusion**

## 2.1 Use case selection approach

In this chapter, the travel context of the 9-seater use-case selection is focused on the Førde-Bergen route in Norway. It explains Norway's strategy for implementing electric aviation for the coming years. This chapter shows the alternative ways of traveling on this route by car (and ferry), bus (and ferry), passenger boat or domestic flight.

The use-case selection was based on the selection criteria concluded in chapter 2. Through literature reviews and expert interviews with stakeholders in the 9-seater field, including research institutes, OEMs, airlines, governments, airports and passengers. A central reference in this selection was the report by Ydersbond (2023) from the Norwegian research institute TØI, which examined the potential of the 9-seater implementation for the Førde-Bergen route.

This chapter outlines the selection of the Førde-Bergen route as a representative use case for exploring the 9-seater electric aviation concept. While this route is used as the central example throughout the thesis, the method and insights can be applied to similar regional routes in Europe, allowing the outcomes to be generalized in the Chapter 11, the Conclusion.

This chapter also presents the field study conducted in Norway to understand passenger needs in the 9-seater service. The research design was designed to this use case.

The central research question is:  
What are the 9-seater service passenger needs and what services should airlines offer to these passengers?

This is explored through three sub-questions:

1. What factors determine a passenger's choice of travel mode?
2. How do passengers experience existing travel modes on the Førde-Bergen route?
3. How is the 9-seater concept evaluated by potential users?

This chapter presents the three qualitative data collection methods used to answer these questions. It explains how the methods relate to the sub-research questions, includes a visual of the geographical research areas, and reflects on the learnings of each method. The in-depth interview method served as the core of the analysis, with on-street interviews and auto-ethnographic research validating insights and uncovering additional themes.

### 3.2 Norway's 9-seater context

In Europe, Norway is leading in sustainable transport options, such as electric ferries and cars. The country offers extensive government subsidies for Public Service Obligation (PSO) routes to ensure transport across low-demand regions. PSO routes are government-funded connections established to maintain transport services on routes that are not commercially viable due to low passenger volumes (Nordic Innovation, 2024).

Norway has a dense network of short-runway airports suitable for 9-seater operations. The country has 48 airports, as shown in Figure 10. Most airports are publicly owned, including 43 operated by Avinor and five additional commercial airports. Norway also has high availability of renewable energy to supply the batteries of the electric aircrafts (Nordic Innovation, 2024). Also, Norway has the highest domestic air travel volumes in Scandinavia. Norwegian citizens are used to fly domestically for business, health or leisure reasons (Nordic Innovation, 2024).

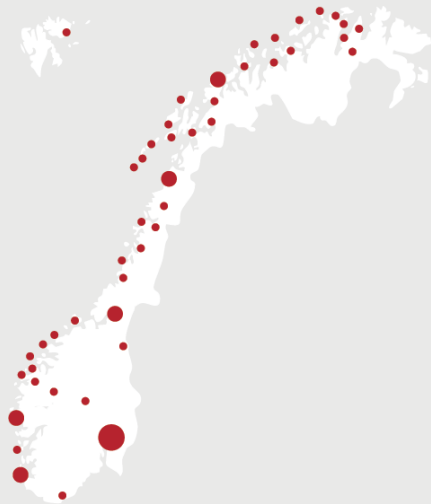


Figure 10: The airport locations in Norway (Avinor, 2024)

NEA and Nordregio (2023) identify Norway as having a high potential for door-to-door air routes where ground transport exceeds 1.5 times the air travel time. While Northern Norway has many rural airports, its harsh weather conditions limit early implementation. Western Norway combines a low travel demand, especially from business sectors like oil, energy, and fisheries (NHO, 2025), with milder weather, making it a strategically relevant region for 9-seater solutions as shown in Figure 11 (Aircontact Group, 2024).

According to Ydersbond (2023), the PSO route between Førde and Bergen in Western Norway presents a relevant case for exploring the potential of 9-seater operations. Implementing such a 9-seater could enhance regional connectivity for businesses in the area. Currently, Førde feels left out to not have a time efficient connection to their main hub in this area: Bergen. A direct flight with an electric 9-seater would offer a 30 minute journey from Bergen airport (Flesland) to Førde airport (Bringeland). Currently, Førde is only connected by air to Oslo, with a flight time of about one hour (Ydersbond, 2023).



Figure 11: West Norway focus for 9-seater (NHO, 2025).

### 3.3 The Førde–Bergen route

The Førde–Bergen route in West Norway presents an ideal use case for a 9-seater electric aircraft. The region faces geographic barriers with mountains, fjords and waters. The geographical barriers limit public transport options, which cause long travel times for the 125 km distance (as the crow flies). Previously, the Førde-Bergen route had a direct flight using a 39-seater aircraft. However, the air-route was stopped in March 2020 due to low passenger demands, unaligned flight schedules and COVID-19. The local governments support relaunching this route with a 9-seater (Ydersbond, 2023).

This route offers several travel options, shown in Figure 12. Car travel with a ferry is the most common mode, offering the shortest travel time (approx. 3 hours) and the highest flexibility, but it is tiring and includes a ferry crossing. Driving without a ferry is difficult due to the fjord geography and results in a 7.5-hour detour. Bus and ferry combinations take around 3.5 hours but offer limited schedule flexibility and are often fully booked, making early morning arrivals challenging. An alternative is driving to Askvoll and taking the passenger boat to Bergen (3.5 hours), which is slower and less suited to business schedules. Flying via Oslo takes 4 hours, which is illogical, time-consuming and unsustainable. Both airports are located about 30 minutes from the city centres by car or public transport (Ydersbond, 2023).

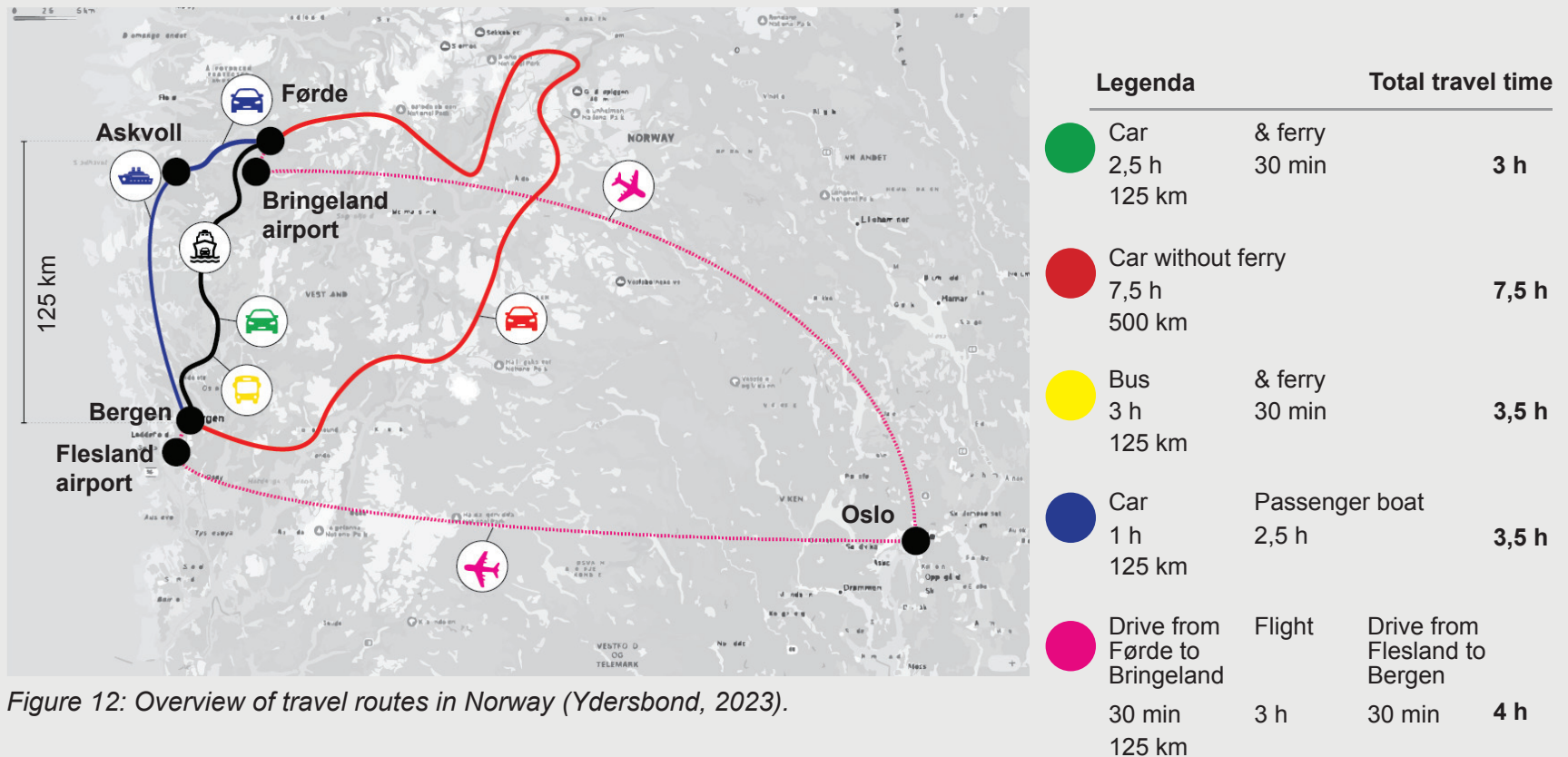


Figure 12: Overview of travel routes in Norway (Ydersbond, 2023).

### 3.4 Field study in Norway

The aim of the research was to explore passenger needs related to the 9-seater service. Three qualitative data collection methods were applied: in-depth interviews, on-street interviews, and auto-ethnographic research.

These methods addressed the main research question:

#### **What are the 9-seater service passenger needs?**

This research question was examined through sub-questions:

1. How do passengers experience existing travel modes on the Førde–Bergen route?
2. What factors determine a passenger’s choice of travel mode?
3. How is the 9-seater concept evaluated by potential users?

The detailed research questions with sub-questions can be found in Appendix C. The qualitative data collection method targeted different research questions (see Table 3) each method was applied. The travel routes focused on the multimodal connection between Førde and Bergen (car, bus, ferry, passenger boat or plane). When analyzing the results the ‘in-depth interviews’ were leading, and ‘on-street interviews’ and the ‘auto-ethnographic research’ were used as enrichment.

The interview design was based on the scenario-based proposition approach (van Kuijk, 2022) and supported by visual tools to guide the conversation and overcome cultural barriers (see Appendix A). Open-ended questions helped explore current travel behavior, pain points, emotional responses, and reactions to the 9-seater concept. The interview structure was pilot tested in the Netherlands (see Appendix B) to improve clarity and flow.

Participants reflected on current transport options and evaluated the new 9-seater service scenario. Most interviews were held in person in Norway in January 2025 as shown in Table 4.

*Table 3: Overview of which research question was included in each method.*

Research question with sub-research questions	In-depth interviews	On-street interviews	Auto-ethnographic research
<b>Research question: what are the 9-seater service passenger needs?</b>	X	X	-
1. How do passengers experience existing travel modes on the Førde–Bergen route?	X	X	X
2. What factors determine a passenger’s choice of travel mode?	X	X	X
3. How is the 9-seater concept evaluated by potential users?	X	X	-

Figure 13 shows where the three qualitative methods were conducted between Førde and Bergen. Each method is marked with a different color:

1. Yellow indicates the locations of the in-depth interviews, conducted in Bergen and Førde. Oslo was also part of the in-depth research, but is not shown in the figure due to scale limitations of Figure 13.
2. Purple highlights the sites of the on-street interviews, held at airports, bus stations, and passenger boat terminals in Bergen, Florø, and Førde.
3. Pink traces the routes traveled during the auto-ethnographic research, covering flights, buses, ferries and passenger boats.

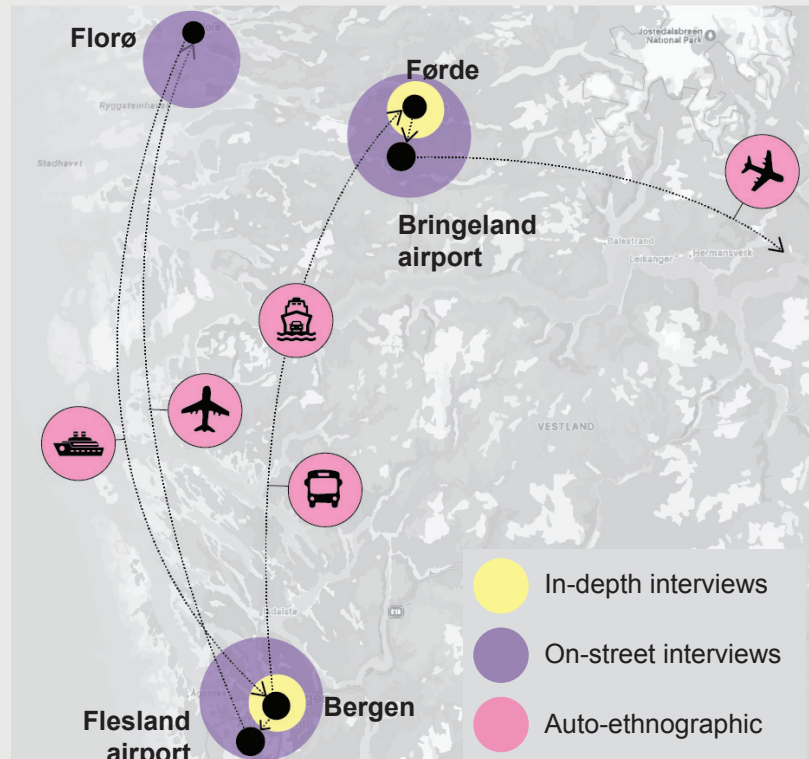


Figure 13: overview of research locations in West Norway

## The in-depth interviews

In-depth interviews were conducted in Norway to uncover the 9-seater service passenger needs. Inclusion criteria required participants to reside in Førde, Bergen, Oslo, or Florø and have prior commute experience traveling the Førde–Bergen route. Participants were mostly frequent travelers between Førde and Bergen, using car, bus, ferry, passenger boat, or plane. The interviews were held in Bergen, Førde, Oslo, and online, lasting 1–1.5 hours. Table 4 shows the participants who were included in for the in-depth interviews. Visual tools supported the interviews (Appendix A). The questions covered current travel modes, gain and pain points, and when participants would consider to switch to a 9-seater (Appendix C).

The interviews were recorded with consent. Participants were recruited through convenience sampling.

Table 4: Participants for in-depth interviews.

Participant	Location	Gender	Forde-Bergen route usage
PD1	Online*	Male	Frequent
PD2	Bergen	Male	Frequent
PD3	Bergen	Male	Frequent
PD4	Bergen	Male	Frequent
PD5	Online**	Male	Frequent
PD6	Førde	Female	Frequent
PD7	Førde	Male	Frequent
PD8	Førde	Male	Frequent
PD9	Førde	Male	Frequent
PD10	Oslo	Female	Rare
PD11	Oslo	Male	Rare
PD12	Oslo	Female	Rare
PD13	Oslo	Male	Rare

\* The participant location is Florø

\*\* The participant location is Bergen

## The on-street interviews

On-street interviews were held at travel locations in Norway to capture real-time passenger experiences. Passengers were interviewed while waiting or during their journey (e.g., bus stations, passenger boat pick up points, or at airports). Table 5 shows an overview of the participants who were interviewed. Conversations focused all on current travel experiences and only if time reactions to the 9-seater scenario using visuals (Appendix A). The interviews lasted 10–20 minutes and were recorded after consent. The most effective moments were just before departure or at arrival points. A total of 15 passengers participated. This method helped validate insights from Method 1 (in-depth interviews) and check if new themes emerged from the on-street interviews.

*Table 5: Participants for on-street interviews.*

Participant	Location	Gender	Travel experience	9-seater
PS1	Flesland airport	Male	X	X
PS2	Flesland airport	Male	X	X
PS3	Flesland airport	Male	X	X
PS4	Passenger boat	Female	X	-
PS5	Passenger boat	Female	X	-
PS6	Passenger boat	Female	X	-
PS7	Passenger boat	Female	X	X
PS8	Passenger boat	Female	X	X
PS9	Passenger boat	Female	X	-
PS10	Passenger boat	Female	X	-
PS11	Bus	Male	X	X
PS12	Bus	Female	X	X
PS13	Bringeland airport	Male	X	X
PS14	Bringeland airport	Female	X	-
PS15	Bringeland airport	Male	X	X

## The auto-ethnographic research

I traveled multiple routes between Bergen and Førde using different modes: bus, ferry, domestic flight, and passenger boat to better understand the passenger experiences on this route. The method gave me a first-hand view of the travel logistics, emotional context, and infrastructure quality. I documented my experiences using a visual travel diary and voice recordings, which were later used to reflect and identify travel pains and gains. The routes traveled for the auto-ethnographic research were based on the Førde–Bergen PSO study (Ydersbond, 2023). The goal of the auto-ethnographic research was to use as many different travel options between Førde and Bergen.

The research covered five days in Bergen and four in Førde. Tested routes included a flight from Bergen to Florø, return via passenger boat, and a one-way trip by bus and ferry. The segment Florø–Førde was skipped due to time and cost. An overview of the trips is shown in Table 6.

This method helped compare travel modes, reflect on real-time emotions and services, and added depth to the user insights collected through interviews.

*Table 6: Overview of travel routes in Norway.*

Mode	From	To
Domestic flight	Bergen	Florø
Passenger boat	Florø	Bergen
Bus and ferry	Bergen	Førde
Domestic flight	Førde	Oslo



### 3.5 Reflection on field study

The in-depth interviews were supported by visual tools that helped overcome cultural and language barriers. Guiding the sessions as open conversations allowed participants to feel comfortable and share more freely. Taking 1.5 hours plus time to reflect afterward worked well. If I planned too many interviews in one day, this would reduce the quality and take me a lot of energy to complete. Offering participants something in return, like a Dutch 'stroomwafel', was a simple but appreciated gesture for their participation.

On-street interviews came with more unpredictability. The richness of responses depended on the participant's willingness, mood, or English skills. Offering a small treat often encouraged participation. Some modes were harder than others: buses had short boarding times and curvy roads, making people feel nauseous; boats caused seasickness and were not ideal for interviews during travel; and aircraft noise made talking nearly impossible to talk to my neighbour. It became clear that interviewing people while they were in motion was much less effective than in waiting areas, where people were relaxed and more open to engage.

The auto-ethnographic research added valuable perspective by experiencing the journey myself. It helped me sense the physical and emotional realities of travel. Capturing lots of photos and videos proved essential, as it gave flexibility later to choose what to use. Writing down reflections right after the journey helped preserve fresh insights. This method brought a deeper, lived understanding to the overall research and helped strengthen the empathy in my design process.

### 3.6 Conclusion

Norway presents a relevant context for electric aviation due to its ambition to lead in electric transport modes, following developments in electric cars and ferries. The country offers a dense network of regional airports, access to renewable energy, and thin but critical passenger flows, particularly for business travel in Western Norway.

The Fårde–Bergen use case in West Norway is suitable for exploring 9-seater operations, as it reflects these conditions. The region's geography, limited rural public transport options, and business travel potential make it an interesting use-case. Currently, the car is the fastest mode, yet it takes approximately three hours to cover 125 km. A direct flight with a 9-seater would reduce this to 30 minutes from airport to airport (Ydersbond, 2023).

This use-case selection forms the basis for applying the qualitative research methods outlined in Chapter 3. The findings from all three methods (in-depth interviews, on-street interviews and auto-ethnographic research) are presented in the next chapter, Chapter 4: Passenger Needs.



*Figure 15: own picture from auto-ethnographic research.*

# Passenger results

# 04

This chapter presents the findings from the field research to explore the passenger needs for 9-seater electric aviation. Section 4.2 outlines the factors that influence passengers' choice of transport mode. Section 4.3 compares the travel experiences of transport modes on the Førde–Bergen route. Section 4.4 explores the motivations for adopting the 9-seater service. Based on the insights from sections 4.2 - 4.4 passenger needs were derived in section 4.5. Section 4.6 concludes the chapter.

## **4.1 Introduction**

## **4.2 Factors for choosing a transport mode**

## **4.3 Passenger transport mode experiences**

## **4.4 Motivations for 9-seater adoption**

## **4.5 Passenger needs**

## **4.6 Conclusion**

## 4.1 Introduction

This chapter presents the results from the in-depth, on-street interviews and auto-ethnographic research. The findings are structured into three sections to answer the central research question:

*What are the 9-seater service passenger needs and what services should airlines offer to these passengers?*

The answer to the first part of the main research question (passenger needs) is explored through three sub-questions:

1. What factors determine a passenger's choice of travel mode?
2. How do passengers experience existing travel modes on the Førde–Bergen route?
3. How is the 9-seater concept evaluated by potential users?

Participant quotes from the transcribed in-depth and on-street interviews are used to support the findings. The findings were compared with existing literature to highlight overlaps or new perspectives.

The insights from the three sub-research questions were synthesized into a set of passenger needs, which are summarized in Table 9. This table shows how each need emerged from the individual research questions, with some needs appearing across the sub-questions. The table provides an overview where each need originated from. Some needs appear in more than one sub-question, reflecting their recurring importance across different sub-questions.

## 4.2 Factors for choosing a transport mode

The interview sample included a diverse group of participants presented in Chapter 3. The data was analyzed using transport choice factors from literature (De Dios Ortuzar & Willumsen, 2011), shown in Table 7 and Figure 16.

