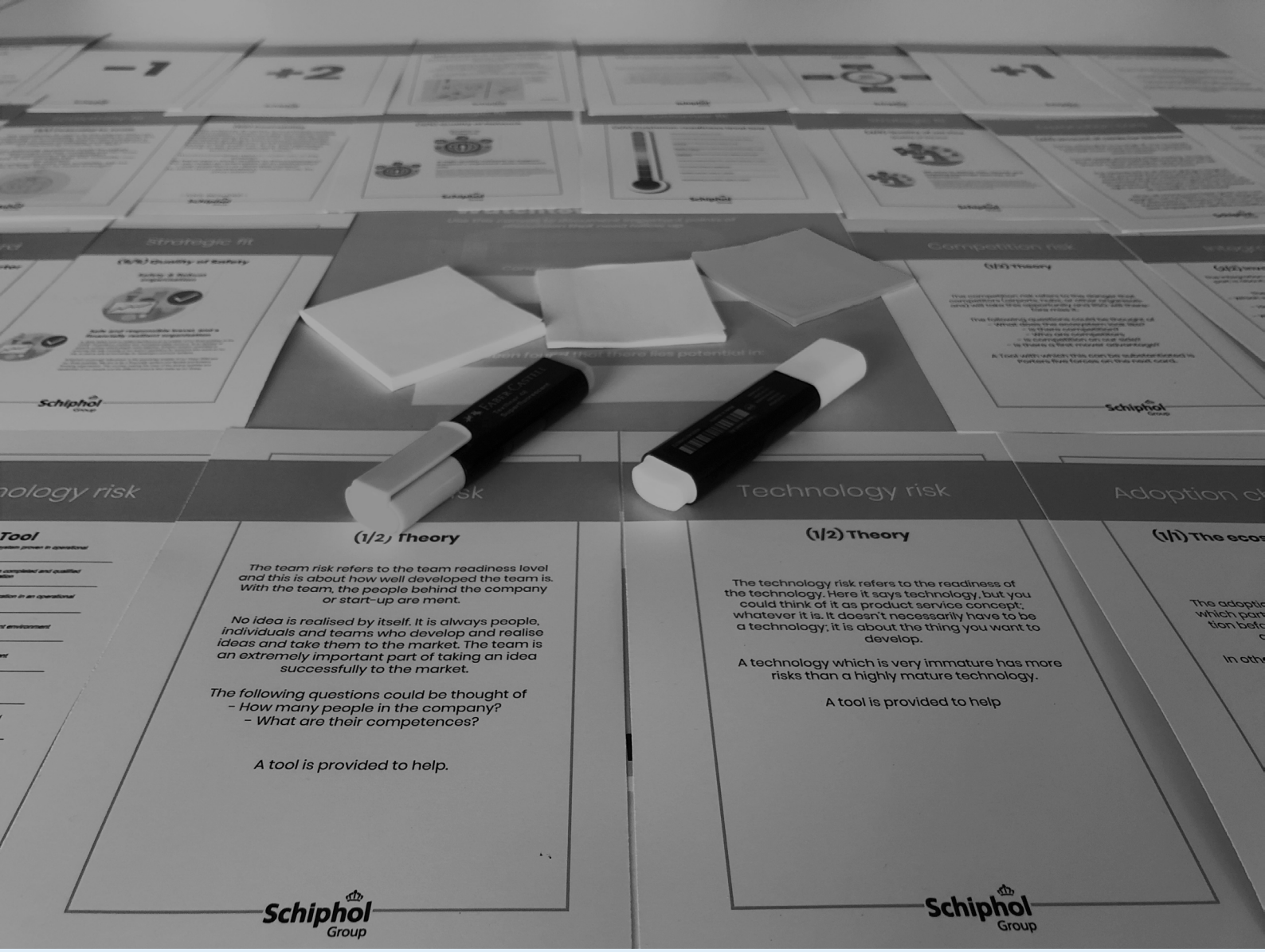

A MODALITY INNOVATION APPROACH

HOW CAN ROYAL SCHIPHOL GROUP IDENTIFY AND SELECT FUTURE PROOF FORMS OF MOBILITY?

MASTER THESIS

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Abbreviations and meaning of terms

List of abbrevatiuons

RSG	Royal Schiphol Group
MMH	Multi Modal Hub
S&AP	Strategy & Airport Planning
IH	Innovation Hub
IB	Innovation Board

List of terms

Modality	A mode of transport / a form of mobility
Company X	An urban mobility company, which can not be named due to confidentiality

Meaning of colours

Blue	Text in blue means the phrase is a key insight

Executive summary

Royal Schiphol Group is the overarching organisation of multiple airports, among which Amsterdam Schiphol Airport. As the world around these airports is quickly changing with aviation under pressure, and a huge amount of new potential modalities, RSG is in need of an approach to deal with new kinds of modalities. This project was executed for the Innovation Hub, part of the department of Strategy & Airport Planning within RSG. The initial assignment was to find a way in which RSG could identify and select modalities with potential.

During the project, first, the context was outlined by analysing the organisation of RSG and the environment in which they are operating. After this, literature concerning open innovation has been compared to the way RSG handles external innovations at the moment, as this is how RSG can strengthen their MMH position further. It appeared that currently, RSG misses a structured approach to handle new modalities. RSG therefore needs a strategy and a corresponding way to assess innovative modalities. An extra exploration was done, consisting of literature, interviews, observations and internal documents, which led to design principles for the strategy and the toolkit.

In the end, a strategy is developed in which 4 steps (identifying, identified, assessing, choosing) were included. In this strategy, RSG is encouraged to connect more to the world of mobility and its future with the use of an orchestrator positioned in-between the innovation hub and a newly acquired scouting team. Executing these steps would lead to a decision on the fifth step: engaging. In the developed strategy, RSG shifts from reacting to modalities to proactively monitoring the world of mobility by providing structure in searching. In this way, they can connect to this future world of mobility, and by regularly assessing modalities, Schiphol can quickly change direction if necessary. Within the strategy, an orchestrator is present to lead the strategy. The orchestrator will be responsible for setting the exact strategy within the MMH direction, as he or she knows what happens in the market and within Schiphol. He or she will be building bridges between RSG and start-ups.

For the assessment, a toolkit is developed in which the factors that influence the potential of a modality at Schiphol have been incorporated and the proposed way of working in the strategy. This is reflected in a card deck that should be used to assess modalities and canvases that should be used to document the session and ensure the session's follow-up is assured. Herein, the toolkit's goal is to facilitate a structured discussion concerning new modalities that can be used to substantiate decision-making by RSG.

