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# Transformation of Schiphol Group



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# Envisioning the future of Royal Schiphol Group towards a multi modal ecosystem

A strategy to redefine and improve the future experiences of mobility by exploring successful facilitation of multi modalities at RSG.

## Graduation Thesis

Delft University of Technology  
MSc. Strategic Product Design  
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“Cities themselves are mobility systems, giant machines to serve the needs of the people who live and work in them. They whirr and crackle along with trains, subways, buses, boats and trams, and more private taxis, motorbikes and personal cars. Around the machine, people walk and cycle, inserting themselves into the flow like ants, checking every space for the best way through.”

- Smith & Vardhan (2017)

# PREFACE

I would like to welcome you warmly to read my master thesis that envelops my journey as a Master student of Strategic product design at the faculty of Industrial design engineering, TU Delft. As I near the end of my journey at this institution, I am optimistic that it will only lead to more successful path towards my career.

The final semester of my masters was exciting and scary as I explored unknown territories of mobility, looking back now it is safe to say that I was able to navigate confidently and leave a piece of my mark in the industry.

Of course, this thesis would not be complete without the support and belief placed in me by my incredible supervisory team, my loving family and the very best of friends. I would like to take this opportunity to thank my mother - Lamiya Merchant, who has always believed in me and supported me to achieve my dreams selflessly. This thesis is dedicated to her and hope it lives on as inspiration to be resilient and adapting in the face of change. I would also like to thank my sister - Ruqayyah who has taken care of me everyday and helped me with unimaginable challenges while living in a foreign country all alone. A mention to all my

friends, Manjinder, Ahni, Camilo, Willem & Segher for encouraging me throughout this journey and endless lunch & coffee breaks.

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This thesis would not have been possible without the collaboration of the Innovation Hub at Royal Schiphol Group and cooperation of all stakeholders involved. Thankyou for your dedication towards betterfying our community and treating me as an equal contributor in this traditional industry.

Finally, Thankyou Jehan. For always believing in me and so much more throughout this project.

Happy Reading !

# Executive Summary

With increasing modes of transport such as hyperloop, UAM, hydrogen planes, etc., as well as public transportation not aligning with our complex lives, an opportunity for a multi modal hub is created.

A multi modal hub by is a place where users can switch seamlessly from one mode of transport to another with convenient facilities designed for a low carbon solution.

Royal Schiphol Group aspires to have the most sustainable and high quality airports by 2050 and in order to achieve this ambition, a central innovation hub was created that identified a transition towards a MMH. In theory, RSG is considered as a MMH because it connects people to different modes of transport but in order to strengthen that position and truly operate as one, RSG will have to co-create a future vision to align all its stakeholders and identify user needs to design strategic initiatives and create a better user journey for its end passengers is required.

In order to design for this ambition, I immersed myself in the complex context of mobility and explored several trends and developments that can influence the future of mobility and RSG's MMH. I interviewed several experts within the field of mobility and internally at RSG to validate the trend research and co-create the future vision (see figure 0). From the vision and further interviews with stakeholders, I subtracted new strategic solutions for RSG to implement in order to reach the desired future vision.

The scope for this assignment focuses on all the regional airports that RSG offers in the Netherlands. Due to the individual developments currently taking place at each airport towards a MMH and ambition of

creating a shared ecosystem and not just a hub at AAS. Future modalities were considered such as Hyperloop and UAM to co-create the future vision as very little information is known to RSG about their ambition for the future. Aviation and current modalities were out of scope as the knowledge is known to RSG and remains a constant within its ecosystem. Finally, users aged 23 - 35 were chosen due to the limit on time and access to different categories of users. Also, their knowledge on future trends and position in society allowed them to share valuable insights that can mold the future user of tomorrow.

In order to create the future vision a trend analysis and co-creation workshop was conducted that resulted in insights such as; In the future people might live offshore due to the increasing water levels as a result of global warming, 2) Traditional workers and the week will be redefined due to increase in remote working and AI replacing jobs and 3) Increased interactions between human and machines could lead to an isolated life. Stakeholders reacted to these trends which led to insights such as; 1) People will remain resilient, 2) congestion might increase if not dealt with properly and 3) the future is experience economy.

Based on the research, a future vision for RSG's MMH was created that states, "By 2050, Schiphol Group should envision, a flex mobility ecosystem that adapts to situations and user needs resulting in an antifragile way of working. The goal is to create tailored services and seamless experiences for users and passengers. The ambition is achieved by increasing proactive collaboration, on time network performance, and decentralizing hub functions.'

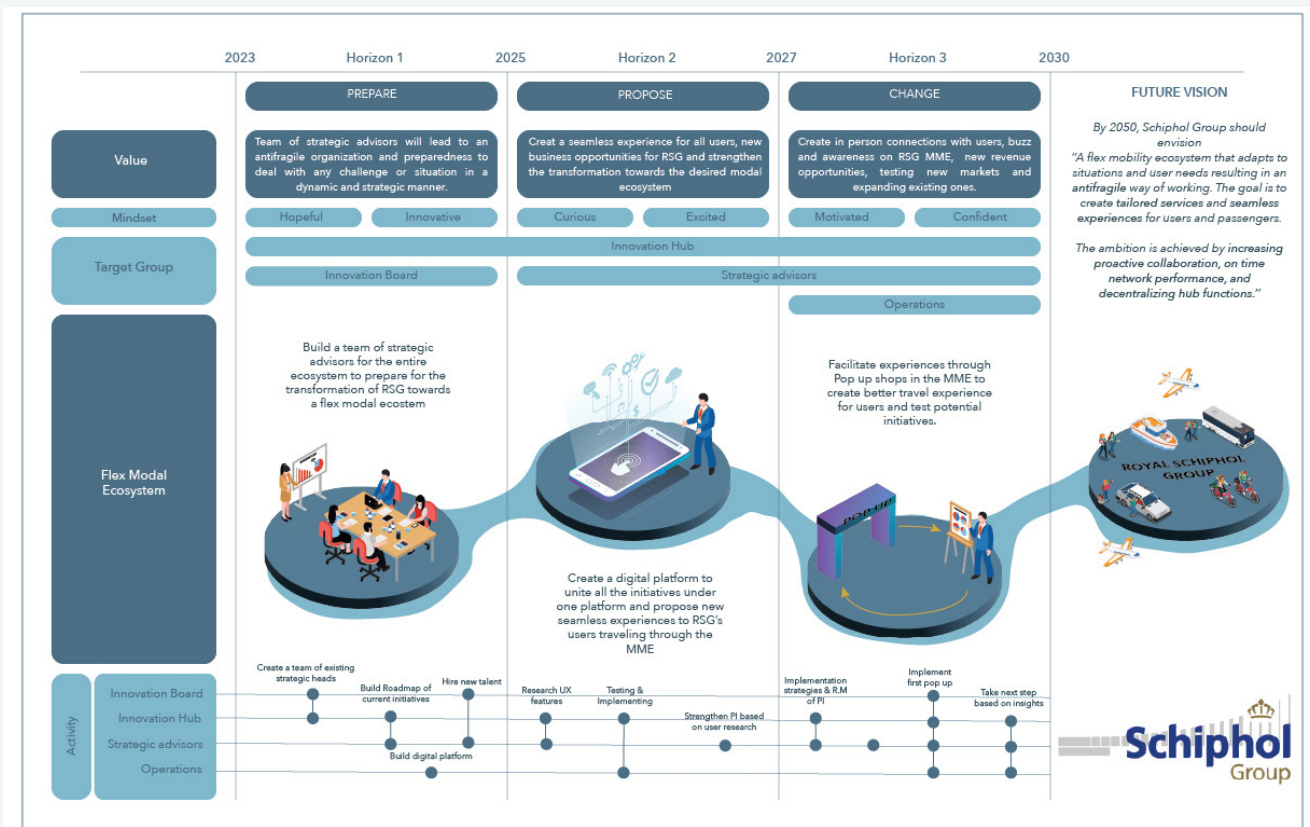


Figure 0. Strategic Roadmap with future vision

The vision creates a direction that aligns all the stakeholders on value drivers that are significant for the successful transformation of RSG into a multi modal ecosystem.

A co-creation workshop with users was conducted to base the future vision with users and create new strategic initiatives for RSG to implement. A worldview of trends was drawn and distinct personas based on characteristics such as; way of working, emotions, connection time and use of modalities was created. User journeys highlighting specific use cases initiated from the co-creation workshop builds the foundation for RSG's new strategic solutions.

The project concludes with a strategic roadmap (see figure 0) derived from the research and expert interviews so that RSG can start facilitating their transformation towards the proposed and desired future vision of a

multi modal ecosystem. The strategic solutions are as follows;

- 1) Preparing change by creating a team of strategic advisors.
- 2) Proposing initiatives significant to transformation of a MME by creating a digital platform.
- 3) Facilitating change by creating a better experience for their users through pop up experiences. In the process learning and gathering new insights that could lead to expanding into new opportunity windows.

These solutions perfectly fit RSG's overall vision of having the most sustainable and high quality airports in Europe. It also allows RSG to implement multi modality correctly anticipate the transformation of the mobility industry. However, stakeholder validation and further on site research is required to strengthen the strategic solutions mentioned.

# ABBREVIATIONS

MMH	Multi modal hub
MME	Multi Modal Ecosystem
RSG	Royal Schiphol Group
AAS	Amsterdam Airport Schiphol
NLR	Netherlands Royal Aerospace Centre
MaAS	Mobility as a Service
UAM	Urban Air mobility
RTHA	Rotterdam the Hague Airports



# GLOSSARY

## Stakeholder

Shareholders, person or group not owning shares in a company or organization but affected by or having interest in operations.

## Mobility

The ability or tendency to move from one position or situation to another, usually a better one (britannica, 2022)

## Modalities

Transport modes are the means supporting the mobility of passengers and freight.

## Hyperloop

A high-speed transportation system using near-vacuum tubes in which pressurized vehicles travel. Due to low air resistance in the tubes, the vehicles can travel at speeds of over 1000 km/h while being more energy efficient, environmentally friendly, and convenient than airplanes (Delft Hyperloop, 2017).

## Urban Air Mobility

Urban Air Mobility (UAM) envisions a safe and efficient aviation transportation system that will use highly automated aircraft that will operate and transport passengers or cargo at lower altitudes within urban and suburban areas (FAA, 2022).

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# Design Context

This chapter explains the challenge and assignment that forms the brief for this project. It further explains the design approach taken to materialize the results throughout this project.

## 2.1 Introduction

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Royal Schiphol group's future vision of 2050 focuses on being one of the most sustainable and competitive hubs in the world. It stresses providing quality of life, quality of network and quality of service. While it is currently working on these goals through automation of processes, becoming more human independent and investing in sustainable technologies, there is a huge technology driven radical innovation opportunity for faster and more sustainable mobility options such as urban mobility, hyperloop, hydrogen planes, etc currently being developed in the world.

The opportunity for a multi modal hub arises due to transport options within our towns and cities being fragmented and do not align with our complex lives. Multiple modes, each with their own operator, payment platforms, service arrangements and locations can make it difficult to complete our journeys, making the private vehicle the mode of choice (at the point of use) based on simplicity, cost and convenience. The negative consequences of private vehicles are well known - congestion, poor air quality, severance, and safety implications. Linear public transport systems can present a significant time penalty over the private vehicle due to multiple stops and longer distances,

limiting their reach to their fixed routes. "I think public transport is painful," Musk said, reported by Wired. "It sucks. Why do you want to get on something with a lot of other people, that doesn't leave where you want it to leave, doesn't start where you want it to start, doesn't end where you want it to end? And it doesn't go all the time." (Musk, 2018)

Future multimodal Hubs could offer a new, low compromise solution to meet all our mobility needs in a sustainable, efficient, and convenient way. A multi modal hub is a place where people can switch from one mode of transport to another with convenient facilities designed for a low-carbon society as shown in Figure 1. RSG's partnership work is constantly evolving as it currently initiates passive collaboration with these various organizations to explore new forms of mobility, innovative transportation networks and other developments within the mobility landscape to achieve its future vision. While the need for a multi-modal hub is evident and there are various upcoming examples of small-scale multi-modal nodes within cities, there is extraordinarily little research conducted on what a full scale and functional multi modal hub should be in the future.

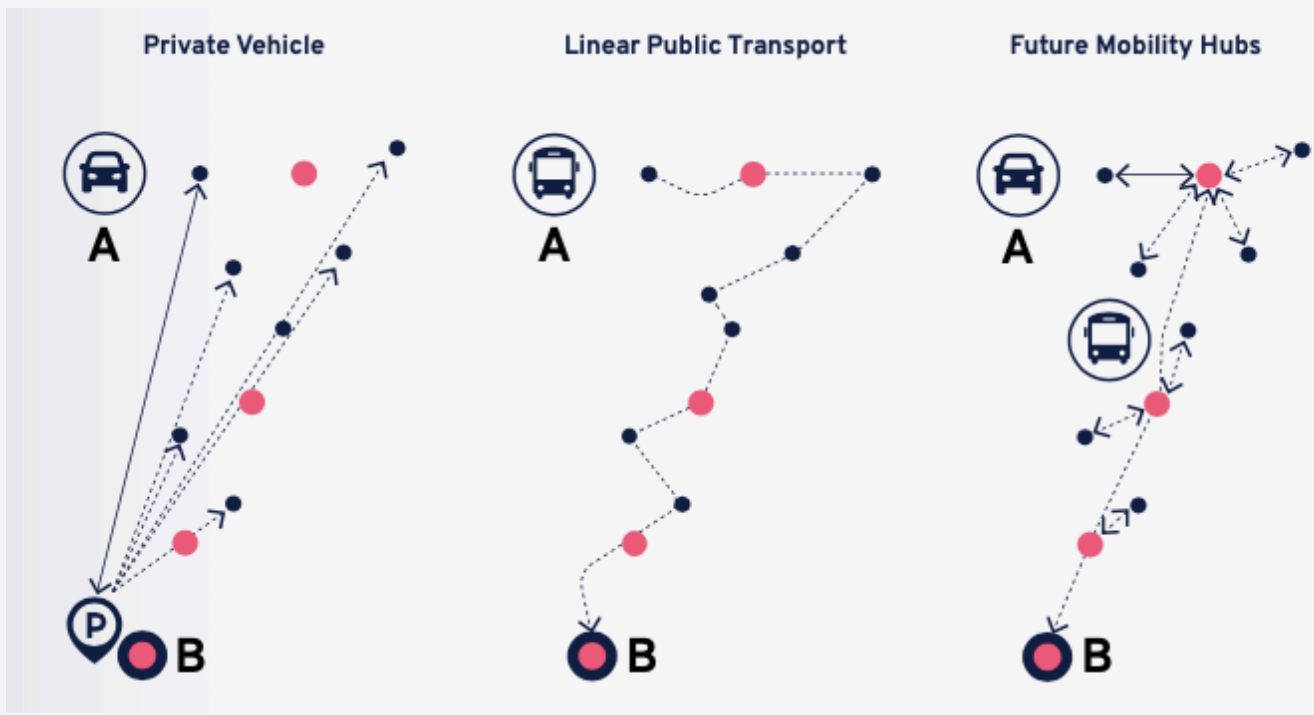


Figure 1. Difference in modes and benefits mentioned (Arup,2021)

<ul style="list-style-type: none"> <li>- Higher vehicle miles, carbon emissions and congestion</li> <li>- Multiple individual trips from A to B</li> <li>- High convenience</li> <li>- Shorter distance and journey times</li> </ul>	<ul style="list-style-type: none"> <li>- Lower vehicle miles, carbon and congestion</li> <li>- Single vehicle consolidates multiple trips</li> <li>- Lower convenience</li> <li>- Longer distance and journey times</li> </ul>	<ul style="list-style-type: none"> <li>- Lower vehicle miles, carbon and congestion</li> <li>- Trips networked around Future Mobility Hubs</li> <li>- Balance between efficiency and convenience</li> <li>- Shorter distance and journey times</li> </ul>
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Part of the reason exists because most of the sustainable transportation that will be part of a multi-modal hub is still being developed. With Schiphol's ambition of remaining as one of the world's most competitive and sustainable hubs, it currently struggles with identifying the wants and needs of users as well as the different modalities that will be integrated and beneficial to Schiphol in the far future. By taking it a step forward and understanding the context of each modality, we will be able to strategically connect modalities and

create a dynamic and seamless mobility experience for passengers from a local perspective to an international perspective. This may seem like a straightforward solution but there are many limitations that exist that could deter the outcome of this opportunity. There is no fixed timeline for when some of these technologies will come into existence and furthermore in use with passengers. To create a multi-modal hub, there will be new infrastructure required and Schiphol has a long leading time when it comes to implementing projects.

### 2.1.1 Problem Definition

The innovation hub at Schiphol has identified the need to transition towards a sustainable multi-modal hub to integrate these future modalities and align with their future vision. Currently RSG lacks a clear understanding and perspective on the scaling of new modalities and envisioning how they all connect in Schiphol's Multi-modal Hub. There is also a knowledge gap on identifying the needs and wants of passengers that would pave the research on scaling various mobility options and understand how they can be beneficial to Schiphol as well as how these modalities will connect and interact with one and another to create a fully functional multi-modal hub.

**The opportunity:** *How do various modalities connect at Schiphol's future multi-modal ecosystem to create a seamless mobility experience for its users?*

By exploring various trend research as well as co-creating with stakeholders, we will be able to better anticipate this future and create use cases to answer questions such as; will Schiphol be one location for all the modalities? or a dispersion of services across the Netherlands? What types of users will exist and how can RSG cater to them as a collaborative MMH?

### 2.1.2 Assignment

The goal of this project is to design a future strategic vision for Schiphol Group which consists of a proposition on how Schiphol Group should position itself as a multi modal ecosystem in the Netherlands and identify user needs and wants in order to provide its users with a seamless mobility experience by 2050. The graduation project will result in a critical and reflective report on the analysis of value that various modalities will bring to Schiphol and its users on its transition towards becoming an interconnected Multi modal ecosystem.

## 2.2 Design Process

For this project, I have adopted the double diamond process as shown in figure 1 as guidance while giving myself enough freedom to follow an iterative process based on feedback and reflection. The double diamond process has been considered in this project due to its nature to clearly identify the difference between the problem and solution space, which is preferable as the problem is not entirely clear in the beginning.

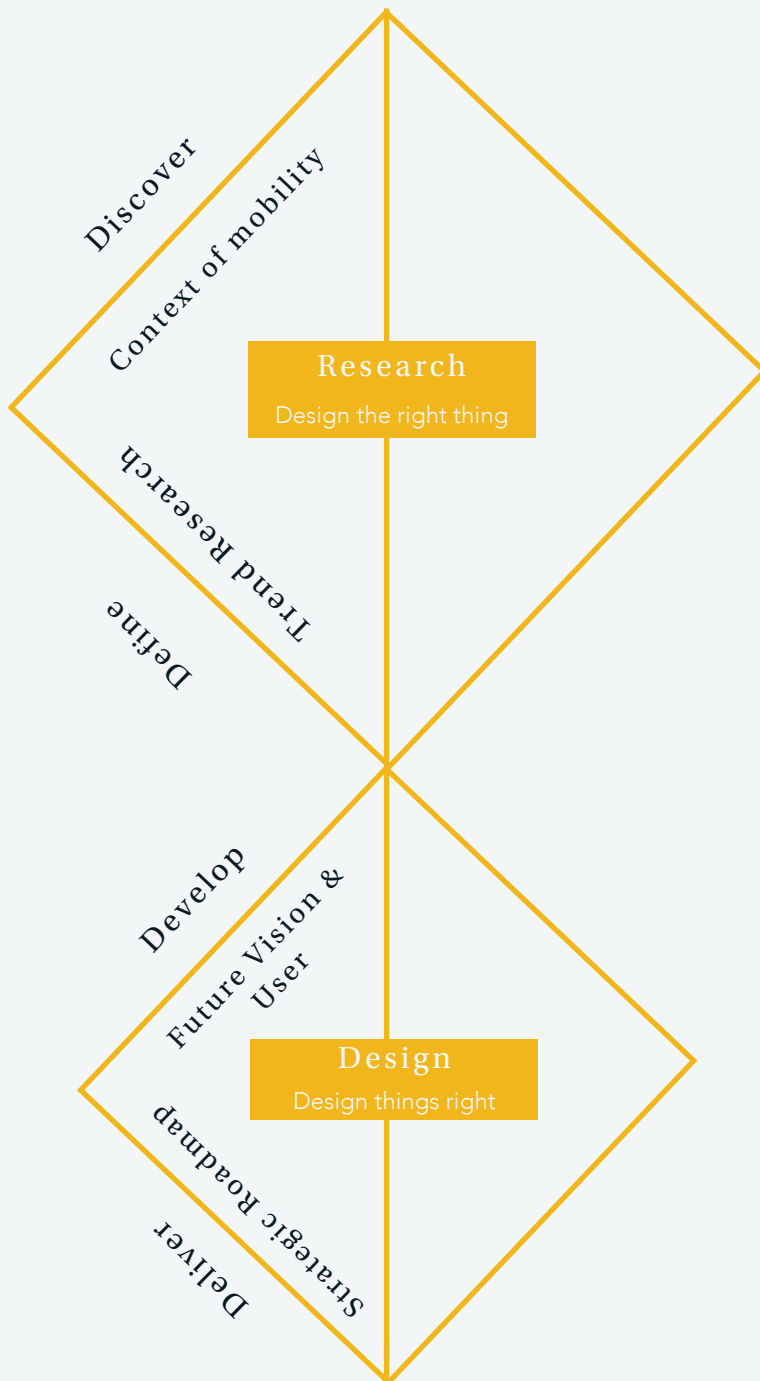


Figure 3. Double Diamond Process

### Discover

The discovery phase is used to discover all the knowledge necessary to understand the context of mobility. This phase is conducted through extensive desk research that consists of trend analysis, expert interviews and consulting internal documents.