The data showed that the trip goal was categorized into leisure or business travel. Participants were asked to rate trip time, convenience, flexibility, costs, and environmental impact based on their trip purpose. Trip time was identified as the most important factor for business travellers. Flexibility increases time efficiency, while convenience contributed to productivity during the journey. In contrast, cost and environmental impact were mentioned as least important.

Leisure travellers prioritized costs, followed by travel time. Cost was commonly weighed against convenience and flexibility. Although environmental impact was not a primary concern for most respondents, it was emphasized by environmentally conscious individuals.

Trip goals also influenced mode choice: business travellers valued time efficiency and flexibility, while leisure travellers prioritized affordability. Attitudes toward transport ranged from habitual use and indifference to social sensitivity, but these attitudes were not found to be decisive in mode choice.

Participants from rural areas viewed the car with ferry as an essential transport mode, given the limited availability of public transport. In contrast, urban residents had greater access to public transport but faced higher costs and congestion associated with car use. Car ownership was linked to residential area, with multi-car households common in rural F rde and car ownership less accessible in Bergen due to higher costs to own the car and limited parking spaces. Safety was a recurring theme, especially given Western

Norway's challenging weather conditions: rain and wind. Ground transport modes, such as cars and buses, were perceived as safer than air travel. A general trust in the Norwegian transport system contributed to a sense of safety, even with minimal ticket checks. Income was relevant in relation to cost sensitivity and when comparing the preferences of younger and older demographic groups. The cognitive load is lowest for the car and ferry combination compared to all other modes.

Reliability emerged as a new factor. It refers to the likelihood of successfully completing the trip as planned. Four factors found in the literature were not explicitly mentioned by participants. These include: license possession, household, activeness and social status, as shown in Table 7.

*Table 7: Definitions of factors for choosing a transport mode (De Dios Ortuzar & Willumsen, 2011)*

Factors to choose mode	Explanation of the factor
● Trip time	Time to travel from A to B.
● Costs	Fixed and variable costs.
● Flexibility	Freedom to choose departure time and route.
● Convenience	Possibility to work or relax during the trip.
● Environment	Emissions, noise and congestions.
● Trip goal	The purpose of the journey.
● Residential area	Density difference of rural and urban spaces.
● Car ownership	The availability of using a car.
● Attitude toward transport	How modes are used or perceived.
● Safety	Perceived security during the journey.
● Income	The height of salary.
● Cognitive load	How much effort is needed to plan or navigate the journey.
+ Reliability	The certainty of arriving on the destination.
■ License possession	The ability to drive a car yourself.
■ Household	The composition of household.
■ Activeness	The level of physical engagement the trip requires.
■ Social status	The extent to which the mode is seen as prestigious or aligned with self-image.

● Mentioned in results and literature   
+ New mentioned in results and not in literature   
■ Mentioned in literature and not in results

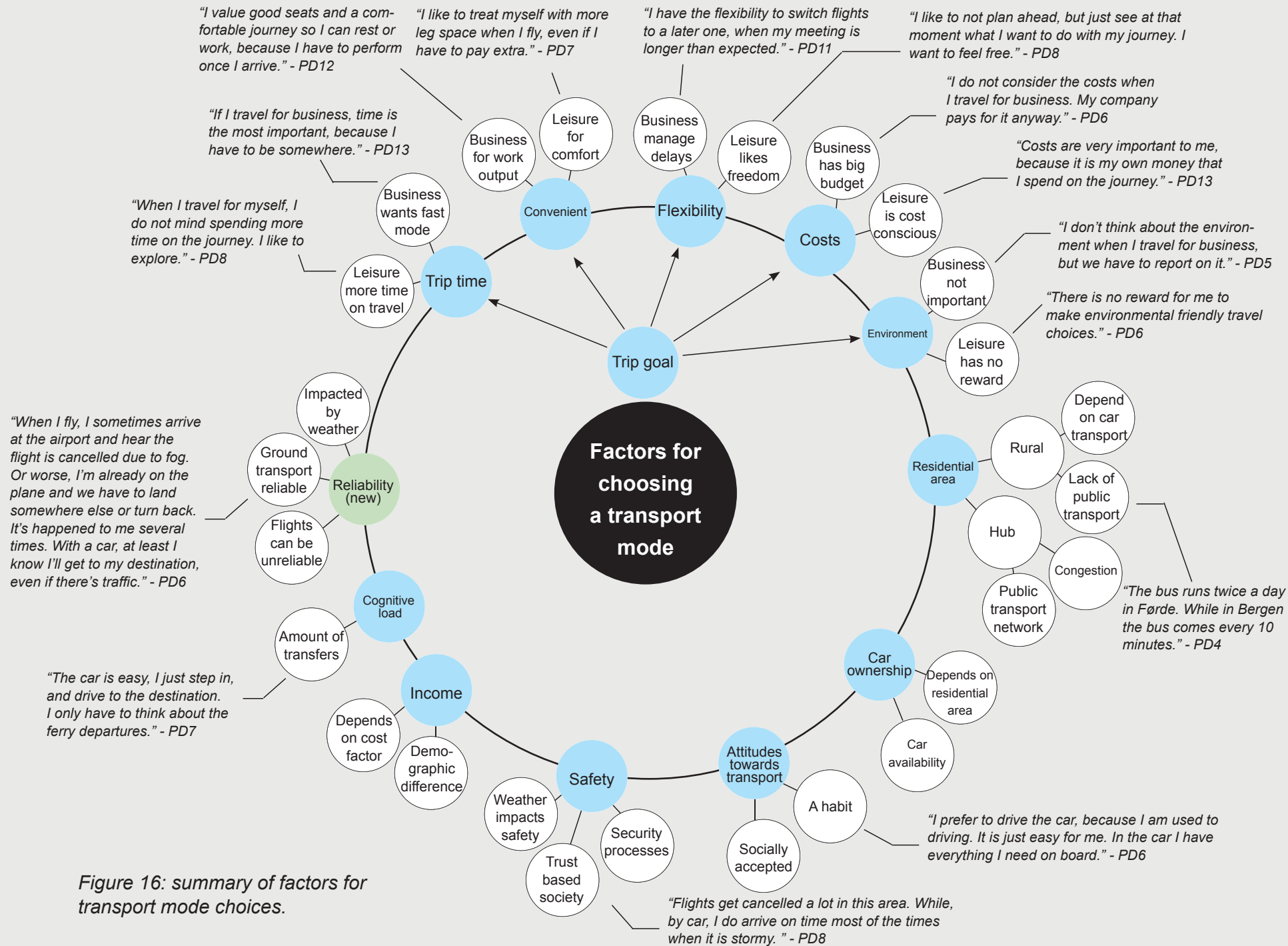


Figure 16: summary of factors for transport mode choices.

### **Concluding passenger needs**

Multiple passenger needs can be derived from this section. Based on the factors from Figure 16, in total 20 passenger needs for business and leisure purposes were derived and shown in Table 9 in “RQ1”. This was a labor intensive process, because it required a synthesis of all in-depth and on-street interviews (Figure 14 from Chapter 3). These passenger needs were still quite broad, since they marked the beginning of the interview set-up, where passengers were allowed to express themselves without guiding questions.

### **4.3 Passenger transport mode experiences**

This section compares the passenger experiences of different transport modes between Førde and Bergen: car & ferry, bus & ferry, passenger boat & car, and airport transport & domestic flight. The 13 mode choice factors outlined in Section 4.2 helped to categorize and compare the four different travel options. The findings are based on in-depth interviews, on-street interviews, and auto-ethnographic research. Each mode is discussed in relation to the 13 factors, supported by visual material in Figures 17, 18 and 19, except for the car, which was not part of the auto-ethnographic study. A comparative overview of all modes is presented at the end of this section in Table 8.

#### **Car & Ferry**

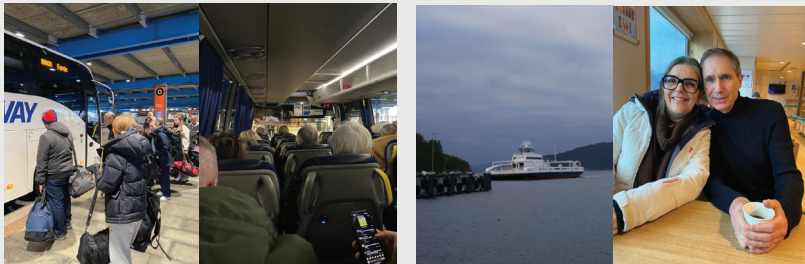
The car combined with ferry travel is perceived as the fastest and most flexible mode between Førde and Bergen. It is considered suitable for business and leisure. It is convenient and low in driving costs. Participants appreciated the flexibility of car departure times, though ferry schedules require planning. The car provides comfort and autonomy, described as a “bubble,” with the ferry serving as a break during travel.

Car ownership is high in Førde and linked to residential location and income. Bergen residents cited higher costs and urban congestion as barriers. Safety concerns were noted due to curvy roads and the physical demand of long drives. While the environmental impact was seen as lower for electric vehicles and ferries, weather conditions and ferry schedules impact the cognitive load in planning.

## Bus & Ferry

Bus and ferry travel (Figure 17) is used for leisure purposes, with fixed schedules limiting its suitability for business travel. It is the second fastest option between Førde and Bergen but involves multiple stops and advance ticket booking. While the bus offers comfort and the possibility to relax or work, its lack of flexibility was noted.

Participants without access to a car were more reliant on bus services. The option is seen as accessible for lower-income travelers and appreciated for its perceived safety and environmental friendliness, due to electric buses and ferries. However, the need to plan access to and from bus stations, combined with ticket availability and multi-modal transfers, increases the cognitive load of the journey.



1. Store luggage, scan ticket and sit. 2. Ferry, go to toilet and get a coffee.



3. Multiple stops during journey. 4. Arrive at Førde bus station.

Figure 17: The bus and ferry journey.

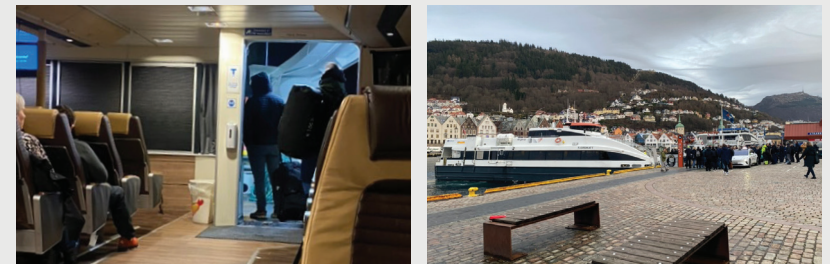
## Car & Passenger boat

The combination of car and passenger boat (Figure 18) is mostly used for leisure travel, with fixed boat schedules making it unsuitable for early morning business meetings. Travel times are relatively long due to multiple boat stops. Although the boat offers opportunities to relax or work, motion from waves can cause seasickness.

This mode is primarily used by residents living along the fjord islands. People can park their car at the pick up locations. The boat is considered affordable and accessible also for lower-income users. Environmental concerns were raised due to the boat's high fuel consumption dragging through the water. The boarding process is perceived as safe due to trust based ticketing (no ticket scan) or without security measures. During transport, weather conditions could impact safety and comfort. The need to plan boat schedules, and first/last-mile



1. Embark boat and find a seat. 2. Work or snack during transport.



3. Wait in line to disembark at stop. 4. Arrive at Bergen centre.

Figure 18: The passenger boat journey.



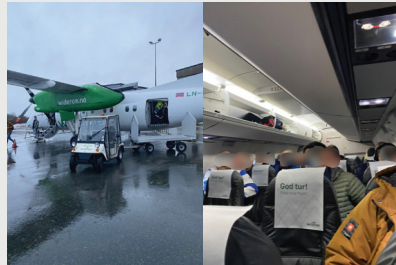
1. Førde bus to airport.



2. Arrive at Bringland airport.



3. Check-in and go through security.



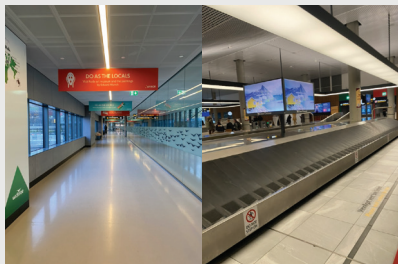
4. Board plane.



5. Fly to Oslo.



6. Transfer at Oslo & fly to Bergen.



7. Arrive at Bergen & pick up luggage.



8. Transfer to public transport.

Figure 19: Domestic flight journey Førde to Bergen.

## Airport Transports & Domestic Flights

Flying domestically (Figure 19) via Oslo is viewed as the least favorable among participants due to its high costs and long travel time. The flight from Førde to Oslo to transfer to a Bergen flight, is considered indirect and illogical for a short regional trip. The process includes multiple transfers, long airport security processes.

Access and security times vary by airport: Førde airport Bringeland offers a time efficient processing and short first/last-mile connections via airport bus. On the other hand, Bergen and Oslo airports involve longer security times and longer walking distances. The limited flexibility of fixed flight schedules and the need to transfer in Oslo was mentioned.

Weather-related disruptions in Western Norway present additional reliability concerns. Fog at Bringeland often results in diversions to alternative airports such as Florø, followed by ground transport to Førde. In some cases, the plane is completely returned to the origin airport without landing. These operational uncertainties affect reliability of the service. The cognitive load is high due to planning transport to or from airports, accounting for potential delays, and airport security processes.

## Comparing the transport modes

Table 8 compares the transport modes on the Førde–Bergen route based on the factors from Section 4.2 and the interview results. Green indicates positive experiences, orange reflects mixed experiences, and red indicates negative experiences.

The car is most preferred for door-to-door travel, compared to ‘bus & ferry’, ‘car & passenger boat’, and ‘airport transport & domestic flight’. This preference is explained by the car’s advantages: it is the fastest option, offers comfort, is cost-effective, especially with electric cars, has lower environmental impact, allows flexible departure times, aligns

with existing habits, and provides a direct connection to the final destination. Car travel was viewed as cognitively less demanding than multimodal options.

### Concluding passenger needs

From this section, 14 passenger overlapping needs were derived. The ‘Car & Ferry’ is the preferred mode for most passengers interviewed. The needs are presented in Table 9 in “RQ2” and were in line with the needs from “RQ1”.

Table 8: Comparing the transport modes .

Factors for choosing a transport mode	Car & Ferry	Bus & Ferry	Car & passenger boat	Airport transports & domestic flights
<b>1. Trip goal</b>	Car suited for business trips or with families.	Leisure, fixed schedule limits business meetings.	Leisure, fixed schedule limits business meetings.	Costly for leisure, and slow for business travel.
<b>2. Trip time</b>	Fastest mode of transport compared to other modes.	Second fastest mode of transport with many stops.	Third longest travel times, with many stops.	Most time intensive mode of transport.
<b>3. Convenience</b>	Being in own bubble and ferry as travel break.	Relax or work on board and ferry as travel break.	Relax or work, but waves cause seasickness.	Airport access and security differs per area
<b>4. Flexibility</b>	Flexible car departure times, but fixed ferry time.	Fixed schedule times and need to book in time.	Not flexible, limited departures with fixed times.	Having to transfer at Oslo limits flexibility.
<b>5. Costs</b>	(Electric) car is cheap, split costs & no ferry fees.	Booking in advance is cheaper than last minute.	Cheap ticket prices.	High ticket prices.
<b>6. Environment</b>	Electric cars and electric ferry with less noise.	Electric busses and electric ferry with less noise.	Polluting mode of transport due to drag.	Very polluting to fly two times.
<b>7. Residential area</b>	Førde reliant on cars, Bergen more congestions	Førde more car use, and Bergen more congestions.	Most suited for people living on the fjords.	Førde–Bergen via Oslo is indirect and illogical.
<b>8. Car ownership</b>	Førde has multiple cars, Bergen costly to own car	Not own a car makes people reliant on bus travel	Drive to harbour in Aksvoll or use the bus.	Drive to airport or use the bus.
<b>9. Attitudes toward transport</b>	Easy to use, flexible, comfortable and direct mode.	Comfortable, environment friendly, but unflexible.	Slow & seasickness, but facilities and city arrivals.	Time consuming, illogical and expensive.
<b>10. Safety</b>	Car is tiring due to curvy roads, making it less safe.	Trust in driver gives a safe feeling in fjord area.	Trust based boarding, but weather impacts comfort.	Weather causes turbulence or no landing in Førde.
<b>11. Income</b>	Higher income people own cars.	Also suited for lower incomes.	Also suited for lower incomes.	For very higher income, since high ticket prices.
<b>12. Reliability</b>	Congestions, but arrive directly at final destination.	Limited tickets, congestions, but ferry prioritizes.	No congestions, but weather cancellations.	Weather causes cancellations or rerouted landing.
<b>13. Cognitive load</b>	Low complexity, but ferry departure times and weather affect planning.	Multi-mode planning, including access to and from bus station.	Requires planning: passenger boat times, park car and last-mile travel.	Multiple modes, weather checks, airport processes cause high mental effort.

Positive experience

Neutral experience (positive and negative)

Negative experience

## 4.4 Motivations for 9-seater adoption

From the in-depth interviews (n = 13) and on-street interviews (n=9) insights into motivations for adopting the 9-seater services were concluded. Participants were presented with a future scenario of the 9-seater journey. This approach explored for what reasons participants would use the service.

Several motivations were identified that could encourage adoption, provided the 9-seater service meets the expectations raised during the interviews. These motivations include benefits the 9-seater should have. Participants highlighted time savings, suitability for business travel, improved work-life balance, and the appeal of a reliable, flexible, and productive journey. Door-to-door convenience, seamless transfers, and the potential for a more sustainable travel option, especially relevant for businesses.

Business travelers were seen as the most likely users. Higher ticket prices were considered acceptable if the service offers significant door-to-door time savings, making the 9-seater a competitive alternative on the Førde–Bergen route.

### Concluding passenger needs

From this section, 10 overlapping passenger needs were derived. These 10 needs were mostly in line with the business travel characteristics, since business travel was mentioned to be the first target group to adopt the 9-seater service. These needs are presented in Table 9 in “RQ3”.



#### Time efficiency compared to car journey

Participants emphasized that the 9-seater must provide significant door-to-door time savings compared to car travel. Time efficiency was linked to improved work-life balance, increased productivity, and reduced waiting times during transfers. The service should reduce the total travel time to encourage behavior change.



#### Reliable mode with minimal disruptions

For passengers it is important to arrive at the destination with minimal disruptions or cancellations.



#### Time efficient travel increases work-life balance

Losing less time with travel, allowing more quality time with family and friends, is a strong motivator to choose the 9-seater. This is most valued if the 9-seater enables a round trip on the same day.



#### Flexible mode in departure.

The flexibility of the 9-seater schedule and availability should compete with the flexibility of car transport.



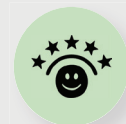
#### Productive mode in transit

The 9-seater should have work facilities during travel so passengers can spend their travel time on work related tasks.



#### Seamless transfers between transport modes

Informed transfers between modes where passengers know where to go and how to transfer in their door-to-door trip.



#### Convenience to perform at work

Short and comfortable 9-seater journeys give passengers to opportunity to recharge and perform at their best in work-related trips.



#### Sustainable mode

Sustainable transport like 9-seaters help businesses benefit to achieve their sustainability targets in the future.

## 4.5 Derived passenger needs

Sections 4.2, 4.3, and 4.4 addressed the three sub-research questions. Based on the insights from these sections, a set of overarching passenger needs was identified. These needs were derived by synthesising recurring themes within and across each sub-section. Table 9 shows which needs emerged from which section. Some needs were supported by all three sections, while others were identified in only one or two.

*Table 9: Ranked needs derived from the results sections.*

Passenger needs	RQ 1 from section 4.2	RQ 2 from section 4.3	RQ 3 from section 4.4
1. Time efficiency	X	X	X
2. Reliability	X	X	X
3. Flexibility	X	X	X
4. Have an overview	X	X	X
5. Productivity	X	X	X
6. Seamlessness	X	X	X
7. Convenience	X	X	X
8. Work life balance	X	X	X
9. Lower emissions	X	X	X
10. Financial freedom	X	X	X
11. Safety	X	X	-
12. Control	X	X	-
13. Support	X	X	-
14. Responsibility	X	X	-
15. Simplicity	X	-	-
16. Balance	X	-	-
17. Freedom	X	-	-
18. Enjoyment	X	-	-
19. Inclusiveness	X	-	-
20. Cost-conscious	X	-	-

A total of 20 passenger needs were derived from the data and are presented in Table 9. These needs are defined as essential elements that passengers require or expect throughout their travel journey. The table is ranked in order of relevance, from top to bottom, based on how frequently and strongly they were mentioned in the interview results. Needs ranked at the top were supported across all three sections, followed by needs supported in two sections, and those found in one section only.

The most prominent need is time efficiency, traveling from door-to-door in the shortest possible time. Other highly prioritised needs include reliability, flexibility, having an overview, productivity, seamlessness, convenience, work-life balance, lower emissions and financial freedom. Further identified needs include safety, sense of control, support, responsibility, simplicity, balance, freedom, enjoyment, inclusiveness, and cost-consciousness.

## 4.6 Conclusion

This chapter explored the passenger needs for 9-seater adoption through three sub-questions.

Findings show that different factors shape mode choice (4.2), and that the car is currently the most preferred option on the Forde-Bergen route (4.3). As such, the 9-seater must compete with the car in order to change behavior. The 9-seater was seen as most suitable for business travelers needs (4.4).

In total, 20 passenger needs were identified based on the interview findings from the three sub-research questions. These 20 needs form the foundation for the persona development in Chapter 5.