This report describes the entire process to come to the final design. The final design is further elaborated on, an implementation plan is proposed, and lastly, a discussion and recommendations of the final design are provided to reach its full potential.

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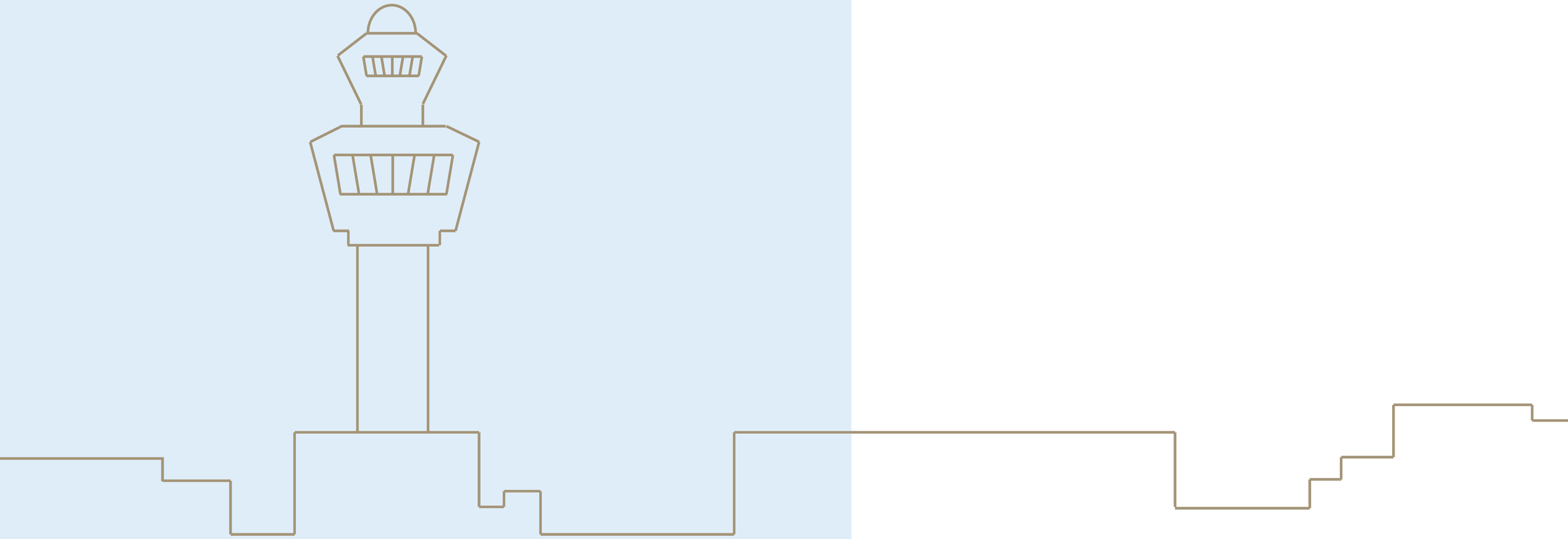
01

INTRODUCTION



Chapter

1.1 Background

In the (near) future, there will be a huge amount of new potential entrants in the world of mobility. Short-distance flights might be replaced by hyperloops or international (night) trains, and urban air mobility might develop faster than we think. With a future being highly uncertain and with long development timelines, it could be important to Royal Schiphol Group (RSG), which owns and manages several (large) airports or terminals, to prepare itself for the changing world of mobility and to start thinking of an approach on new disruptive kinds of nmodalities. Before aviation, as we know it now, will be disrupted by a new transport mode, and Schiphol loses its current position.

Generally, when companies are very good at something, they tend to find it hard to do something radically different. This is being reflected in aviation. At the moment, most innovation in aviation is sustaining or incremental innovation on existing technology. Also, for RSG, it seems more attractive to focus on incremental/sustaining innovation to improve current aviation. This focus causes smaller companies to focus on segments of the market that the large companies do not focus on. The risk for RSG here is that one of these smaller companies will find a way to disrupt the market. Therefore RSG should also consider focusing on these different segments of the market. This dilemma is called the innovators dilemma, as described by Christensen (Christensen, 1997). To overcome this dilemma, RSG should find a way to in which they are able to identify these potential disruptions before RSG will be disrupted.

Apart from the huge amount of potential entrants in the world of mobility and the innovators dilemma, more factors are threatening Schiphol's current operating model and are moving Schiphol in a direction to explore different modes of transport. The environmental pressure, illustrated by the recently published IPCC report (IPCC, 2021), and Schiphol's direct external factors like growing noise complaints (BAS, 2020) are both examples of negative factors for aviation as we know it now.

If Schiphol wants to stay relevant in the future and pursue its own ambition of ´Connecting the world', Schiphol should be sustainable for potential shifts in the world of mobility. As the world of mobility will not stay the same and might change frequently, constant changes should be taken into account. However, RSG does not know how to do this. Therefore this graduation project will contribute with an approach to assist Schiphol in the process of identifying and selecting new forms of mobility.

Problem Owner / Scope
Royal Schiphol Group is the overarching organisation of Amsterdam Airport Schiphol, regional Airports in The Netherlands, and several international Airports. RSG is the owner of Rotterdam The Hague Airport and Lelystad Airport, and on top of that, they have the majority of the shares of Eindhoven Airport. Besides, RSG has a share in the Groupe ADP, Brisbane Airport, Hobart Airport, and retail operator one of JFK's Terminals. This is visualised in figure 1. RSG is the problem owner, and therefore this project will be addressed for RSG. For the scope of this project, Amsterdam Airport Schiphol will be considered as a case of reference. This is done because it is expected that for each airport, different circumstances might result in different insights. As the workload of this project is limited, there has been chosen to look at Amsterdam Airport Schiphol specifically. In the end, it will be considered to what extent the insights of this project can be used for the regional airports and RSG´s international airports.

Figure 1. RSG and its airports

Chapter

1.2 Problem description

As a starting point of this project, this chapter presents a preliminary problem description. This preliminary focus has been given as scope and direction of the first part of the research and, therefore is the starting point of the project. During the first phase of the research, this problem focus is examined and is, if necessary, further scoped later.

1.2.1. Preliminary problem statement

As stated previously, RSG will partly shift its focus to new kinds of mobility, which is part of one of the innovation hub's portfolio, as will be described later. However, the innovation hub does not know how they should search for new kinds of mobility in the constantly changing world of mobility. Besides, they do not know how they would be able to select the modalities with the most potential for RSG. RSG has experience with such outside-in innovation focused on mobility, for example, Hyperloop. Yet, a structured approach is missing. This project aims to assist Schiphol in the process of identifying and selecting new forms of mobility. To summarise, the preliminary problem statement is stated below, followed by its sub-questions.