### Define

The define phase helps to create a concrete design direction based on the research conducted. Themes are formulated by clustering insights found during the discover phase and further defined to scope the problem.

### Develop

The develop phase focuses on the ideation of the direction chosen. Ideation follows design principles and is tailored to the type of outcome generated. In this project, strategic design principles were used to ideate a future vision co-created with users. Further ideation using Vip methodology & unexpected consequences resulted in persona creation and use cases specific to the challenge defined in the previous phase.

### Deliver

The deliver phase focuses on delivering the final outcome to the stakeholders in question and iterating it based on their feedback. The testing was done in several phases with different stakeholders and finally presented the results to the wider business.



## 2.3 Strategic Design Approach

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Strategic design is getting far less blurry with more organizations starting to adopt its practices (Calabretta and Kleinsmann, 2017). While the process does not stray far from traditional industrial design, designers are starting to deconstruct complex ecosystems and think in holistic, solution-based strategies (Stompff, 2012 as cited in Verbaan, 2018). The design orthodox way of working (user centeredness, collaborativeness and prototyping) has also evolved from product-form-centric design in the industrial era, to experience (value-in-use) design in the service era, and digital era (Calabretta and Kleinsmann, 2017).

Strategic design proves valuable to large organizations in complex industries such as Schiphol Group because it uses design methodologies to dissect the complex and ambiguous layers of an organization's ecosystem, users, stakeholders and their business models. The birds eye view of a strategic designer as well as their ability to filter relevant information and translate that into design opportunities has elevated the role of design in organizations to one that imparts significant value in the system. It also allows organizations to stay relevant and ahead of their time by analyzing trend research and creating a holistic understanding of the future. Organizations like Schiphol that face constant threats from a competitive growing market as well as experience slow change from within the company need to adopt strategic design practices to remain relevant in the industry.

Together with exploring the customer's perspectives (Wise and Baumgartner, 1999 as cited in Calabretta

and Kleinsmann, 2017) and collaborating closely with users to meet their ever changing needs (Vargo and Lusch, 2008 s cited in Calabretta and Kleinsmann, 2017), designers can deliver meaningful experiences for large organizations. Collaboration with users is a core skill for designers and their focus is delivering a human- centered holistic experience. They are able to achieve this by "pursuing both emotional and functional fulfillment of user needs and achieve human-centeredness throughout a series of interfaces between the customer and the service system" (i.e. different touchpoints)" (Secomandi and Snelders, 2011 as cited in Calabretta and Kleinsmann, 2017 )

Designers are skilled at transforming data into new insights, but all value is lost if they do not align with the stakeholder's goals, roles and responsibilities (Kleinsmann, Valkenburg, and Sluijs, 2015). Collaboration has transformed from collaborating with users on a product level (e.g: production facilities) to collaborating with users on an ecosystem level (Mobility, Healthcare, etc).

This assignment therefore focuses on two phases: Phase 1: Comprises of understanding the context of the future of mobility and the ecosystem; and co-creating the desired future vision with stakeholders. Phase 2: Comprises of Developing the future vision and co-creating personas and use cases with end users which is later mentioned in this thesis (Refer chapter 6: defining the direction).

### 2.3.1 - Understanding the context of future mobility

In order to truly understand the context of future mobility, a deep dive into the current mobility ecosystem was done. The process kicked off with creating a modality radar that listed current and new modalities ranging from a local to international perspective. This step was crucial to get a good understanding of the increasing amounts of modalities that create a need for a MMH and stake out potential stakeholders for user research later in the process.

#### *Relation of users & mobility*

The study continued with researching the need for a multi modal hub in the Netherlands by understanding the relation between Dutch users and mobility (What is the preferred means of modality? what is currently lacking in the system? and what are current user needs?). This information would validate the problem statement mentioned in the brief and solidify the need to solve it. A brief study is conducted on the Royal Schiphol group to understand their vision, values, scope and partnerships. It allows the reader to understand the need for RSG to transform towards a multi modal hub.

#### *Expert Interviews*

On concluding that study, a range of interviews with experts on passenger experience and innovation from Schiphol were conducted to understand future passenger behavior in relation to Schiphol's airport and proposed multi modal hub. The interviews were conducted according to non-structured guidelines (Refer Appendix 1 - Expert Interviews) virtually. The interviews were better left unstructured because they allowed freedom for the stakeholders to freely speak about the development of the MMH and provide information unique to Schiphol. It was important to conduct these interviews initially to align with the stakeholders, goals and developments already taking place at RSG. The interviews were conducted individually with the stakeholders and lasted up to

an hour. The insights were recorded and analyzed for interesting quotes, challenges, or opportunities.

#### *DESTEP Methodology*

On gathering enough insights of the mobility context in relation to RSG without being too influenced by expert biases, I started to explore future trends and developments through the DESTEP methodology. DESTEP is an abbreviation and stands for Demographics, Environmental, Social, Technological, Economic and Political trends (Van Vliet, 2010). This design methodology allows designers to explore and analyze trends and development from a holistic perspective by considering all domains that can influence human behavior in society. The external environment can be divided into the Meso- and the Macro environment (Van Vliet, 2010). The Meso environment is the industry that the organization is active in and can influence this environment, in the case of RSG the meso environment is commercial aviation and cargo specifically. The Macro environment consists of all other factors that can influence the organization (Van Vliet, 2010). The DESTEP analysis allows the designer to explore the macro environment and provide organizations with information that could potentially influence them as well as analyze how far along a timeline these trends and developments will occur. In the case of an ecosystem as radical as mobility, there is constant change and disruptions created by advancement in technology, war, movement of goods and services that do not follow a linear progression in time. Hence, creating a timeline of events/trends proves valuable to ground a speculative vision. On these bases, the DESTEP methodology was used. Several rounds of research were conducted and analyzed to push the boundaries and gather truly future focused trends. The insights were clustered based on similar themes to reveal distinct design opportunities which were later validated with internal and external stakeholders.

### 2.3.2 Co-Creation workshop with external modality Stakeholders

A co – creation workshop was hosted with external mobility stakeholders to validate the trend research and co – create the future vision together. The workshop was conducted virtually to reach a wider audience and done simultaneously with all the stakeholders. By putting all the participants in one room, it was valuable to see how each of them reacted to the insights individually but also discussed with other participants how it could affect mobility on a whole and the entire value chain. Fruitful discussions that encouraged collaborations arose due to participants building off each other and realizing that the future will thrive on mobility against challenges and not competition against each other. The workshop was done according to structured interview guidelines (Refer Appendix 3: Co creation workshop) to prevent any restrictive mindsets from stakeholders and invaluable discussion on certain biases. The workshop consisted of interactive activities like quizzes, sticky notes and plotting graphs. The reason to do this was to engage the participants and irk them to have discussion pertaining to certain trends without relying excessively on any prior preparation or knowledge.

The participants selected for the workshop represented diverse types of modalities such as Hyperloop, UAM, Royal aerospace center and MaAs. These stakeholders were reached out to as they are RSG's primary stakeholders in the development of the multi modal hub and will be affected firsthand by the future vision. They also have great industry knowledge but lack a futuristic mindset due to their nature to solve incremental day to day challenges in their respective fields. The stakeholders approached are also primary stakeholders in the field of mobility and can influence the meso environment, hence, it was imperative to align them with the future trends and co-create the future vision so that they are also able to spread the awareness and work towards the same future vision. From the perspective of RSG, it was crucial to validate the research and create a human – centered holistic future vision.

## Conclusion

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Strategic design is the practice of deconstructing complex ecosystems and deriving holistic and solution-based strategies. Its practices are considered valuable for Schiphol because it allows the organization to remain relevant in a competitive, uncertain and complex industry. Together with co-creation with stakeholders, this project uses the insights gathered to build the foundation for a future vision on multi-modality for Schiphol. Therefore, the design approach of this project focuses on two main phases; (1) understanding the context of the future of mobility and the ecosystem; and co-creating the desired future with stakeholders. (2) Developing the future vision and co-creating personas and use cases with end users which is explained later in this thesis. To obtain the best results, several design methodologies such as DESTEP trend analysis, stakeholder mapping, expert interviews, workshopping, Unexpected consequences and more were used and tailored according to the information required. Having structured my design approach, the knowledge is used to start exploring the context of mobility. Before deep diving into the mobility ecosystem, an in-depth understanding of Royal Schiphol Group as an organization is required to create a foundation on which this thesis will be built.



# Royal Schiphol Group

An exploration of the Schiphol Group and its relation to mobility is conducted to form the basis of this project. This chapter will give the reader an in-depth understanding of the organization's values and way of working, before diving deep into the need for Schiphol to transform into a multi modal hub

### 3.1 History of Schiphol Group

In 1916, Schiphol was bought by the army and had its first flight landed on the premises. It faced many problems over the years, from soggy land with no runways to being completely destroyed after World War 2. While setbacks were large, the innovative mindset of Schiphol flourished and in 1926, Jan Dellaert created a new plan for the airport to ensure safety, capacity and accommodate changing technology ("Schiphol | Airport history", 2022).

In the 1980's an increase in competition paved the path for the hub-and-spoke concept: passengers flying from different airports to the same destination first travel to a 'hub', where they converge and all go on to take the same plane to their ultimate destination. Schiphol becomes one of the big European hubs, and in 1988 the central government designates Schiphol as a 'Mainport': an international air, road and rail hub and a major driver of the Dutch economy ("Schiphol | Airport history", 2022).

By shifting its value stream to appeal more passengers with the AirportCity concept, Schiphol aimed to become more than just a place where passengers arrive, depart or change planes. The goal is for the airport to become a kind of city that never sleeps ("Schiphol | Airport history", 2022). It has to have facilities for everyone: shops, restaurants and hotels, but also banks, a library, a museum and even a casino.

With the last vision achieved successfully, Schiphol Amsterdam airport has become the most connected travel hub in Europe in terms of direct connectivity and ranks third worldwide in terms of indirect connectivity (ACL, 2021). Their success has fueled their ambition to further create the world's most sustainable and high-quality airports as mentioned in figure 4. They aim to achieve this future vision by 2050 by relying on strengthening the four cornerstones that make up this vision. The four cornerstones are;



Figure 4. Royal Schiphol Group, Future Vision 2050

#### Quality of life

"Schiphol Group aims to operate zero-emissions and zero-waste airports by 2030" (RSG, 2021). Their focus is on ensuring a healthy living environment for residents and communities while doing so according to the sustainability goals (RSG, 2021).

#### Quality of Service

"Schiphol Group aim is to be the first choice for its stakeholders and users. They aim to achieve this ambition by orchestrating smooth and inspiring passenger journeys enabled by the latest technology and trends that impact user experience in a positive way (RSG, 2021).

#### Quality of Network

RSG is the center of facilitating an open economy for the Netherlands due to its connectivity with the world. This pillar focuses on ensuring better and stronger connections to and from the Schiphol airports to facilitate the economic growth of the Netherlands (RSG, 2021).

#### Safety & Robust

The focus of this pillar ensures safe and responsible travel for its users and robust organization for its employees and stakeholders. RSG aims to be a financially resilient, flexible and forward-thinking organization (RSG, 2021).

## 3.2 innovational mindset of RSG

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Dating back to the dawn of flight, Schiphol Group has been a leader of the aviation community and its employees see themselves as innovators. To push the aviation industry forward, it is imperative to keep exploring (disruptive) opportunities that challenge the status quo. To make this possible, a central Innovation Hub was formed, which has since started to coordinate and accelerate long-term transformational and disruptive innovation projects at Schiphol Amsterdam airport. Together with smaller innovation hubs formed at the regional airports, collaborative innovation is maximized towards the overall strategy and vision of RSG.

## EARTH

The earth initiatives include incremental innovations. Improvements to day-to-day challenges, executed in well-understood steps. It helps to expand our current reality.

In order to boost creative output, the innovation hub has developed their own way of working, which creates a feeling of sense in our rapidly changing world. The idea is to look beyond the horizon by distinguishing three types of innovation that help navigate the uncertainty ahead:

# MARS

Mars initiatives explore disruptive innovations. Introducing new value chains or operating models. Exploring a distant future, we cannot even envision yet.

# MOON

Moon initiatives focuses on transformational innovations. Fundamental changes to the workings of existing value chains. Exploring an achievable future, we can envision.

The innovation hub mainly focuses their innovation efforts on Mars initiatives, which are referred to as 'innovation families.' There are currently six innovation families and each consists of several projects/initiatives being worked on respectively towards their parent theme. The innovation families include;

Sustainable Aviation	Projects concerning sustainable ways of aviation. E.g Sustainable aviation fuel
Autonomous Airside	Projects that work towards creating an Autonomous airside. E.g Sustainable taxiing
Future Baggage	Projects focusing on creating a better baggage system. E.g Remote baggage check in, Hot & cold separation to manage peaks.
Multi modal Hub	Focuses on projects that help integrate new modalities into RSG and transform into a MMH. E.g MaAs, hyperloop and this project.
Digital Identity	Emerged during the pandemic and focusses on creating a digital identity of the passenger. E. g Antifragility in airports and trying to make RSG more resilient for future pandemics or setbacks.

All the other innovation families have a concrete future vision which was created based on strategic design principles and co-creation with stakeholders. Initiatives are then added over time as projects to achieve the sub vision which ultimately together with the other innovation families contributes to the overall future vision and strategy of RSG. In the case of MMH family, there is a lack of research done to create a co-created future vision, as a result one can follow the incoherence in initiatives currently been developed at RSG towards a MMH.



## Conclusion

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To conclude, The Royal Group of Schiphol has always fostered an innovate mindset throughout the course of their history and its impact has led to the formation of a central innovation hub that solely focuses its efforts towards realizing long term transformational projects to keep Schiphol airports relevant and innovative. RSG's current future vision claims to create the world's most sustainable and high-quality airports by strengthening their four pillars quality of life, quality of network, quality of service and quality of service by the year 2050. To realize this vision, the innovation hub is tirelessly working on initiatives under innovation families that together help to realize RSG's overall future vision.

The multi modal hub family is gaining momentum within the innovation hub as it is directly related to achieving the overall future vision for RSG. Further research conducted in this thesis will allow the reader to understand how transforming into a multi modal hub will contribute to a strengthened network, better service, resilient organization and better quality of life for users. However, first an understanding of why we need a multi modal hub and why should RSG transform into one will be explored in the next chapter.



# Context of Mobility

Having elaborated on the motivation for this master thesis as well as the innovative mindset of Schiphol group, I will clarify the need for a multi modal hub by conducting research on the complex mobility industry. This includes understanding the various mobility developments, the stakeholders and user behaviors within this industry. Furthermore, light will be shed on Schiphol's internal reasons to transition towards a multi modal hub. All this information forms the basis to understand why we need a multi modal hub and why should Schiphol transition to a MMH.

## 4.1 Multi Modal Hub

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Future multi-Modal Hubs will be a cluster of structures that provide users with various transport modes allowing people to switch easily between one mode and another. Several transport operators will collaborate to enhance passenger travel experience by providing them accessibility, convenience, efficiency and sustainable ways to plan their travel. Multimodal hubs go further than just providing users with modalities and offer services such as integrated information, unified payment platforms and more (Arup, 2021).

Paving the way for MMH's does not mean building from scratch but rather developing around existing transport infrastructure such as bus stops, airports, railway stations, etc., while increasing accessibility and mobility around them. New opportunities will be created due to increased movement of people around these MMH's which will result in strengthening the economy in local neighborhoods and creating new revenue streams

(Arup, 2021). Future multi-modal Hubs can adapt over time as new modes such as Hyperloop, UAM, drones and services become available.

A hub, node and spoke approach optimizes network performance and opens corridors to newer routes. "Hubs provide flexible interchange options with a choice of appropriate modes to reflect journey demand. This approach will allow people to travel between different origins and destinations efficiently and without the need to travel long distances to interchange." (Arup, 2021)

"The primary objective of MMHs will be to facilitate improvements in how we access and use existing and new modes for sustainably moving around our towns and cities" (Arup, 2021). This not only includes getting new modes of travel but the ability to tailor public transportation to fit user needs and demands.

## 4.2 Modality Radar

In order to understand the need for RSG to strengthen their transformation towards a MMH, an exploration of the mobility context is valuable. The mobility industry is vast and constantly changing, the biggest change one can put a finger on is the type of mobility that is developed. Hence, the first step is to understand the types of mobility options currently available as well as those being developed for the future. A modality radar was created that listed every modality option in its distinct sphere (see figure 5).

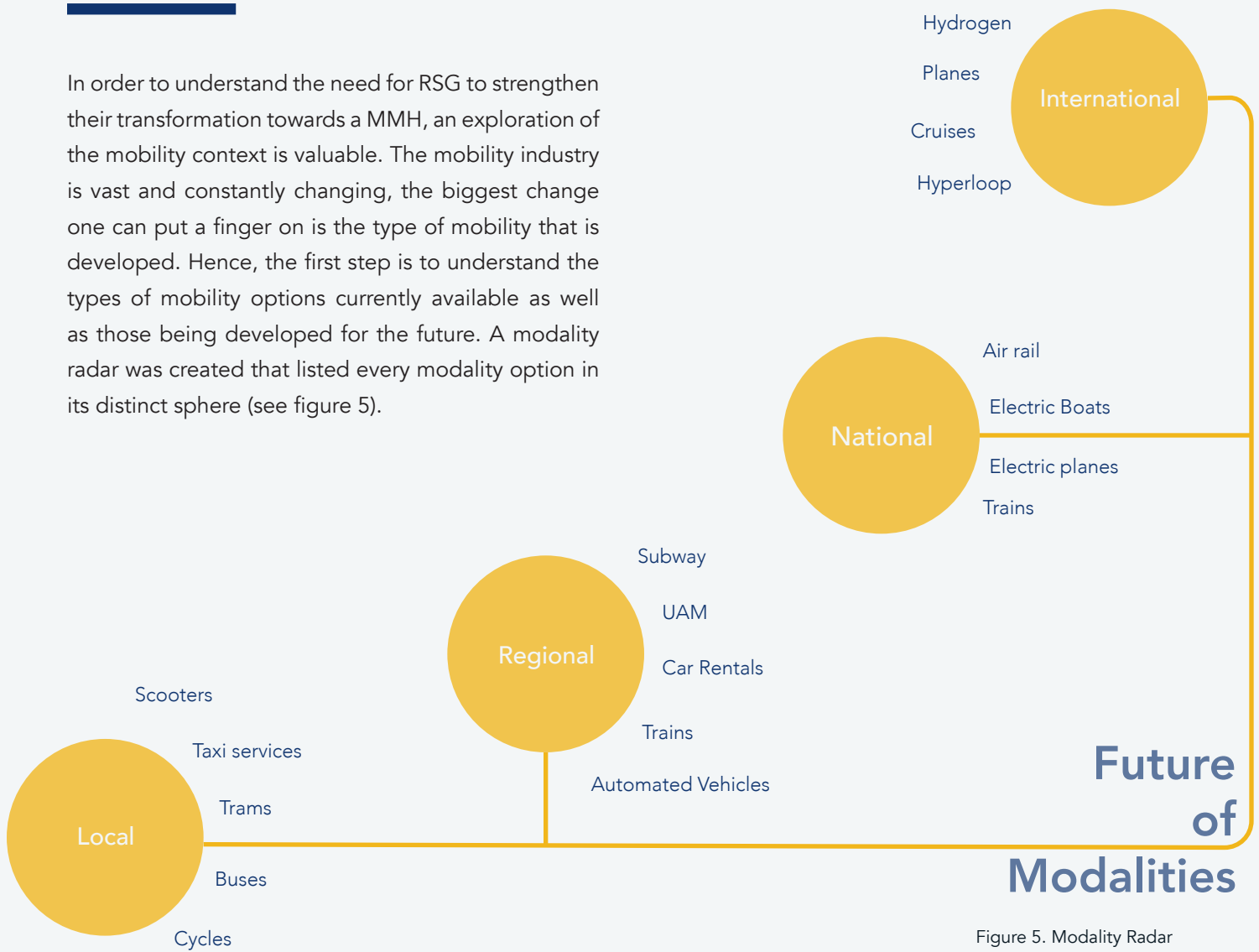


Figure 5. Modality Radar

A modality radar was created that ranged from local to international and listed every modality option in its distinct sphere (see figure 5).

In this context, the focus was broader than mobility options in the Netherlands and covered a huge spectrum from all over the world to design for a future universal multimodal hub.