*Figure 20: own picture from auto-ethnographic research.*

# Persona development

# 05

This chapter discusses the results from Chapter 4. Section 5.1 introduces the chapter. Section 5.2 presents the passenger experience of the car journey on the Førde–Bergen route, because the 9-seater must compete with the car transport mode. Section 5.3 introduces the Time Savvy business persona, developed from the most important passenger needs identified in the results. Section 5.4 concludes the chapter.

## **5.1 Introduction**

## **5.2 9-seater competes with car journey**

## **5.3 The Time Savvy persona needs**

## **5.4 Conclusion**

## 5.1 Introduction

This chapter builds on the results from Chapter 4 to explore how the 9-seater service can meet passenger needs on the Førde–Bergen route. Since the car and ferry is currently the most preferred mode, the chapter begins by analyzing the car and ferry journey in detail. The passenger journey highlights its pain and gain moments in the passenger experience, which helps to understand how to design 9-seater journeys.

Next, the Time Savvy persona is introduced. This persona was developed from the ten most important business passenger needs, distilled from the full list of twenty needs identified in Chapter 4 (Table 9). This persona represents the business traveler needs who is most likely to adopt the 9-seater service. The ten key needs of the Time Savvy persona were clustered based on the literature study of Unger et al. (2016) on business travel experiences. These ten key needs form the foundation for the design criteria outlined in Chapter 6.

## 5.2 9-seater competes with car journey

The car with ferry is the most dominant travel mode on the Førde–Bergen route (Ydersbond, 2023). It offers the fastest door-to-door travel time (approx. 3 hours), with advantages of having flexibility, reliability, and full trip control by having an overview. The car journey consists of five stages: departure, driving, ferry crossing, driving, and arrival.

Figure 21 visualizes this journey by plotting the goals, needs, pains, gains, emotional curve, and quotes per stage, based on the passenger results from Chapter 4. The line represents the passenger experience at that time. Figure 21 shows where the car performs well and where issues like fatigue, planning stress, or ferry waiting times occur. Since the 9-seater must compete with car travel on the Førde–Bergen route, only this journey is highlighted here.

Passenger journeys for other transport modes (bus, boat, domestic flight) are included in Appendix F. Gains from other transport modes that are concluded here are that passengers can work during the trip (productivity) when traveling by bus or passenger boat. Another gain is the integrated shuttle bus service in Førde to reach Bringeland airport which arrives only 30 minutes before departure at the airport. The airport of Bringeland is already experienced as time efficient since passengers only need 15 minutes to go from check-in to board the plane. This small airport experience is an example for the 9-seater services.

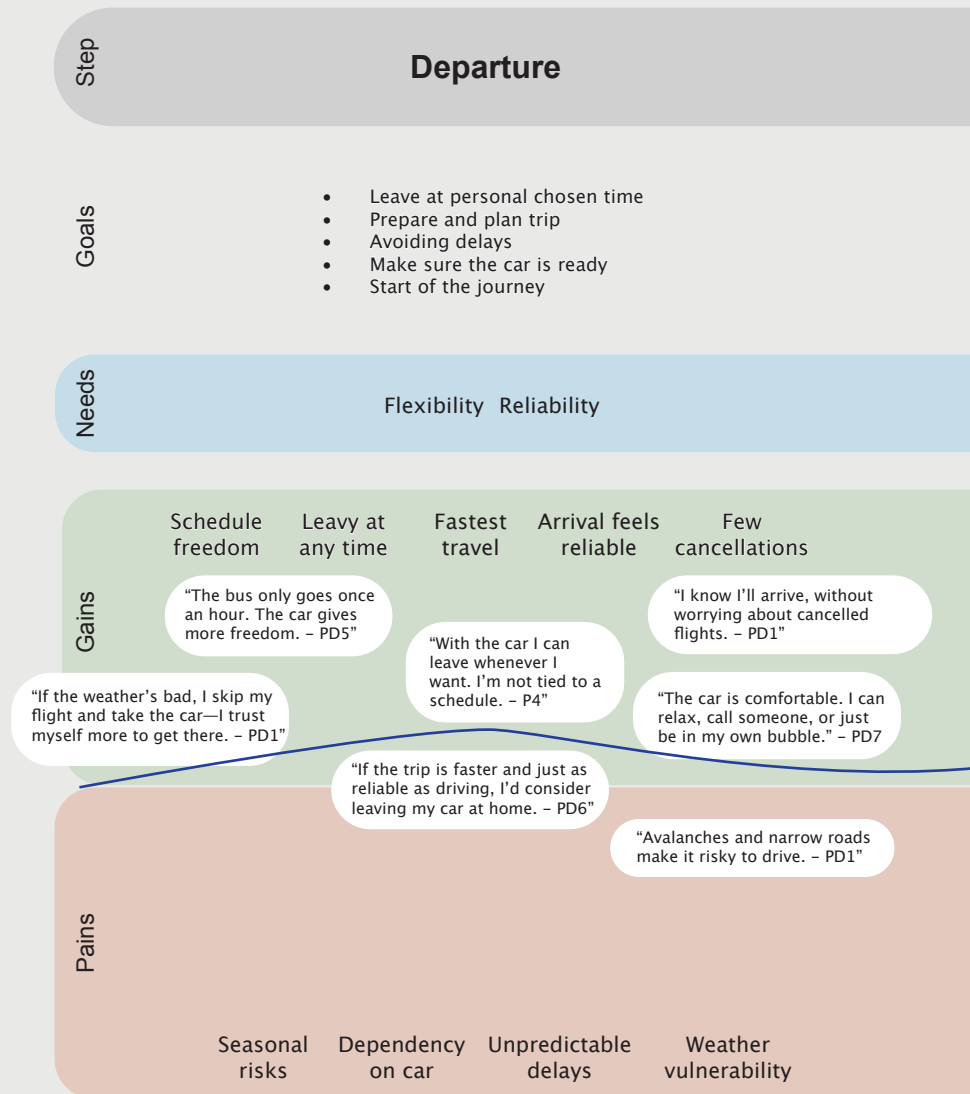


Figure 21: Car experience driving from Førde to Bergen.

## Driving the car

- Driving the car
- Most time efficient route
- Use time efficiency or enjoyable
- Manage ferry timing

## Ferry break

- Waiting for the ferry at ferry departure point
- Boarding the ferry
- Having a break on the ferry
- Debarking the ferry

## Driving the car

- Finish the trip efficiently
- Deal with possible traffic in Bergen
- Combine trip with 'to-dos'
- Maintain focus on arrival

## Arrive at destination

- Stopping at destination
- Parking the car

Convenience Overview Time efficiency

Seamlessness

Convenience Overview Time efficiency

Reliability

Flexible multitasking Route familiarity Comfortable bubble

Natural breaks Simple entry points Enjoy local travel

Flexible multitasking

Direct travel Reliable arrival

"There's boredom too—I can't really do much when I'm driving." – PD2

"A service that updates me if something changes would give me peace of mind." – PD10

"The ferry is a nice break, I don't need to stop elsewhere." – PD7

"I am used to the congestions around Bergen, but still it is the fastest mode for me." – PD4

"I wish I could just relax and work instead of focusing on driving." – PD1

"I like that there are no security checks, it is just very easy to enter the ferry." – PD4

"It's faster when everything goes well, but I need to plan for the ferry timing." – PD7

"If I drive, I can plan extra stops, like picking something up from IKEA." – PD5

"The ferry does not wait for me, so sometimes I feel rushed to make it on time." – PD6

"Knowing my whole trip is arranged would take away a lot of planning stress." – PD10

"Deboarding the ferry is stressful—everyone rushes off and the road narrows quickly." – PD1

"Parking is difficult where I live. Sometimes public transport is easier." – PS2

Mental load Driving fatigue Limited productivity Ferry stress

Boarding chaos No back-up options Planning complexity

Driving fatigue Congestions

Parking hassle

### 5.3 The Time Savvy persona needs

A selection of the passenger needs identified in Chapter 4 (Table 9) was used to develop a persona tailored to the 9-seater service. Both the literature discussed in Chapter 2 and the field research findings from Chapter 4 indicate that business travellers are the most likely early adopters of the 9-seater.

The identified needs were clustered in Appendix G, resulting in a needs-based business persona: the Time-Savvy persona, shown in Figure 22. This clustering was based on shared characteristics and behavioral drivers relevant to business travel.

The Time-Savvy persona includes ten needs, visualized in Figure 22. These needs form the foundation for the design brief in the following chapter. The needs-based traits of the Time Savvy persona align with the findings of Unger et al. (2016). This study explores business travel experiences through a qualitative study.



*"I take the most time-efficient journey to get from A to B."*



Time efficiency



Flexibility



Have an overview



Seamless transitions



Lowering emissions



Reliability



Productivity



Convenience



Financial freedom



Work-life balance

Time efficiency is identified as the most important need. The Time Savvy persona aims to minimize total travel time, including waiting and transfer durations. They are often willing to pay higher prices for direct routes. Time efficient travel reduces stress levels and enhances productivity, as time can be used effectively for work-related tasks.

Reliability is essential for trust and planning. Predictability in schedules helps travelers manage disruptions. Similarly, flexibility enables travelers to adjust bookings in response to unforeseen changes.

The need to have an overview reflects transparency and clarity in the travel steps. Transparency helps travelers to make informed decisions. Convenience is valued as it lowers travel-related stress and contributes to a more relaxed, comfortable experience. Comfort, in turn, supports productivity.

Seamless transitions between transport modes positively impacts the perceived quality of the trip. The desire for financial freedom is reflected in the fact that employers often cover the costs, value-for-money remains important.

Though lowering emissions was not a major theme, Unger et al. (2016) and the results note that sustainability is gaining importance, particularly when embedded in company policies. Lastly, work-life balance is indirectly supported by time efficiency. Time efficient travel enables more personal time at home and reduces fatigue. Time efficient travel is important for both professional and personal wellbeing.

Figure 22: The Time Savvy persona needs.

## 5.4 Conclusion

The car with ferry is the main competitor for the 9-seater service on the Førde–Bergen route. The car offers a time efficient, reliable, flexible and controllable journey. Based on the 20 identified passenger needs from Chapter 4, the business-focused persona was derived: the Time-Savvy persona.

The Time-Savvy persona consists of ten needs: time efficiency, reliability, flexibility, productivity, having an overview, convenience, seamless transitions, financial freedom, lowering emissions, and work-life balance.

In the next chapter (Chapter 6), these ten needs are translated into design criteria, which guide the next 'diamond' of the process: the Design phase.

# Design brief

# 06

This chapter concludes the research phase and presents the design brief that guides the next phase of the project. Section 6.1 defines the design problem, followed by section 6.2 which outlines the design vision and goal. Section 6.3 clarifies what is out of scope, and 6.4 lists the design criteria. The next chapter starts the design phase, exploring the ideation of the 9-seater services and the passenger concept selection.

**6.1 The design problem**

**6.2 The design goal**

**6.3 Out of scope**

**6.4 The design criteria**

## 6.1 The design problem

### The central research question

What are the 9-seater service passenger needs and what services should airlines offer to these passengers? This chapter focuses on translating passenger needs to design criteria for the 9-seater services (Figure 23).

### The initial design problem

The initial design problem explores how Embraer could show to airlines that there is a viable market to enter with a 9-seater aircraft. To do this, it's important to understand who the passengers are and what their needs are, and what kinds of services airlines should offer to meet those passenger needs.

### The reframed design problem

The initial design problem cannot be solved theoretically, therefore a use-case is chosen. Currently, there's no time-efficient way for Time-Savvy passengers to travel from Førde to Bergen in Norway. The 9-seater should compete with the door-to-door car journey, since currently it is the most time efficient way to travel. The target group that is most likely to first adopt the 9-seater services is the Time Savvy persona.

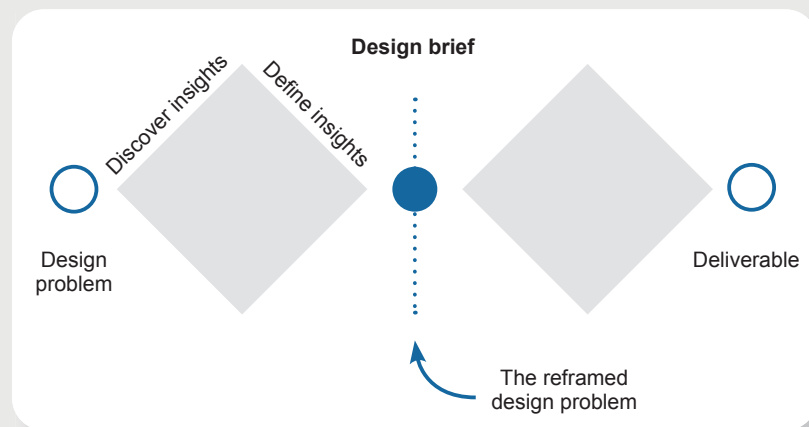


Figure 23: overview of reframing the design problem.

## 6.2 The design goal

The **first deliverable** is the **service journey of the 9-seater door-to-door experience** for the time-savvy persona. The 9-seater journey focusses on traveling from Førde to Bergen, including service touchpoints, divided into physical and digital services that focus on the time savvy persona needs.

The **second deliverable** is a **supporting roadmap towards 2040**, showing which services should be prioritized first and how services evolve over time for the time-savvy passenger. The roadmap also highlights which other needs-based personas to focus on in each time horizon, and what actions stakeholders should take to support the development of these 9-seater services.

### 6.3 Out of scope

This project does not focus on the sustainability impact of choosing a 9-seater, as Time-Savvy passengers do not base their travel choices on environmental factors. The project also leaves out the focus on the electric 9-seater aircraft, since the focus on the project is to look at the door-to-door services airlines should offer to passengers. In this project it is assumed the OEM has the technological capability to build the aircraft.

## 6.4 The design criteria

The design criteria for this thesis focus on the needs of the time savvy persona defined in chapter 5. The ten needs of the time savvy persona guide the design of the service touchpoints for the 9-seater journey. The criteria are explained down below.

### Time efficiency



The 9-seater services offers time efficient transport services as well as airport services.

### Reliability



The 9-seater service is reliable, where passengers arrive at their destination with minimal disruptions.

### Flexibility



The 9-seater service is flexible in how passengers book their door-to-door trip.

### Productivity



The 9-seater service offers productive facilities where passengers spend their time effectively on work.

### Have an overview



The 9-seater service offers passengers an overview of their journey by transparent communication of their trip to let them feel in control.

### Convenience



The 9-seater service lowers passenger stress by offering a hassle free experience that is comfortable.

### Seamless transitions



The 9-seater services integrates ground transport with the 9-seater flight to ensure seamless transitions between transport modes.

### Financial freedom



The 9-seater services is payed by companies who have a bigger budget to spend on time efficient travel.

### Lowering emissions



The 9-seater service focusses on lowering emission in the door-to-door trip.

### Work-life balance



The 9-seater service improves work life balance for business travelers.



Figure 24: own picture from auto-ethnographic research.

# Ideation & passenger concept selection

# 07

This chapter initiates the design phase by focusing on the desirability of the 9-seater service. Paragraph 7.1 introduces the design approach for the 9-seater ideation. Paragraph 7.2 presents the co-creation of the eShuttle journey and services, followed by 7.3 where passengers select the most relevant service touchpoints. Paragraph 7.4 shows the final selected passenger touchpoints. The next chapter dives into the iteration session of the service touchpoints with stakeholders to evaluate and co-create their viability.

- 7.1 Design approach for 9-seater ideation**
- 7.2 Co-creating the eShuttle services**
- 7.3 Participant selected service touchpoints**
- 7.4 The selected passenger touchpoints**
- 7.5 Conclusion**

## 7.1 Design approach for 9-seater ideation

This chapter includes the ideation phase and shows how the 9-seater services were developed into the 'eShuttle' concept. A co-creation session with TU Delft master students was used to design the door-to-door journey from Førde to Bergen and to ideate eShuttle service touchpoints. During this session, the 9-seater was developed into the 'eShuttle' concept, which shows the service touchpoints. The co-created journey includes 37 digital and physical ideas of the service touchpoints based on the design criteria from Chapter 6.

An online passenger concept selection was conducted with six travelers in Norway to select and reduce the 37 ideated service touchpoints. This session focused on gathering feedback about the service touchpoints, identify which touchpoints were seen as most valuable and what the most important design criteria were to design the services for.

A total of 21 service concepts were selected during the passenger concept selection session. An evaluation of the design criteria identified the five most important design criteria. The 21 selected eShuttle services reflect these five priorities and were mapped onto the door-to-door journey from Førde to Bergen to indicate when each service becomes relevant.

## 7.2 Co-creating the eShuttle services

This co-creation session focused on re-imagining the door-to-door journey between Førde and Bergen, with a focus on the needs of the time-savvy passenger. Together with three IDE master students, we explored what a seamless and efficient 9-seater door-to-door journey could look like. The goal was to come up with ideated service touchpoints along this journey.

The session started with a presentation to set the context, introducing the needs of the time-savvy passenger, and the real-life context of Førde and Bergen airports through visuals and a short case-study. After this, I ran a 'How Can You' ideation session to unlock creative ideas and explore the key needs of this traveler type. Based on these explorations, we designed the journey of a Time-Savvy traveler, 'Bjørn', and mapped out the services he would need along the way.

The main purpose of this session was to generate ideas for touchpoints along the Førde–Bergen route. This session led to the creation of the eShuttle service concept.

### Purpose of the session

To ideate both physical and digital service touchpoints for the time-savvy passenger on the Førde–Bergen route in 2040.

### Session set-up

1. Presentation to introduce the research background
2. 3 IDE master student participants (2 SPD & 1 IPD)
3. 2-hour session
4. Participants familiar with design thinking and methods like 'How Can You'

### Session flow

1. Introduction
2. Icebreaker exercise to get to know each other
3. Presentation of the personas and route context
4. 'How Can You' ideation session. The HCY's were:
  - 4.1. How can you be time efficient?
  - 4.2. How can you be reliable?
  - 4.3. How can you be flexible?
  - 4.4. How can you be productive?
  - 4.5. How can you have an overview?
6. Designing the passenger journey
7. Defining key service touchpoints
8. Group discussion on what to focus on for implementation

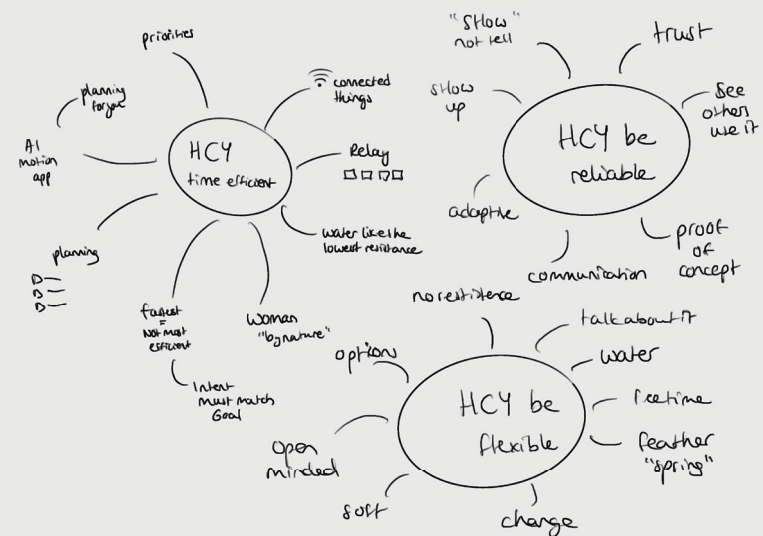


Figure 25: Example of the co-created the 'How Can You'.

## The designed passenger door-to-door journey

On this page, I present the co-created eShuttle door-to-door journey, focused on the route from Førde to Bergen. Bergen is the 'big city' for people living in Førde, where they regularly travel for meetings and business.

Figure 26 shows 12 scenes that illustrate the steps a Time-Savvy passenger goes through, combining both digital and physical touchpoints to enable a seamless and time-efficient journey. These steps form the basis for the service touchpoints that were ideated to support this future travel experience.