RSG needs an approach to **identify** and **select** future proof forms of mobility

It is expected that these are the two steps to be gone through before being able to engage with a modality.:

- *How can Schiphol monitor the development of emerging modalities?*

- *How can Schiphol know how to select modalities with potential?*

1.2.2. Goal of the project

The goal is to design an intervention that will help Schiphol identify and select new modalities which are relevant and competitive, and accepted in a future society. The intervention could be a new process, a tool, a method, or an organisational intervention, which should, in the end, be transformed into a practical application.

1.2.2. Research questions

To find a solution for the problem statement, the main research and 4 sub research questions question have been formulated. In the first part of this report, the sub research questions are answered, which form the foundation of the revised problem statement of a potential intervention. This is visualised in figure 2.

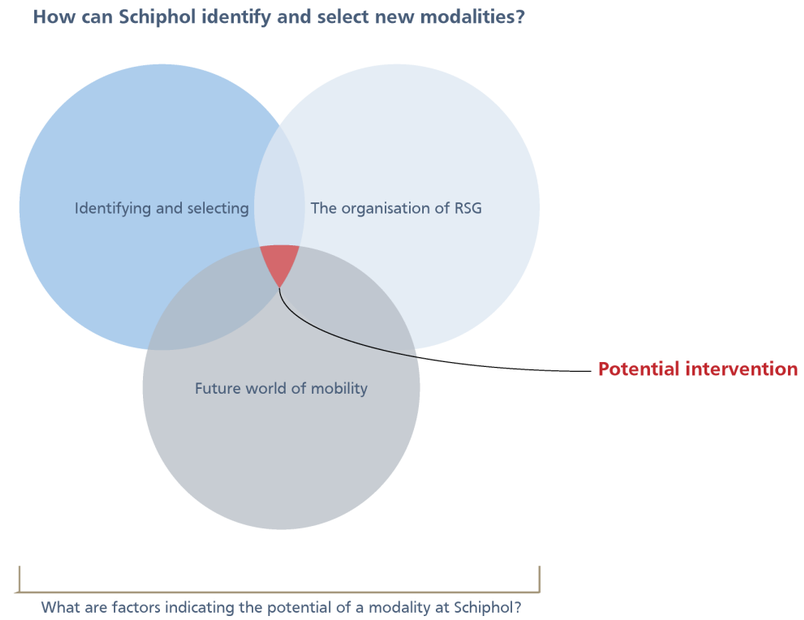


Figure 2. Research questions

RQ	How can Schiphol identify and select new modalities?
RQ1	How can identifying and selecting innovations succeed in corporates?
RQ2	How can an intervention concerning new modalities be implemented within the current organisation of RSG?
RQ3	What does the (future) world of mobility look like?
RQ4	What are factors indicating the potential of a modality at Schiphol?

Chapter

1.3 Project approach

For this project, I have applied the double diamond approach as guidance through the project, which is visible in figure 3. This approach is based on two phases of the project. First, the problem space is examined, followed by a problem statement. After this, the solution diamond is explored, consisting of ideation, prototyping and testing. The double diamond has been chosen as there is a clear difference between the problem space and the solution space, which is preferable in this project because the problem might not be entirely clear in the beginning of the project. Furthermore, data collection was done following the principles of Sanders and Stappers (2012), visualised in figure 4.

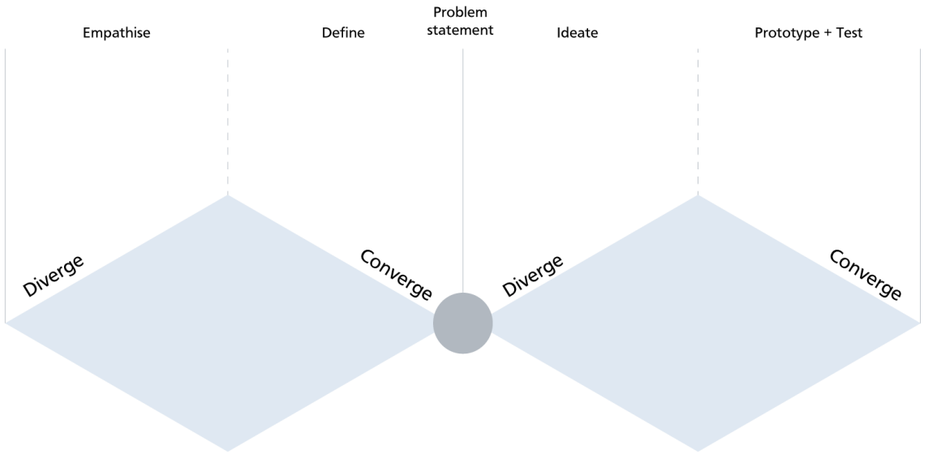


Figure 3. The double diamond approach

1. Empathise

This phase was about understanding how innovation works, trying to understand the needs of Schiphol, and gathering all knowledge necessary to understand the world of mobility. This has been done through extensive literature research, (semi-structured) interviews, informal conversations, case studies, consulting internal documents, and observations. The duration of almost half a year of experiencing RSG gave a feeling of the organisation and contributed to empathising with RSG and the problem they are facing. This, by joining the rituals at the innovation hub and having informal conversations.

2. Define

All the insights gathered had to be sorted so that the problem could be stated. This was done by gathering all insights and repeatedly clustering them to identify overarching themes. In the end, a revised problem statement was defined, which had the most important parts of the empathise-phase in it. In the end, there were two problems identified. From these problems, the design brief and design principles were formed, which were the starting point of the second part of the research, starting with ideate.

3. Ideate

The design principles were used to brainstorm for ideas. In the end, three idea directions were formed from which one was chosen to further develop. Furthermore, experts were consulted, and literature was used as a theoretical foundation for the outcomes.

4. Prototype + Test

The chosen idea direction was further developed in the prototype phase. Prototypes were tested iteratively from an early phase. This mostly because I had no prior experience with developing a toolkit. Stakeholders from Schiphol have been gathered in a co-creation session to develop the prototype. These tests resulted in a final MVP that was used for a final user test. The final MVP to be tested was tested in a real user test. For this test, an evaluation plan was developed, and multiple scenarios were tested. During these tests, assumptions were validated, which were used as improvements for the final design.