At the Local level in figure 5, studies indicate that the modality options present are bicycles, E-bikes, Bike sharing services, Ride hailing services, scooters, buses and Trams. At a regional level, one can find the Subway, Urban air mobility and ride hailing services (Taxi's and Uber's). On a national level, studies indicate that the train, electric boats and cars (rental/owned) are the best choice of modalities available. Finally,

planes, E-planes, Hydrogen planes, Hyperloop and Cruises are the modalities that can be used to travel internationally (Arup, 2017). The levels were created to give an understanding of the extent to which a mobility type is capable of going as well as their extent and infrastructure in which they are used.

From this literature, the reader is made aware that the number of modality options are only going to increase in the future with the sole purpose of transporting users from point A to point B seamlessly. The point of concern arises when thinking about how these different modalities will co-exist within a MMH and serve its purpose to the users.

## 4.3 Mobility in the Netherlands

On scoping the various modal options in the previous chapter, one can argue that there would be a direct correlation between the number of people who use public transport and number of modalities to transport them. Or else why would governments and tech companies spend billions of dollars on research, resources and infrastructure if not for the proper use of the people? Contrary to widespread belief, current statistical data on the usage of mobility services in the Netherlands shows otherwise.

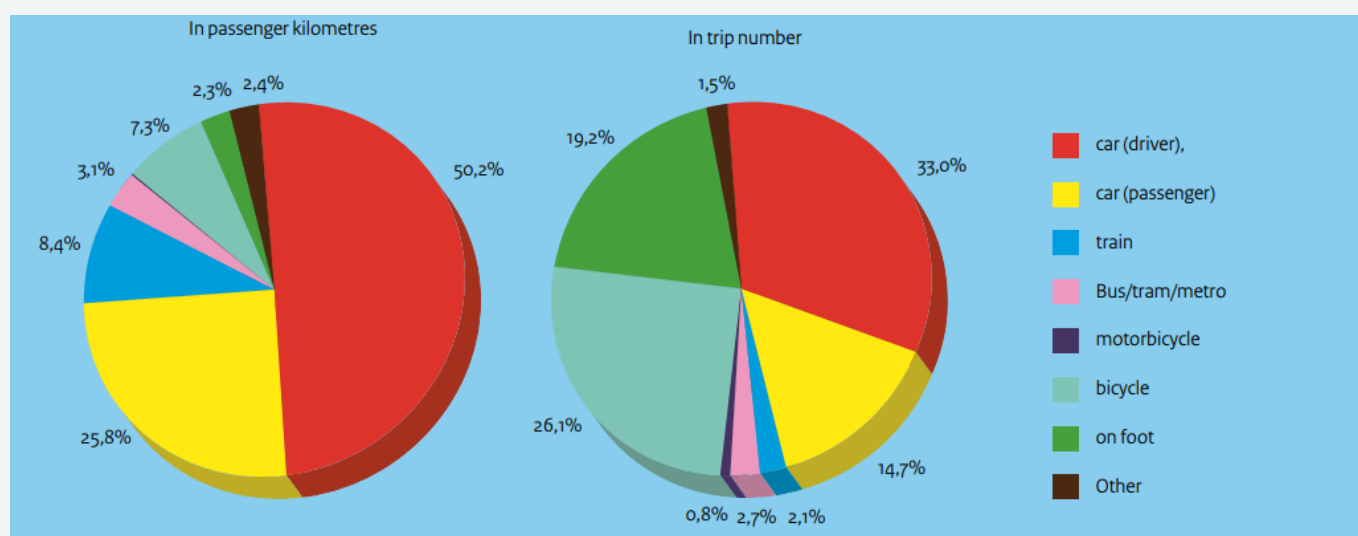


Figure 6. Modal split in the Netherlands in (1) passenger kilometres performed and (2) trip number

The Netherlands is a densely populated country with 16.5 million inhabitants and the Dutch population generate a whopping 4.5 million trips by bus, tram and metro in the Netherlands on a daily. They complete an average of one million trips by train and at least 14.5 million by bicycles. However, on closer inspection of the modal split in Figure 6, the first choice of mobility option in the Netherlands remains a privately owned vehicle, making up to 50 % of kms travelled and number of trips taken. Cycling and walking are the second most preferred ways of modalities.

This means that people prefer taking their own private modes of transportation rather than using public transportation on the basis of accessibility, convenience and flexibility of use. Public transport can be a hassle due to the fragmented and inconvenient process. Newer, Faster modalities and snazzy technologies are not going to solve these challenges but creating a space that gives users the freedom to access the modality of their choice and providing them with a seamless and personalized experience would help encourage users to gradually switch to public transportation and ditch their privately owned vehicles. (Refer Chapter 4.1, 5.1, 5.2.1)

## 4.4 RSG - Local to Global

Now that we have analyzed a need for a multi modal hub, there is relevance in understanding the need for RSG to strengthen their direction towards a MMH. The research is conducted by exploring the ecosystem of RSG as well as the macro environment which is further elaborated upon in chapter 5.2 (Trend analysis)



Figure 7. Royal Schiphol Group Partnerships

As previously discussed in this report, a multi-modality hub is one where users can easily switch between various types of modes. By definition, Amsterdam airport Schiphol is already considered as a multi modal hub due to its nature of connecting people from interconnecting flights to trains, buses, taxis and car parks.

Over the years, Schiphol has become one of the best-connected hub airports in Europe, with 296 direct destinations. In 2021 amidst the Covid'19 pandemic when commercial aviation was the most affected, 25.5 million passengers (about the population of Texas) were served by the Dutch airport. As shown in figure 7, Schiphol Group is the owner and operator of Rotterdam the Hague Airport and Lelystad Airport and holds a major share in Eindhoven Airport (Royal Schiphol group, 2021). Apart from its regional partnership, RSG also holds major shares in international airports as shown in figure 7. This existing extensive network on a national and international level boosts RSG's position in the field of multi-modality.

Currently each airport on a regional level operates flights daily but there can be an exciting opportunity for RSG to spread out various modalities and functions to specific airports, hence, solidifying themselves as a

multi modal ecosystem. Amsterdam Schiphol airport also ranks number one in its connections across the Netherlands. A huge opportunity gap is created in proper use of existing resources towards a MMH, such as the extensive train connections to Schiphol or the entirety of Lelystad airport, due to the lack of a shared understanding towards a proposed future vision.

Amsterdam Airport Schiphol currently operates on the 'Hub' and 'spoke' concept. According to this concept, passengers flying from different airports to the same destination first converge at a 'Hub' and then get on the same flight to their final destination (RSG, 2021). The term is coined based on the analogy of a bicycle wheel, with the hub being the center and spokes originating from the center outwards representing the flight routes. As mentioned in chapter 4.1, a hub and spoke approach optimizes a multi modal hub and hence, strengthens the need for RSG to transform into a multi modal hub.

Finally, the overall future vision for Schiphol mentioned in chapter 3.1 creates a compelling reason for RSG to adopt the multi modal hub system in order to increase their overall quality of network, service and life.

## 4.5 Stakeholder Mapping

“A stakeholder is any person, group, or institution that, positively or negatively, affects or is affected by a particular issue or outcome. We identify stakeholders as people, institutions, or social groups that are involved in, or affected by, decision-making regarding particular design issues” (Retegi and Predan, 2019 as cited in verbaan, 2018).

In the case of RSG, a stakeholder analysis is done and mapped to create a good understanding of the various stakeholders that will influence or are directly influenced by the transformation of RSG into a MMH. (See figure 8)

In this thesis, the main focus is put on the end users (passengers) and other modalities as the brief of this project emphasizes in the beginning. Not only does this stakeholder map create an overview of the ecosystem but highlights the value exchange between stakeholders which will create the foundation of relevant knowledge to build this thesis on. In order to remain within the scope of the project, airline carriers are not considered throughout this project as aviation has remained constant for years and RSG has enough knowledge on the subject to make appropriate decisions for the future

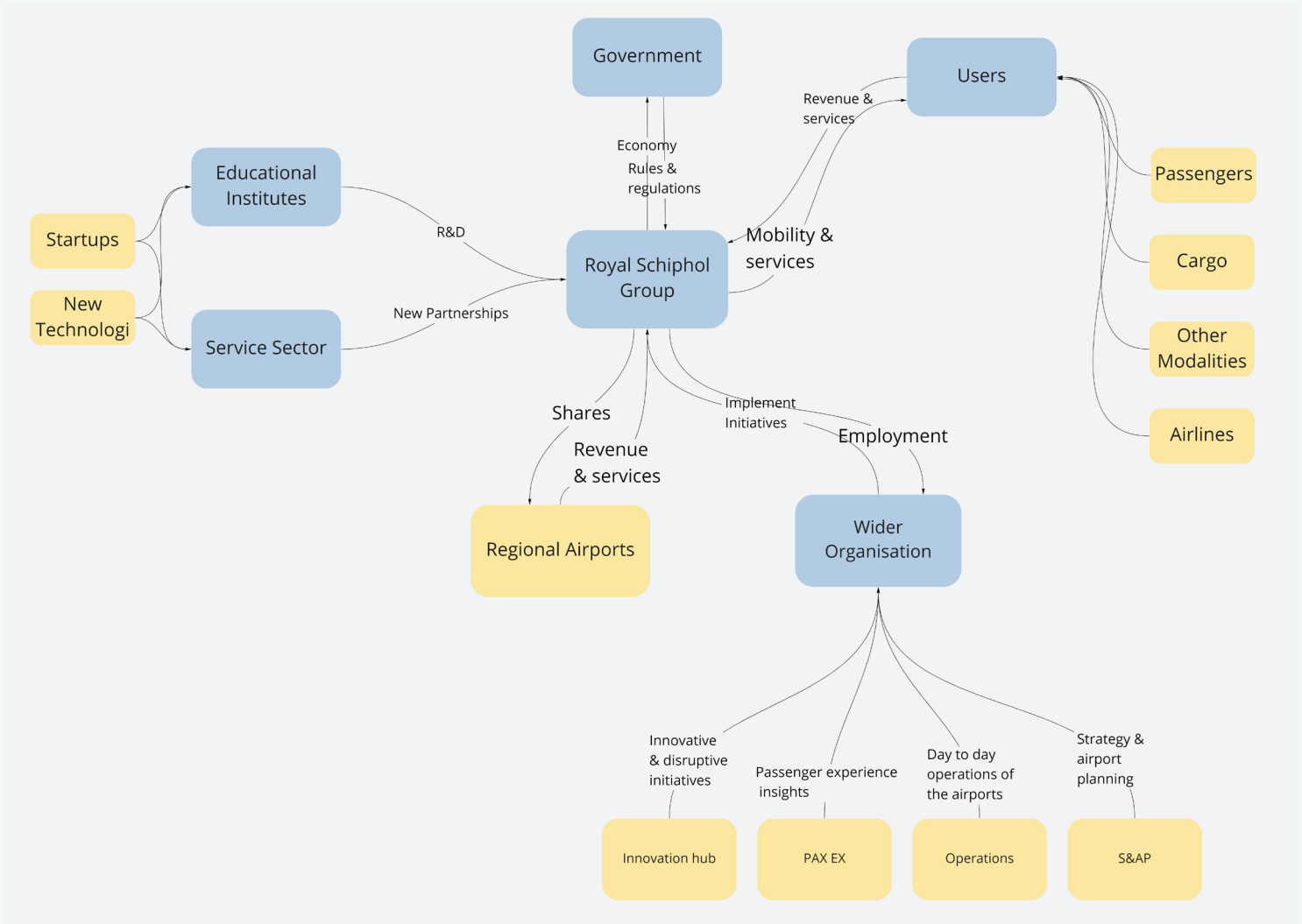


Figure 8. Stakeholder Map

## Conclusion

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To conclude this chapter, a future MMH is one where user can switch between various modalities easily. It will arise around already existing infrastructure and function on a hub and spoke concept. The MMH primary function will be to facilitate improvements to how we access public transportation with seamless experiences. MMHs are growing in popularity due to the rising nature of newer, faster and sustainable modalities and better mobility experiences tailored to the user. Modality options exist at each level ranging from local to international, and it is getting more evident to explore how these modalities will co-exist on a hub level.

Users still prefer to use their privately owned vehicles and the question still lingers how can we transform user behavior? Furthermore, RSG is proving to practicing the notions of a multi modal hub such as the 'hub and spoke' concept and connecting users with different modalities but without a clear direction to follow, a huge loss of opportunity is evident. A stakeholder map is analyzed to create an overview of various stakeholders and value exchange within this ecosystem, emphasis on the end passenger and other modalities is considered throughout this project as knowledge gap exists on this domain within RSG. Having created a solid foundation for the need of a MMH and exploring stakeholders within it, the next chapter explores the macro environment through trend research to start building a concrete future vision for RSG.





# Trend Research

This chapter explores trends and technological developments that can disrupt/ change the mobility industry over the years. This chapter is most important to understand the future context of mobility and creates the foundation of a holistic perspective in which the desired future vision will be created. First, I will explore three main trends currently disrupting the industry. Then I explore future focussed trends which prove more valuable for RSG and finally I validate these trends through a co-creation workshop with mobility stakeholders. The chapter concludes with insights that pave the way for creating a new future vision of RSG as a MMH.

## 5.1 Expert Interviews

### Introduction

Expert interviews are important because they allow you to quickly deep dive into industry knowledge and uncover a lot of truth from experts in the field without forming too much of a single bias. They are considered a vital resource in future oriented projects as their insights are used to fill knowledge gaps, insinuate provocative viewpoints and counter arguments (Evans, 2011 cited in Verbaan, 2018) In this instance however, Schiphol does not have a dedicated team working on the MMH project within

the organization which was a struggle to find relevant stakeholders to interview and gain knowledge from. Most of the organization still believes and functions as an airport and only will transform to a MMH once there is a future vision in place alongside sufficient research and co-created implementation strategies including high profile modalities such as Hyperloop, UAM or Hydrogen planes, ignoring the fact that Schiphol is in theory a multi modal hub and connects passengers to a vast number of modalities already.



Figure 9. Departments within RSG from where experts were interviewed

Despite these limitations, expert interviews were conducted with internal stakeholders from Schiphol who excelled in passenger experience and innovation as illustrated in figure 9. They were the key to providing industry knowledge and aligning with initiatives that are currently being implemented at Schiphol. The interviews were conducted according to semi structured interview guidelines (Refer Appendix 1: Expert Interviews) and paved the initial path to scope my project and find gaps of opportunity. The interview was recorded and insights were analyzed to cross reference during desk research to create a complete and compelling narrative

## Insights

*“The future passenger wants accessibility, flexibility and options.”*

Speaking about user behaviors, the expert also mentions mobility as a service and the unification of various stakeholders on a single platform to create a seamless experience for passengers. These thoughts were resonated by all experts, that collaboration and unification amongst stakeholders was weak which resulted in a fragmented process. It is interesting to note from the insights that there is an evident shift in value streams for RSG as it undergoes its digital transformation.

From being a plot of land that facilitated a modality and good connection times, the focus is now shifting on providing seamless experience for passengers and offering mobility as a service. An expert from PAX EX ended the interview stating, *“RSG could remain relevant in the future by shifting its value stream from being an airport to a service provider.”*

Focusing on the words ‘could remain..’ highlights a level of uncertainty about the future and what is expected out of Schiphol Group. The lack of awareness and direction towards transforming into a MMH becomes evident in the final quote.



## Conclusion

It is evident through the interviews that certain stakeholders within Schiphol were thinking about the MMH through user focused change such as mobility as a service, seamless mobility and data enabled mobility, but the challenge they face is not having strong and compelling insights on the future users’ needs or a strong holistic perspective on the future. The insights were generalized and could be used in any context of mobility, which does not create a coercive case for the organization to transform and adopt this change as RSG has always had unique problems to deal with as opposed to its competitive hubs from around the world. Having gathered insights from within the organization on a meso level, it is now interesting to explore the macro environment through various trends and developments that will shape the future of mobility, and eventually create a holistic future perspective in which the future vision for RSG MMH will fit.

## 5.2 Current Trend Analysis

The world of mobility is currently transitioning towards four main trends / technological developments, i.e.; Mobility as a service; Seamless mobility, Data enabled mobility and new communities being formed around multi modal hubs. While the focus is on these trends, there are many more mentioned that give the reader a complete idea of the current context of mobility. Please refer Appendix 2: Trend Research

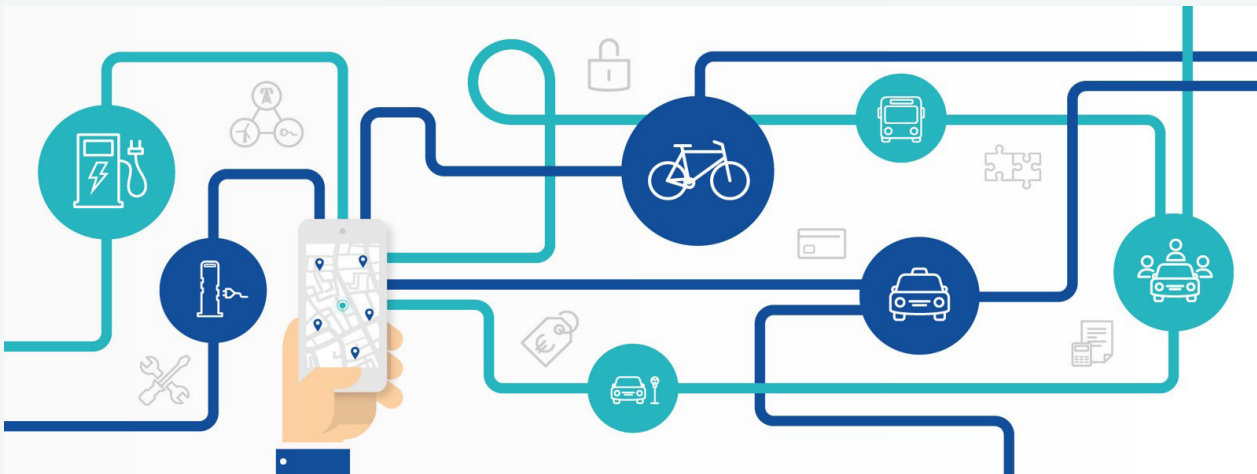


Figure 10. Mobility as a Service

### Insights

#### Mobility as a service (Seamless mobility):

Mobility as a service (Seamless mobility): Evidence suggests that by 2025, privately owned cars will become obsolete. Urban dwellers will prefer to use public transport, ride sharing and hailing services to lead a sustainable lifestyle, avoid congestion and expensive city fees. (Deloitte Insights, 2017). Mobility options will be offered on a unified platform as a service as illustrated in figure 10 where users will be able to plan the most optimal

route, switch frequently between modalities to reach their destination and have unified information and payment options. Mobility as a service helps users to have more accessibility, flexibility, and efficiency in their journeys. An example of Mobility as a service is a mobile application called Whim, which is currently introduced in Helsinki. The concept is similar to Netflix, where you can subscribe to all your transport needs. The ticket purchased allows users to use it on all modalities and is even extended to renting cars and bicycles. (Deloitte Insights, 2017).

## New Communities are being formed around a MMH:

New Communities are being formed around a MMH: Mobility hubs or 'nodes', where you can switch from various modalities also offer flexible workplaces, fitness and food amenities, e-commerce collections points as illustrated in figure 11 (Deloitte Insights, 2019), Hence increasing economic activity in neighborhoods but also giving users additional value for the time spent commuting.



Figure 11. Illustration of a thriving multi modal node.



Figure 12. Various data collection points to create a seamless user journey.

## Data Enabled Mobility:

In order to power mobility as a service, data will be collected at each point in the journey as illustrated in figure 12 to analyze and predict the users journey. An integrated platform called "Next OS" that will serve as "the brain of the entire transportation system." Next OS—central to achieving systemwide optimization—will turn integrated data into insights that planners can use to better manage transportation systems and the movement of people and goods (Deloitte insights, 2019).

Large organizations such as RSG that are really good in what they do, tend to find it hard to adopt radical disruptions and often face the dilemma of getting disrupted by smaller companies. UBER and LYFT are such examples and are current market dominators for these trends. They do a great job at providing mobility as a service to its users. Schiphol on the other hand is now starting to convert these trends into reality by creating a service platform that unites different stakeholders and gives users a seamless passenger experience. Tech

companies are known for their fast-paced innovations and capabilities to make independent decisions. Due to the radical nature of the mobility industry and the constant technology advancements that cause new disruptions, Schiphol is often left playing catch up due to "politics and difficulty to adopt change in the organization" (Stakeholder interview, 2022). For Schiphol to truly become early adopters of innovation, they need to design for the far future and begin taking decisions from today towards the desired vision.