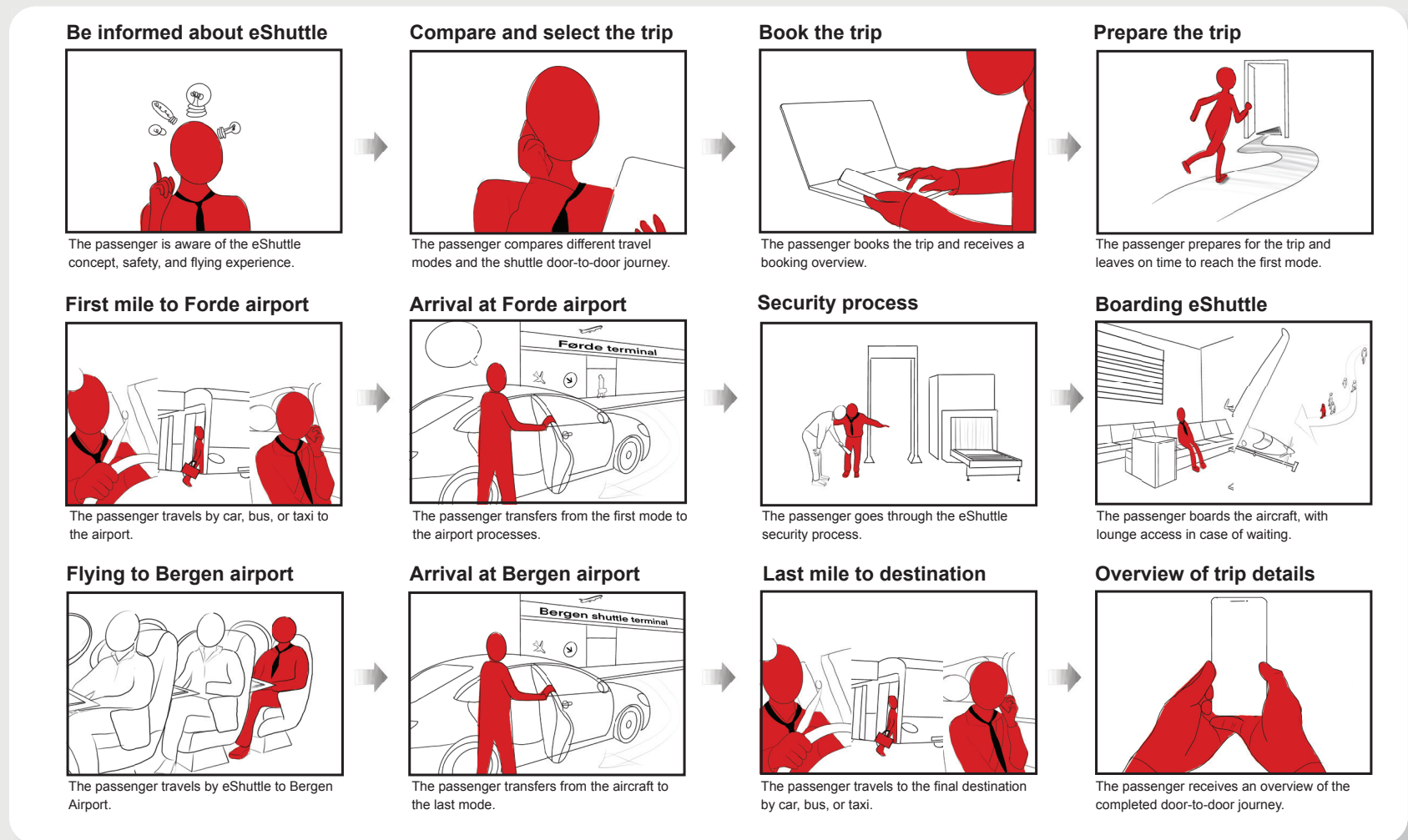


Figure 26: The co-created journey that reflects the 'standard' steps of a (multimodal) journey.

## The ideated service touchpoints on this journey

Out of the co-creation 37 service touchpoints were ideated. Figure 27 shows a visual overview of the first 6 touchpoints touchpoints. The total overview of the touchpoints can be found in Appendix G. Each touchpoint was designed with a visual presentation, a description of the service and what passenger need it fulfills.

### 7.3 Participant selected service touchpoints

Online sessions were conducted with six Norwegian participants who also participated in the previous in-depth interviews preseted in Chapter 3. The selection of the six participants matched with the Time Savvy persona needs. The online sessions helped to select the most promising service touchpoints and to identify the most important time savvy passenger needs. The participants were introduced to the

design criteria, the eShuttle journey, and the ideated service touchpoints. Through an open conversation, the session gathered their feedback on how the touchpoints aligned with their needs. The session included a ranking of the most important services and the evaluation of the Time Savvy needs. The complete session is presented in Appendix H.

### The purpose

To select the most promising service touchpoints and to identify the most important time savvy passenger needs.

### The set-up

- Conducted using online A3 PDFs in presentation mode
- Six Norwegian business travelers (two from Bergen, two from Førde and two from Oslo)
- 60 minutes per participant
- Participants were familiar with the research, because they participated in the in-depth interviews.

### Session flow

1. Introduction
2. Time Savvy persona needs
3. eShuttle journey
4. Ideated touchpoints
5. Participants ranked the most important services
6. Participants evaluated the design criteria

### Limitations

Learnings emerged from the participant sessions. Presenting 37 touchpoints in one round overwhelmed participants, leading to fatigue and reduced feedback quality, especially since the touchpoints were shown in the same order. Detailed visuals and descriptions sometimes caused confusion; simpler, more conceptual representations would have been clearer. In future sessions, pre-selecting fewer, more relevant touchpoints and simplifying the presentation would help participants focus and provide deeper, more meaningful feedback.

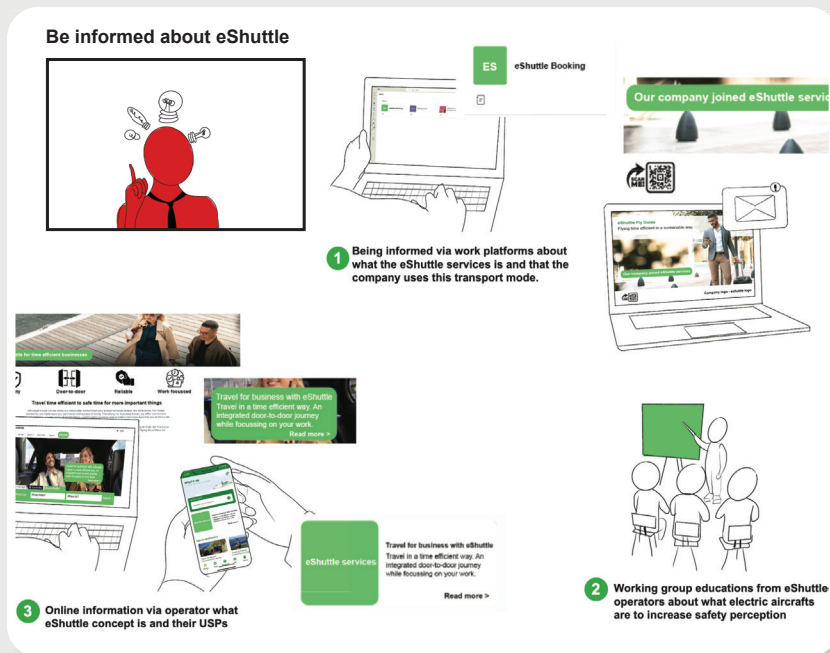


Figure 27: Example of eShuttle touchpoint evaluation format.

## The five most important criteria to focus on

Figure 28 shows the results of the design criteria evaluation with six participants. The five most important criteria were flexibility, time efficiency, reliability, having an overview, and productivity. Flexibility ranked highest, as the ability to adapt plans allows travelers to use time efficiently, even when changes occur. Time efficiency was still crucial, enabling more time for work and less for travel. Reliability was essential to ensure timely arrivals for business needs. Having an overview reduced uncertainty, while productivity enabled working during the journey. The criteria seamless transitions, work-life balance, convenience, financial freedom, and sustainability were not prioritized, because they were seen as outcomes of the top five or less relevant for business travelers.

The five criteria are described on the right on how passengers expect them to be reflected in the service touchpoints. Appendix I shows the detailed results overview of the participant selection sessions.

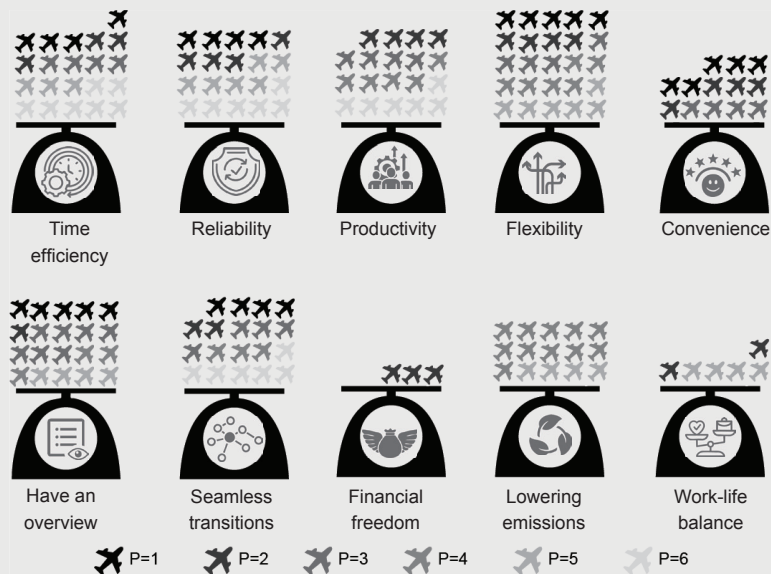


Figure 28: how participants evaluated the design criteria.



### TIME EFFICIENCY

(Going from A to B in the most time efficient way)  
 Description: passengers want to spend as little time on travel as possible.  
 Reflects in touchpoints: time efficient transport options, minimal security, pre-ordered services, and minimal external services.



### RELIABILITY

(Trust the systems performance)  
 Description: passengers want to arrive on time without disruptions or missing connections.  
 Reflects in touchpoints: real-time travel updates, and integrated connections to reduce uncertainty.



### FLEXIBILITY

(Being able to adapt travel plans when needed)  
 Description: passengers value freedom to adjust their schedule when they need to.  
 Reflects in touchpoints: any time rebooking options and rush hour departure times.



### HAVE AN OVERVIEW

(Knowing what to expect cross the door-to-door trip)  
 Description: passengers want an integrated overview that connects first & last mile, airport and flight.  
 Reflects in touchpoints: make informed travel decisions, compare trip characteristics and being able to control travel steps by yourself.



### PRODUCTIVITY

(Making efficient use of time while in transit)  
 Description: passengers want to work or rest based on their needs.  
 Reflects in touchpoints: comfortable work environments.

## 7.4 The selected passenger touchpoints

From the initial 37 touchpoints, the participant sessions selected 21 service touchpoints. The selection of the 21 touchpoints was based on the participant feedback and ranking of the most important services presented in Appendix I.

Figures 29 and 30 show the digital and physical touchpoints. The touchpoints are described visually, supported by text and a participant quote.



Figure 29: digital touchpoints.

## Digital touchpoints

The digital touchpoints that remained focus on the practical needs of the journey: booking the trip, getting continuous updates, offering real-time information and flexibility along the way. They also include pre-ordering services and give an overview of the journey details such as emissions, cost and travel time. In the design of the digital touchpoints, there is assumed that passengers have phones, laptops or other digital 'tools' to get in touch with the digital touchpoints.

## Physical touchpoints

The physical touchpoints mainly focus on fast processes in the first and last mile and at the airport. Here, having staff present where needed, pick-up points for pre-ordered services and spaces to either work or relax during the trip were considered most important. Flexibility was not addressed in physical touchpoints, as it is primarily enabled through digital services such as booking and rebooking options.

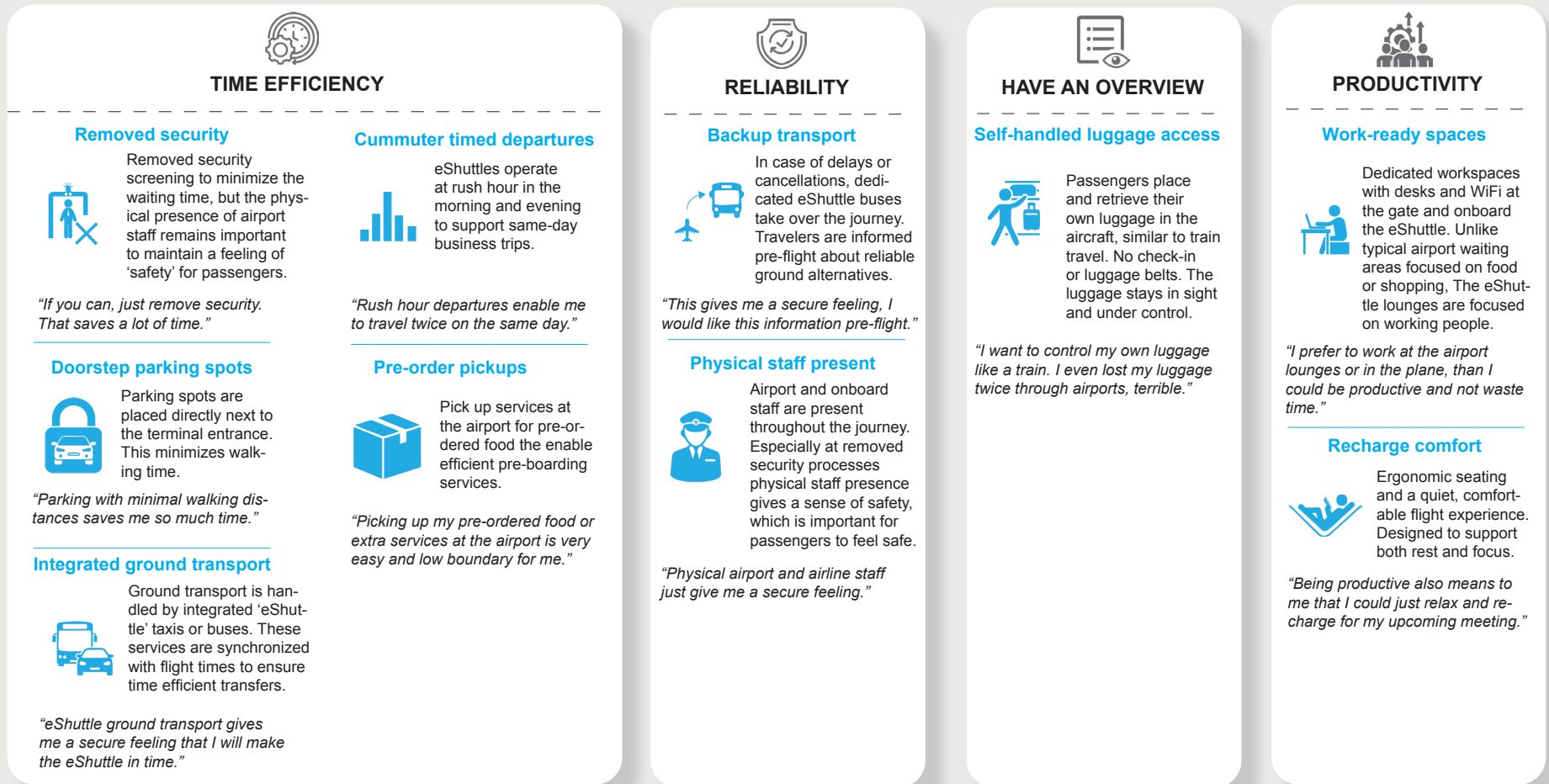


Figure 30: physical touchpoints.

## The passenger touchpoints plotted onto the journey

The selected passenger touchpoints are plotted on the door-to-door journey. The Figure 40 shows the distinction between digital and physical touchpoints, with a short description of

the goal of each touchpoint at that step in the scenario. The digital pre-order services are connected by a dotted line to the physical touchpoints. This line visualizes when the digital service becomes 'reality' in the scenario.


























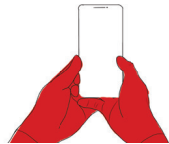














		Before the trip			During trip		
		Being informed	Compare and select	Booking the trip	Prepare for trip	First mile	Arrive at airport
Scene		The passenger is introduced to the eShuttle concept.	The passenger is benchmarking the door-to-door options.	The passenger booked the door-to-door trip in one ticket.	The passenger is prepared for the trip and departs.	The passenger is using the first mode to Forde airport.	Passenger arrives at Forde airport.
							
Digital touchpoint		  <p>Direct booking via airline for eShuttle door-to-door trip</p> <p>Information about what the eShuttle service is.</p>	  <p>One platform to compare all transport modes for door-to-door trip.</p> <p>Comparing time, costs and emissions to make a trip decision.</p>	   <p>Pre-order services at booking</p> <p>Receive one integrated ticket for all modes.</p>	  <p>Receive information about eShuttle safety procedures before boarding.</p> <p>Update about travel documents and timings next mode via eShuttle app.</p>	 <p>Tracking of current mode and estimated time of arrival.</p>	 <p>Update airport processes and departure time eShuttle.</p>
	Physical touchpoint			 <p>Rush hour frequency to match back and forth commute.</p>		 <p>Transport services such as taxi and bus for first mile to reach the airport.</p>	 <p>Integrated parking of own car services to minimize time spend at airport.</p>

Figure 40: digital and physical touchpoints with what characteristics after passenger evaluation.

	Security process	Boarding eShuttle	Flying to Bergen	Arrive at airport	Last mile	Overview of trip
Scene	<p>The passenger goes through security.</p> 	<p>The passenger uses lounge services and boards eShuttle.</p> 	<p>The passenger is being flown to Bergen airport.</p> 	<p>The passenger transfers from plane to last mode.</p> 	<p>The passenger uses the last mode to their destination.</p> 	<p>The passenger receives travel overview of details.</p> 
Digital touchpoint		  <p>Being able to switch flights at the airport.</p> <p>Overview of seat and luggage availability</p>	 <p>Tracking of eShuttle flight time, estimated time of arrival and next mode.</p>	 <p>Transfer time update from eShuttle to last mode.</p>	 <p>Update of arrival time to destination.</p>	 <p>Receive travel overview of costs, emissions and travel time for company reporting.</p>
Physical touchpoint	  <p>Removed security screening to reduce time spend in airport.</p> <p>Physical staff for help and safety perception for the removed security.</p>	 <p>Pick up point for pre-order services.</p> <p>Work places at airport.</p>  <p>Alternative transport for disruptions.</p>	  <p>Storing own luggage.</p> <p>Work places on board.</p>  <p>Comfortable seats to relax.</p>	 <p>Transport services for last mile to reach the airport.</p>		

### **The new touchpoints in relation to the 9-seater context**

These 21 touchpoints address the entire door-to-door journey. They introduce integrated first- and last-mile transport, or offer connected parking services for travelers who drive themselves. Passengers can compare full door-to-door travel options based on emissions, time, and cost instead of only comparing flights.

By booking a complete door-to-door trip, passengers receive real-time updates for each part of their journey, including any taxi, bus, or shuttle services they've booked as part of their eShuttle connection. This creates a transparent travel experience (unless they opt to drive themselves). The system allows for last-minute flight switching to adapt to changing schedules, and eShuttle frequencies are aligned with early business meeting to enable return commutes on the same day.

Time-consuming elements like security screening processes and airport luggage handling are removed to streamline the journey. Instead, passengers carry their own luggage on-board, similar to train travel, allowing for faster boarding and arrival processes. At the same time, the presence of airport staff is retained to maintain a sense of safety for the security part. If passengers drive themselves, integrated parking services directly in front of the terminal reduce walking time. In case of disruptions, reliable alternative ground transport is offered and communicated upfront, so travelers can complete their journey without uncertainty.

Finally, the touchpoints include spaces to work or relax, at the gate or on board. At the end of the trip, passengers receive a summary of total travel time, emissions, and cost, helping businesses report on sustainable travel, which is an increasingly important requirement driven by governmental climate policies.

### **7.5 Conclusion**

The passenger concept selection resulted in a focused set of 21 eShuttle service touchpoints. The 21 service touchpoints, both digital and physical, address the five most important design criteria of the Time-Savvy persona: time efficiency, reliability, flexibility, overview, and productivity.

The next step is to assess the 21 touchpoints from a stakeholder perspective to understand how implementable the services are from a business perspective.



*Figure 41: own picture from auto-ethnographic research.*

# Stakeholder iteration of eShuttle concept

# 08

This chapter continues the design phase by focusing on the viability of the 9-seater service touchpoints. Section 8.1 explains the design approach for the stakeholder iteration. Section 8.2 presents the iteration session outcomes with stakeholders, followed by section 8.3, which shows how the eShuttle service touchpoints were refined.

- 8.1 Design approach for stakeholder iteration**
- 8.2 Touchpoint iteration with stakeholders**
- 8.3 The iterated eShuttle service touchpoints**
- 8.4 Conclusion**

## 8.1 Design approach for stakeholder iteration

This chapter presents how the stakeholder iteration was conducted to evaluate and co-create the 21 service touchpoints.

In the evaluation session, stakeholders assessed the 21 touchpoints and the five most important criteria: time efficiency, reliability, flexibility, have an overview and productivity. The goal from the service evaluation was to identify how realistic it was from a business perspective to implement these services and who is responsible for the services. The co-creation part explored new design ideas for the services touchpoints or what touchpoints were overlapping and could be combined into one.

The five most important design criteria were evaluated based on what is most viable to address first. As a result from this stakeholder iteration phase, the iterated eShuttle concept services touchpoints were explained, combining both passenger desirability and stakeholder viability.

## 8.2 Touchpoint iteration with stakeholders

The touchpoint concepts from chapter 7 were iterated with stakeholders. The iteration sessions consisted out of evaluations and co-creations to create viable touchpoints. The sessions were held with stakeholders from the aviation industry. Some sessions were held online with Norwegian stakeholders. Other sessions were held in person with Dutch stakeholders. The iteration sessions revealed design ideas and barriers to further improve the touchpoints. The barriers of the touchpoints are elaborated further in the recommendations in Chapter 11.

The sessions were set up as presentations where the passenger insights from the participant sessions were explained, followed by the selected passenger touchpoints. These touchpoints were discussed in an open conversation with the stakeholders to gather feedback for further iterations and barriers of the services. The session showed the participant selection results (Appendix I) to evaluate these results from a business perspective.

### The purpose

To evaluate the digital and physical touchpoints based on viability from a stakeholder perspective, discuss responsibilities per touchpoint, identify final iterations, and explore possible barriers for the services.

### The set-up

- Conducted using A3 PDFs in presentation mode
- Six stakeholders from the electric aviation market in Norway and the Netherlands
- 60 minutes per participant
- Participants were not yet familiar with the research

### Session flow

1. Introduction
2. Presentation of the Time Savvy persona
3. Presentation of the passenger evaluation session results
4. Presentation of the future scenario
5. Iterated touchpoints
6. Open discussion on design ideas, barriers and responsibilities for the services

### Reflection

In the stakeholder session helped to reduce the 21 touchpoints to 15 final touchpoints. The evaluation of 21 touchpoints is still quite a lot. Designing many touchpoints led to a broad set of solutions, but it is hard to dive deep into each touchpoint due to time constraints. Also, the discussion about the passenger results and the stakeholder responsibilities was planned at the end of the session, when participants were already getting tired. This likely affected the depth and quality of their input. Since the order of topics stayed the same, this fatigue probably played a role in how the later topics were discussed. If the session were done again, it would help to limit the total number of touchpoints even more and place the more important discussions (such as evaluating the touchpoints) earlier in the session.