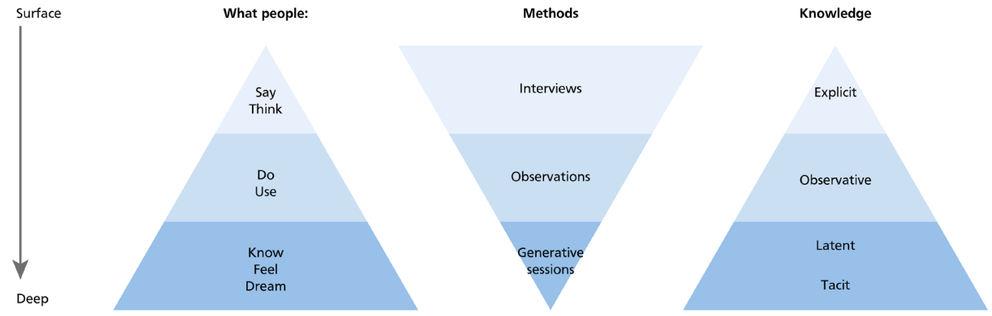


Figure 4. Data collection (adapted from Stappers and Sanders, 2012)

Chapter

1.4 Process

With the double diamond as guidance, the following process has been gone through. The four phases of the double diamond, as explained in chapter 1.3, have been joint together with the process, as visualised in figure 5.

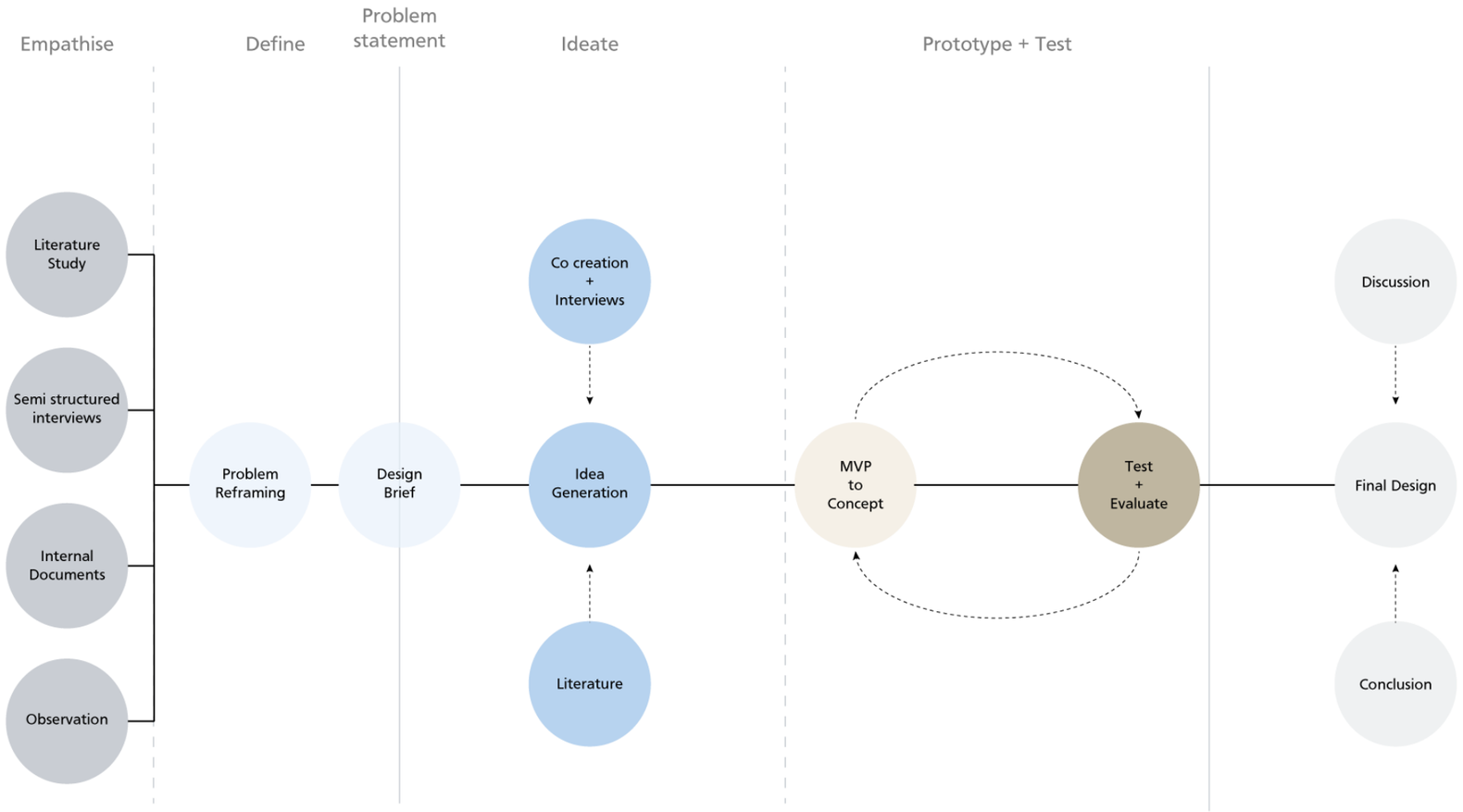
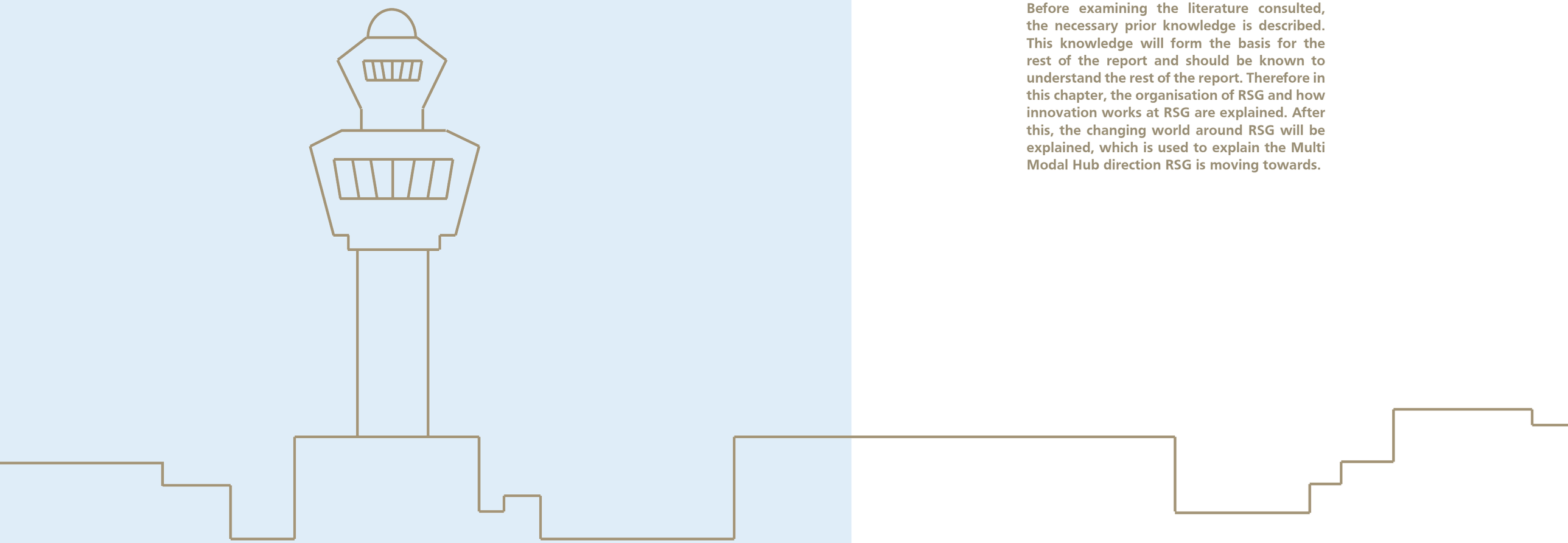