## 5.2 Future Trend Analysis

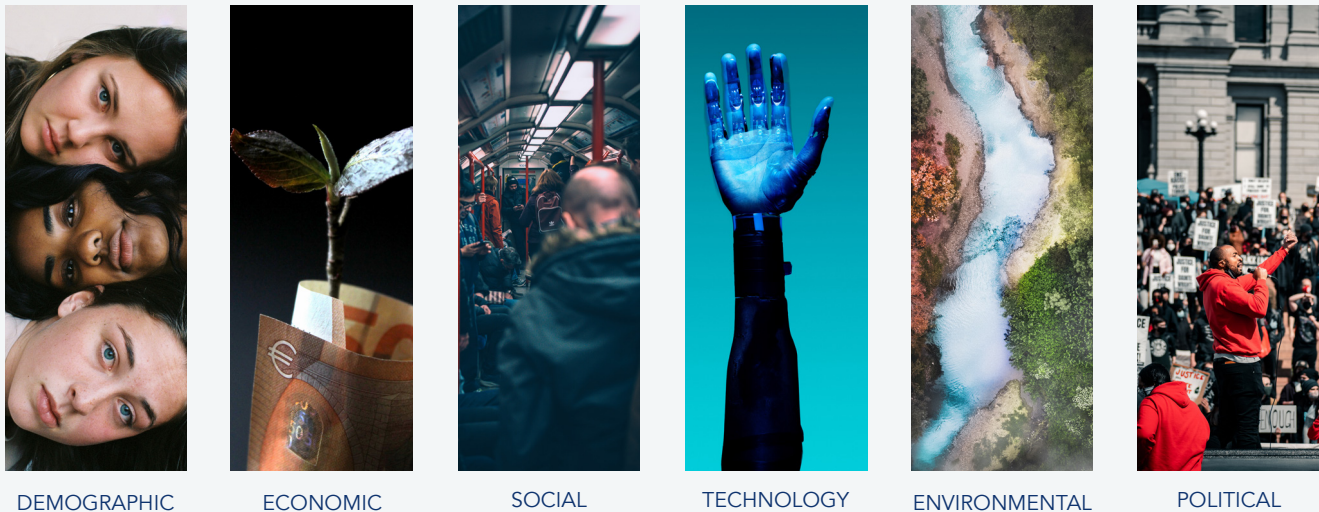


Figure 13. DESTEP methodology

### Introduction

In order to bring value to Schiphol and innovate for the future, an Indepth trend analysis was conducted using the DESTEP methodology (Van Vliet, 2010). The DESTEP methodology proved most effective when having to collect trends from all domains as mentioned in figure 12 and create a holistic understanding of the future context of mobility.

As previously discussed in this report, the mobility ecosystem is large and can be dependent on a number of factors and societal triggers. The research allowed me to collect several independent developments and trends which were clustered together based on similar themes to create a complete future scenario.

The scenario's are as follows;

# Insights

## #1 Water Natives

Research predicts that the ocean level will rise from 20 cm to 90 cm in the 21st century with a status quo of 50 cm as opposed to the 20th century which recorded it as 10cm (Vincent Callebaut Architectures, 2022). “The international scientific scene assets that a temperature elevation of 1°C will lead to water rising of 1 meter. This increase of 1 m would bring ground losses emerged of approximately 0.05% in Uruguay, 1% in Egypt, 6% in the Netherlands, 17.5% in Bangladesh up to 80% approximately in the atoll Majuro in Oceania (Vincent Callebaut Architectures, 2022). “Researchers are

exploring a new approach to building offshore hubs of habitation, commerce, education, and recreation designed to ease pressures facing coastal cities squeezed between rising populations, rising seas and storm risk, resource limits, and threatened ecosystems” (Revkin 2019). Utopian and dystopian visions of our humanity shifting from land to sea have been prevalent for years but in more recent times, drastic steps have been taken to construct new ecosystems on / under the water.



Figure 14. Lilipad, Amphibian city by Oceanix

Oceanix, a company created by a mix of partners including Danish architect Bjarke Ingles are currently developing an amphibious city. Lilipad is a prototype that showcases a galaxy of satellite floating hexagonal modules that will be connected to form arrays and host sustainable workplaces, housing, recreational facilities, agricultural ecosystems and more (See Figure 14). Ferries and drones are said to be used to commute within this utopian city (Vincent Callebaut Architectures, 2022).

More developments include an underwater city that could become reality by the year 2030 as claimed by the Japanese engineering company named Shimizu Corporation. The city design features a habitable settlement on the surface and uses the resources of the ocean to be self-sufficient. The city named Ocean Spiral (see Figure 15) can provide its inhabitants with housing and working facilities as well as energy, food and water (Jordahn, 2017).



Figure 15. Ocean Spiral city prototype by Shimizu Cooperation



Figure 16. Under - underwater restaurant in Norway



Figure 17. Amphibio - Garment to breath underwater

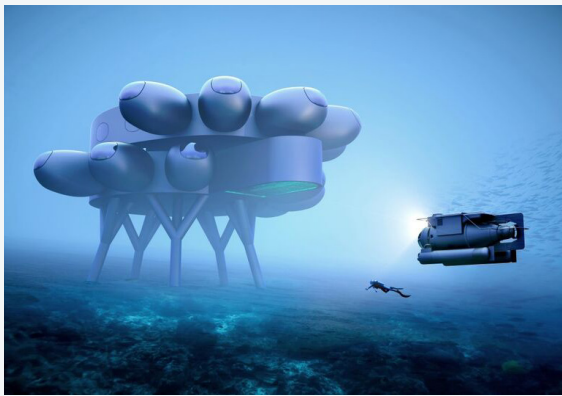


Figure 18. Prometheus - Underwater research Lab

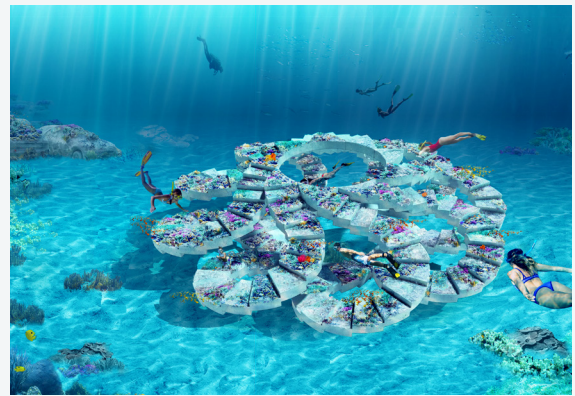


Figure 19. The Reef Line - Underwater sculpture park

This trend of shifting habitation from land to offshore is further solidified by the smaller developments that are currently taking place such as Europe's first underwater restaurant opening up in Norway (Fig. 16) (Gibson, 2020), Royal college of art and design student Jun Kamei creates a garment that can allow users to breathe underwater (Fig 17) (Hitti, 2018), Prometheus is the first underwater research lab developed for scientists to develop a self-sustaining ecosystem underwater by famous architect Yves Beher (Fig 18) (Block, 2020), OMA designs an underwater sculpture park and The Reefline for Miami (Fig 19) (Gibson, 2020).

Amidst the growing trend of increase in water levels globally due to Global warming, one can only ask what is the world of mobility and transport doing to facilitate a successful shift of humanity from land to offshore living? And more importantly how does Schiphol remain antifragile in this transformation? Important questions can be asked here such as; What will travel look like with people living and working offshore? How will country borders be divided and will people migrate to settlements based on their nationalities or based on their livelihood and interests? This further poses the question of whether necessary travel will shift from people to cargo and services? Emphasis has to be placed on the shift in human behavior and social values and how that will transform the mobility industry.



## #2 Isolation over Socialisation

The future is heading towards a society where human to human interaction will decrease by 30% and there will be preferred desocialization which will result in serious consequences (Gorescu, 2014). Newer services, AI and machine learning have users yearning for more human to machine interaction as opposed to speaking to another human which can be seen in figure 21. The effects of these trends have resulted in social anxiety amongst newer generations and has been drastically increasing after the world was forced to lockdown during the Covid'19 pandemic and society was forced to communicate to or through their machines. This trend will only continue to grow in the future and extreme consequences will result in a

downward spiral in social behavior. "A lack of physical interactions in a person's youth will create a strong protector ego that will repulse human interactions and will generate people with lack of confidence and a huge low self-esteem problem. It will not be as bad as it seems, people will be protected in their own world with multiple channels to interact in a protected (id wise) way. The good side of this equation is freedom of choice and equality of opportunity for most of the people around the world. Real time translation and personalized cognitive learning process will be available for anyone globally. Repetitive or forced work will be done directly by machines and humans will leave their peak of creation." (Gorescu, 2014).



Figure 20. Image showcasing a woman in a relationship with a robot.



Figure 21. Young millennial seeking virtual assistance in a supermarket.

Physical interactions will be limited to intimate affairs with friends and family or formal business meetings, while 80% of the remaining interactions like working, shopping, commuting, dating, etc will be done through a machine (Gorescu, 2014). The consequences predicted from this trend is that humans will become more shy and social interactions will mimic the ones we had during the middle ages. As an impact of this trend, we will see an even bigger demand for new experiences and travel, where people will travel to remote locations to isolate.

A deeper insight into this trend also focuses on intimate relationships transforming from a feeling to more of an attitude or social construct. People around the world are choosing to remain single and old stereotypes of marriage and needing a partner are starting to fade as Netizens continue to form new bonds over the Internet or with robots. Figure 20 depicts a woman enjoying a cup of tea with a robot signaling that social constructs are changing drastically with advancement in technology.

“In 2021 more than 37.5 million American adults live alone. In Sweden, Denmark, Norway, and Finland – countries with some of the highest living standards – about 40% of households consist of just one person. By the year 2030 this percentage will have increased by 50% or more, depending on the country. The numbers show that millions of people around the world are living single lives devoid of long-term or serious romantic relationships. Such people are called “singletons”. Collectivism, including family life, is, for the most part, a relic of the past. Instead, these people live for the sake of self-development, and their lifestyle is progressive” (Holzel and Ruzas, 2021). These users are comfortable with their independence and feel like they do not need a partner for activities as depicted in figure 22.

# 37.5 million American live alone

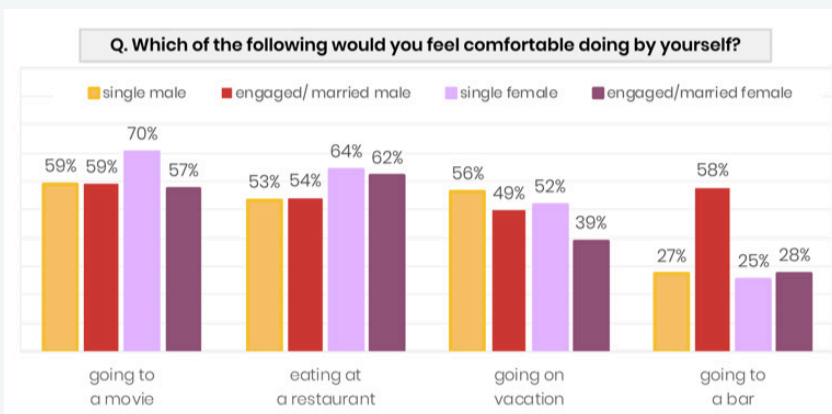


Figure 22. Statistics depicting singletons comfortable with doing activities. (Ypulse, 2019)

# 75% singles want to solo travel

As trends suggest people might grow more and more distant physically, but increased accessibility and opportunities create a smaller world, one can only ask, how will increased isolation amongst people affect social behaviors in relation to travel and commuting? Will travel become more of an escape from reality? Will people in the future value services where they can interact with nature, animals or robots over humans and what does this mean for Schiphol as a service provider? Will this shift in interaction trigger new jobs for people to train/cultivate robots, nature and animals in our society to help with reduced human interactions of the future generations?

### #3 Redefining the work week & workers

The Covid'19 pandemic drastically changed the front of working by forcing people around the world to work remotely by using online mediums to reduce the spread of the virus. The change that was first criticized has now been wholly accepted by the newer generations of the working class due to its nature of being flexible, adaptable and opening up new possibilities for work. Companies are also starting to adopt hybrid or remote working to accommodate flexibility for their employees, cut costs on office space but also expand their reach to hire experts from a global position without having to pay for their relocation and legal fees.

We see this trend growing tenfold by 2050 with telecommunication and computing becoming more

powerful by four thousand times than today and new services in the era of digitalization coming up like the Metaverse. Facebook's Metaverse is said to host most social interactions within its digital platform through the use of digital avatars as shown in figure 24, redefining the meaning of virtual reality and physical interactions including travel in the coming years. With the crash in housing markets and overpopulation of cities, people will look to relocate to rural areas, far away from their place of work which will also create the need for remote working. The increase in remote working will allow people to become 'global employees' who work at an organization for the global impact and not just directed at a single country's economy.

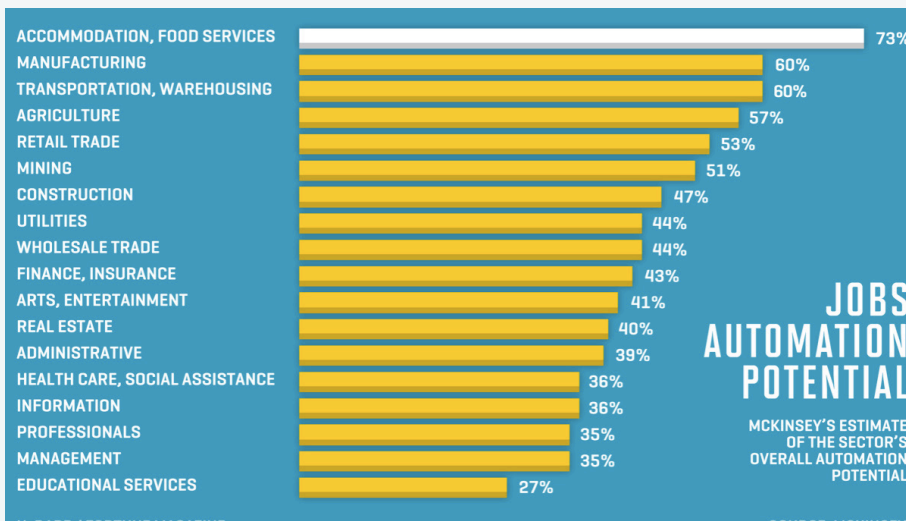


Figure 24. Future work meetings in the Metaverse.

Figure 23. Statistics representing jobs most likely to be automated in the future (Rapp & Okeefe, 2017).

Transformation of work will be from physical labor and constant day to day work to service oriented and innovation based work. This shift of work culture will be caused because of the increased use of AI and machine learning to take over 50% mundane daily tasks and free up people to focus on innovation and redefine what a traditional work week would look like in the future (Gorescu, 2014). We already see the effects of this trend with organizations shifting to a 4-day work week in Europe

and most jobs already automated as shown in figure 23. The redefinition of the work week puts some emphasis on the increased idle time that people will have and whether it makes sense to have weekends in the future? Work life balance will not be resolved completely but it will have a completely different approach and its strain will be seen on how people choose to travel to pass by their idle time, be remote workers and effectively use their work week.

## Conclusion

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This chapter explores the current and future trends from various perspectives that can affect the mobility industry, with a focus on social impact to gauge behavioral aspects of the future user. The current trend developments include mobility as a service, data enabled mobility and shared mobility leading to the formation of new communities around hubs. Major tech companies and new startups are implementing ideas within these trends in order to solve significant issues in mobility such as unsustainable travel, inaccessibility, limited flexibility and inefficient travel for users. However, For Schiphol to remain relevant and create value to its users, it must look far into the future and start innovating to compensate for its slow nature of change. Hence a deep dive into far future trends was conducted and resulted in scenarios such as people living offshore due to increased water levels, isolation over socialization due to increase in human – machine interactions and redefining the work week based on remote workers and AI powered tasks. These scenarios help to paint a holistic understanding of the future world and the users in it.

Together with this holistic future scenario, insights from expert interviews and ideation will form the foundation for the future vision of Schiphol's multi modal hub. Only conducting the research is not enough if stakeholders do not validate and align with this holistic future context, hence the next step was to naturally validate these trends with mobility stakeholders and record their reaction towards the suggested future.

## 5.3 Co-creation Workshop

“Co-design means mutual learning between users and designers. During a co-design process, all stakeholders increase their knowledge and understanding. Users benefit from potential options they had ignored. And designers, who need knowledge about the users, are provided with experiential knowledge.” (Retegi and Predan, 2019 as cited in Verbaan, 2018)

The goal of this workshop is to align experts from various mobility sectors (i.e., Hyperloop, UAM, Drones, etc) (see Figure 25) and record their reactions on the future of mobility based on previously conducted trend research. The insights collected would help me create a desired future vision for RSG multi modal hub.

In order to prepare the workshop, I used structured interview guidelines to create an interactive online workshop. The main activity of the workshop was designed in a way that would allow the participants to first guess the developments currently taking place in the world and then understand the trend that follows it. This approach resulted in overcoming any challenges of participants being too resistive to future trends, unresponsive or only focusing on a single tangent. The workshop also gave freedom to discuss the different views from experts individually. The workshop was recorded, and insights were analyzed to observe possible correlations or differences when thinking about the future context of mobility. For a detailed description of the results, see (Appendix 3: Co-creation workshop)

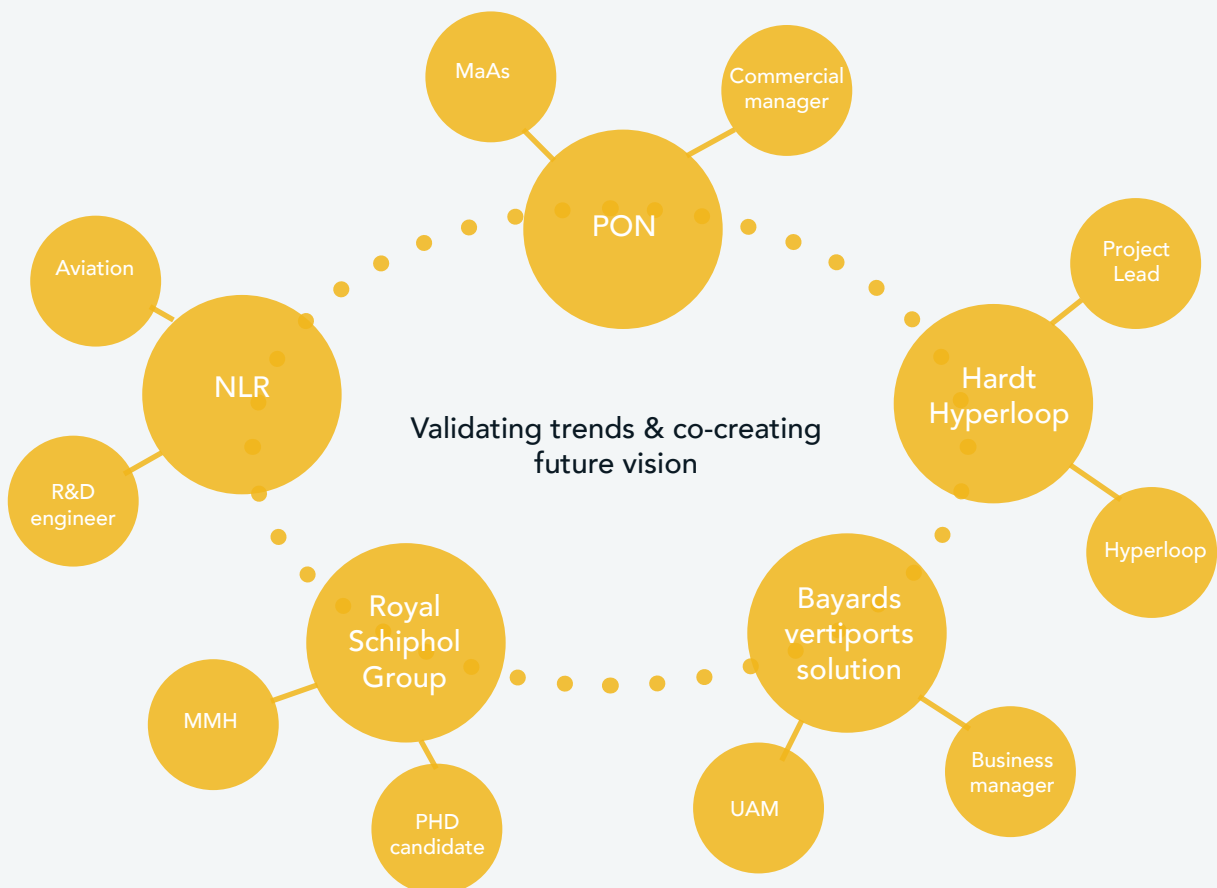


Figure 25. Roles and companies of participants in the workshop

## Insights

*".....makes me feel sad."*

This quote was repeated after each trend was presented; it represents the first reaction that the experts had on hearing the direction our future might be heading towards. This explains the lack of awareness towards future trends not relating to technology or sustainability, as well as an evident struggle to design mobility for the users instead of designing mobility based on technology and then forcing new user behavior. This means that Schiphol will have to play an active role to provide this knowledge to mobility stakeholders before integrating different modalities in a hub to prepare for these future trends and build on that knowledge, identifying themselves as the 'Early Adapters.'

## Resilience

*People have a way to overcome any challenge, if the water level rises, then we will build upwards or more dams. We have always been land people, we will find a way to live on land." - Bayard Vertiport Solutions*

It was made quite evident from the group discussion where everyone agreed that we will still find a way to live on land despite the increasing water levels due to Global warming. Alternate impacts of this trend suggested that people will build more dams, vertical cities and cities that can facilitate an occasional flood. This could pose a threat for mobility stakeholders that have been developing infrastructure and technology to use on land of today. Increasing water levels are not on the radar currently because the mobility industry is still trying to tackle the reduction of CO2 emissions. While there is truth in the quote mentioned here that people are resilient and will find a way to solve any problem, there has been hard facts to show that people have also lost a lot of time, resources and man power while overcoming a challenge they were unprepared for but aware of. The mobility industry, including Schiphol group, will have to become better than resilient in order to make the most of its challenges and reduce its impact on the environment and people.