Label name	Stakeholder	Theme raised
S1	Airline (NL)	Barriers and design ideas for airline
S2	Airline (NOR)	Barriers and design ideas for airline
S3	Airport (NL)	Passenger experience, ownership airport and airline.
S4	Airport (NOR)	Passenger experience, ownership and co-operation.
S5	Government (NOR)	Supporting role government
S6	Consultant (NL)	Passenger experience

## Identified design ideas and barriers for the touchpoints

In this section, the eShuttle journey is shown in Figure 42 with the selected passenger touchpoints from Chapter 7. Each touchpoint was discussed with stakeholders to identify design ideas and possible barriers. The design ideas helped to

iterate the touchpoints. The barriers mentioned by stakeholders are used as input for the recommendations in Chapter 11. The key takeaways from the stakeholder evaluation are listed in the next paragraph.


















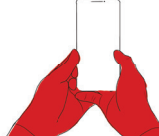






		Before the trip			During trip		
		Being informed	Compare and select	Booking the trip	Prepare for trip	First mile	Arrive at airport
Stakeholder feedback	Scene	<p>The passenger is introduced to the eShuttle concept.</p> 	<p>The passenger is benchmarking the door-to-door options.</p> 	<p>The passenger booked the door-to-door trip in one ticket.</p> 	<p>The passenger is prepared for the trip and departs.</p> 	<p>The passenger is using the first mode to Forde airport.</p> 	<p>Passenger arrives at Forde airport.</p> 
	Touchpoints						
Stakeholder feedback	design ideas	<p>S6: Combine information new travel experience and safety.</p> <p>S1: Unnessecary airline as travel agency.</p>	<p>S3: One touchpoint that shows all booking information, seat availability, and trip details.</p>	<p>S6: Offer flexibility only if passengers pay for this. Otherwise not viable.</p>	<p>S6: Combine information new travel experience and safety.</p>	<p>S4: Cars with a pick-up-route for multiple passengers to increase flexibility.</p>	
	barriers		<p>S2: Airlines do not like to share their data to other modes of transport for one platform building.</p>	<p>S4: Many departures is not viable due to high costs to book slots at the airport.</p>		<p>S4: Airport locations differ in rural areas how close they are located to city centre. This affects the first or last mile.</p>	











Figure 42: touchpoints with stakeholder design ideas and barriers.

Scene	Security process	Boarding eShuttle	Flying to Bergen	Arrive at airport	Last mile	Overview of trip	
<p>The passenger goes through security.</p> 	<p>The passenger uses lounge services and boards eShuttle.</p> 	<p>The passenger is being flown to Bergen airport.</p> 	<p>The passenger transfers from plane to last mode.</p> 	<p>The passenger uses the last mode to their destination.</p> 	<p>The passenger receives travel overview of details.</p> 		
Touchpoints							
Stakeholder feedback	design ideas	<p>S6: Eliminate security for aircrafts under 19 passengers.</p> <p>S6: Create 'feeling of security' with physical security staff doing random checks.</p>	<p>S6: Offering flexibility if paid extra for.</p> <p>S3: Catering self services and pick up points at lounges.</p>	<p>S3: Baggage delivery services.</p>	<p>S4: eShuttle flight as first of last leg of international flight.</p> <p>S5: Bergen airport functions as international hub.</p>	<p>S3: Cars with a pick-up-route for multiple passengers to increase flexibility.</p>	<p>S2: Possibility to unlock new routes through passenger data.</p>
barriers	<p>S5: Create new passenger stream at airports affect how airports are designed.</p>	<p>S4: Need to learn new way of working with eShuttle rush hour</p> <p>S2: Switching flights impacts business model.</p>	<p>S4: On-board consumption affects turn around time.</p> <p>S4: eShuttle aircraft design should distribute weight.</p>				

## Stakeholder touchpoint iterations

This section highlights the main takeaways from the stakeholder feedback: touchpoints that were iterated and new ones that had not been identified before. Four existing touchpoints were refined to increase viability of the concepts, and two new touchpoints were added to enhance the passenger experience. The iterated digital services are shown in dark orange and the iterated or new added physical touchpoints are shown in dark blue.

Figure 43 shows an overview of how the stakeholder feedback for each touchpoint shaped the final 15 touchpoints. The process of how the 21 touchpoints were iterated into 15 final touchpoints is based on, combining, iterating, removing or adding touchpoints.

Before stakeholder feedback	Stakeholder feedback point	After stakeholder feedback	How the feedback impacts the final touchpoints
	<i>"Flexibility in switching eShuttle flights is not viable for the business model with 2 pilots and only 9 passengers, unless passengers are willing to pay extra for this flexibility." - S6</i>		Flexibility to switch flights was only kept as an option if passengers pay extra. The eShuttle service has a fixed schedule due to operational and cost constraints (small aircraft capacity, pilot crew, and slot fees).
	<i>"Removing security could give an unsafe feeling. This could be overcome by implementing random security checks done by airport staff to reassure passengers and save time." - S6</i>		Physical airport staff were added to perform random safety checks. This ensures passengers feel safe, while the main security process remains fast and efficient.
	<i>"Passengers should also be able to use self-service machines for food and products without staff." - S3</i>		Lounge touchpoints were adapted to include vending machines for food and product purchases. This allows passengers to buy something without pre-ordering, reducing the need for additional staff and lowering operational costs.
	<i>"Car services could pick up passengers with the same eShuttle departure or arrival, giving them a reliable first or last mile to the airport." - S4</i>		A car sharing service for first and last mile gives passenger a reassured feeling they will make the eShuttle flight in time. The car transport offers passengers a flexible way of transport to their final destination.
This touchpoint is new	<i>"Baggage delivery would make the trip easier without carrying heavy bags in case you need those for meetings." - S3</i>		The touchpoints now include an optional door-to-door luggage delivery service. This reduces the amount of luggage on board and helps balance aircraft weight, while still allowing passengers to bring personal luggage if needed.
This touchpoint is new	<i>"The eShuttle opens new routes to improve connectivity between rural areas and hubs. This could even lead to position Bergen Airport a hub, where eShuttles are the first or last leg of international flights" - S2</i>		A ground transport services at Bergen Airport to support transfers between the eShuttle and international flights. Also, route development is addressed aimed to unlock connections between rural and hubs based on demand.



### **8.3 The iterated eShuttle service touchpoints**

After the participant and stakeholder session, the fifteen iterated digital and physical eShuttle service touchpoints have been designed. First, the digital touchpoints are presented in orange, followed by the physical touchpoints in blue.

The touchpoints primarily focus on addressing the five key Time Savvy needs: time efficiency, reliability, having an overview, productivity, and flexibility.

These touchpoints are presented in a visual format on the following pages, where each touchpoint includes a concept icon, a title, the specific Time Savvy need it addresses, a description of the service, and a supporting quote from either a participant (P) or stakeholder (S).

### 1. Benchmark trip



Driven by reliability need

This digital touchpoint enables passengers to compare their full door-to-door journey on the airline platform. It presents eShuttle, car, passenger boat, and regular flights side by side, showing travel time, costs, and emissions. Also, showing how many seats and luggage spaces are available on the eShuttle. This touchpoint also includes the pre-order service of catering, which is connect to the physical touchpoint 10.

*“I want to see all options side by side so I can compare the eShuttle with other modes, so I can choose the most suitable trip.” - P2*

### 2. Real time updates



Driven by ‘have an overview’ need

Passengers receive continuous updates on their transport mode, arrival times, and next steps. Clear info on transfers and security processes reassures passengers and keeps them in control of their journey.

*“Getting updates about the trip makes me feel in control of my schedule.” - P4*

### 3. Trip overview



Driven by ‘have an overview’ need

After the trip, passengers get a full trip summary, showing emissions, costs, and time savings compared to other modes. This supports business sustainability reporting and encourages future bookings. An incentive program highlights personal benefits beyond business interests.

*“I’d like a summary so I can show how sustainable and time-efficient my trip was. Now I have to calculate the emissions, time, and costs of every mode myself and report that to the company. This would save a lot of time.” - P3*

### 4. Information electric aviation



Driven by reliability need

This touchpoint familiarizes passengers with electric flying. Before booking or boarding, they receive clear information on how electric aviation works, its safety procedures, and what to expect in emergencies. This builds confidence and awareness of this new way of flying.

*“I need to know electric flights are safe so I feel comfortable before booking and boarding an eShuttle.” - P4*

### 5. Flexible eShuttle changes



Driven by flexibility need

This touchpoint offers passengers the option to switch flights for an additional fee. Flexibility is possible but comes at a cost, as the small-scale service with two pilots and nine passengers must stay financially viable.

*“Flexibility is offered if passengers pay extra for this service, otherwise it is hard to build a viable business case around 2 pilots and a 9-passenger aircraft.” - S6*

## 6. Baggage delivery



Driven by time efficiency need

Passengers can digitally book a luggage delivery service for bulky or work-related items, reducing to carry baggage onboard. Physically, the service includes a scheduled pick-up from home or office, ensuring bags arrive at the destination. This enhances comfort and supports aircraft weight efficiency.

*“If I need to bring large items for a meeting, like presentation materials, I’d prefer a baggage delivery service so I don’t have to carry everything myself.” - S3*

## 7. Rush hour departures



Driven by time efficiency need

This touchpoint reflects passengers’ need for flight schedules aligned with the workday, offering early morning and evening departures that enable same-day round trips. Between Bergen and Førde, flights can be scheduled every hour during peak morning and evening times, with one midday flight.

*“Morning and evening flights let me do a full workday trip on the same day, so I could have dinner at home with my kids.” - P5*

## 8. Integrated ground transport



Driven by time efficiency need

Integrated first and last mile services for the eShuttle door-to-door journey. Shuttle buses, car or taxi services are coordinated, or passengers can choose to use their own mode of transport. Passengers on the same flight and located near each other are grouped, reducing costs and ensuring they reach the airport on time. Having pick-up services gives passengers a reliable feeling. Once they are on this mode of transport, they feel assured they will make their flight on time.

*“Once I’m in the eShuttle ground transport, I know I’ll catch my flight on time, since I would feel like I already made my trip in time.” - P5*

## 9. Seperate security stream



Driven by time efficiency need

This touchpoint minimizes the security process by providing a dedicated security lane for eShuttle passengers, separate from regular airport security. Time efficiency is prioritized, while the presence of physical airport staff performing random checks reassures passengers about safety without adding unnecessary steps.

*“Removing security could give an unsafe feeling. This could be overcome by implementing random security checks done by airport staff to reassure passengers and save time.” - S6*

## 10. Pre-order & self catering



Driven by time efficiency need

This touchpoint reflects that passengers prefer catering options only if they save time. Passengers can pre-order meals for pickup at the airport or use vending machines in the lounge waiting areas before boarding the eShuttle. These options reduce the need for airport staff and let passengers quickly grab a meal without delaying their journey.

*“I would skip meals at home if I can grab pre-ordered food at the airport or on the eShuttle. That saves me time.” - P2*

### 11. Workspaces



This touchpoint ensures passengers can work productively during downtime, with desks, comfortable seating, and WiFi in lounges and on board the eShuttle. This helps them make better use of their travel time.

*“I need WiFi and a comfortable space so I can use my travel time productively. I like to prepare for meetings at those moments” - P1*

Driven by productivity need

---

### 12. International transfers



This touchpoint enables passengers to use the eShuttle as the first or last leg of international trips from Bergen. Airport transport can transfer passengers directly from the eShuttle to the international gate, ensuring a fast and seamless connection to other flights.

*“The eShuttle opens new routes to improve connectivity between rural areas and hubs. This could even lead to position Bergen Airport a hub, where eShuttles are the first or last leg of international flights” - S2*

Driven by time efficiency need

---

### 13. Luggage self-handling



This touchpoint gives passengers control over their luggage. Like on a train, they place their bags in the aircraft themselves and collect them directly after landing, removing the wait at the baggage belt and saving time. Unlike the home-to-destination delivery service, this is for passengers who prefer to keep their bags with them throughout the journey.

*“I’d rather handle my own bag so I know it’s with me the whole time. I prefer the luggage system works the same as trains, where I can place and control my own luggage.” - P1*

Driven by time efficiency need

---

### 14. Back-up transport



This touchpoint prepares passengers for disruptions or delays by offering reliable alternative ground transport, like buses. Passengers are informed before they leave home, helping them make an informed travel decision if delays occur.

*“If there’s a delay, I want to know if there is an alternative before I leave home. I want to have reliable transport that takes me to my destination, rather than taking the risk of taking a flight and landing at a different airport instead. This happens too many times to me.” - P4*

Driven by reliability need

---

### 15. Reserved parking spaces



This touchpoint minimizes walking distances from car to terminal. Assigned parking spots, booked with the eShuttle ticket, save time otherwise spent finding and paying for parking.

*“Having a prepaid spot near the entrance saves travel time. Every airport does it differently now, and it’s so inconvenient.” - P3*

Driven by time efficiency need

## 8.4 Conclusion

The stakeholder iteration session helped refine the 21 passenger-selected touchpoints (Chapter 7) into 15 viable service touchpoints for the eShuttle concept that reflect the five most important design criteria of the Time Savvy persona needs.

As a result, the ranking of design criteria was adjusted to: time efficiency, reliability, having an overview, productivity, and flexibility. An important insight was that flexibility is difficult to guarantee while maintaining a viable business model and was therefore ranked at last. The next chapter presents the eShuttle concept.

# eShuttle concept design

# 09

This chapter presents the eShuttle concept design based on the outcomes from the desirability and viability phases. Section 9.1 explains the concept design approach. Section 9.2 introduces the eShuttle vision and concept. Section 9.3 outlines the benefits for airlines and OEMs. Section 9.4 plots the eShuttle services onto the journey with involved stakeholders. The chapter ends with a short conclusion in section 9.5.

## **9.1 Introduction**

## **9.2 The eShuttle concept**

## **9.3 eShuttle benefits for airlines and OEMs**

## **9.4 eShuttle services along the journey**

## **9.5 Conclusion**

## 9.1 Introduction

In this chapter, the eShuttle concept is explained. First, the eShuttle vision is presented, followed by a comparison of the eShuttle with car travel on the Førde - Bergen route. This comparison shows how the eShuttle scores compared to the car, based on the five most important design criteria: time efficiency, reliability, overview, productivity, and flexibility.

The benefits of the eShuttle concept for airlines and OEMs are described. At last the 15 selected service touchpoints are plotted on the door-to-door journey.

## 9.2 The eShuttle concept

In 2040, the eShuttle service offers a new travel way for regional door-to-door journeys. It is a time-efficient journey that feels reliable, gives passengers overview and control throughout their trip, allows them to be productive during travel, and offers flexibility when plans change (see Figures 45 and 46).

The eShuttle service introduces several new elements compared to car travel. In terms of time efficiency, it combines first and last mile transport with simplified ground processes and a short 9-seater flight, offering an alternative to the 3-hour car journey. Regarding reliability, the eShuttle provides pre-arranged alternative transport in case of delays and is in-flight less sensitive to disruptions. In contrast, car travel consists of a single mode and is impacted by congestion or travel fatigue.






eShuttle	VS	Car & ferry
Integrated first/last mile, fast ground processes and 30 minute eShuttle flight (Ydersbond, 2023)	 Time efficiency	3h drive (Ydersbond, 2023).
Alternative transport and constant updates to reduce uncertainty.	 Reliability	In control over journey to reach final destination (Brink et al., 2023).
One integrated platform with transparent information.	 Have an overview	One mode reduces the need to plan, only for congestions (Brink et al., 2023).
Facilities to work at airport lounges or in eShuttle.	 Productivity	Minimal productivity with calls during driving (chapter 5).
Flexibility if paid for due to limitations business model.	 Flexibility	Flexible to leave at any time (Brink et al., 2023).

Figure 45: the eShuttle compared to the car.

In terms of overview, the integrated door-to-door trip allows passengers to compare travel time, emissions, and costs in advance, while also receiving continuous updates throughout the journey. Concerning productivity, the eShuttle offers spaces to work or rest during waiting times and onboard, whereas productivity during car travel is typically limited to phone calls. With regard to flexibility, car travel allows passengers to depart at any preferred time. The eShuttle operates on scheduled departures, which limits the ability to switch flights freely, due to constraints related to maintaining a viable service model.

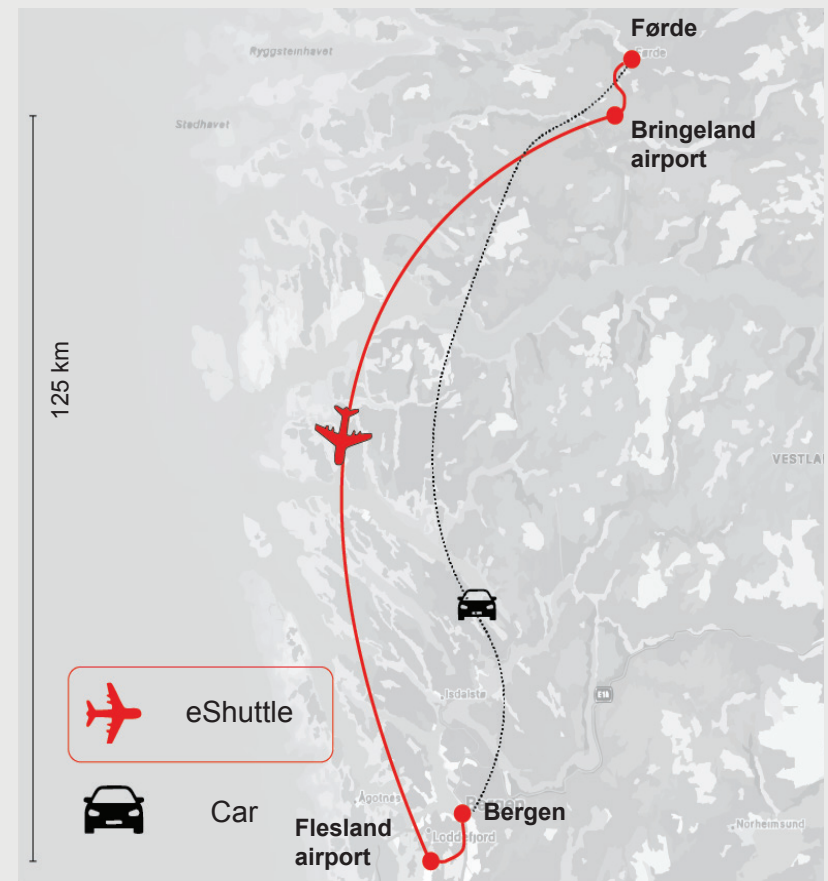


Figure 46: eShuttle and car on the Forde-Bergen route.

### 9.3 eShuttle benefits for airlines and OEMs

The eShuttle service creates benefits for both airlines and OEMs as shown in Figure 47.



#### Airline

##### Increased regional passenger demand

The eShuttle unlocks new rural–hub connections, expanding the airline’s regional network and increasing passenger volumes on short-haul routes.



##### Boost in international connectivity

By offering the eShuttle as a first or last leg of an international flight, airlines increase passenger demand connected to rural areas.



##### Access to premium business passengers

Time-savvy travelers are willing to pay more for time efficient services. This creates a passenger base who are willing to pay more for premium services.



##### Data-driven network development

The integration of the full door-to-door eShuttle journey enables airlines to collect passenger data to identify underserved routes, optimization of flight schedules, and the strategic development of new 9-seater connections.



#### OEM

##### Development of business case on small scale

The 9-seater segment allows the OEM to gain operational experience in electric aviation. The learnings from the 9-seater market lay the groundwork for scaling up to larger aircraft types in the future.



##### Play a role in the total door-to-door journey

While the OEM typically focuses on aircraft manufacturing, engaging in the 9-seater market allows them to potentially play a role in ground transport. The OEM could help with the development of how the aircraft integrates and works together with other modes in the door-to-door services.

Figure 47: the benefits for airlines and OEMs.

## 9.4 eShuttle services along the journey

The digital and physical eShuttle touchpoints from chapter 8 are placed along the door-to-door journey in Figure 48. Touchpoints are shown in order of when they happen during the trip.










		Before the trip			During trip		
		Being informed	Compare and select	Booking the trip	Prepare for trip	First mile	Arrive at airport
Scene		The passenger is introduced to the eShuttle concept.	The passenger is benchmarking the door-to-door options.	The passenger booked the door-to-door trip in one ticket.	The passenger is prepared for the trip and departs.	The passenger is using the first mode to Forde airport.	Passenger arrives at Forde airport.
Digital touchpoint		 <p>Information electric aviation</p>	 <p>Benchmark options</p>	 <p>Benchmark options</p>	 <p>Baggage delivery</p>	 <p>Real time updates</p>	 <p>Real time updates</p>
Physical touchpoint						 <p>Integrated ground transport</p>	 <p>Reserved park spaces</p>  <p>Back-up transport options</p>

Figure 48: the eShuttle touchpoints plotted in the journey steps with stakeholder reference per step.