Figure 5. Project overview

02

CONTEXT ANALYSIS



2.1 INTRODUCTION

Before examining the literature consulted, the necessary prior knowledge is described. This knowledge will form the basis for the rest of the report and should be known to understand the rest of the report. Therefore in this chapter, the organisation of RSG and how innovation works at RSG are explained. After this, the changing world around RSG will be explained, which is used to explain the Multi Modal Hub direction RSG is moving towards.

2.2 Introduction to Royal Schiphol Group

In the year 2021, Schiphol Amsterdam Airport was the most connected travel hub in Europe in terms of direct connectivity and worldwide the third best-connected travel hub in terms of indirect connectivity (ACI, 2021). This respectively refers to the number of direct flights available and the number of places people can fly to with a connecting flight.

RSG wants to maintain this position, which is reflected in RSG's strategy originates from its vision for 2050, which is to create the world's most sustainable, high-quality airports (RSG, 2021) and the 'why' of RSG of 'connecting your world'. This is reflected in four so-called cornerstones that they want to strengthen further: Quality of Network, Quality of Life, and Quality of Service, and Safety and a Robust organisation. The vision of RSG and its four pillars are explained hereafter, and is visualised in figure 6.

Figure 6. Strategy of RSG (adapted from RSG, 2022)

Vision Schiphol

The 'why' of Schiphol is: ''Connecting your world ''. Herein, the ambition of RSG is to create the most sustainable, high-quality airports, which sets a new and aspirational goal for the organisation and the wider Dutch industry. This vision is being substantiated by four fundamental pillars: Quality of Network, Quality of Life, Quality of Service, and Safety and Robust organisation.

Pillar 1: Quality of Network (QoN)

RSG benefits to employment, GDP, and logistics for the region around its airports and The Netherlands as a whole. Therefore, Schiphol wants to provide connectivity, especially to its first-class network of destinations.

Pillar 2: Quality of Life (QoL)

Apart from keeping Schiphol strongly connected, Schiphol's second pillar focuses on the living environment around them, locally and worldwide. Focus points herein are positively benefiting to climate change and the Sustainable Development Goals, realising to be energy positive, creating circular business operations, promoting sustainable aviation, and creating a healthy environment around its airports.

Pillar 3: Quality of Service (QoS)

To keep a competitive advantage over its competitors, Schiphol's goal is to remain the first choice by providing constant high-quality service in a safe, seamless customer experience, together with unique, memorable experiences.

Pillar 4: Safety and a Robust organisation

It is essential within operations at Schiphol to create a safe environment for passengers, employees and locals. On top of that, Schiphol is aiming to be a strong and adoptive organisation to reach its 2050 vision.

2.3 Innovation within Royal Schiphol Group

Now that the strategy is explained, the focus will shift to how innovation works at RSG. Innovation in the organisation of RSG is done in collaboration between Amsterdam Airport Schiphol and the local airports in The Netherlands. The direction of innovation is based on the overall strategy and vision of RSG. The Innovation Hub works according to their path to Moon and Mars, terms which they use for exploitive design and explorative design. This means they mostly focus on early-stage innovation with which they can benefit to the long term future of RSG. This is being reflected in the purpose of the innovation hub:

''To explore & realise disruptive innovations to sustainably connect your future world''

The innovation hub is responsible for long-term innovation, which new modalities in the Multi Modal Hub (MMH) context are. The Innovation Hub currently consists of a head of innovation, three innovation leads, three innovators, two phd'ers and several interns (figure 7). Projects which they are working on are originated from six so-called innovation families, which are directly formed from RSG's vision. The innovation families are the main themes of ideas that the innovation hub is working on. There are 6 innovation families: Sustainable Aviation, Autonomous Airside, Healthy Environments, Future Baggage, Digital Identity, and Multimodal Hub (figure 8). Within these 6 innovation families, this project is about the identification and selection of new projects in the MMH family and how this can be done best. Therefore this project will initially be executed for the innovation hub.

Figure 7. Members of the innovation hub

Head of innovation	—	*End responsible for the innovation hub within RSG*
Innovation leads	—	*End responsible for one or more innovation families*
Innovators	—	*Working on one or more innovation projects*
PHD'ers	—	*Doing research*
(Graduate) Interns	—	*Doing research*

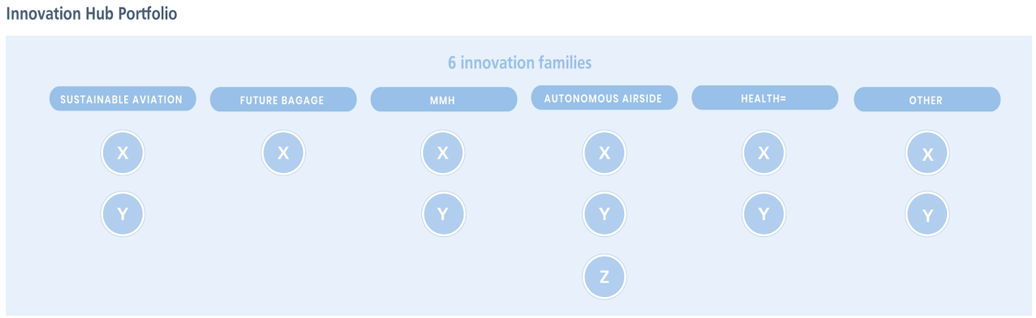


Figure 8. Overview of 'innovation families' of the innovation hub

Sustainable aviation	*— Projects concerning sustainable ways of aviation. An example is sustainable aviation fuels.*
Autonomous airside	*— Projects concerning an autonomous airport. An example is sustainable taxiing*
Healthy Environments	*— Projects concerning the environment of RSG. Examples are DeNoize, and UFP mitigation*
Future Baggage	*— Projects concerning future baggage. Examples are remote baggage, and BagsID*
Digital identity	*— Projects concerning digital identity of travellers. Examples are health recognition, and healthy terminals*
Multi Modal Hub	*— Project concerning the multi modal hub. Examples are hyperloop, and this project.*