## Congestion

*“It concerns me that the amount of mobility is increasing, in other words: Extra mobility instead of substituting mobility.”*  
- Schiphol

Schiphol explained one of the biggest problems that we face in mobility today is congestion (traffic jams, wait lines, etc). The reason for developing hubs and introducing new modalities and services is to reduce the congestion built up by offering accessibility and more efficient ways to transport people without having to wait in traffic or lines for hours. But the reverse effect might take place if new modalities are added and not substituted. A messy use of resources, several payment options, different rules and regulations and frictive transitions between modalities will lead to users getting discouraged from using public transport.

## Experience Economy

Bayard Vertiport Solutions highlighted the significance of experiences in the future and how that will be the rising factor for people to determine how good a product or service is. “In the experience economy, companies attempt to adopt a service centric view where customers play a central role in the creation of value, and the delivery of holistic and engaging experiences becomes a key competitive driver” (Pralalad and Ramaswamy, 2004; Vargo and Lusch, 2004 as cited in Calabretta and Kleinsmann, 2017 ) With most mobility options becoming sustainable in the near future, the determining factors come down to cost and experience. The most interesting thing, however, is newer generations are willing to pay a little more if it means it guarantees them a seamless or new experience. This insight is also reflected in my trend research which refers to future users wanting to travel for an experience rather than just travelling for a holiday. (Refer Appendix 2; trend Research)

## Accessibility

NLR believes that accessibility of mobility will not be solved in the near future. Arguments were made that “only a specific (Rich) group of people will be able to afford public transportation.” Public transportation is currently expensive and with an increase in modality options with a personalized and seamless experience, the bill will add up if users want to commute on a regular basis. This will limit accessibility of mobility options to people and result in congestion on roads and cheaper modes of transportation.

## Unsociable

*“The end of shared mobility.”*

- NLR

Social isolation and preferred seclusion will create a huge challenge for shared mobility as well as public transport. Participants discussed the possibility of users having an increased desire to own their own vehicle as an impact or seek more private and personalized options. Moreover, users might seek experiences that allow them to isolate or retreat and are far away from human interaction. However, with future mobility aiming to connect people closer, it is interesting to speculate the change in value that future mobility will have to offer its unsocial users.



## Conclusion

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The co-creation workshop helped to validate the trend research and align stakeholders towards a co-created future vision for the multi modal hub. To summarize the insights, experts felt upset towards the future we might be heading towards and agreed that the industry was not thinking about the far future but only focusing on solving today's challenges such as reducing carbon emissions and creating seamless passenger experiences.

Discussions on the trend research led to newer challenges to solve such as being resilient, accessibility, congestion and social isolation. The workshop was successful in reminding stakeholders that future mobility is not a competition but a collaboration between various modalities to overcome challenges faced by users. The research so far in this thesis has been divergent, exploring the context of future mobility. It also marks the mid point of the project. However, based on the double diamond process, the next chapter converges all these insights and further scopes the research question in relation to RSG. This step is crucial and will help to design an appropriate future vision specifically for RSG.



# Define the Direction

Having concluded all the research from user interviews and trend research, this chapter defines the main insights from the previous research and scopes the original research question to a more defined one that is valuable to RSG and the future of multi mobility. Having a defined direction paves a path for a more explorative design approach pertaining to the scoped research question and its context, hence the second diamond of the double diamond process will also be explored in this chapter and pave the way for ideation and iterative development of the chosen deliverables.

## 6.1 Problem Statement

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On better understanding the context of mobility, light was shed on the knowledge gaps that existed in understanding the future user. Certain future trends created assumptions on user behavior, but this knowledge remains dormant if not used in the right context. Furthermore, on speaking to the internal and external stakeholders, there was a huge dissociation amongst their vision for RSG to transform into a future MMH and this translated into a messy collaboration and overlap of various initiatives and decision making.

Hence, a decision was made to define my research question. The original research question is "How do various mobility stakeholders connect at Schiphol's future multimodality ecosystem to create a seamless mobility experience for its users?" However, the new research question is "What sort of users will exist in the proposed future ? How will Schiphol's MMH facilitate their new travel experiences?"

The new question still fits within the larger context of the original question but the focus is shifted from integrating and connecting mobility stakeholders to identifying future user behaviors that will naturally shape the way for facilitation of modalities and travel experiences at RSG's MMH. The research question focuses on three main aspects which are; What is the proposed future of a MMH? Who are the users? And how will RSG facilitate their new travel experiences? Therefore it is important that these questions are solved individually with their own separate outcomes but use insights gained to build each other up coherently. Imagine a holistic sphere which is the future context of mobility derived through trend research, the deliverables are then different levels within this sphere ranging from a macro to micro level. Together A holistic ecosystem consisting of a new future vision, users and initiatives within the organization is created.

1 On the macro level, A future vision will be created in collaboration with internal & external stakeholders at Schiphol that will align all the stakeholders and create clarity within the organization on this mission. The vision will include the desired future based on value drivers significant for RSG to transform into a MMH.

2 Diving deeper, the next level will comprise the future personas and use cases that will exist within the proposed future. The persona's and use cases will be created based on passenger research (Interviews and co-creation workshop) and will help RSG to identify user focused initiatives to implement in the future as a MMH. Finally, zooming into the micro

3 level that comprises RSG as an organization. On considering the future vision and user needs, strategic initiatives will be listed for RSG to implement in order to work towards facilitating future user centered travel experiences in the desired future.

## 6.2 Design Approach

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### Future Vision

After the different analyses, expert interviews, and trends research (Refer chapter 5), A future vision was created based on the knowledge gathered fused with my creative thinking and constant stakeholder feedback. In order to create a successful and compelling future vision, it should comprise of four main characteristics: Clarity, value drivers, artifact and magnetism (Simonse, 2017). Clarity of a vision indicates the ability for anybody to immediately picture them experiencing the future without much explanation (Reid, Roberts, and Moore, 2015; Shipley, 2002 as cited in Verbaan, 2018); Value Drivers help to clearly indicate how the problem of the future will be solved. It helps to create new KPI's and goals for the organization (Heinonen and Hiltunen, 2012 as cited in Verbaan, 2018); Artifact is the manner through which the future vision can be materialized (Meija Sarmiento, Simonse, and Hultink, 2015 as cited in Verbaan, 2018); Finally, magnetism refers to the vision's ability to compel readers and attract/motivate them to achieve the vision (Reid et al., 2015 as cited in Verbaan, 2018). In order to achieve the overall future vision 2050 of RSG (refer chapter 3.1), a more concrete future vision for multi modal hub has to be created. This will help align all the stakeholders and create a distinct direction to follow.

### Personas & Use cases

Personas are fictional characters that are created from

research to represent the various user types that might use a particular service, brand, product, etc (). These personas encompass user behaviors, values and needs which creates for a new perspective to view the target audience and design for them. In order to create these personas, trend research was clustered and polarized against each other to create a worldview. From there certain characteristics helped to build the foundation of the personas. Later a detailed character sketch was created with the help of user and trend research.

A co-creation workshop with users was conducted that consisted of the methodology unexpected consequences to help create a user journey of the future users through the MME and brainstorm potential initiatives that RSG should implement as they transform towards a MME.

### Strategic Roadmap

Finally a strategic road map is created to encompass the desired future vision, the strategic initiatives and the steps to be taken in order to successfully transition to a MME. A road map is defined as "a visual portrayal of design innovation elements plotted on a timeline" (Simonse, 2017). Roadmaps are keen to organizations as they support the innovation strategy and decision making. They essentially offer a tactical plan to turn a future vision into a reality (Simonse, 2017). The roadmap in question consists of a product-service layer, user values, target audience and first steps to be taken.

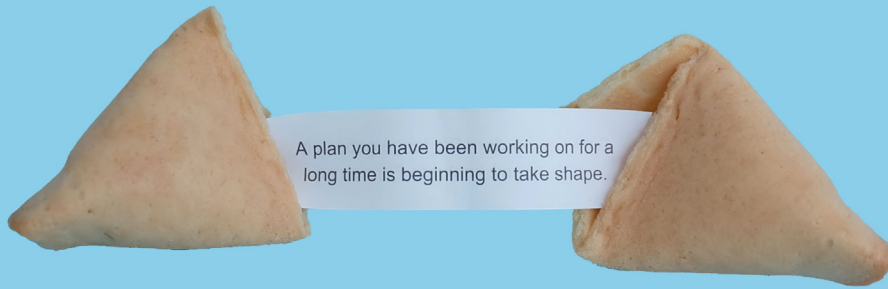
## Conclusion

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On analyzing insights from the research conducted in the first phase of this thesis, a conscious decision was made to further define the direction and narrow the scope of the research question to create more value for RSG. The original research question is “How do various mobility stakeholders connect at Schiphol’s future multi modality ecosystem to create a seamless mobility experience for its users?” However, the new research question is “What sort of users will exist in the proposed future ? How will Schiphol’s MMH facilitate their new travel experiences?”

There are three defined outcomes that will be created to answer these questions and they are a future vision on RSG as a MMH, personas and use cases identifying user behavior and finally strategic initiatives for RSG to implement as they move towards a MMH transformation, visualized in a strategic roadmap.

After defining the direction, a divergent leap is taken into ideating the future vision in collaboration with multiple stakeholders.



# Future Vision

Having gathered, structured and analyzed all my research up until this point, I started to formulate the future vision for RSG. A vision is useful for aligning all the stakeholders and creates a shared understanding of the desired future. Future visions tend to face resistance from stakeholders if proper collaboration is not ensured and stakeholder needs are not fulfilled. The end goal of my future vision is to create a clear direction for RSG to ensure a successful transformation towards a MMH but also provoke conversations early on about future user needs and how to design a mobility system around that.

By 2050, Schiphol Group should envision

A **flex** mobility **ecosystem** that adapts to situations and user needs resulting in an **antifragile** way of working. The goal is to create **tailored services** and **seamless experiences** for users and passengers.

The ambition is achieved by increasing **proactive collaboration, on time network performance, and decentralizing hub functions.**

## 7.1 Future Vision

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There are many advantages to visual thinking of a future vision such as increased transparency and effortless communication (Soni, 2021) when presenting it to stakeholders, but in this case a future vision statement was formulated. This was done to keep consistent with RSG's main format of future visions which is a statement supported by illustrations. The statement alone is considered the best method for stakeholders to roast the future vision and generate valuable iterations without feeling like it is the finished product and cannot be altered. Therefore, I created more ownership on the final result as every stakeholder could co-create the definitive future vision.

The timeline of the future vision is 2050 because most trends and developments are set to occur from now until 2050, so that gives RSG a good timeline to estimate impact of these trends. It also allows for less uncertainty as the overall strategy for RSG is to become the most sustainable and high-quality airports by 2050 which is achieved through the created future vision of multi modal hubs.

The future vision stresses on creating tailored services and seamless experiences for the users of RSG that include airline carriers, baggage handlers and other modalities as well as the end passengers. This was important to distinguish from the stakeholder feedback as revenue is generated from both parties and RSG is liable to providing value to all its users.

The future vision uses the term flex mobility ecosystem instead of multi modal hub as it is a corporate vision pertaining to all current airports and future hub projects under the Royal Schiphol Group and not just Schiphol Amsterdam airport. The term 'flex ecosystem' was coined by one of the stakeholders from operations at Schiphol group to highlight the dynamic nature of the ecosystem to provide more than just modalities but services and experiences based on user situation and needs (refer Appendix: User Testing). This type of system will result in an antifragility within the larger organization's way of working. Together with antifragile organization and dynamic hub facilities, RSG's multi modal hub will be able to achieve their overall future vision of being the most high quality airports.



## Antifragile Way of Thinking

The significant effects of the Covid'19 pandemic stirred an increased interest towards creating a "resilient" strategy within the commercial civil aviation industry (Tuchen et al., 2020; ICAO, 2020; Terry, 2020; Gössling, 2020; Lenot and Stewart, 2020; and Bouwer et al., 2022 as cited in Alexander et al, 2022). Arguably, the aviation sector specifically airports, were hit the hardest by the ongoing pandemic (Nakamura and Managi, 2020, Sokadjo and Atchadé, 2020; Zhang et al., 2020; and Coelho et al., 2020 as cited in Alexander et al, 2022). Despite the major setbacks, the aviation industry is slowly recovering and is doing so in a way that will be resilient to another pandemic in the future. From previous trend research and user insights, stakeholders argue that the future will have an increased number of pandemics due

to increased accessibility and connectivity of mobility, also potential flooding due to increase in water levels (Refer chapter 5.2.2). Stakeholders also argued that man always conquered and would find a new solution to challenging circumstance (Refer chapter 5.2.3). While RSG has proved victorious emerging from various setbacks over history (refer chapter 3.1), all these threats will cause a strain on RSG's resources and reputation if it continues to deal with setbacks as it did with the Covid'19 pandemic and current challenges like the surge of passengers during the May holidays as shown in figure 26. In order to protect and defend its MMH from any kind of setback, RSG will have to adopt an 'antifragility' strategy within the organization's way of working.



Figure 26. Chaos at AAM during May holidays. (Twitter, 2022)

Antifragility, a concept introduced by Nassim Taleb in 2012 defines a company's ability to experience constant downsides from setbacks, causing them to break over time (Taleb, 2012 as cited in Alexander et al, 2022). The aim is for organizations to be completely robust or indifferent to any stressor, but since that is realistically unachievable, antifragile refers to the nuance that things get better with exposure to shocks (Taleb, 2021 as cited in Alexander et al, 2022). Currently at RSG's innovation hub, research is being conducted towards creating an antifragile airport in relation to pandemics and I incorporated towards the overall vision of RSG 2050 to create high quality airports (Refer chapter 3.2). Therefore, as RSG transforms towards a MMH, threats will be heightened and alignment towards a shared vision of antifragility within the organization should be prioritized.

On adopting antifragile practices, RSG will be able to gain from adversities and emerge strengthened from any challenge they face at the multi modal ecosystem (Taleb, 2012; Hillmann and Guenther's, 2021 as cited in Alexander et al, 2022). Develop new capabilities based on proactive learnings from past experiences (Alexander et al, 2022) and consistently grow and flourish despite adversities. All these values combined will position RSG high in the multi-modality ecosystem as a high-quality hub and remain relevant in an expanding competitive industry.

## Flex Modal Ecosystem

The Covid'19 pandemic also gave rise to remote workers as explored in chapter 5.2.2 Trend analysis – Redefining work week and remote workers. As an impact of this trend, future users will demand value for each minute of how they spend their time and having to wait endlessly at a MMH to kill time will be frowned upon. Currently startups around remote workspaces are emerging and growing in popularity, In the future RSG will have to adopt a similar concept to expand their MMH from facilitating modalities to facilitating a one stop solution for all (Refer chapter 5.3 Co creation with stakeholders, experience economy and chapter 5.2.2 Trend research – Isolation over socialization). This could

include new services that could include workspaces, supermarkets, pick up points, entertainment, etc.

This strategy enhances the user's seamless experience by giving them access to all their needs and it reduces congestion (Refer chapter 5.3 Co creation with stakeholders) by managing peaks and increasing capacity of the hub in dealing with various procedures such as baggage, security and check ins. RSG can easily facilitate the integration of infrastructure development in their MMH because of its business model dealing with real estate (RSG, 2021).

## Three Pillars of the Future Vision

In order to formulate the future vision statement, significant variables impacting the context of mobility were selected from trend research, stakeholder feedback and defined (See Appendix 4: Future Vision). Eventually those variables were clustered into larger factors and included in the future vision as pillars to strengthen to achieve the desired future vision.

The three pillars are as follows; Proactive Collaboration, On time performance and decentralizing hub functions.

## Proactive Collaboration

In order for RSG to transition towards the desired future, internal stakeholders have pushed for the need of more proactive collaboration amongst all stakeholders in the value chain. Currently, there is a huge gap in collaboration amongst airline carriers and the airport itself where airlines believe that the passenger data is theirs and do not share this information with Schiphol creating an unhealthy relationship and user journey from both sides (Refer Appendix 4: Future Vision). In the future with more modalities getting integrated, data sharing will become an integral part of collaboration to create a seamless passenger journey. . Data will be used to analyze and predict trends in real time to increase efficiency of the mobility system and give users access to personalized and seamless experiences (Refer chapter 5.2.1). This proactive collaboration can be initiated through starting the conversation with stakeholders about owning passenger data, finding common grounds to agree upon and sharing value to encourage proactive collaboration

## On time Performance

Currently AAS thrives on its short connection time and on time performance to uphold its reputation as a hub. In the future with excess modalities and passengers, RSG will have to increase its efficiency of managing connections of passengers between modalities to withhold their short connection time and on time performance. This can result in redefining their network performance within Europe and then internationally to reduce congestion of passengers and modalities as well as create a seamless experience for all users.

## Decentralizing Hub Functions

A huge emphasis was placed on redirecting resources and initiatives backed by significant evidence to create an ecosystem and not a single hub (Refer Appendix 4: future Vision). Currently RSG owns significant shares in regional airports but is not using them to their full potential and each airport is developing individually. For RSG to transform towards a multi-modal ecosystem, significant efforts have to be made to decentralize hub functions and them across the ecosystem to create a larger impact. This pillar can be achieved through examples like; Lelystad airport as an exclusive Hyperloop station, since it has resources and land to develop on. Stakeholders were quick to mention that decisions such as these have to be backed by strategic evidence of value and impact (Refer Appendix 4: Future Vision).

## Conclusion

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Based on the trend research and co-creation workshops, a future vision was drafted for RSG which goes as; "By 2050, Schiphol Group should envision, A flex mobility ecosystem that adapts to situations and user needs resulting in an antifragile way of working. The goal is to create tailored services and seamless experiences for users and passengers. The ambition is achieved by increasing proactive collaboration, on time network performance, and decentralizing hub functions."

RSG should aim to create a flexible mobility ecosystem in collaboration with all the relevant stakeholders, regional airports and future hubs that is dynamic and adapts to user needs. The result will be an antifragile way of working within the organization which is needed to gain from adversities and emerge strengthened from any challenge they face at the multi modal ecosystem. However the ambition relies on three main pillars that need to be strengthened which are; increasing proactive collaboration, on time performance and decentralizing hub functions.

In order to identify potential initiatives significant for RSG to implement to achieve this desired vision, personas identifying user behaviors and use cases are created. The next chapter explores these personas and use cases before identifying potential initiatives.



# Personas & Use cases

This chapter explores the future user and their behaviors traveling through RSG's multi modal ecosystem through the form of personas and use cases. The personas are developed through a co-creation workshop conducted with current users and the use cases are developed based on the insights from the user workshop as well as the trend insights and future vision. This chapter consists of three main parts; Trend analysis leading to future personas, co-creation workshop validating personas and leading to insights of user behavior and finally, use cases comprising of potential initiatives significant to RSG's future multi modal ecosystem.

## 8.1 Personas

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Currently the user personas that exist for Amsterdam airport Schiphol is that of a business passenger and tourist (Refer Appendix 1: Expert Interviews). The Research is quite outdated, and proposes a very linear way of thinking about passengers and their journeys. Since then, the trend research conducted in chapter 5 suggests an evolution in user behavior as an impact of certain trends and developments in the world.

One of the main insights from the trend research that suggest towards a new user type in the future is that of; Remote workers and Global citizens. This trend puts a spin on the traditional thought of a business travelers and it is interesting to understand the characteristics and behaviors of this user that will differentiate him from the traditional journey of a business traveler. Furthermore, the traditional role of a tourist is also transformed to an experience dweller as increasing passengers seek specific experiences rather than a destination as the trend research (Refer Appendix 2: Future Trend Research) suggests. While the traditional type of travelers will exist in the future, it is interesting to see how their behaviors differentiate them from the stereotypical passengers that we know of since yesterday.

Another factor to consider when thinking about the future user is their emotions when traveling. The

Covid'19 pandemic saw a rise in two types of travelers; one that was fearful and cautiously decided to travel after a long time and the other which was relaxed and bounced back to travel as soon as restrictions were lifted. In the future with increased connectivity leading to common pandemics and greater environmental impacts such as flooding (Refer chapter 5: trend Analysis), passengers will be divided based on their emotions and trust over the system.

Finally Amsterdam airport Schiphol boasts over its short connection times and on time performance. Currently passengers have little to no choice over the number of connections and layover time. The only factor determinant is that of cost. However, In the future with added modalities, passengers will be able tailor their journeys and have a choice over their layover time and the number of modalities they wish to connect between. This will create a huge opportunity for RSG in the future from being just a hub towards becoming more of a dynamic ecosystem of services and modalities.

Therefore the factors affecting the future user are;

- Way of working (remote or onsite)
- Type of Travel (Experience dweller)
- Connection Time & number of modalities used
- Trust in the system

## World view

In order to create specific personas, a worldview taken from the Vision in product design methodology was created. Creating a worldview is done by finding new relationships with clusters created from trend research (Hekkert, 2011). In this case, the clusters are the factors mentioned above. It is meaningful to place clusters that oppose each other or conflict in polar dimensions

to reveal contrasting user traits. Each dimension represents a contrasting aspect of the plausible future and since each dimension can hold true, the future will unfold in the interplay between these dimensions, which is the kind of spectrum one expects when dealing with different types of users (Hekkert, 2011).