Scene	Security process	Boarding eShuttle	Flying to Bergen	Arrive at airport	Last mile	Arrival destination
The passenger goes through security.	The passenger uses lounge services and boards eShuttle.	The passenger is being flown to Bergen airport.	The passenger transfers from plane to last mode.	The passenger uses the last mode to their destination.	The passenger receives travel overview of details.	
Digital touchpoint	 Real time updates	 Real time updates  Flexible eShuttle changes	 Real time updates	 Real time updates	 Real time updates	 Trip overview & incentives  Baggage delivery
Physical touchpoint	 Seperate security stream	 Pre-order & self service catering  Rush hour departures  Workspaces	 Luggage self handling  Workspaces	 International transfers	 Integrated ground transport	

## 9.5 Conclusion

This chapter introduced the eShuttle concept, which included the vision and how the eShuttle scores compared to car travel based on the most important needs. From this ranking it can be concluded that the eShuttle competes with the car on time efficiency, reliability, having an overview and productivity. While for flexibility the car scores remains the most flexible, due to the limited flexibility the eShuttle could offer in departure times and options.

The eShuttle presents benefits for airlines, to increase regional passenger demand where eShuttle flights serve as first or last leg of international flights, attract premium business travelers, collect passenger data, and improve the passenger experience. For OEMs, it supports small-scale business development, offers pilot routes for market expansion and opens new opportunities across the door-to-door chain.

Finally, the 15 service touchpoints are plotted on the Førde to Bergen passenger journey. The passenger journey included stakeholders who were involved for those service touchpoints in each step. Chapter 10 builds further on what the stakeholder roles are per service touchpoints. This stakeholder responsibility is reflected in how to implement the services to 2040 through a strategic roadmap.



Figure 49: own picture from auto-ethnographic research.

# Roadmap for implementation

# 10

This chapter presents the roadmap for implementing the eShuttle services. Section 10.1 explains the approach taken. Section 10.2 introduces the Wheel of Responsibility, which outlines who is responsible for each touchpoint. Section 10.3 describes the door-to-door journey. Section 10.4 presents the implementation roadmap across four horizons. The chapter ends with a short conclusion in section 10.5.

- 10.1 Approach for eShuttle implementation**
- 10.2 Wheel of responsibility for stakeholders**
- 10.3 The eShuttle door-to-door journey**
- 10.4 The roadmap**
- 10.5 Conclusion**

## 10.1 Approach for the eShuttle implementation

This chapter presents the strategic roadmap for implementing the eShuttle concept. The four stakeholders described in Chapter 2 are used: the airline, the airport, the government and the OEM. At first, the different layers of responsibilities for each touchpoint are described and explained through the 'Wheel of Responsibility'. The 'Wheel of Responsibility' shows who is leading in ownership, who support the services, and who enables the services.

The 'Wheel of responsibility' is used to plot the 15 eShuttle services over time on the strategic roadmap. Also, the chapter describes how the eShuttle door-to-door journey works in a four step approach. The strategic roadmap reflects the 15 services, the stakeholders and the main goals per horizon. Overall, four horizons are used in the roadmap to divide the eShuttle implementation over time to 2040.

## 10.2 Wheel of responsibility for stakeholders

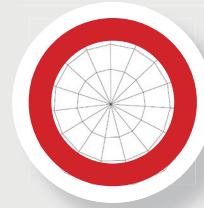
To realize the door-to-door eShuttle experience, the fifteen passenger touchpoints are divided among the four stakeholders described from chapter 2: airlines, airports, governments and OEMs. Each plays a different role in making the service possible, from owning key passenger-facing services to enabling them in the background. The wheel of responsibility (Figure 50) visualizes the degree of involvement each stakeholder has per touchpoint and helps to make this division transparent.

The wheel is structured around three layers of responsibility: leading responsibility, collaborative supporters and service enablers. This structure helps clarify how responsibilities are shared and where collaboration between stakeholders is needed.



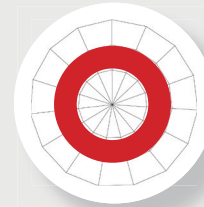
Figure 50: the wheel of responsibility.

### Leads responsibility



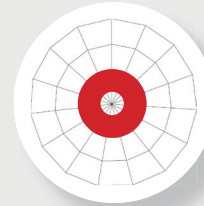
Represents stakeholders that are directly responsible for delivering and maintaining the passenger-facing service.

### Collaborative supporters



Includes stakeholders who support the service through partnerships and are linked to passenger interactions, but less intensive than the 'Responsible Stakeholders'.

### Service enablers



Stakeholders who do not interact directly with passengers but are essential in enabling that services exist. These stakeholders support through regulation, funding or infrastructure.

## The airline

Figure 51 shows the airline who carries the main responsibility for owning the eShuttle door-to-door journey. The plotted points are determined through the stakeholder feedback presented in Chapter 7. Airlines collaborate with airports, governments and OEMs, the airline is in the lead. Their role includes offering benchmark options, continuous updates across all transport modes, ensuring time-efficient and flexible services, pre-order caterings or baggage delivery options, and seamless connections between ground transport, eShuttle flights and international flights.

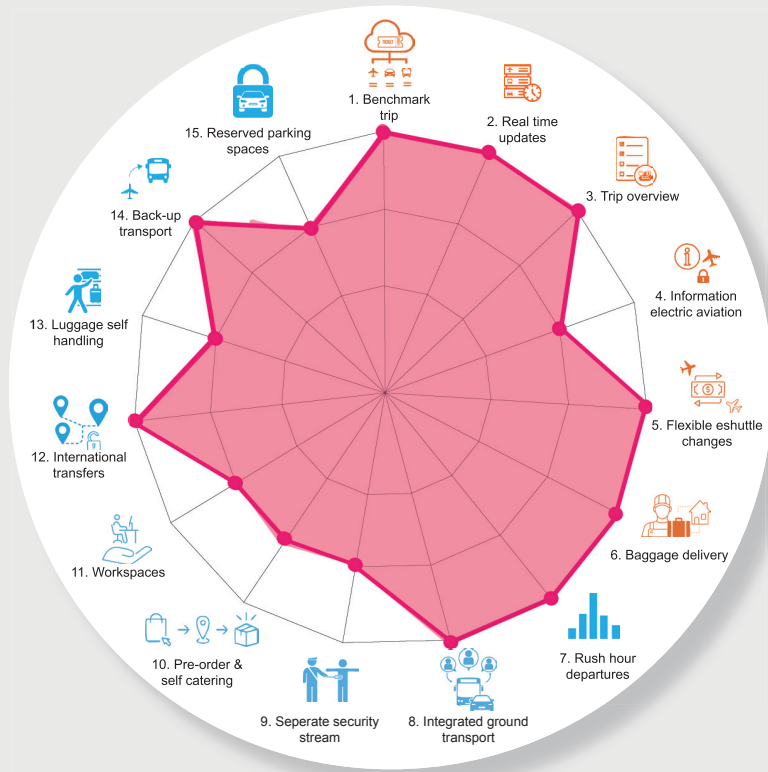


Figure 51: the wheel of the airline responsibility.

## The airport

The airport's responsibility (Figure 52) lies in enabling the services at the terminals. Working closely with airlines, their focus is on time-efficient passenger flows, such as integrated parking spaces, dedicated eShuttle security streams, work lounge facilities, pickup points for self-service or pre-ordered items, and assuring a seamless transfer between the eShuttle and ground transport. The airport must also support flexibility in eShuttle departures and arrivals, which requires airports to rethink their current way of working.

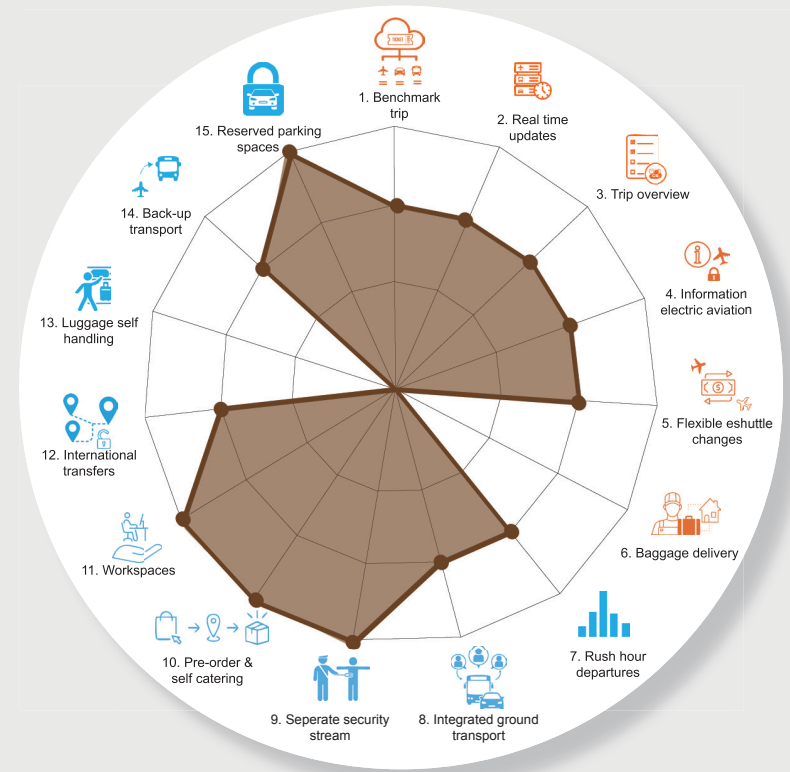


Figure 52: the wheel of the airport responsibility.

## The government

For the government (Figure 53), the focus lies on realizing the touchpoints by making new security regulations, ticket fundings, promoting electric aviation among passengers, and enabling data sharing between different transport operators in the door-to-door journey for real time updates. Governments must also invest in electric aviation infrastructure and require companies to increase reporting on sustainable travel. The government leads a national electric aviation promotion plan to promote the shift towards electric aviation in Norway.

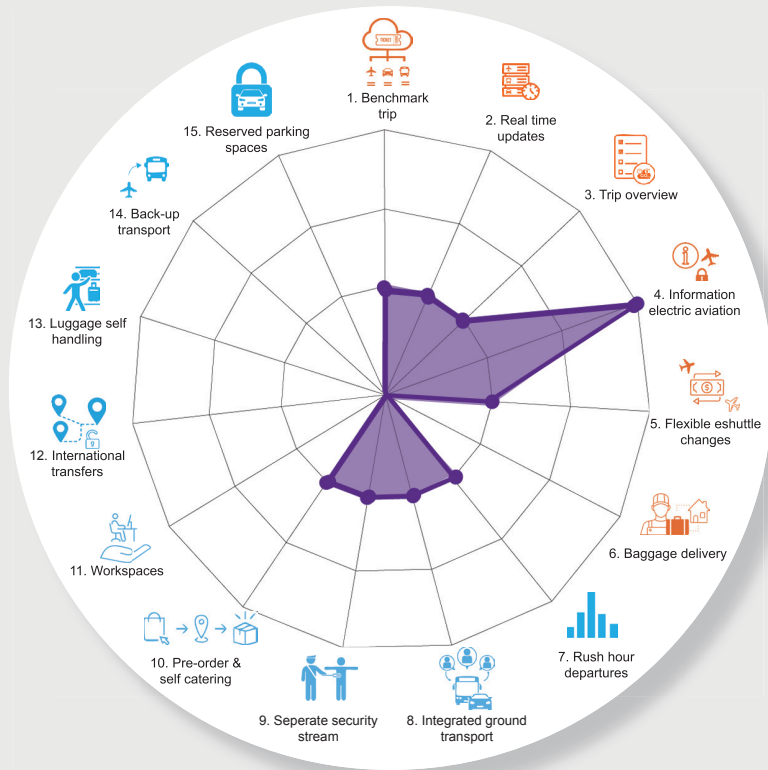


Figure 53: the wheel of the government responsibility.

## The OEM

OEMs like Embraer take a more passive role (Figure 54). They act on a demand-supply basis once the airline sees a viable market. They must ensure the aircraft design supports time-efficient travel, with luggage storage space and work-friendly interiors. In addition, OEMs can support airlines in expanding the total journey by integrating ground transport services. They also play a role in explaining what the next flying experience is when promoting the eShuttle concept. Also, OEMs should offer services that make the tracking of eShuttle trips possible (e.g. travel time) to support the passenger with a trip details overview.

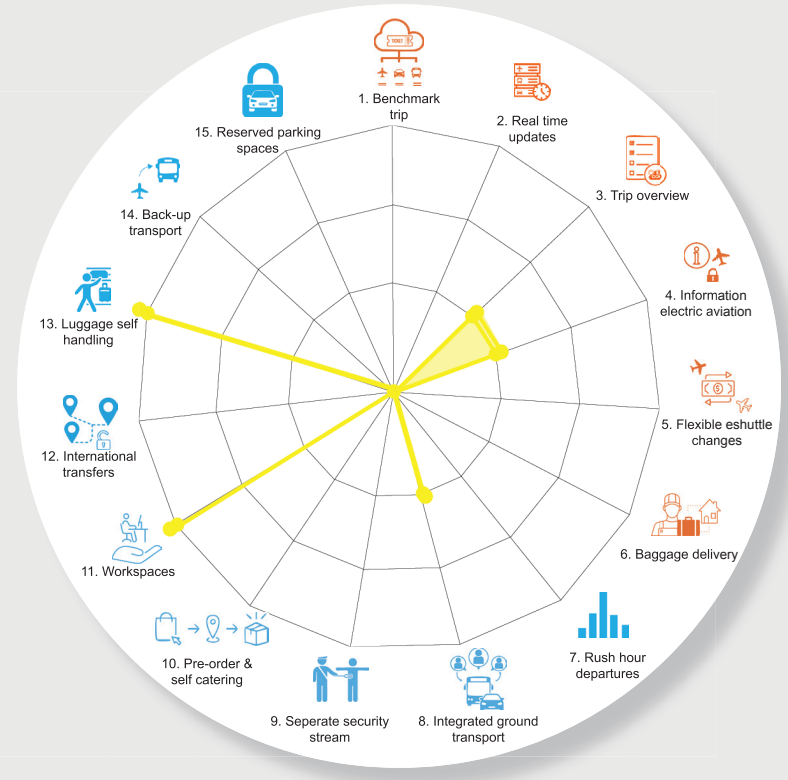


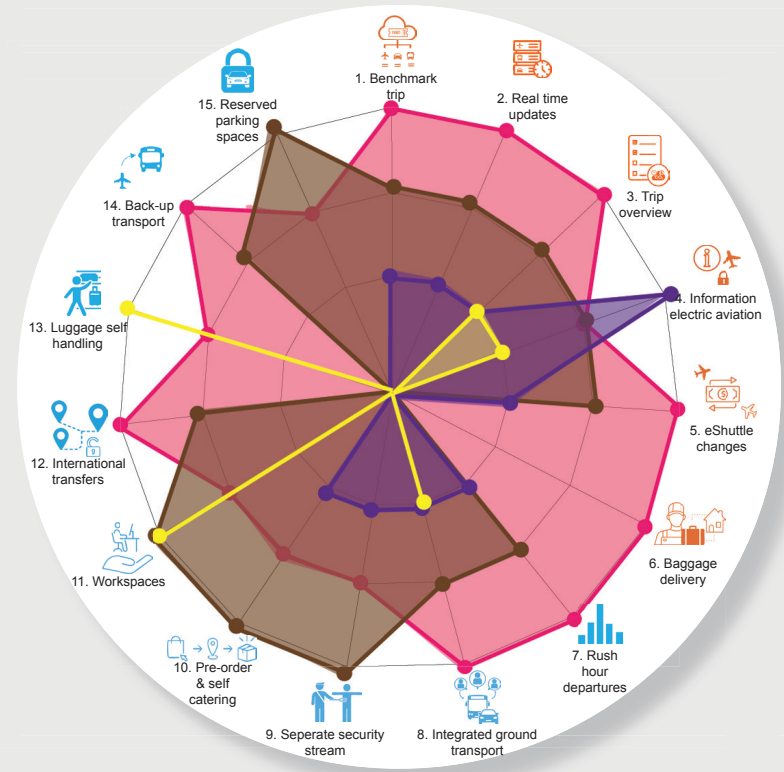
Figure 54: the wheel of the OEM responsibility.

## Wheel of shared responsibility

The implementation of the 15 eShuttle touchpoints requires shared collaboration across stakeholders. In Figure 55, the overlapping responsibilities are visually mapped. While each touchpoint has one primary stakeholder responsible, most involve supportive roles from others to ensure seamless execution. The only touchpoint with two end-responsible stakeholders is Workspaces, where both the OEM and the airport must independently facilitate spaces, onboard and at terminals, for productive passenger use.

The airline is the main responsible stakeholder across most touchpoints, especially those that involve digital integration, passenger communication, and multimodal coordination. The airport is primarily responsible for airport-side processes but frequently plays a supporting role to enable airline services, such as offering space or infrastructure. The OEM is responsible where the aircraft itself shapes the passenger experience, such as luggage handling, workspaces, and information on electric aviation. The OEM acts mainly as a service enabler by designing aircraft that support these experiences. The government plays a key enabling role across horizons by setting up regulations, designing PSO contract requirements, subsidizing ticket prices, and launching national promotion plans to position electric aviation in the market.

How the touchpoints are linked to the stakeholder responsibilities is presented in the next pages where the roadmap for implementation is explained. The timeline is spread out over 15 years of development. The horizons are aligned with the long development times of the aircraft sector.



### Legenda

- Airline
- Airport
- Government
- OEM

Figure 55: the wheel of shared stakeholder responsibility.

### 10.3 The eShuttle door-to-door journey

The door-to-door journey of the eShuttle service connects the 9-seater aircraft with first and last mile ground transport, offering multiple ways for passengers to complete their trip.

The build up of the eShuttle door-to-door journeys are explained in Figure 56. A four step approach is presented, which is also included in the horizons in next section 10.4 The Roadmap

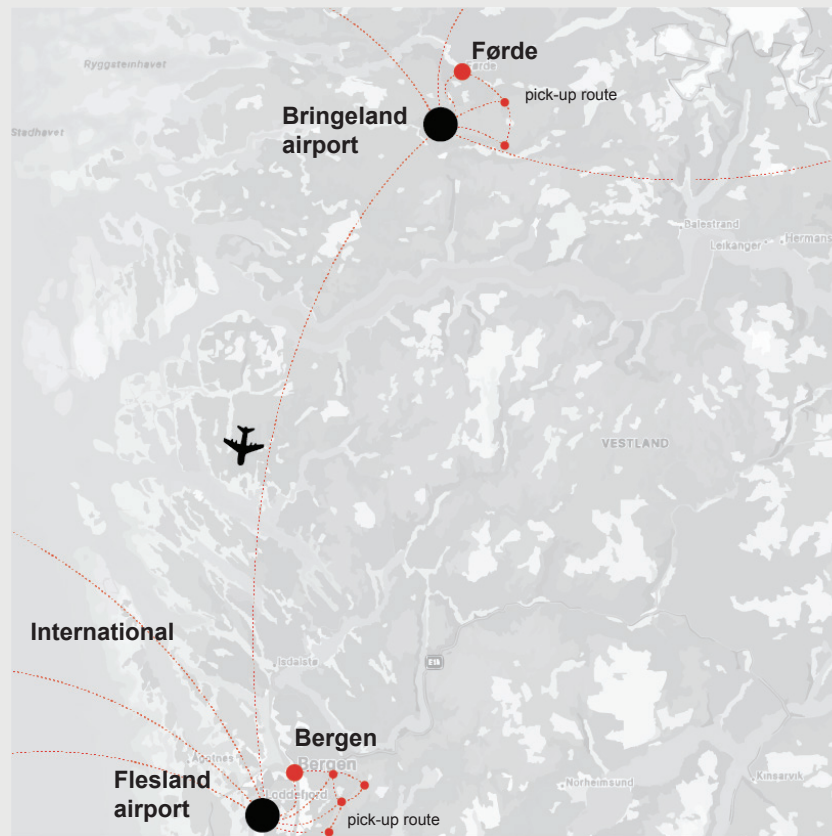
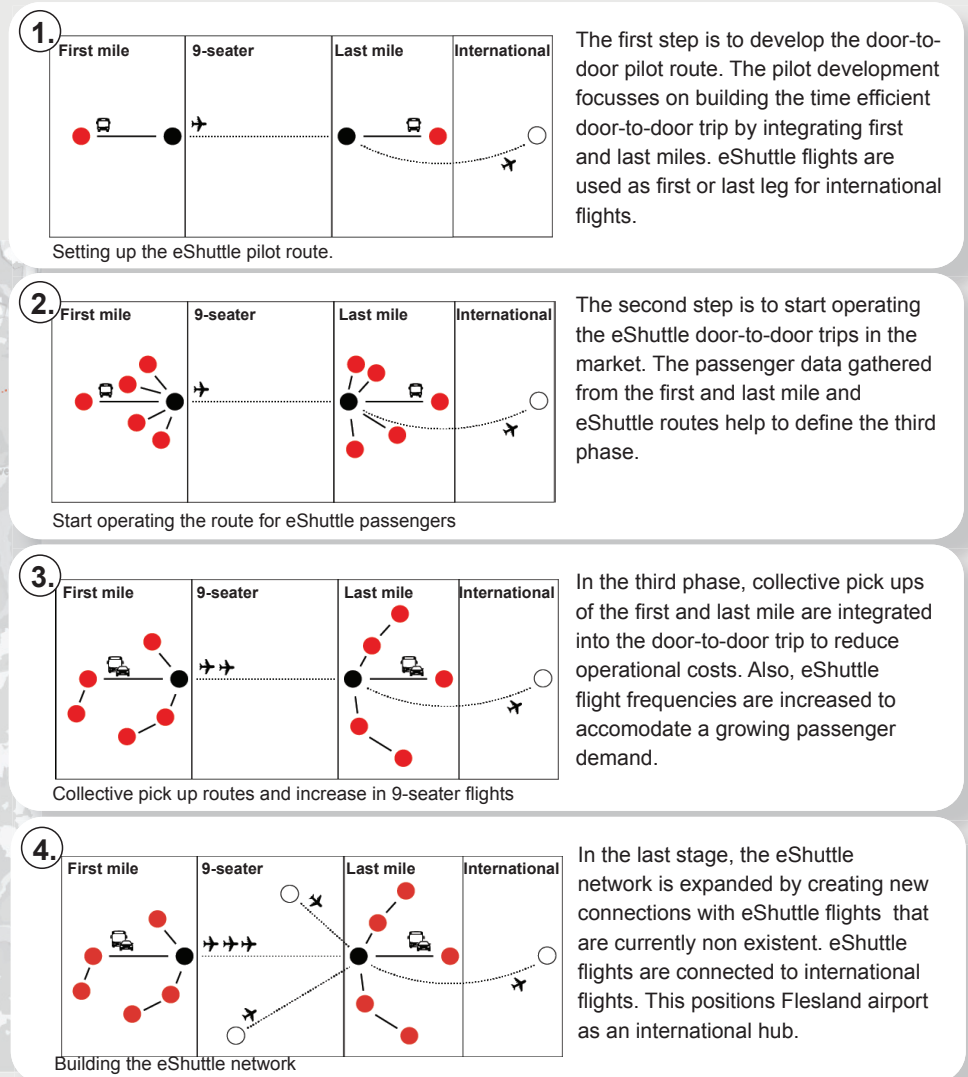


Figure 56: door-to-door eShuttle services.