Decision making

The innovation board is the group of people deciding which ideas and innovations will actually be executed at the airports of RSG, so they are responsible for innovation funding. The composition of the IB is as follows: CEO Schiphol, Head of Innovation of Schiphol, Director Schiphol International, and the regional airports are represented, as shown in figure 9. It is important to take the innovation board into account as they have a big say in decision making for the innovation hub.

Figure 9. Composition of innovation board

Way of working innovation hub

The way of working of the innovation hub is now briefly explained according to the steps in which they execute innovation projects, which is visualised in figure 10. An important remark is that there is not always a clear order of steps and that it is an iterative process, which is a characteristic of innovation projects in general. Normally their way of working consists of the following steps:

1. ´First´ they start with their **mission**: These are the biggest problems to solve for RSG; in other words, their 6 innovation families.

2. Then their **astronauts** are defined: this is the ecosystem in which they operate within a project.

3. Then the **telescope**: the mission is being tested. In other words, their mission is made quantifiable, and the question is raised why this problem has not been solved yet.

4. Based on the telescope, an alluring perspective can be created. This is called **stargazing**. Here a statement with the solution in it is created. A picture of what the future would look like and how the future of 2050 is envisioned.

5. After this, prototyping and conceptualization are done. Starting with **a blueprint** first, which is being tested during the **test launch**. Finally, during the **touchdown** something will be integrated, or not.

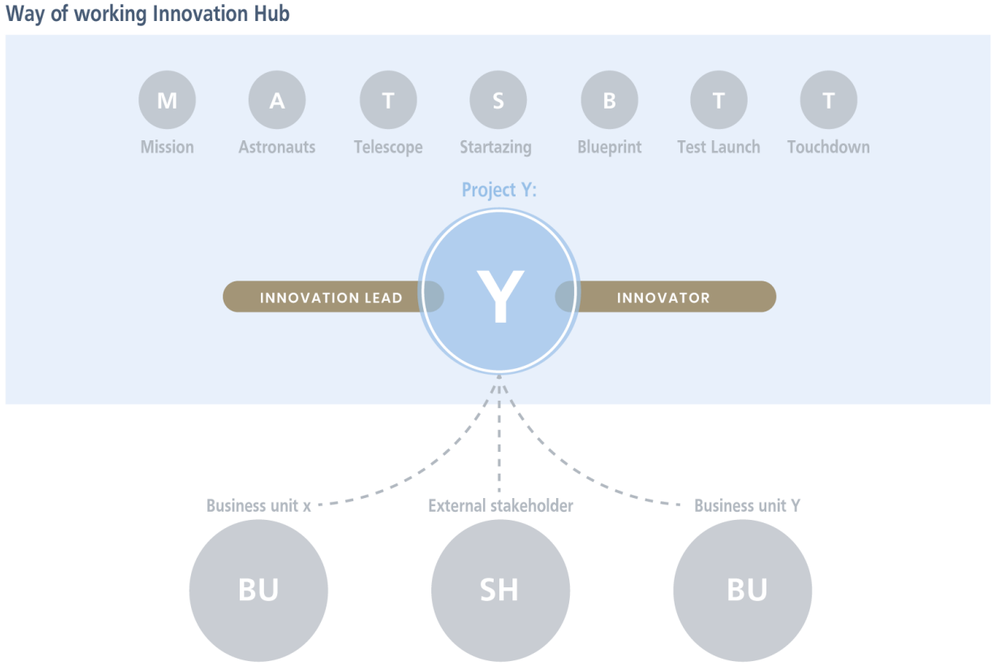


Figure 10. Way of working innovation hub

The innovation hub within the organisation of RSG

The Innovation Hub is part of the Airport & Strategy (S&AP) department, which works on the overall guidelines and planning of the mid and long term by deciding on the facilities and the future of Schiphol. As this overlaps with the MMH strategy, also S&AP will have to be incorporated into the intervention. The guidelines and planning of the future are documented in Schiphol's Midterm-planning and long-term planning. It would be valuable to see if the intervention could benefit to the MasterPlanning (MP) and the MidTermPlanning (MTP) made within S&AP. The MP is being updated every 5-7 years in which major changes in world economics are being taken into account and is looking at the next 50 years. MTP is a strategic investment plan for the coming 10 years, so this is more focused on the shorter term innovation. These plannings represent strategic projects on the midterm and long term planning (2050) based on which assets are assigned within Schiphol.

The Ecosystem of innovation

Now that we know what innovation initiatives are based on, it is interesting to understand how the entire ecosystem works. Herein, all the explained parts of how innovation is being applied have been combined into one overview, which is shown in figure 11, on the next page. From decision making by the innovation board on top, to the innovation hub and its way of working, all the way to single projects on the bottom. This all within the department of S&AP.