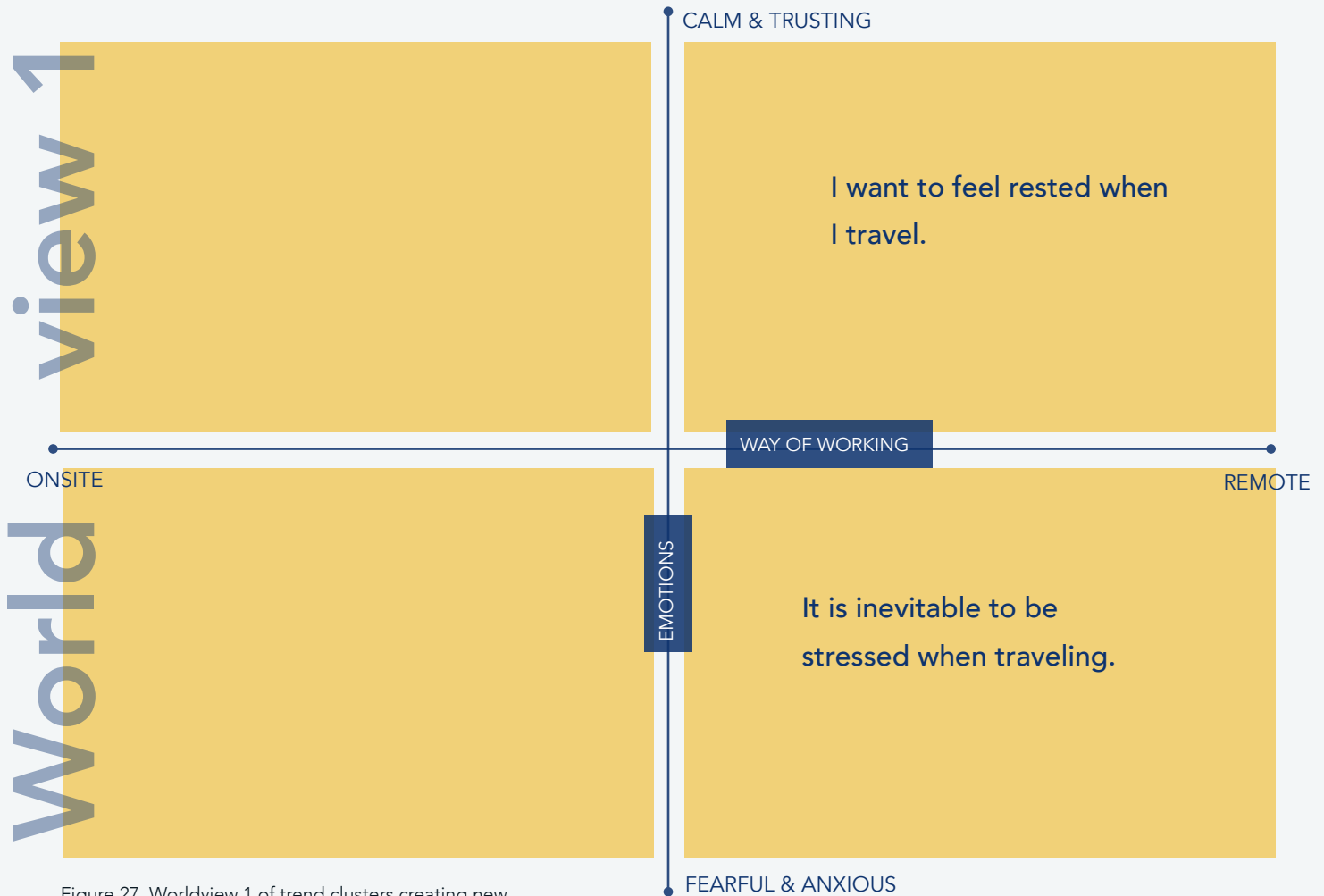


Figure 27. Worldview 1 of trend clusters creating new user behaviors

In worldview 1 as illustrated in figure 27, the x – axis represents emotions and the Y –axis represents way of working. These factors were pinned together because of a common denominator which is user behavior. Four distinct types of users emerge from this worldview but due to scope of this project, we will focus on the remote workers only. In the future, there will be remote workers who are anxious when they travel and remote workers who trust the system and find peace within their commute. Ideally for RSG, they need to work towards converting the anxious users towards trusting the system and maintaining the trust of the calm remote workers.

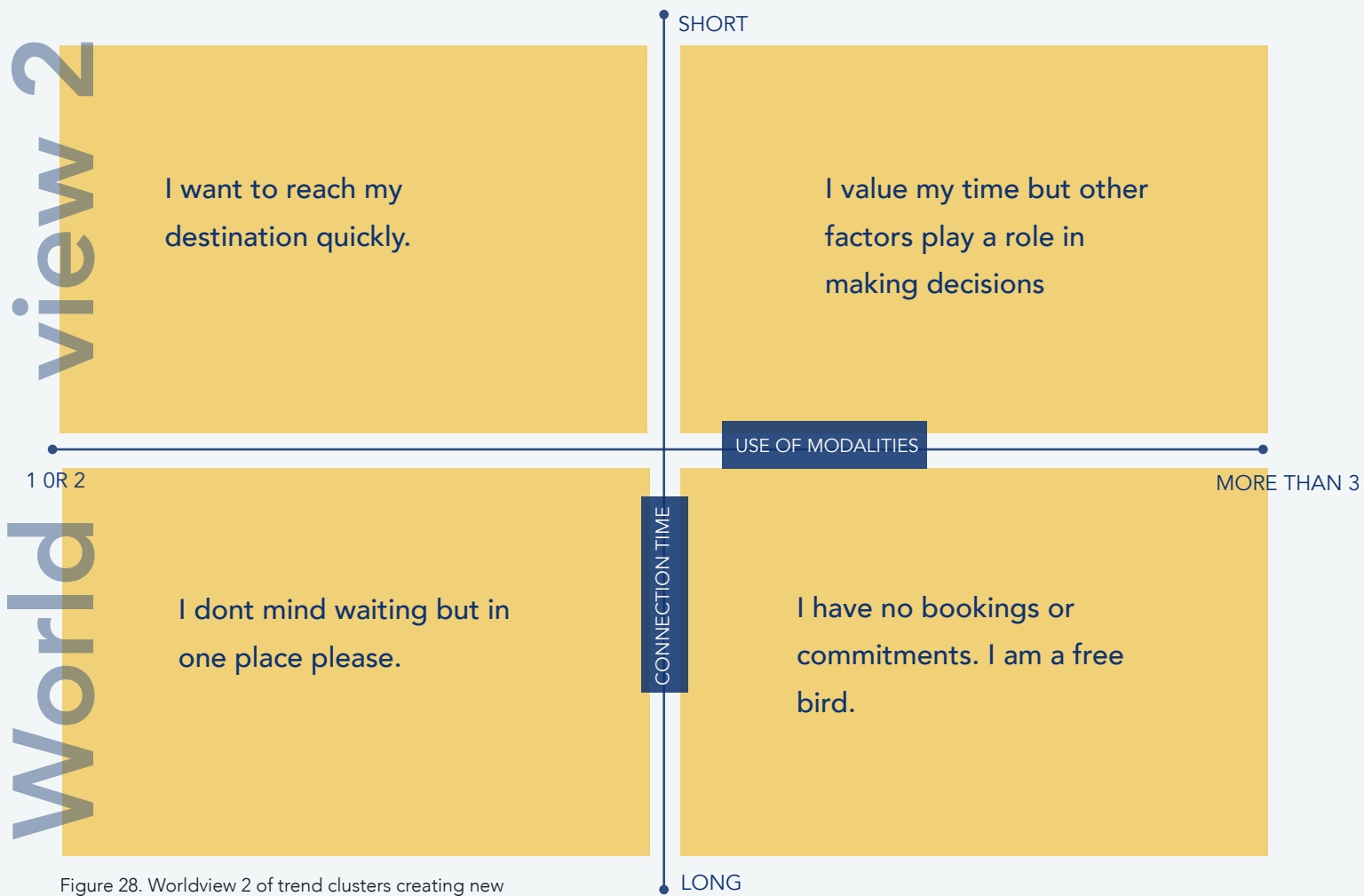


Figure 28. Worldview 2 of trend clusters creating new user behaviors

In worldview 2 as illustrated in figure 27, the x – axis represents connection time and Y – axis represents use of modalities. These factors were pinned together because of the common denominator between them which is use of resources (time and modes). The focus is largely on users who want a short connection time and uses more than 3 modalities because RSG can optimize peaks and congestion by dispersing people in varied directions in a quick turn over.



## Personas

Based on the worldviews, trends and user insights, four personas were created that highlight a larger aspect of the persona's values and lifestyle and not just focused on their travel style. This allows the reader to understand how this persona will make decisions in travel and what is it they value most.

# 1)



## Georgina

- 27 years
- Occupation: Sustainable influencer (Goes around the world living sustainably and showcases that via social media)
- Gives workshops on remote living & traveling sustainably.
- Goes on excursions to rescue to animals and clean up beaches
- Loves engaging with locals and helping the community
- Doesn't make a ton of money and usually works on endorsements
- Lives by opportunity and always has spontaneous travel plans.
- Minimalist living and only owns a good camera & laptop
- No time crunches
- Uses her time productively and always finds new hustles to make some cash.

- 36 years old
- Remote worker at a huge global consultancy.
- Spends every 1 - 2 years in a new country picking up projects he likes.
- Travel is covered by his company so he enjoys good benefits and the best of modalities
- Likes to travel efficiently and quickly. Hates the entire process of traveling
- Concerned for his safety and wellbeing, Pablo always makes sure to be equipped for emergencies.
- Doesn't own a car or house. Lives minimally
- Enjoys his independence and is single.
- Preferred mode of travel is an E-bike or shared mobility in large cities.



## Pablo

# 2)

## Personas

# 3)



## Willem & Friends

- 24 years
- University friends studying different subjects.
- They take a trip every couple months to enjoy a new experience that they are into or research a new one.
- They barely carry any luggage because they believe in bringing back more memories and souvenirs from the destination. Also everything is always available everywhere.
- They are excited for the travel while departing but hate the travel back home after a long and exciting weekend of partying.
- They usually travel for short trips to align with university schedules
- Want to meet new people and feel the experience through out

- 34 years
- Occupation: Freelance designers who believe they are global citizens.
- They live in their self sufficient van that they have created all on their own and travel around the world.
- They require lots of charging stations and parking lots.
- They are conscious of their carbon footprint and want to travel consciously on their own personalized experience.
- They are cautious of hubs and airports in general because the whole process is stressful. They fear the risk of getting sick or losing their cargo.
- Mostly travels the roads in the van and uses a cycle in the city.
- Only uses other modalities to transfer their van
- Lives on complete digitalization.



## Alex & Sam

## 8.2 Co - creation workshop with Users

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A co creation workshop was conducted with a group of users aged 23 – 33 to validate the persona's and create user journeys and potential initiatives for RSG's flex modal ecosystem which are illustrated as part of figures 29 - 33. The workshop consisted of the design methodology called 'Unexpected consequences.' In this methodology, participants are asked to brainstorm consequences that could occur based on a trigger or trend. These consequences are usually in the form of ideas or initial concepts which can later be developed as products and services within an organization. The idea behind this exercise is to think of the unpredictable and unexpected things that can occur, one example of this methodology is the birth of Walmart.

Walmart supermarket was created after the invention of the car. Nobody suspected that with increased mobility, people could start traveling further away to collect supermarket items in bulk and bring them home all at once. Hence, creating a new link in the supply chain and revolutionizing the industry completely. Another example that seconds this notion is the birth of aviation by the Wright Brothers. Their dream of advancing mobility and connecting more people with the invention of an aircraft led to an unexpected outcome of using airplanes as machines of war in World

War One and hence after (History cooperative, 2019). Therefore, it is extremely important to consider most outcomes and use that knowledge to create passenger journeys for the better.

In this project two separate groups of users were chosen to conduct this exercise with. The exercise was conducted in three rounds of 30 minutes, where 15 minutes each for brainstorming individually and then another 15 minutes for discussing the insights. The two groups were divided based on being physically present and virtually and the tools used for each group was post – its and a wall for the physical group and Miro for the virtual group. The users chosen were early professionals and students from different parts of Europe ranging from ages 23 until 35. There were 4 participants in each group and a total of 8. Due to the limit on time and scope of this project, I chose users that were easy to source but also who could understand technology of the next generation and was financially stable as user groups from older generations. Together, their insights could mold the passenger of tomorrow. The insights of this workshop is explained through the use cases presented in figures 29 - 33.

# USER JOURNEY 1 - GE

1) Georgina is flying from Peru to Barcelona with a stop over at Schiphol.



Georgina uses the remote luggage option provided which means her luggage will be dropped off at her hostel and will travel separately from her.



11) Georgina arrives at BCN. She receives a notification showing Her luggage has already made it to her hostel.



2) She gets on a Hydrogen flight from Peru and lands in Schiphol at 9am on Tuesday. She has a connecting E-flight from Schiphol to Barcelona at 12 pm.



3) She gives up her seat to another PAX who was in a hurry and decides to look for another option on her Schiphol app.



4) Finds all available option going to BCN & decides to book the more sustainable cheaper option. That's the Hyperloop leaving the Ams Zuidas station at 17:00pm.

Figure 29. Complete User journey of Georgina

# GEORGINA

10) They arrive and board at the given time in a seamless way without facing any queues or congestion.

9) Max & Georgina reserve a shared cab to AMS Zuid on the Schiphol app. Based on their ETA a token number is issued for boarding the Hyperloop.

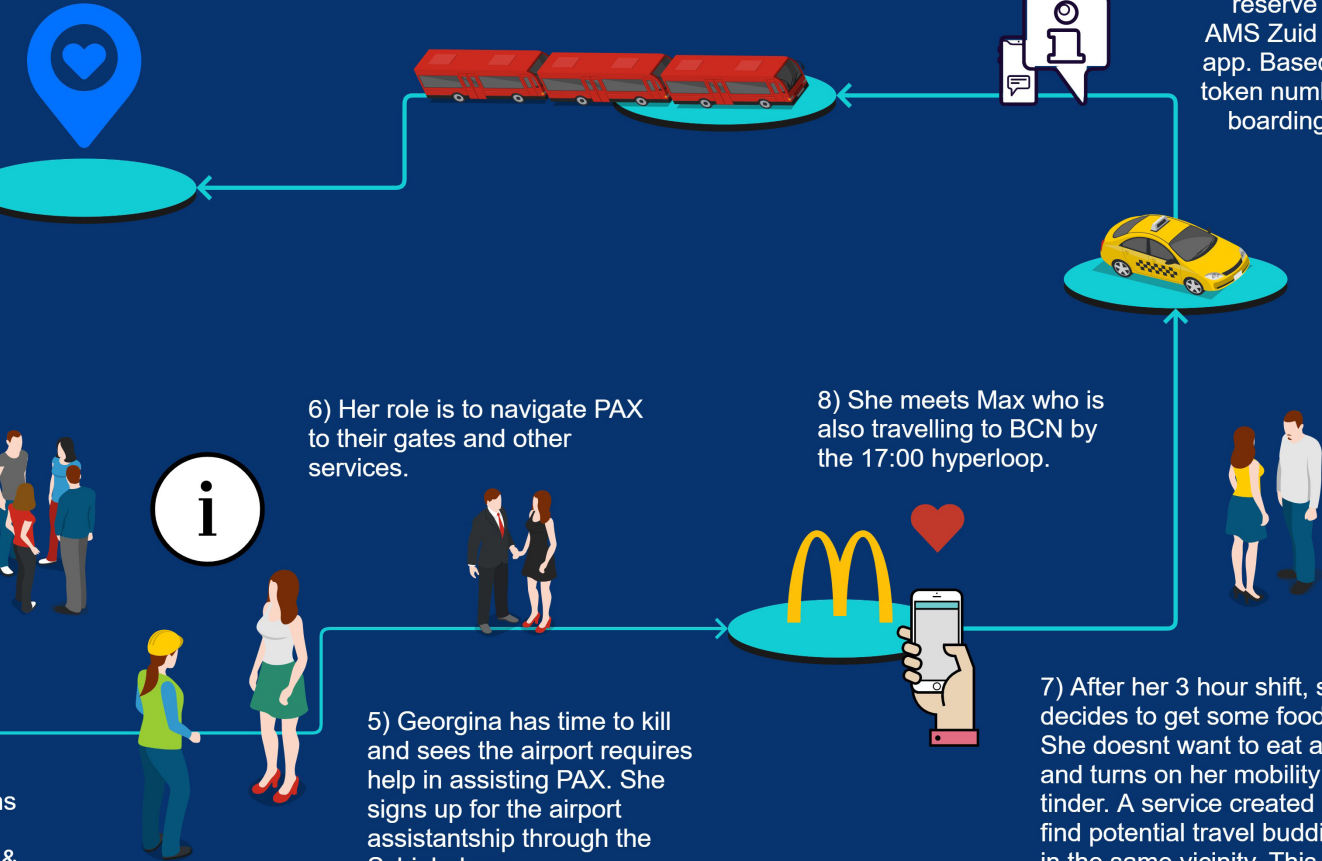
6) Her role is to navigate PAX to their gates and other services.

8) She meets Max who is also travelling to BCN by the 17:00 hyperloop.

5) Georgina has time to kill and sees the airport requires help in assisting PAX. She signs up for the airport assistantship through the Schiphol app.

This was she can use her time to help out the community and earn some money.

7) After her 3 hour shift, she decides to get some food. She doesn't want to eat alone and turns on her mobility tinder. A service created to find potential travel buddies in the same vicinity. This service makes travel a more shared experience.



# USER JOURNEY 2- Wi

1) A group of friends are going for the F1 race in zandvoort, NL from London, UK. They book the F1 tickets and are redirected to book their travel.



2) They arrive at AAS through an E-flight



3) While waiting for their shuttle connection to Zandvoort, the friends spot a F1 experience pop-up at AAS. Fans can plan an f1 simulator, buy F1 merch, oranje clothes



5) TH  
cong  
zand  
take



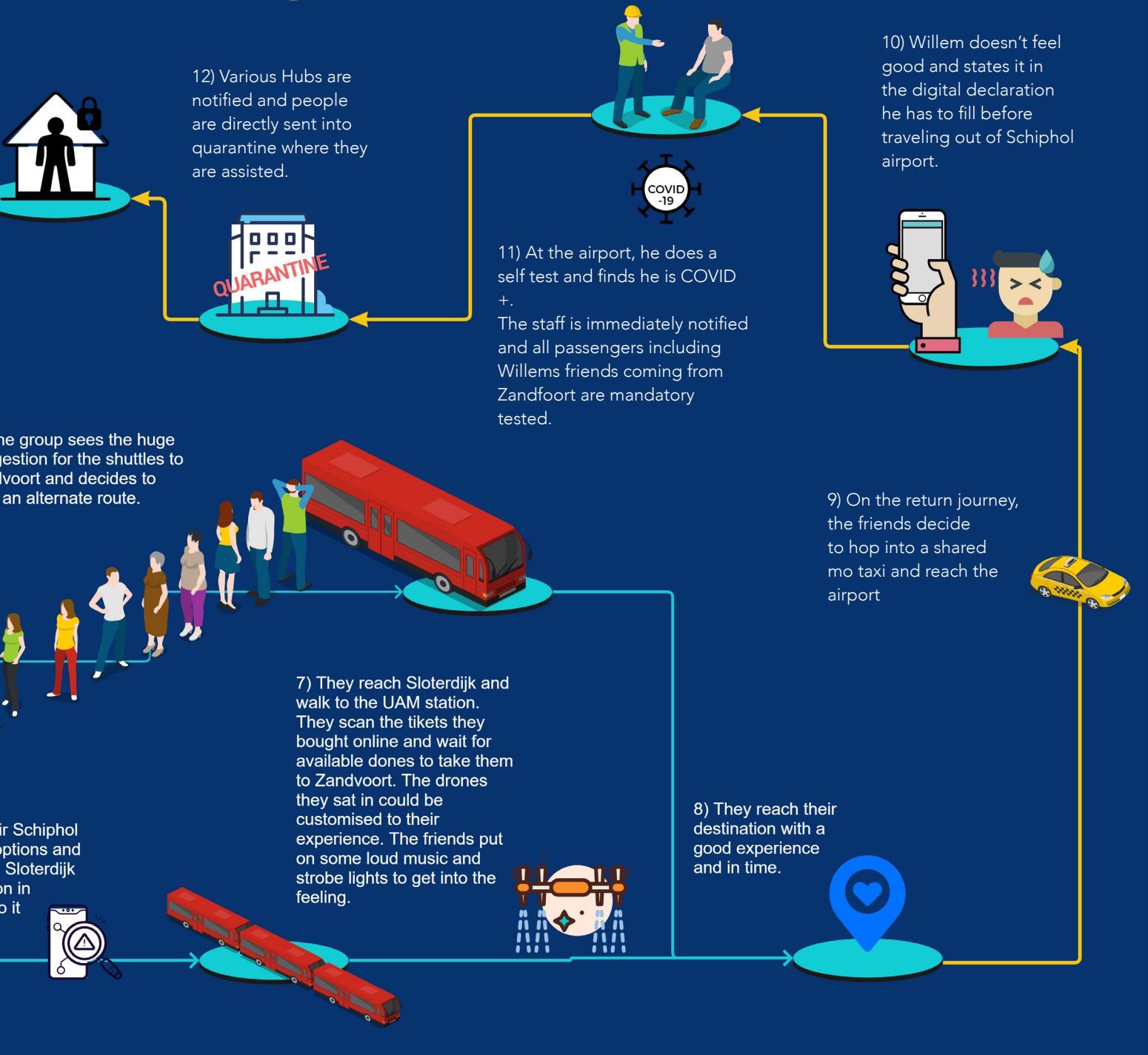
4) The group of friends connect with other fans. This creates a better experience for the group as they were looking to expand their group.