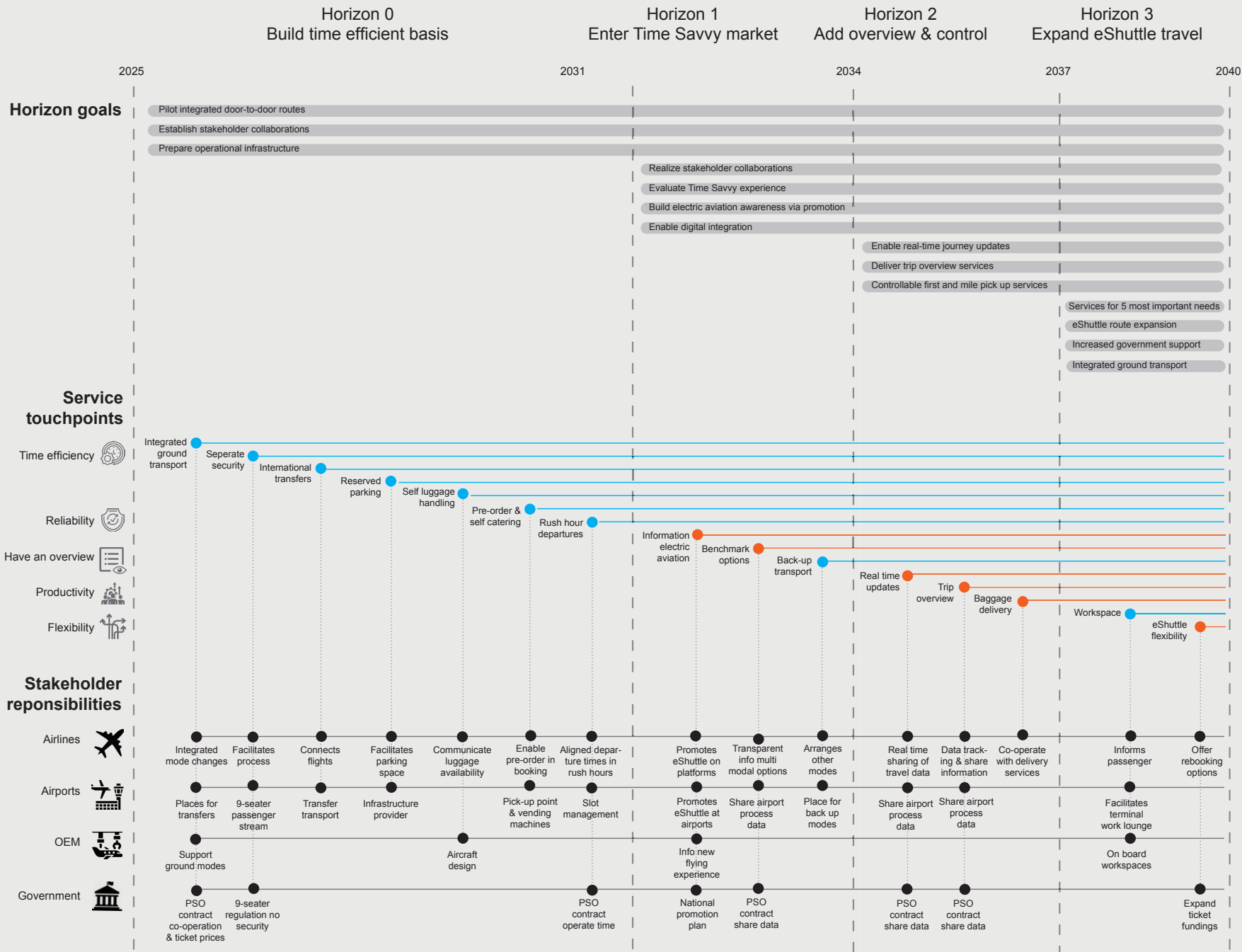


## 10.4 The roadmap

This roadmap outlines the phased development of the eShuttle service over a 15-year period, divided into four strategic horizons. It combines long-term horizon goals, the implementation of service touchpoints, and the distribution of stakeholder responsibilities.

The roadmap begins with Horizon 0 (2025–2031), a six-year phase focused on building the foundation for time-efficient, door-to-door services in preparation for the introduction of the electric 9-seater around 2030. This is followed by three consecutive three-year horizons (Horizon 1–3), each expanding the service offer, evolving into an integrated network of door-to-door eShuttle routes.

The focus of the roadmap lies on the implementation of the five most important needs of the Time Savvy traveler, for which 15 prioritized touchpoints were developed. These were selected based on the passenger insights from Chapter 7 and stakeholder evaluation from Chapter 8. As a result, not all design criteria from Chapter 6 are included.



# Horizon 0: 2025-2031

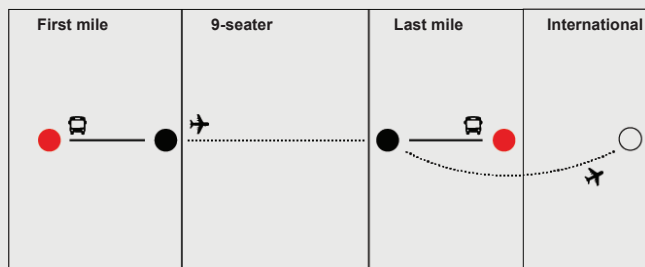
## Build time efficient basis

Horizon 0 focuses on building the basic services for time-efficient travel over the period 2025–2031. The electric 9-seater is expected to be released around 2030, so this stage prepares the services and operations to start flying in Horizon 1 from 2031, with the Time Savvy traveler as the first target group. The aim is also to set the first steps for the eShuttle door-to-door route.

### Key horizon goals

- Pilot integrated door-to-door routes:** test and refine door-to-door route planning with ground transport partners.
- Establish stakeholder collaboration:** build partnerships and align responsibilities to enable the eShuttle touchpoints.
- Prepare operational infrastructure:** set up the essential physical infrastructure for the eShuttle operations that meet time-efficient travel needs.

### Route focus



Setting up the pilot route

### The five time savvy needs



### eShuttle touchpoints



### Key stakeholder responsibilities for the touchpoints

- Enable integrated ground-air mode changes in the journeys.
- Facilitate the process for a separate fast security stream.
- Offer connecting flights for international transfers.
- Facilitates reserved parking spaces at airports.
- Monitor luggage capacity per flight to enable self luggage handling.
- Inform passengers and arranges about rush hour departure schedules.
- Waiting areas for ground transport for fast eShuttle transfers.
- Enable a separate security stream for 9-seater passengers.
- Airport transport for fast eShuttle - international transfers.
- Assign parking spaces for eShuttles close to the terminal.
- Slot management for efficient rush hour departures and arrivals.
- Support cooperation with ground transporters for door-to-door trip.
- Design the aircraft weight distribution of luggage storage spaces.
- Require airlines through PSO contracts to integrate ground transport in journey.
- Fund the ground transport part of the ticket to keep door-to-door prices viable.
- Adapt security regulations so 9-seaters have simplified security checks.
- Enforce PSO contracts with flight times that match passenger needs during morning and evening commutes.

# Horizon 1: 2031-2034

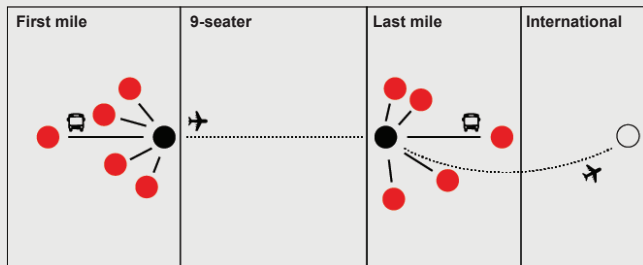
## Enter Time Savvy market

This horizon focuses on entering the business travel market by targeting the Time Savvy persona. While Horizon 0 laid the foundation, this phase launches the door-to-door service with a focus on time efficiency and reliability. Horizon 1 marks the start of actual operations, with services aligned to meet the five most important needs of the Time Savvy passenger.

### Key horizon goals

1. **Evaluate Time Savvy experience:** conduct pilot evaluations with Time Savvy personas to assess the first eShuttle services.
2. **Realize stakeholder collaboration:** activate operational collaborations among airlines, airports, OEMs, and government for service rollout.
3. **Build awareness through promotion:** launch a national electric aviation promotion plan to position the eShuttle as a new travel mode.
4. **Enable digital integration:** integrate the eShuttle service into airline platforms to benchmark door-to-door options for passengers.

### Route focus



Start operating the route for eShuttle passengers

### The five time savvy needs



### eShuttle touchpoints



### Key stakeholder responsibilities for the touchpoints

- ✈️ • Promote the eShuttle service through their own platforms to inform passengers about electric aviation.
- ✈️ • Provide benchmark options by cooperating with ground transport and showing transparent door-to-door travel comparisons via platform.
- ✈️ • Arrange and communicate back-up transport options to passengers in case of delays.
- ✈️ • Promote electric aviation within the airport environment.
- ✈️ • Communicate estimated ground transport times at airports that are included in the benchmark comparisons.
- ✈️ • Facilitate designated areas at the airport for back-up transport modes to operate from.
- ✈️ • Provide input for promoting the eShuttle as a new flying experience.
- ✈️ • Build aircraft that enable data tracking and sharing.
- ✈️ • Launch a national promotion plan to support the introduction of electric eShuttles.
- ✈️ • Include benchmark requirements in PSO contracts to ensure airlines present full door-to-door options and enable data sharing for mode comparison.

# Horizon 2: 2034-2037

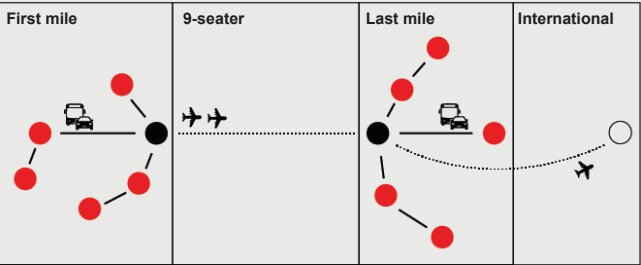
## Add overview & control

In Horizon 2, the eShuttle service expands its focus from offering a time-efficient and reliable journey toward giving passengers a clear overview of their entire door-to-door trip. The goal is to support passengers in feeling in control of how they plan and navigate their journey. Real-time updates and end-of-trip overviews help travelers make informed decisions before and during travel.

### Key horizon goals

- 1. Enable real-time journey updates:** share real-time travel data across stakeholders to provide passengers with continuous updates throughout the door-to-door journey.
- 2. Deliver trip overview services:** provide passengers with a clear summary of their trip at the end, including travel time, emissions, and transfer moments.
- 3. Controllable first and last mile services:** use Horizon 1 passenger data to implement pickup services that collect passengers at their exact locations, replacing fixed routes to give more control.

### Route focus



Collective pick up routes and increase in eShuttle flights

### The five time savvy needs



### eShuttle touchpoints



### Key stakeholder responsibilities for the touchpoints

- Share live travel data with passengers to keep them informed throughout their journey.
- Track and provide end-of-trip summaries for passengers.
- Collaborate with delivery services to offer baggage drop-off and delivery at the destination.
- Share airport data with airlines to support accurate travel updates and trip summaries for passengers.
- No direct role defined for these touchpoints
- PSO contracts to force data sharing between airlines and airports to ensure passengers receive live updates and end-of-trip overviews.

# Horizon 3: 2037-2040

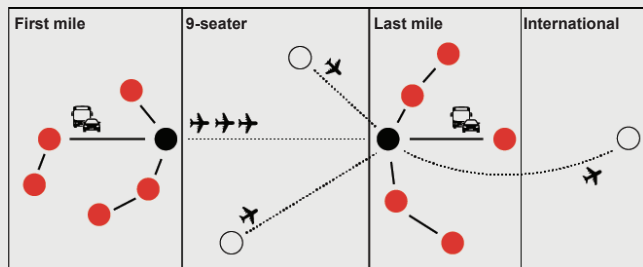
## Expand eShuttle travel

Horizon 3 marks the final phase, where the goal is to scale up the eShuttle service into a full network of door-to-door connections. All touchpoints are now implemented, offering passengers a complete journey experience. In this phase, the focus lies on expanding productivity and flexibility services. The eShuttle adds new routes and increased government support ensure accessibility and affordability for a broader audience.

### Key horizon goals

1. **Target the five important Time-Savvy needs:** finalize the offering of services that address all key needs: time efficiency, reliability, overview, productivity, and flexibility.
2. **eShuttle route expansion:** identify and develop new route opportunities for 9-seater operations, focusing on underserved connections that do not yet exist.
3. **Increased government support:** increase government involvement in subsidizing infrastructure development for new routes, lower ticket prices across to target a wider range of passenger profiles. The goal is to build a national regional air mobility network.

### Route focus



Building the eshuttle network

### The five time savvy needs



### eShuttle touchpoints



### Key stakeholder responsibilities for the touchpoints

- ✈️ • Arranges workspace access at airport terminals for productive waiting time.
- ✈️ • Enables flexible eShuttle changes by offering rebooking services for an extra fee.
- ✈️ • Provides pre-order and self-catering options in the terminal to allow passengers to plan their time efficiently.
- ✈️ • Creates designated workspaces at terminals to support passenger productivity.
- ✈️ • Facilitates pre-order pickup points and self-service vending machines for food and drinks.
- ✈️ • Designs aircraft interiors with workspace to work comfortably during the flight.
- 🏛️ • Expands public ticket funding schemes to include flexible flight changes for eShuttle users.

## 10.5 Conclusion

The Wheel of Responsibility shows that the airline is responsible for most eShuttle service touchpoints. The airport is a key partner but only responsible for airport-related services. The government plays an enabling role by setting PSO rules that support service viability. The OEM has a passive role and is only responsible for building the aircraft and its related services.

The eShuttle concept shows a four step approach to build the door-to-door journey. This step-by-step approach shows how the needs build up throughout the trip expansions.

The roadmap outlines the step-by-step development of the eShuttle service toward 2040. In Horizon 0 (2025–2031), the time efficient service foundations are established, including a first pilot route. Horizon 1 (2031–2034) marks the launch, targeting the Time-Savvy business traveler. Horizon 2 (2034–2037) enhances the journey with greater control and having an overview. By Horizon 3 (2037–2040), the eShuttle evolves into a full regional network with all 15 touchpoints in place.

# Conclusion

# 11

This chapter presents the final conclusion of the graduation project. Section 11.1 discusses the generalizability of the findings. Section 11.2 provides stakeholder-specific recommendations based on the research. Section 11.3 outlines the limitations of the study. The chapter ends with Section 11.4, which shows the overall conclusion.

**11.1 Discussion**

**11.2 Recommendations**

**11.3 Limitations**

**11.4 Conclusion**

## 11.1 Discussion

This project explored passenger needs and service design for the adoption of 9-seater electric aircraft, using the Førde–Bergen route as a case study. While this route has unique geographical, infrastructural, and climatic characteristics, the findings offer broader relevance for other regions with similar mobility challenges.

However, the different local contexts shape how the service touchpoints should be designed. In Norway alone, the diversity in airport locations and accessibility already impacts route design. For example, while Florø's airport is integrated into the city center (Avinor, 2025), Førde's requires a 30-minute drive to Bringeland airport. Such differences affect first–last mile efficiency and the generalizability of this case to other routes.

The 9-seater is also relevant beyond replacing long car and ferry journeys, it can serve as a first or last leg for international flights. The eShuttle service as a first or last leg expands its role in the mobility system but raises sustainability concerns. If the 9-seater electric flights lead to increased international air travel, the overall greenhouse gas emissions may not be reduced.

In Norway, where 95% of new cars sold are electric (Sunnfjord Commune, 2025), the sustainability advantage of short electric flights over nearly emission-free ground transport is less clear. In this context, the strategic value of 9-seaters may lie more in unlocking remote areas with no time efficient ground transport.

This project focuses on the Time Savvy business persona. The eShuttle service reflects the core needs of this persona which include time efficiency, reliability, flexibility, productivity, and having an overview. The 15 services designed for this

persona type are specifically focused in meeting these passenger needs. To meet other persona types with different needs, future work should explore other services to meet the needs for persona who are more focused on leisure.

Integrating electric aviation into public transport networks requires rethinking what counts as “public transport.” As argued by NEA (2024), including electric aircraft in this definition could improve accessibility for rural areas reliant on air links, enabling broader use of sustainable transport. The 9-seater is also a stepping stone toward a broader electric aviation system. It can support the development of larger regional aircraft (30–100 seaters). For the designed services, this means that while the 15 touchpoints are designed for the door-to-door journey of a 9-seater, the services can act as a starting framework for other electric aircraft models. Future work should research how these services can be adapted to different electric aircraft scales, passenger types, and network contexts.

## 11.2 Recommendations

Based on the findings of this thesis, the following recommendations are provided for stakeholders involved in the development of 9-seater electric aviation services:

### Airlines

To support early adoption, airlines are encouraged to further research the passenger aspect in developing a desirable business model for 9-seater services. Pilot operations on low-density routes, such as Førde–Bergen, can be used to evaluate the service touchpoints to gather passenger feedback during their trip. Additionally, airlines should expand persona development to include diversified business segments, such as premium executive services, or non-business segments, such as leisure travelers.

### OEMs

OEMs such as Embraer are advised to conduct a life cycle assessments (LCAs) comparing the 9-seater's environmental impact to that of electric car travel, particularly in regions with a high share of electric vehicles. This will help clarify the environmental value proposition of electric aviation. To support adoption, OEMs should invest in promoting the 9-seater's unique flight experience and educate potential passengers on the benefits a 9-seater brings to passengers. Strategic planning should also include the development of a broader aircraft portfolio (30, 50 or 100 seaters) to enable scalable electric aviation networks. Furthermore, OEMs are encouraged to identify new thin routes in Norway where the 9-seater could offer a time-efficient alternative to car travel to show to airlines on what routes they could operate.

### Airports

Airports should assess the infrastructure upgrades required to support electric aircraft operations, particularly in relation to charging capacity. In rural areas, improving first- and last-mile accessibility is essential to ensure seamless travel chains. In urban contexts, minimizing congestion while maintaining efficient airport access remains a priority. Rural airports are already time efficient; larger hubs can learn from them by developing streamlined terminals for 9-seaters. The airport terminals should accommodate a 9-seater security process. Given the varying airport sizes and locations across Norway, infrastructure planning should be context-specific and supported through pilot studies.

### Governments

The Norwegian government should continue supporting the development of electric aviation through the identification of new PSO (Public Service Obligation) routes and by financing pilot projects via initiatives such as the Avinor Test Centre (Avinor, 2025). PSO contracts should include specific criteria for 9-seater services, ensuring cooperation between airports and airlines in delivering integrated door-to-door mobility. Importantly, the government is advised to formally include 9-seaters in the national public transport system, thereby to create a more accessible transport network for rural-hub connections. Investment in electric charging infrastructure at airports is also necessary, as most airports are state-owned. A critical topic is security regulation: the government should simplify security procedures for 9-seater operations. Lastly, national and local governments must work together to adapt services to regional needs, acknowledging that air transport dependencies differ between urban and rural communities. An important future case-study could be the development of 9-seater services for healthcare patients.

### 11.3 Limitations

Several limitations should be considered when interpreting the results of this study. First, most participants were sampled through the TØI report and were already familiar with the concept of electric aviation. Although some new participants were included, this prior knowledge may have influenced their responses and openness toward the 9-seater concept. Additionally, the sample consisted of 28 respondents from Norway, limiting the generalizability of the findings across different cultural or regional contexts.

The study was conducted as a qualitative exploration, focusing primarily on the desirability of the 9-seater service. While insights were generated, the limited sample size and absence of quantitative validation limit the generalizability of the results. The time-constrained nature of the study also limited the depth of data collection and analysis. The data sampling was done by a 10-days study trip in January 2025, which was a one time field trip.

Language was another factor, as the study was conducted in a Norwegian use-case with participants of varying language proficiency. Although visual tools supported communication, language barriers may have affected the precision of responses or the depth of expressed needs.