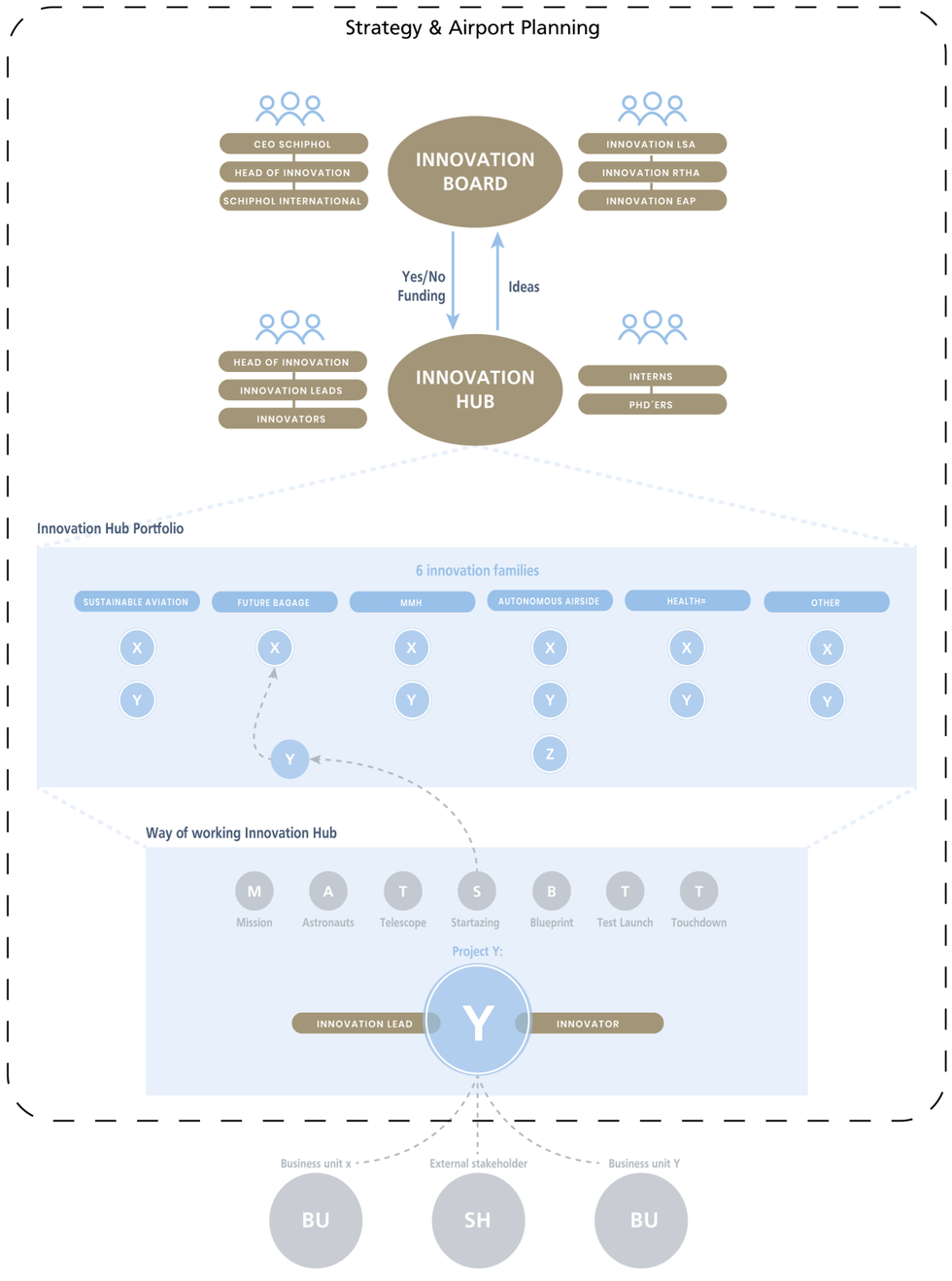


Figure 11. The total ecosystem of innovation within Schiphol

2.4 Changing environment around Royal Schiphol Group

Now that the RSG and innovation within RSG have been analysed, it is valuable to look at the need for RSG to strengthen their MMH direction. This is firstly done by looking at the bigger context in which RSG operates: the world of mobility. It is highly plausible that the world of mobility around Schiphol will change significantly in the future. Trends like globalisation, climate change, urbanisation, and technological developments will probably have significant influence (KPMG, 2019; Deloitte, 2021). It should be noted that these are current trends expected to influence the future. These might, however, change. Therefore, trends should be monitored constantly.

Herein climate change and technological developments are the two trends with biggest influence on aviation are climate change and technological developments. To illustrate climate change, at the moment, aviation accounts for around 2-3% of global carbon emissions. However, if no changes are made, this will most probably increase to around 27% by 2050 (Deloitte, 2021). Therefore, aviation is under pressure, and the European aviation sector proposed an approach to be carbon neutral in 2050 (Destination 2050). To reach this, aviation shifted focus from just technological (energy efficiency) and operational improvements (efficiency operations), also to alternative fuels, like hydrogen or biomass. Besides, electric aviation is being looked at as an alternative. Theretofore, apart from climate change, also technological developments in these fields will be crucial for the further future.
Both of these trends benefit to RSG's strategy to open up for new modes of transport. On top of these innovations in aviation as we know it, there also is a huge amount of potential new modalities which might be able to substitute current modes of aviation. To give a glimpse of what this future might look like, research has been done in the field of potential modalities. This has been done to illustrate the complexity of the landscape and to illustrate how extensive this field is. This has been done by identifying potential modalities of the future which can be incorporated into RSG's hub model by looking at modalities Schiphol is currently already looking at. For this, it has been found that there are endless companies active. To illustrate, an overview has been created which companies are of high potential in their branches. As there were too many companies active, there has been made an overview with 8 different companies for each of the following directions to show how complex and large the network is. This gives an overview of potential modalities Schiphol could be identifying and selecting, visible in figure 12.

2.5 Changing environment within Royal Schiphol Group

Apart from the huge amount of potential new entrants, the question is if the direction towards a MMH also fits RSG's internal strategy. Within RSG, the innovation directions are based on the overall strategy and vision of RSG. Previously RSG focussed mostly on their quality of service. However, with the vision for 2050, RSG broadened this also to QoN and QoL. The essence for RSG to move in the MMH direction is here explained along with three of the four pillars of its strategy. The fourth pillar (Safety and Robust Organisation) will now be neglected, as this pillar focuses mainly on the internal wellbeing within the organisation of RSG.

- QoN for RSG complies with being connected to the rest of the world. This is currently mostly pursued by Schiphol's hub-and-spoke model, referring to the way Schiphol is connected to other airports and, therefore, to the rest of the world. The MMH direction can be strengthened by attracting new modalities that can feed this model or even replace airlines in this model.
- The QoS represents the part of the strategy that RSG pursues to make sure that Schiphol is a place where a high amount of people have a positive experience and to catch their flights on time without delay. This can be reached by optimising the 'landside' hub and being reachable on the landside of the airport. The MMH-direction can benefit to this by offering people more options, which will make sure it is easier to connect to other modes of transport on time.

- QoL refers to the optimization of the ecological footprint of RSG and by optimiznig Schiphols nuisance to its direct environment. By selecting modalities that are better than modalities now, the MMH direction can significantly improve Schiphol's quality of life.