6) They check the app for available connections, see a train to Ams and an UAM station within walking distance to

Figure 30. Complete user journey of Willem and his friends

# Willem & friends



## 8.3 Use cases

### 1. Travail

In the future, passengers will actively seek ways to productively use their time in the flex modal ecosystem and one of the ways they can do this is by offering their services and skills required by the operations within the ecosystem in real time as illustrated in figure 31. The concept is inspired from the mobility service Uber, where users can sign up to be drivers and offer their services to passengers in the area. Similarly, a user can register on a digital platform facilitated by RSG and add all his relevant details. The user can then choose from a list of required services within the safety regulations of the MMH and follow instructions to complete the task. The concept can be validated as valuable for RSG as it currently engages

in a similar program where employees can volunteer to be airport assistants. During the May holidays of 2022 (Elton, 2022), a large surge in passengers and low staff elevated the need for such a concept.

This concept revolutionizes how services are offered and creates value for the user and organization. The user can help the community, spend his time productively and make some money while commuting. The organization on the other hand remains dynamic in dealing with challenges, can cater personalized experiences to a variety of audiences and manage resources in a cost effective manner.

The concept is called Travail because it translates to work in French and sounds like Travel in English, which is what the concept is about - Work while traveling.

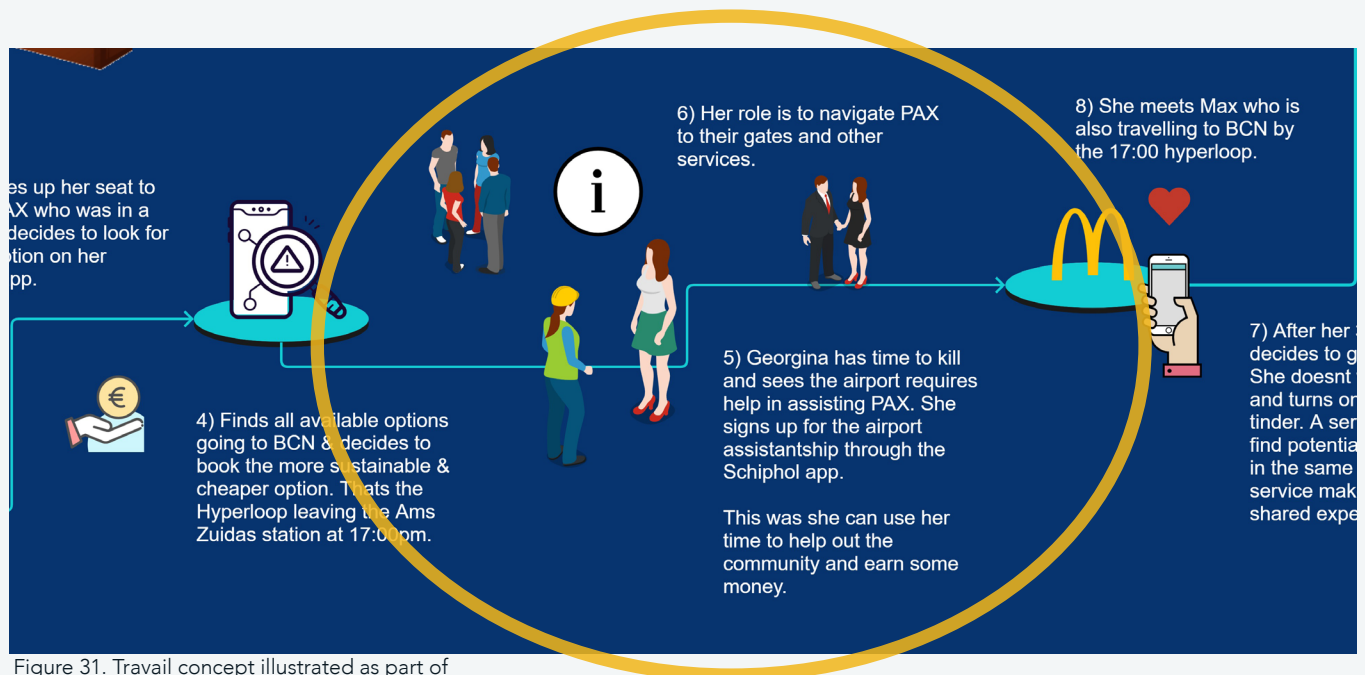


Figure 31. Travail concept illustrated as part of Georgina's user journey (Figure 29)

<b>Target Group:</b>	Solo travelers with long connections
<b>Areas of Effect:</b>	Assistance in Navigation/wheelchair or using self serve kiosks. Foyer, Departures and arrivals
<b>Barriers:</b>	High level of security and risk will shortlist willing users and areas of service.
<b>Drivers:</b>	Productive use of time (Trend), Dynamic & Antifragile (Trend & F.V), Helping the community (Trend & Persona), Remote working & Global citizens (Trend, persona)
<b>Value:</b>	1)Productive use of time for users. 2) Increased resources & manpower to help RSG in the MMH



## 2. Experience-ators

For RSG to successfully create a multi-modal ecosystem, they will have to facilitate experiences rather than just the modalities for their users (Refer Appendix; Trend Research). A concept that stems from this trend is an Experience pop up stores in and around the flex modal ecosystem. Temporary pop ups that host unique experiences for travelers to enjoy as they commute will radicalize the passenger journey completely as shown in figure 32. One of the users stated that they usually

get extremely ecstatic after they pass immigration/ security because they feel like the holiday has officially begun but the entire process from there until you exit the arriving airport is dull and doesn't give you a feel of being on holiday. The value that is created from this concept is not just giving passengers a better experience but rather a unique one while traveling. This concept will result in more passengers choosing RSG's multi modal ecosystem to travel from.

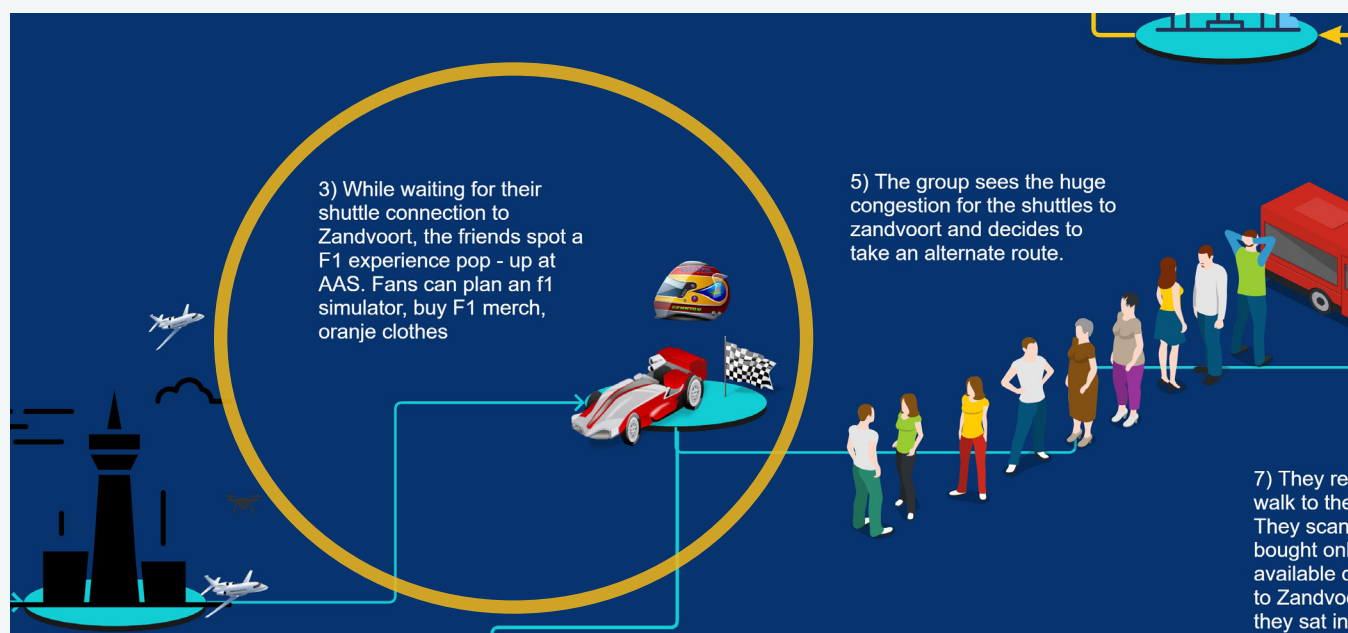


Figure 32. Pop up Experiencenators use case illustrated within the bigger user journey of Willem & friends in figure 30.

<b>Target Group:</b>	All types of users
<b>Drivers:</b>	Experience Economy (Trend), Better passenger Experience (Challenge)
<b>Value:</b>	Better experience while traveling for users. 2) More business generated for RSG. 3) Test potential ideas and create new revenue streams.

### 3. Schiphol Chipkaart

With travel becoming increasingly seamless due to MAaS, there is an opportunity for mobility on a whole to convert towards subscriptions and zonal travel similar to traveling by the metro. Change in political borders due to climate crisis, politics and war as well increased connectivity can result in people traveling across designated zones rather than cities or countries. In order to seamlessly facilitate this travel across zones, passengers will be able to subscribe to a particular zone if they travel frequently to the cities within that zone and use a card similar to the OV chipkaart on any

modality that travels there (See figure 33). By doing so, passengers save on time while individually booking tickets each time they wish to travel but also time in checking in at the airport. Passengers also save money as they pay an annual subscription and don't fall prey to seasonal prices. RSG on the other hand benefits from this payment methods as all modalities will have standard prices and act as equal stakeholders within the larger ecosystem. This will result in better relationships amongst mobility stakeholders willing to work for the greater benefit of mobility and not from a competitive aspect.

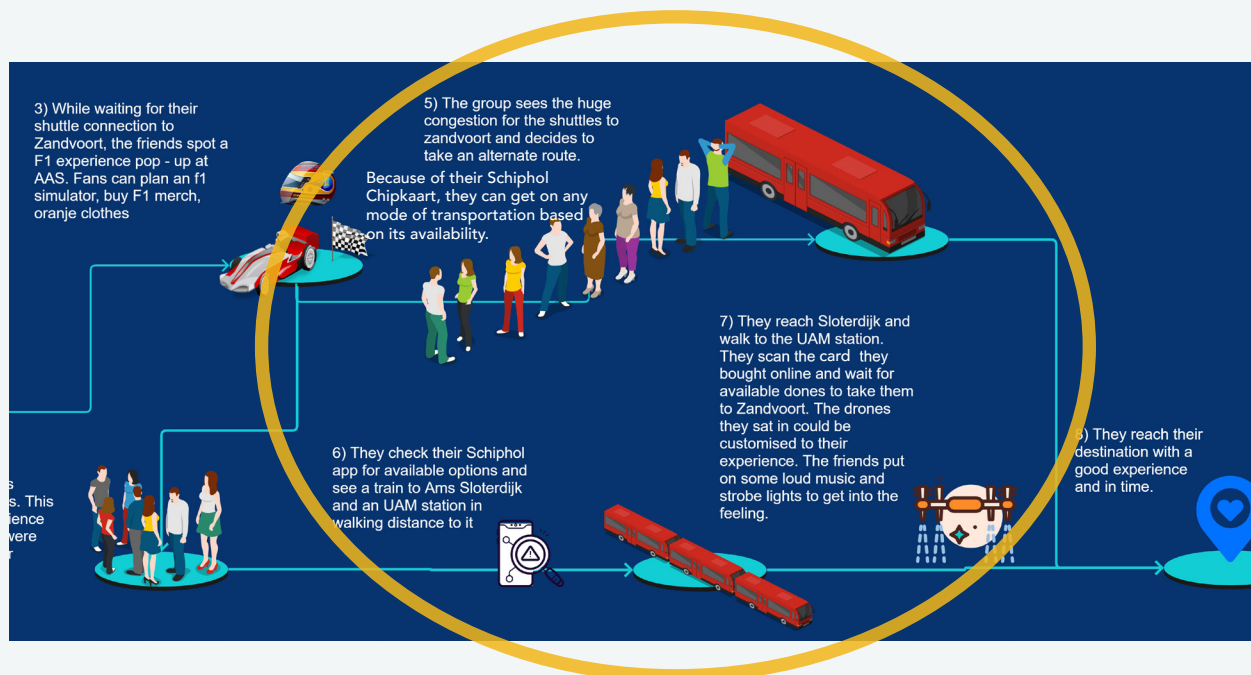


Figure 33. Schiphol ChipKaart use case illustrated within the bigger user journey of Willem and his friends in figure 29.

<b>Target Group:</b>	Remote Workers
<b>Barriers:</b>	Standardization of prices will be impossible. 2) Last minute bookings and cancellations will cause unoptimisation of modalities.
<b>Drivers:</b>	Remote working ( trend), MAAs, Seamless and personalized user journey, Political impacts
<b>Value:</b>	1) Seamless travel experience for users. 2) Standardization & cooperation

## 4. Depolarize me

Passengers in the future will be spoiled with tailored choices due to suggestive AI within the mobility industry and end up getting polarized. We see that trend currently taking place within the entertainment industry with services such as Netflix constantly suggesting users with new choices in the same genre based on their previous viewing habits, this results in a polarized perspective of users and down a rabbit hole of the same type of content. However, users are starting to get frustrated with the AI and want

to expand their perspective but don't know how or what to look for. Similarly with mobility becoming highly predictable and tailored, users are going to want to challenge it and create their own path and experience. Similarly, a service will be created for users who want to challenge the AI and go on their own adventure unique to them. This service will keep travel unique and exciting for passengers but also allow RSG to manage crowds that are all traveling towards the same destination at once.

**Target Group:** Experience dwellers, Isolators, remote workers

**Drivers:** Productive use of time (Trend), Dynamic & Antifragile (Trend & F.V), Helping the community (Trend & Persona), Remote working & Global citizens (Trend, persona)

**Value:** 1)Productive use of time for users. 2) Increased resources & manpower to help RSG in the MMH

## Conclusion

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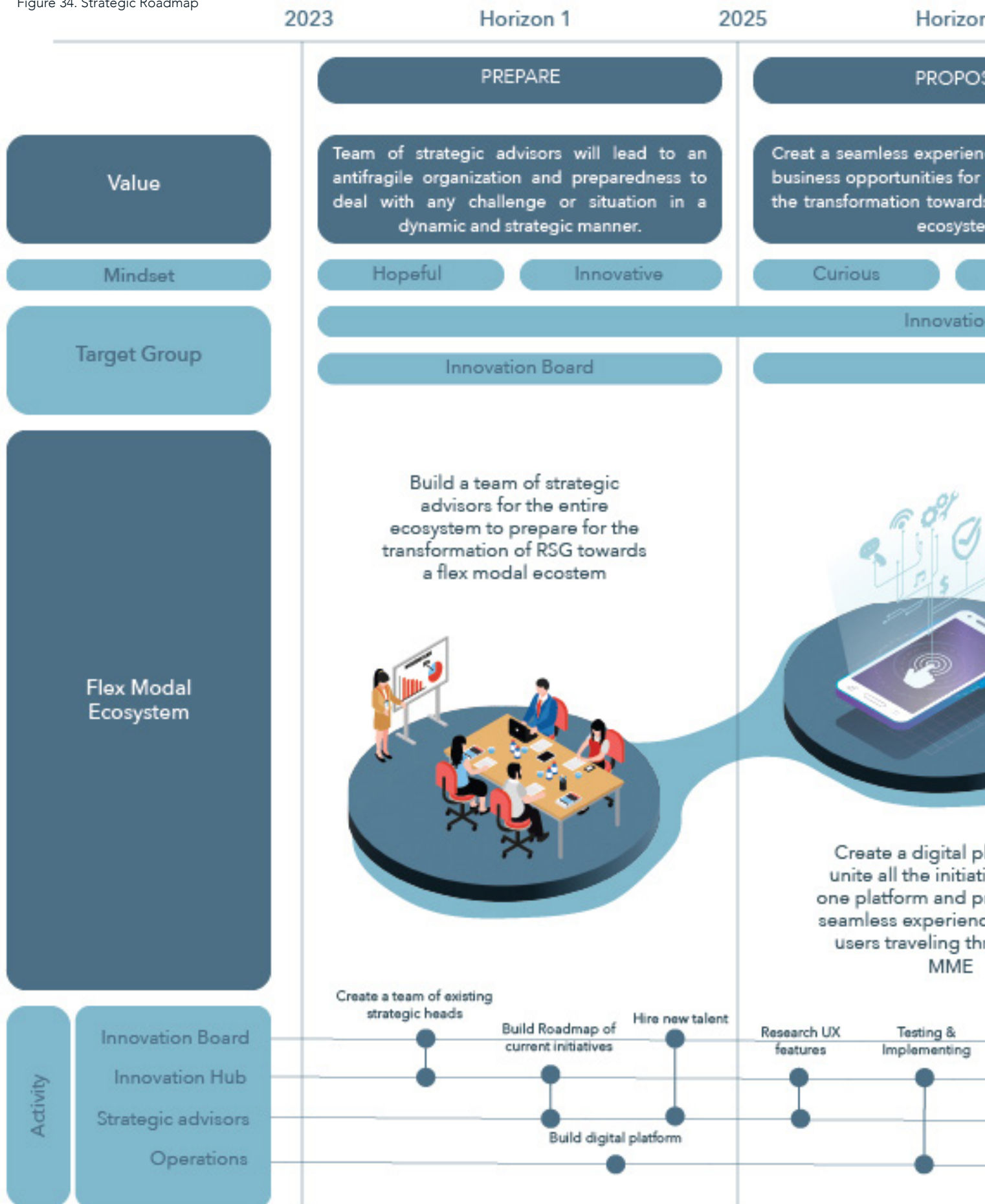
Four distinct personas was created based on worldviews with conflicting factors. The factors identified for future users are; 1) Type of travel (remote working or experience dweller), 2) Connection time (Short or long) and 3) number of modalities used. These factors indicate the user behavior through the multi modal hub but insights from trend research and co-creation workshops suggest use cases such as; Finding work at Schiphol, Experience pop ups, Depolarizing by challenging the AI and Subscription to zones. These use cases suggest new services that could emerge in the future to create a seamless travel experience for the passengers and also potential opportunities for RSG to implement. For the organization to benefit from this knowledge, a strategic roadmap is created and visualized.



# Strategic Roadmap

Based on the above exploration of user journeys, potential initiatives and future vision, I foresee strategic opportunities for RSG to begin implementing in order to reach the desired future vision of a flex modal ecosystem. Three distinct opportunities have been chosen which I believe impart the most value to the entire process. First steps and horizons are explained and visualized in the overall strategic roadmap in figure 34.

Figure 34. Strategic Roadmap



CHANGE

CHANGE

FUTURE VISION

ce for all users, new RSG and strengthen the desired modal m

Create in person connections with users, buzz and awareness on RSG MME, new revenue opportunities, testing new markets and expanding existing ones.

By 2050, Schiphol Group should envision "A flex mobility ecosystem that adapts to situations and user needs resulting in an antifragile way of working. The goal is to create tailored services and seamless experiences for users and passengers.

Excited

Motivated

Confident

The ambition is achieved by increasing proactive collaboration, on time network performance, and decentralizing hub functions."

n Hub

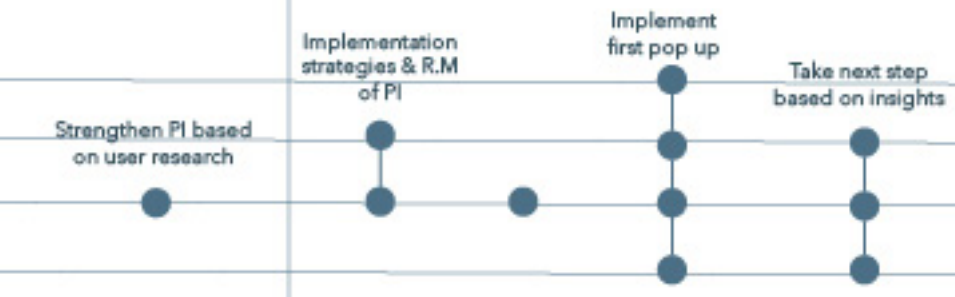
Strategic advisors

Operations

Facilitate experiences through Pop up shops in the MME to create better travel experience for users and test potential initiatives.



Platform to lives under propose new es to RSG's rough the



# HORIZON #1



Figure 35. Horizon 1 of the strategic roadmap



## Horizon 1 - Building a board of strategic advisors

Royal Schiphol Group needs to hire a team of strategic advisors spread across the organization in various departments and regional airports who are able to foster and facilitate strategic thinking within the operations. Active collaboration within this team of strategic advisors will lead to an antifragile organization and preparedness to deal with any challenge or situation in a dynamic and strategic manner.