The study used a hypothetical 9-seater scenario to assess future mobility preferences. Participant feedback may differ from actual behavior in a real-world operational setting, introducing a degree of uncertainty. Furthermore, the research focused predominantly on the passenger perspective. The stakeholder involvement was limited due to time of the project.

Finally, the Førde–Bergen route presents a context-specific case characterized by particular geographic and infrastructural conditions. This setting may not fully reflect the constraints and opportunities of similar thin-demand routes elsewhere.

## 11.4 Conclusion

This conclusion answers the research question: “Who are the passengers in the electric 9-seater and what kind of services should airlines offer to meet the passenger needs?”

On the Førde–Bergen route in Norway, this research identifies the Time-Savvy business traveler as the first passenger segment for the 9-seater electric aircraft. Initially, ten passenger needs were uncovered, but through co-creation, passenger concept selection, and stakeholder evaluation, five core needs emerged as decisive for adoption: time efficiency, overview, reliability, productivity, and flexibility. These core needs shaped the design of the 15 service touchpoints that make the eShuttle concept.

The 9-seater must compete directly with car travel, which currently takes around three hours on this route. This makes it essential for airlines to offer services that make the 9-seater not only faster but also more reliable, structured, and productive than traveling by car. The final service touchpoints include benchmarking the door-to-door trip in terms of time, cost, and emissions; real-time updates; simplified security; flexible rebooking; baggage delivery options; integrated parking and ground transport; and productivity-enhancing features such as workspaces and catering. These touchpoints ensure that the 9-seater becomes a time-efficient and seamless alternative for business travelers.

The project also demonstrates that the success of the 9-seater depends on collaboration between stakeholders. A roadmap until 2040, structured around a “wheel of responsibility,” shows how implementation should be shared: airlines own the passenger experience through the service touchpoints, airports provide physical enablers, governments secure regulation and funding, and OEMs ensure that the aircraft supports the service design.

For Embraer-X, this thesis marks the start of systematically exploring human desirability in electric regional aviation. By understanding what passengers value most and translating those needs into services, Embraer-X can replicate this research method across other routes and geographies to guide both business models and product development.

Ultimately, the 9-seater is the starting point of a service-driven model for zero-emission regional air mobility. By beginning with the Time-Savvy business traveler on the Førde–Bergen route, building services around their needs, and fostering collaboration between stakeholders, Embraer-X, passengers and other stakeholders lay the foundation for a desirable electric air mobility future.



# References

## A

- ACI EUROPE. (2023). EUROPEAN REGIONAL AIRPORTS. ACI EUROPE.
- Adey, P., Bissell, D., McCormack, D., & Merriman, P. (2012). Profiling the passenger: mobilities, identities, embodiments. *Cultural Geographies*, 19(2), 169–193. <https://doi.org/10.1177/1474474011428031>
- Advanced Airmobility Expo. (2025). Advanced Air Mobility Expo. Advanced Air Mobility Expo. <https://www.advancedairexpo.co.uk/news/a-deep-dive-into-aam-uam-and-ram-understanding-the-different-forms-of-air-mobility/>
- Ali, Z. M., Calasan, M., Gandoman, F. H., Jurado, F., & Abdel Aleem, S. H. E. (2024). Review of batteries reliability in electric vehicle and E-mobility applications.
- Alyavina, E., Nikitas, A., & Njoya, E. T. (2024). Mobility-as-a-Service and unsustainable travel behaviour: Exploring the car ownership and public transport trip replacement side-effects of the MaaS paradigm. *Transport Policy*, 150, 53–70.
- Amadeus. (2023). Technological innovation driving the passenger experience revolution at global airports. Amadeus | the Leading Travel Technology Company.
- Anagnostopoulou, E., Urbančič, J., Bothos, E., Magoutas, B., Bradesko, L., Schrammel, J., & Mentzas, G. (2018). From mobility patterns to behavioural change: leveraging travel behaviour and personality profiles to nudge for sustainable transportation. *Journal of Intelligent Information Systems*, 54(1), 157–178. <https://doi.org/10.1007/s10844-018-0528-1>
- Anker, M. A. (2022). Powertrain sizing of an All-Electric commuter aircraft for the Norwegian Short-Haul Network [Master's thesis].
- Ansell, P. (2023). Review of sustainable energy carriers for aviation: Benefits, challenges, and future viability.
- Antcliff, K., Borer, N., Boeing, Alaska Airlines, Reliable Robotics, Xwing, Oldham, J., Courtin, C., Bradley, M., Roy, S., Lynch, B., Guiang, A., Stith, P., Sun, D., Ying, S., Patterson, M., Schultz, V., Ganzarski, R., Noertker, K., . . . Ouellette, R. (2021). Leveraging our national investments to energize the American travel experience (A. Sperandio, K. Niedermeier, & A. Tourkaman, Eds.).

- Antcliff, K., Borer, N., Sartorius, S., & Saleh, P. (2021). Regional Air Mobility. [https://www.researchgate.net/publication/351128786\\_Regional\\_Air\\_Mobility](https://www.researchgate.net/publication/351128786_Regional_Air_Mobility)
- Arvidsson, R., Nordelöf, A., & Brynolf, S. (2023). Life cycle assessment of a two-seater all-electric aircraft. <https://doi.org/10.1007/s11367-023-02244-z>
- Avinor Test Arena. (2025). Test Arena.

## B

- Bakır, M., & Itani, N. (2024). Modelling behavioural factors affecting consumers' intention to adopt electric aircraft: A Multi-Method investigation. *Sustainability*, 16(19), 8467. <https://doi.org/10.3390/su16198467>
- Baumeister, S., Leung, A., & Ryley, T. (2020). The emission reduction potentials of First Generation Electric Aircraft (FGEA) in Finland. *Journal of Transport Geography*, 85, 102730.
- Borer, N. K., Blaesser, N. J., Patterson, M. D., & NASA Langley Research Center. (2021). Regulatory considerations for future regional air mobility aircraft. In NASA Langley Research Center.
- Boshell, F., Kang, S., Gorini, R., Kadir, M. A., & International Renewable Energy Agency - IRENA. (2022). The role of renewables in decarbonising the aviation sector. ICAO.
- Brandt, P. (2021). Passenger attitudes towards regional electric aviation and the anticipated changes in the customer journey
- Bråthen, S., & Halpern, N. (2011). Impact of airports on regional accessibility and social development.
- Brdnik, A., Kamnik, R., Marksel, M., & Božicnik, S. (2019). Market and Technological Perspectives for the New Generation of Regional Passenger Aircraft.
- Brink, L., Brown, R., Mahan, S., Esqué, A., Meigs, B., & Riedel, R. (2023, May 31). Short-haul flying redefined: The promise of regional air mobility. McKinsey & Company.
- Brummelhuis, M., & Vugts, G. (2022). The total cost estimation is that flying electrically on a yearly basis is quite a lot cheaper than using conventional planes. This discrepancy is mostly caused by the lower price per unit of energy when using electricity.

## C

- Calabretta, G., Baldassarre, B., Bocken, N. M. P., & Jaskiewicz, T. (2017). Bridging sustainable business model innovation and user-driven innovation: A process for sustainable value proposition design.
- Carreira, R., Patrício, L., Jorge, R. N., & Magee, C. (2014). Understanding the travel experience and its impact on attitudes, emotions and loyalty towards the transportation provider—A quantitative study with mid-distance bus trips.
- Cavicchia, C., Tybjerg, J. K., Salonen, H., Brynteson, M., & Wendt-Lucas, N. (2024). Ten-year Regional Outlook: Future Perspectives for Electric Aviation in the Nordic Region.
- Cavicchia, R., Nordregio, Tybjerg, J. K., Nordregio, Salonen, H., Nordregio, Brynteson, M., Nordregio, Wendt-Lucas, N., Nordregio, Gísladóttir, S., University of Akureyri Research Centre, Jóhannesson, H., & University of Akureyri Research Centre. (2024). Electric aviation and the effects on the Nordic region. In *Electric Aviation and the Effects on the Nordic Region* [Report].
- Civil Aviation Authority. (2025, February 3). <https://www.caa.co.uk/>
- Coalitie Anders Reizen. (2024). Bedrijven zeggen toe CO2 uitstoot van zakelijke vluchten met een kwart te reduceren. Anders Reizen Coalitie.
- Čulík, K., Poliak, M., & Kalašová, A. (2022). The importance of connecting the First/Last Mile to public transport.

## D

- Datey, A., Kao, B., Francisco, R., Moradpour, M., Kim, R., Bronicki, N., & Rakas, J. (2023). Noise Footprint of Electric Aviation at Regional Airports: A Case Study of VNY. *IEEE*, 1–14. <https://doi.org/10.1109/icns58246.2023.10124303> Deloitte. (2022, December 1). Quantitative quick scan on electric flight below 500km [Slide show].
- De Dios Ortuzar, J., & Willumsen, L. G. (2011). Modelling transport.
- Designboom. (2021, July 19). aviation unveils alicé, an all-electric, 9-passenger commuter aircraft. *Designboom | Architecture & Design Magazine*. <https://www.designboom.com/technology/eviation-alice-all-electric-aircraft-07-19-2021/>
- Design Council. (2005). *The Double Diamond* - Design Council. <https://www.designcouncil.org.uk/our-resources/the-double-diamond/>
- Di Mauro, G., Guida, M., Olivares, G., & Gomez, L. M. (2024). Paving the way for the electrified future of flight: safety criteria development for integrating structural batteries in aircraft. *Aerotecnica Missili & Spazio*. <https://doi.org/10.1007/s42496-024-00207-7>

## E

- EFC. (2025). *Charging Ahead - Transforming airports for electric flight* [Slide show]. Electr.
- Embraer. (2025). Interview with Embraer about the 9-seater.
- European Commission. (2025, April 4). Demography 2040: cities keep growing, while population shrinks in remote rural regions. The Joint Research Centre: EU Science Hub.

## F

- FAIR. (2023). *HOW TO ACCELERATE THE IMPLEMENTATION OF ELECTRIC REGIONAL AVIATION*. [https://www.kvarken.org/wp-content/uploads/2022/09/FAIR\\_Slutrapport\\_A4\\_Aug\\_2022\\_v002\\_DIGITAL.pdf](https://www.kvarken.org/wp-content/uploads/2022/09/FAIR_Slutrapport_A4_Aug_2022_v002_DIGITAL.pdf)
- Fogg, B. J. (2025). *Behavior Model - BJ Fogg*. Behavior Model. <https://www.behaviormodel.org/>

## G

- Garus, A., Alonso, B., Raposo, M. A., Ciuffo, B., & Dell'Olio, L. (2022). Impact of New Mobility Solutions on Travel Behaviour and Its Incorporation into Travel Demand Models. *Journal of Advanced Transportation*, 2022, 1–24. <https://doi.org/10.1155/2022/7293909>
- Gibbons, S. (2024a, January 12). *Journey Mapping 101*. Nielsen Norman Group. <https://www.nngroup.com/articles/journey-mapping-101/> Gibbons, S. (2024b, January 30). *UX Roadmaps: definition and components*. Nielsen Norman Group. <https://www.nngroup.com/articles/ux-roadmaps/>
- Gilberg, A. M. (2024). Interview Start Norge AS.
- Goldmann, A., Sauter, W., Oettinger, M., Kluge, T., Schröder, U., Seume, J., Friedrichs, J., & Dinkelacker, F. (2018). A study on electrofuels in aviation. *Energies*, 11(2), 392. <https://doi.org/10.3390/en11020392>
- Government Norway. (2024). *Government*. Government.no. <https://www.regjeringen.no/en/id4/>
- Grunfelder, J., Julien Grunfelder, & Shinan Wang. (2016). AIR ACCESSIBILITY: Passenger numbers increasing, but the best is yet to come. In *NORDREGIO* (No. 2016132; p. 1).

## H

- Hameed, I., Chatterjee, S., Zainab, B., Xian Tzhe, A., Shea Yee, L., & Khan, K. (2024). Navigating loyalty and trust in the skies: The mediating role of customer satisfaction and image for sustainable airlines. <https://www.sciencedirect.com/science/article/pii/S2666188824001485>
- Han, H., Yu, J., & Kim, W. (2019). An electric airplane: Assessing the effect of travelers' perceived risk, attitude, and new product knowledge.
- Hellesund, S. & Elfly Group. (2019). Business models for Nordic electric aviation. In Project Report From the Nordic Network for Electric Aviation (NEA) 1.0. <http://norden.diva-portal.org/smash/get/diva2:1718226/FULLTEXT01.pdf>
- Hendriks, R., (2021). A service design vision for air-rail journeys. In J. I. V. Kuijk & S. Hiemstra-van Mastrigt (Eds.), *Seamless Personal Mobility Lab*.
- Holley, D., Jain, J., & Lyons, G. (2008). Understanding business travel time and its place in the working day. *Time & Society*, 17(1), 27–46. <https://doi.org/10.1177/0961463x07086308>

## I

- I&W [Ron]. (2024). Interview Ron van I&W: Over RAM in de luchtvaart binnen Nederland.

## K

- Keller, E., Eisen, C., & Hanss, D. (2019). Lessons learned from Applications of the Stage Model of Self-Regulated Behavioral Change: a review. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.01091>
- Kennis instituut Mobiliteit. (2021). Business flights: travellers, trips, purposes and prospects.
- Kent, J. (2014). Driving to save time or saving time to drive? The enduring appeal of the private car.
- Kluge, U., Ringbeck, J., & Spinler, S. (2020). Door-to-door travel in 2035 – A Delphi study. *Technological Forecasting and Social Change*, 157, 120096. <https://doi.org/10.1016/j.techfore.2020.120096>
- Leiper, N., Witsel, M., & Hobson, P. (2008). Leisure travel and business travel: a comparative analysis. *Journal of Tourism & Hospitality*, 2(1), 1–10. [http://epubs.scu.edu.au/tourism\\_pubs/115/](http://epubs.scu.edu.au/tourism_pubs/115/)

## L

- Luftfahrtstilsynet. (2018, May 16). About Civil Aviation Authority Norway. Luftfahrtstilsynet. <https://luftfahrtstilsynet.no/en/about-us/about-caa-norway/>
- Lundberg, T. (2022). Accessibility study for electric aviation: Part of the project Electric Aviation and the Effect on Nordic Regions.
- Lundberg, T. (2023, December 11). Accessibility study for electric aviation. ArcGIS StoryMaps. <https://storymaps.arcgis.com/stories/3b35687163744e69a6966b5b9fad976e>
- LYGG. (2024). Interview LYGG met Katja Head Customer Experience.

## M

- Mahalingam, R., Mitchell, A., & Riedel, R. (2023, March 7). How customer experience will make or break advanced air mobility. McKinsey & Company.
- Mavris, D. N., & Justin, C. Y. (2022). REGIONAL AIR MOBILITY MARKET STUDY. ResearchGate.
- Mehdizadeh, M., Kroesen, M., & Peron, M. (2025). How zero-emission flights might redefine travel behavior.
- Millán, A., Fanjul, M. L., & Moital, M. (2016). Segmenting the business traveler based on emotions, satisfaction, and behavioral intention. *Psychology and Marketing*, 33(2), 82–93. <https://doi.org/10.1002/mar.20856>
- Ministry of Trade, Industry and Fisheries. (2014). Future North: Final report from 'Knowledge Gathering – Value Creation in the North.

## N

- NACO & NLR. (2021). Roadmap: Electric flight in the Kingdom of the Netherlands [Slide show]. NACO.
- Net-Zero Carbon Emissions by 2050. (2021, October 4). <https://www.iata.org/en/pressroom/pressroom-archive/2021-releases/2021-10-04-03/>
- New McKinsey study on regional air mobility | ERA. (n.d.). <https://www.eraa.org/new-mckinsey-study-regional-air-mobility>
- Nordic Energy Research. (2023). Overview of Electricity and Energy Capacity for the Establishment of Electric Aviation Routes in the Nordic Region. <https://pub.nordregio.org/wp-2023-5-overview-of-electricity-and-energy-capacity/#>
- Nordic Innovation. (2024). Reinventing aviation in the Nordics. <https://norden.diva-portal.org/smash/get/diva2:1912532/FULLTEXT02.pdf> Nordic
- Network for Electric Aviation [NEA]. (2023). Accelerating the development of electric aviation in the Nordic countries. <http://norden.diva-portal.org/>

smash/get/diva2:1811595/FULLTEXT01.pdf

- Nordregio. (2023). Accessibility study for electric aviation: Part of the project Electric Aviation and the Effect on Nordic Regions. <https://storymaps.arcgis.com/stories/3b35687163744e69a6966b5b9fad976e>
- Nordregio. (2024). Electric Aviation Policy Roadmap. <https://pub.nordregio.org/pb-2024-5-electric-aviation-policy-roadmap/key-challenges-and-how-they-can-be-tackled.html>
- Nordregio, NEA, & HeartAerospace. (n.d.). Future of Electric Aviation: Policy Roadmap. Nordregio – Electric Aviation, online. 2024
- Norwegian Ministry of Transport. (2024). National transport Plan 2025-2036: English Summary.
- Notenboom, B. (2025). DPG Media Privacy Gate. <https://www.trouw.nl/tijdgeest/met-schuldgevoel-vliegen-naar-de-spaanse-zon-niet-nodig-stelt-deze-klimaatjournalist-b3d31762/?referrer=https%3A%2F%2Fwww.google.nl%2F>
- Nradmin, & Wangsness, P. B. (2021). Electric flight route Stavanger-Bergen – Commitment to testing electric planes is socially beneficial | Nordic Road and Transport Research.

## O

- Okonkwo, E. (2023). Technological Transition to Electric Aviation in the Kvarken Region: A Review of the FAIR Reports (Finding Innovations to Accelerate the Implementation of Electric Regional Aviation) (13(1)). *Journal of Geography, Politics and Society*.

## P

- Pitt DISC. (2021, August 19). Making sense of Diffusion of Innovations Theory | Implementation Science [Video]. YouTube. <https://www.youtube.com/watch?v=Qbheq-ggY4M>
- Plimmer, G., Georgiadis, P., Pickard, J., & Murray, C. (2025, January 29). 'The only winners are lawyers': Heathrow braces for long journey to third runway. *Financial Times*. [https://www.ft.com/content/a16706ea-9d64-4840-a0fc-4a7c922d3840?utm\\_source=chatgpt.com](https://www.ft.com/content/a16706ea-9d64-4840-a0fc-4a7c922d3840?utm_source=chatgpt.com)

## R

- Ramos, E. M. S., Bergstad, C. J., & Nässén, J. (2020). Understanding daily car use: Driving habits, motives, attitudes, and norms across trip purposes. <https://www.sciencedirect.com/science/article/pii/S1369847819302165>
- Reed, J., & Reed, J. (2021, December 15). Eviation Aircraft's Executive

Cabin Design Features Wider Seats, Panoramic Windows with Zero Carbon Emissions. *Avionics International*. <https://www.aviationtoday.com/2021/12/15/eviation-aircrafts-executive-cabin-design-features-wider-seats-panoramic-windows-zero-carbon-emissions/>

- Redondi, R., Malighetti, P., & Paleari, S. (2013). European connectivity: the role played by small airports. *Journal of Transport Geography*, 29, 86–94. <https://doi.org/10.1016/j.jtrangeo.2013.01.010>
- Reducing emissions from aviation. (n.d.). Climate Action. [https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-aviation\\_en](https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-aviation_en)
- Revolution. (2024, April 24). Regional air mobility: Back to the future? *Revolution.aero*. [https://www.revolution.aero/deep\\_dive/regional-air-mobility-back-to-the-future/](https://www.revolution.aero/deep_dive/regional-air-mobility-back-to-the-future/)
- Roe, J. S. (2022). Exploring the User Centred Mobility Solution Design in Application of Qualitative Research Methodology. [https://www.researchgate.net/publication/366281406\\_Exploring\\_the\\_User\\_Centred\\_Mobility\\_Solution\\_Design\\_in\\_Application\\_of\\_Qualitative\\_Research\\_Methodology](https://www.researchgate.net/publication/366281406_Exploring_the_User_Centred_Mobility_Solution_Design_in_Application_of_Qualitative_Research_Methodology)
- Roland Berger. (2024). Regional air mobility.
- Roland Berger & DLR. (2024). Advanced air mobility on the runway to commercialization: A close look at eVTOL unit economics.

## S

- Sánchez Gassen, N., Heleniak, T., & Nordregio. (2019). THE NORDIC POPULATION IN 2040 – Analysis of past and future demographic trends. In Nordic Thematic Group for Sustainable Rural Development, Nordic Council of Ministers, & Nordic Council, NORDREGIO REPORT 2019:6. Nordregio. <https://www.nordregio.org>
- SAS reintroduces European Business Class starting October 1 - SAS. <https://www.sasgroup.net/newsroom/press-releases/2025/sas-reintroduces-european-business-class-starting-october-1/>
- Schmalz, U., Paul, A., & Gissibl, V. (2021). An explorative study of corporate travellers' perception at a German airport. *Journal of Air Transport Management*, 92, 102040. <https://doi.org/10.1016/j.jairtraman.2021.102040>
- Schmitt, D., & Gollnick, V. (2015). Aircraft Manufacturer. In *Air Transport System* (pp. 157–186). [https://doi.org/10.1007/978-3-7091-1880-1\\_6](https://doi.org/10.1007/978-3-7091-1880-1_6)
- Schouten, T. (2025, May). Vaeridion [Slide show]. EFC Day Schiphol.
- Shanmugavel, N., & Balakrishnan, J. (2023). Influence of pro-environmental behaviour towards behavioural intention of electric vehicles.



*Figure 58: own picture from auto-ethnographic research.*