Personally, I believe along with several stakeholders at RSG that current decision making is backed by personal motivations which creates incoherence in the organization's planning. This solution will help align the organization to implement projects of high value

backed by strategic research and achieve the overall future vision of 2050 of being the highest quality and chosen multi modal hubs in Europe.

This is the first horizon of the roadmap and undoubtedly the most significant as illustrated in figure 35. Based on prior knowledge of the organizations ability to reset after the COVID'19 pandemic, where most personnel were laid off due to the pandemic. It takes around 2 years to source and create a team that can create impact within the organization. Hence, this horizon takes place from the start of 2023 until 2025 to be able to see real impact from this initiative.

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### Drivers

1) Incoherence in decision making and lack of strategic research conducted for the benefits of the entire organization. Aligning all regional airports and future hubs within one single ecosystem.

2) Antifragile is a buzzword floating around the organization and needs to be strengthened and ingrained in people's mindset while working. Dire need of transformation towards an antifragile way of thinking is required.

3) Increased pandemics and climate changes will create havoc on the organizations and its resources, if not dealt with in a strategic and antifragile way.

### First Steps

1) Create a board with existing innovation/strategic heads.

2) Start building a roadmap of potential initiatives along with stakeholders towards the MMH. Ask questions such as where can we pilot certain modalities? Is it strategic in the long term? Are we using the resources we have available to the best of our potential? How do we slowly introduce the current airport as a MMH to the organization, users and end passengers already? What is required to transform the organization & users thinking of RSG from airport to MMH?

3) Hire new talent in various skills to assist in strategic thinking and collaboration amongst all stakeholders

# HORIZON #2

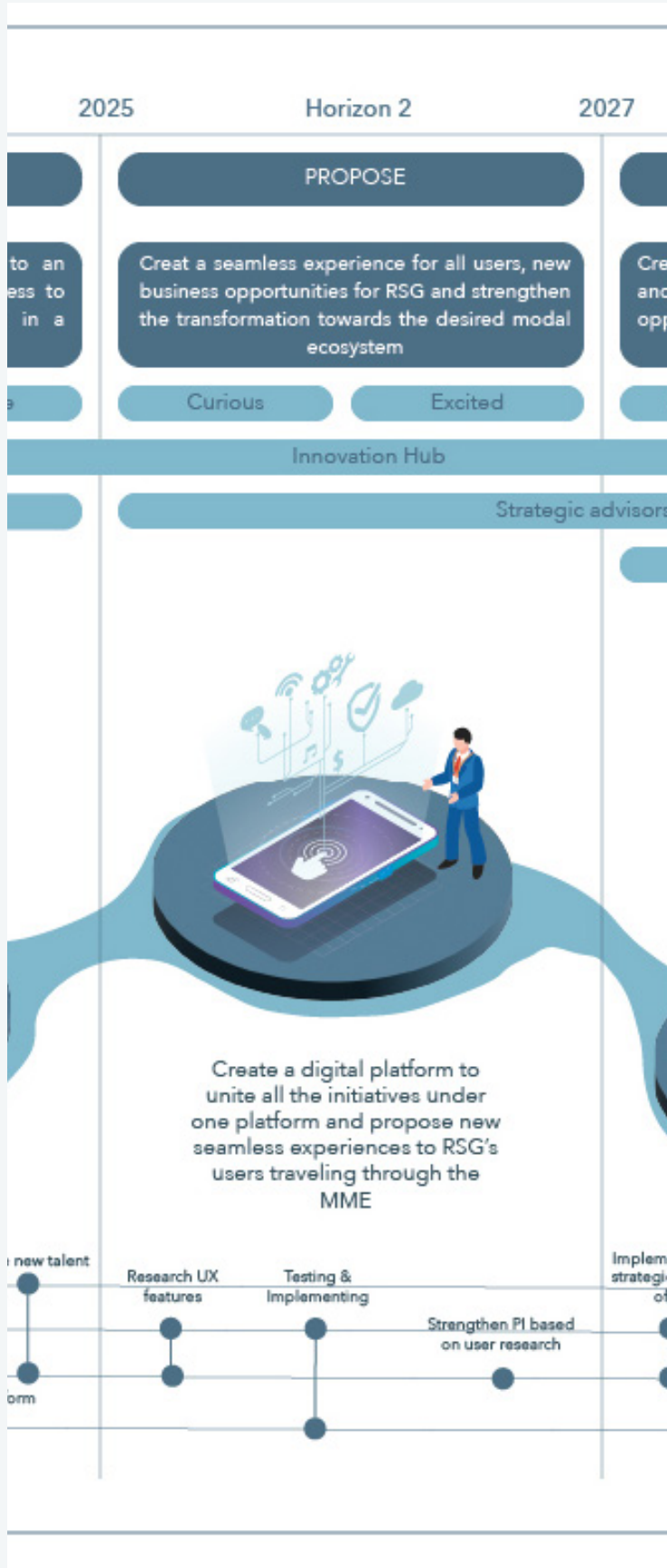


Figure 36. Horizon 2 of the strategic roadmap

## Horizon 2 - Creating a digital platform for RSG MME

A digital platform must be created to unite all the initiatives provided by RSG flex modal ecosystem to its users and end passengers. In my opinion, RSG should strengthen its position as a service provider in its transformation towards digitalisation by creating a solid platform that provides users and passengers services useful to them and efficient for the multi modal ecosystem. The platform can host a variety of services mentioned from the use cases (Refer chapter: 8 Use case) and more depending on user centered needs. Hence, creating a seamless experience for all users, creating a new business opportunity for RSG and strengthening the transformation towards this modal ecosystem.

Horizon 2 as featured in figure 36 has knowledge that is created in horizon 1 will be used to implement this horizon. I foresee this horizon existing between 2025 and 2027 because of the amount of time it takes society to adopt a new digital platform and integrate it into their user behavior. There are many factors that come into play when adopting new technology such as employment and financial stability, trust, literacy, user reach, etc that can slow down the process ( WEFForum, 2022). The timeline is chosen based on market research conducted that states Uber took an estimated 2 years before implementing its first ride sharing services and launching in three international cities ("The History of Uber - Uber's Timeline | Uber Newsroom", 2022).

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### Drivers

- 1) Mobility as a service is increasing and unification of information and payment services under one platform is gaining more significance in the world of mobility (Refer Chapter 5: Current trend research). A gap in opportunity exists in unifying all the mobility stakeholders under one platform and facilitating them which can be orchestrated by RSG.
- 2) Rise in digital nomads creates a need for digitalisation of all features and services (Refer to chapter 5: Trend analysis)
- 3) RTHA airport is currently working on creating a mobile application to unify all modal options and give users options for their travel (Refer Appendix 1: Expert Interviews Ahmad) but this is not enough and has to be created on a larger scale in collaboration with various stakeholders in the larger organization and regional airports.
- 4) RSG is currently in its transformation towards digitalisation. (Refer Appendix 1: Expert Interviews Ahmad)

### First Steps

- 1) Create a team within operations to work on the digital platform
- 2) Collaborate with regional heads, innovation hub, users and stakeholders to research new features to be added on the platform
- 3) Start testing features with target users.

# HORIZON #3

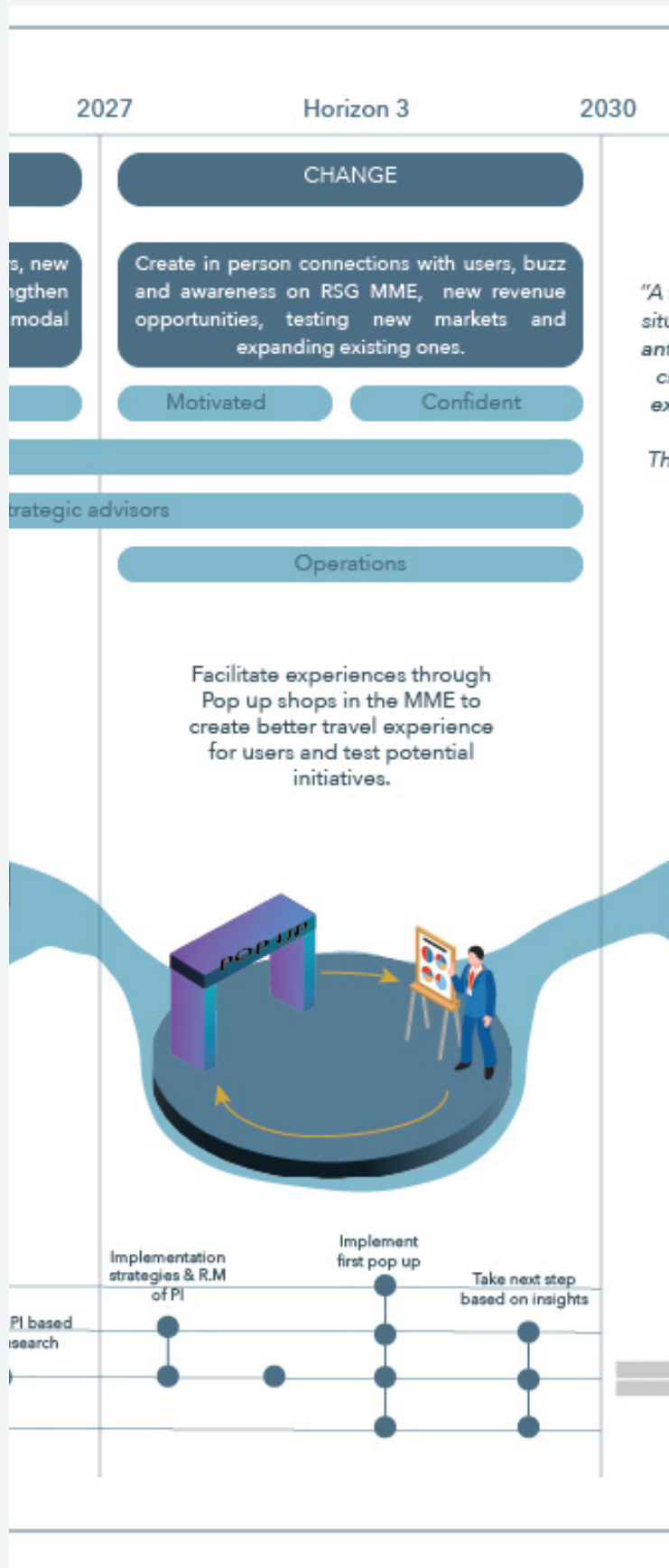


Figure 38. Horizon 3 of the strategic roadmap

## Horizon 3 - Pop up stores

In my final recommendation, I would advise RSG to facilitate diverse pop up stores within the ecosystem of the multi modal hubs that provide passengers with fun experiences and initiatives that could create a better experience for the passenger journey as well as gather new insights for RSG to learn from. These pop up stores can vary from being a targeted experience for a festival, sports like F1 or football or to piloting certain initiatives that could be interesting for users such as flex work spaces, remote baggage check in, managing congestion through token initiated queuing system, etc. Through these fun temporary pop up experiences, users and the organization can learn from each other on how to better the experience of traveling via Schiphol's flex modal ecosystem. The fun experiences also generate curiosity in users and allow them to have a unique experience each time they travel. From the organization's perspective, they can find new business ventures to expand in based on the success of the pop

up initiatives. The value created from these pop up experiences are; creating in person connections with users, buzz and awareness, new revenue opportunities, testing new markets and expanding existing ones.

The final horizon mentioned in figure 38 focuses on implementing initiatives from the first two horizons as well as strategically gathering new insights to develop future initiatives for a dynamic and successful flex modal ecosystem. This horizon takes place from 2027 until 2030, while setting up a pop up experience is not time consuming, the overall process to create the experience based on user centered research and then gathering and analyzing new insights to develop further initiatives will take time. Also time is taken into consideration from implementing the first pop up store to actually making it a success within the larger ecosystem.

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### Drivers

- 1) An increasing amount of users are seeking experiences while they travel and the service era is transforming towards an experience economy (Refer chapter 5: Trend research, 6: co creation workshop).
- 2) AAS used to facilitate global experiences in the foyer but stopped it despite its huge success ( Refer Appendix: User feedback Futur evision)
- 3) Smart way to adapt to changing desires and user needs and tailor services to the user (Trend)

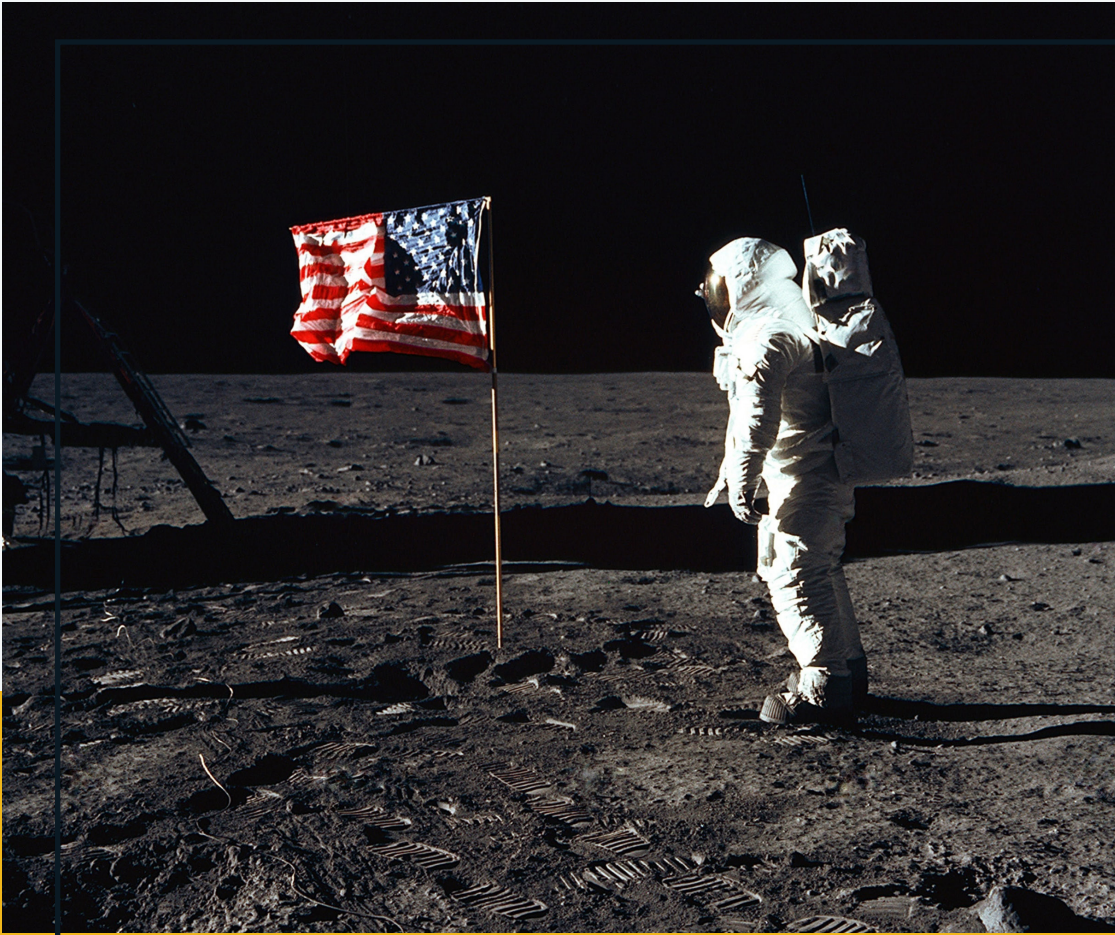
### First Steps

- 1) Strengthen the list of potential initiatives based on user research
- 2) Create implementation strategies and roadmaps for each initiative. Also business models should be created to estimate cost benefit analysis. Prioritize the initiatives based on the knowledge gathered.
- 3) Implement a small but significant pop up and see the impact caused.

## Conclusion

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Finally, in order for RSG to impart value to all their users and successfully transform towards the desired future vision for a multi modal hub, I believe it should take two years from now to set up a board of strategic advisors within the ecosystem to make strategic and profitable decisions towards the dynamic MME. In the meantime, a digital platform should be created and implemented in the next two years that facilitate some of the initiatives thought by the strategic advisors. Finally pop up stores facilitating new experiences for users should be implemented until 2030 and insights gathered from these pop up stores should contribute to new market research and potential business expansion ideas.



# Conclusion

Based on the above exploration of user journeys, potential initiatives and future vision, I foresee strategic opportunities for RSG to begin implementing in order to reach the desired future vision of a flex modal ecosystem. Three distinct opportunities have been chosen which I believe impart the most value to the entire process. First steps and horizons are explained and visualized in the overall strategic roadmap.

## 10.1 Conclusion

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This thesis set out to explore the future vision and users needs of a multi modal hub for Royal Schiphol Group to create strategic opportunities towards transforming into a multi modal hub. Therefore, the overarching research question of this thesis was: How do various modalities connect at Schiphol's future multi modal ecosystem to create a seamless mobility experience for its users?

In order to answer this question, research was conducted on the context of mobility and the role of RSG within it which led to understand the need for a MMH. Current and future focused trend research together with expert interviews from the field of mobility and RSG allowed me to create a future vision positioning RSG as a future multi modal hub. The future vision was iterated by multiple stakeholders within the organization and industry. A co-creation workshop with end users combined with insights from the future vision and trend research paved the way to create personas and identify user behavior through use cases. Finally, a strategic roadmap was conjured based on potential strategic initiatives found from user research and the future vision that can be valuable for RSG to implement in order to successfully transform towards a multi modal hub.

There are four main findings from this thesis, they are the future trend research, vision, user behavior and strategic solutions for RSG respectively.

### Trend Research

The future always remains uncertain but trends suggest that by 2050 an increase in water levels due

to global warming might impact the way people live and travel, probably resulting in a new lifestyle called water natives. Preferred human to machine interactions might lead society towards becoming more isolated and quality experiences will help to regain a social interaction amongst people. Finally remote working and dependency on machine learning in the workplace suggest a redefine to the traditional work week and workers in the future. These trend together suggest a holistic understanding of the future context of mobility and user behaviors for RSG to create a future vision.

### Future Vision

Based on the trend research and co-creation workshops, a future vision was drafted for RSG which goes as; "By 2050, Schiphol Group should envision a flex mobility ecosystem that adapts to situations and user needs resulting in an antifragile way of working. The goal is to create tailored services and seamless experiences for users and passengers.

The ambition is achieved by increasing proactive collaboration, on time network performance, and decentralizing hub functions."

RSG should aim to create a flexible mobility ecosystem in collaboration with all the relevant stakeholders, regional airports and future hubs that is dynamic and adapts to user needs. The result will be an antifragile way of working within the organization which is needed to gain from adversities and emerge strengthened from any challenge they face at the multi modal ecosystem. However the ambition relies on three main pillars that need to be strengthened which are; increasing proactive collaboration, on time performance and decentralizing hub functions.



## Personas And use cases

Four distinct personas was created based on worldviews with conflicting factors. The factors identified for future users are; 1) Type of travel (remote working or experience dweller), 2) Connection time (Short or long) and 3) number of modalities used. These factors indicate the user behavior through the multi modal hub but insights from trend research and co-creation workshops suggest use cases such as; Finding work at Schiphol, Experience pop ups, Depolarising by challenging the AI and Subscription to zones. These use cases suggest new services that could emerge in the future to create a seamless travel experience for the passengers and also potential opportunities for RSG to implement.

## Strategic Roadmap.

Finally, in order for RSG to impart value to all their users and successfully transform towards the desired

future vision for a multi modal hub, I believe it should take two years from now to set up a board of strategic advisors within the ecosystem to make strategic and profitable decisions towards the dynamic MME. In the meantime, a digital platform should be created and implemented in the next two years that facilitate some of the initiatives thought by the strategic advisors. Finally pop up stores facilitating new experiences for users should be implemented until 2030 and insights gathered from these p[op up stores should contribute to new market research and potential business expansion ideas.

However the desired future vision will fail if proper proactive collaboration is not maintained and organization thinking is not transformed from thinking as an airport. To conclude, RSG has an opportunistic future ahead of them as a multi modal ecosystem within Europe, if initiatives are implemented ahead of time with proper collaboration and antifragility thinking.

## 10.2 Next Steps

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The future vision for Schiphol Group's multi modal hub is a very promising one but in order to make use of its full potential, further studies regarding its validation with external stakeholders and a business model should be conducted. Furthermore, time permitted me to narrow my scope and only speak to a handful of certain user types but for RSG to take this further, they should consult more user groups to identify diverse user needs and behaviors.

The trend research conducted is solid and creates a good understanding of the future but potential initiatives ideated through user research must be further explored to create a working prototype from the initial ideas mentioned. Also validation of these ideas should be carried out as part of an iterative process. The concepts from the use case are mainly

focused on desirability but lack foundation for being viable and feasible. Hence, they should be explored further to really bring value to Schiphol group. One such example is the idea of Travail. Questions like; what will it cost the organizations to run this program? How can we prevent terrorists and harmful people to take advantage of this program? How does it impact the business on a wider scale than just managing peaks? , should be explored.

Finally, the strategic roadmap along with its solutions should be validated with the wider business and specific decisions should be made based on their feedback. Since this vision is shared and meant to have equal representation of all stakeholders in the business, the strategic roadmap should also convey that ownership.

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