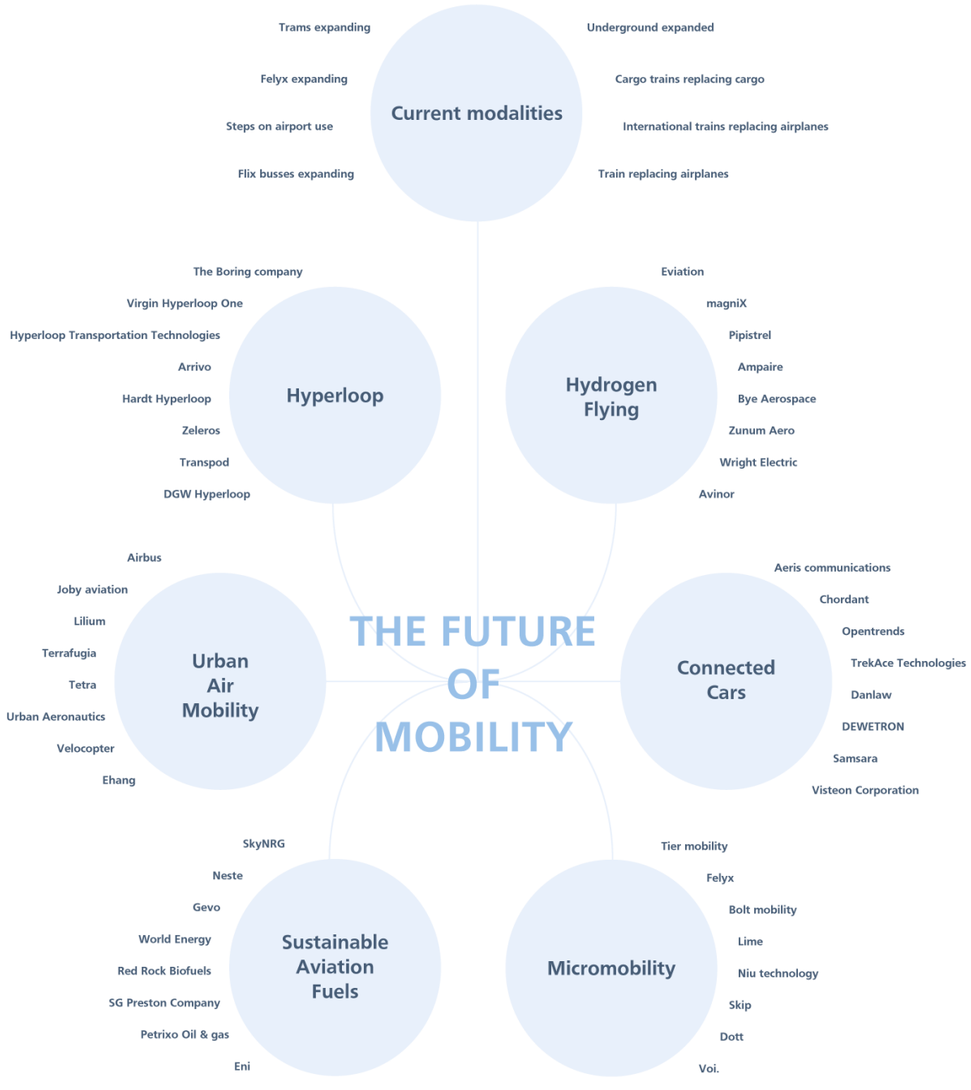


Figure 12. A glimpse of the future of mobility

2.6 Multi modal hub

It is now illustrated that external factors and internal factors are moving RSG towards focussing more on new modalities. This means RSG should do something with this: RSG has to innovate, and in chapter 1.3.4 it has been described how RSG does this normally. However, the question is how they can do that in the MMH context. As RSG owns airports and not modalities, the innovation approach of RSG will have to be done via open innovation. Later in this report, literature on open innovation will be consulted and RSG´s current innovation approach on external innovations will be discussed. Then conclusions will be drawn about what in this current approach can be used in modality-innovation. Firstly, now the Multi Modal Hub is described and why this is such a complex subject.

Modalities arrive and depart at junction points (airports), which means airports, like Schiphol, actually already are MMHs. As stated in chapter 1.1, Amsterdam Airport Schiphol will be taken as case when looking at a MMH. Amsterdam Airport Schiphol currently is one of the largest travel hubs in Europe concerning direct and indirect connectivity. Currently, 109,000 people travel via Schiphol every day (RSG, 2021). There are numerous definitions when talking about a hub. In general, hubs are places where different modalities come together. For airports in specific, however, apart from this definition, 'hub' also refers to the hub-and-spoke model (Appendix I for explanation). This project will focus on the edge of both definitions. On the one hand, an intervention will be designed, which will help in attracting more modalities to Schiphol as a MMH. On the other hand, the hub-and-spoke model will be taken into account, as this might influence the potential of a modality at Schiphol. Namely, feeding the current operations at Schiphol significantly benefits the potential of a modality. Apart from the hub-and-spoke model, another factor what makes Schiphol and airports in general complex in terms of implementing potential modalities, is the difference between airside and landside travel. This complexity will be explained along with a stakeholder analysis of Schiphol's current operating model in the next subchapter.

2.6 Stakeholders within RSG's current operating model

When thinking of new modalities for the MMH direction, it is important to know which other stakeholders should be incorporated. Here an overview is presented of the different stakeholders involved in the operation of at Schiphol. Therefore a stakeholder analysis has been done, as visible in figure 13. From this stakeholder analysis, the main takeaway is that a deviation in airside vs landside should be made. Airside travel is more complex due to the safety measures as well as traffic rules. They have to deal with ´LuchtVerkeersleiding NederLand´ (LVNL). Besides, airside transport is still in its infancy compared to landside travel. The first time people could fly was in 1783, whereas the wheel was invented 3000 years BC. One can imagine the adaption to airside travel is not yet as developed as travelling by ground. Obviously, this will not apply to all comparisons of airside vs landside, although, in general, things are easier to implement on the ground.

Limitations
This stakeholder map focuses on which stakeholders are directly or indirectly involved in the operations of Schiphol. With an overview, it can be examined which potential stakeholders have an influence on which types of modalities. There will most likely be more factors when implementing a new modality, but this overview gives an overview of the stakeholders in normal circumstances and above all indicates the importance of taking stakeholders into account.

2.7 Context conclusion

This chapter examined the context of this project by elaborating on RSG, its environment and the need for RSG to do something with this. With the changing environment around RSG and the huge amount potential entrants in the market, RSG needs to think of a MMH direction in which they focus on new modalities. Since RSG is dependent on external parties innovating on modalities, they will need to develop a modality innovation approach for external innovations: called open innovation. Therefore, literature concerning open innovation is examined in the next chapter, which will act as a foundation for the rest of the project. After that, there will be examined how RSG deals with external innovations currently, to see where they can improve.

Stakeholder map Schiphol

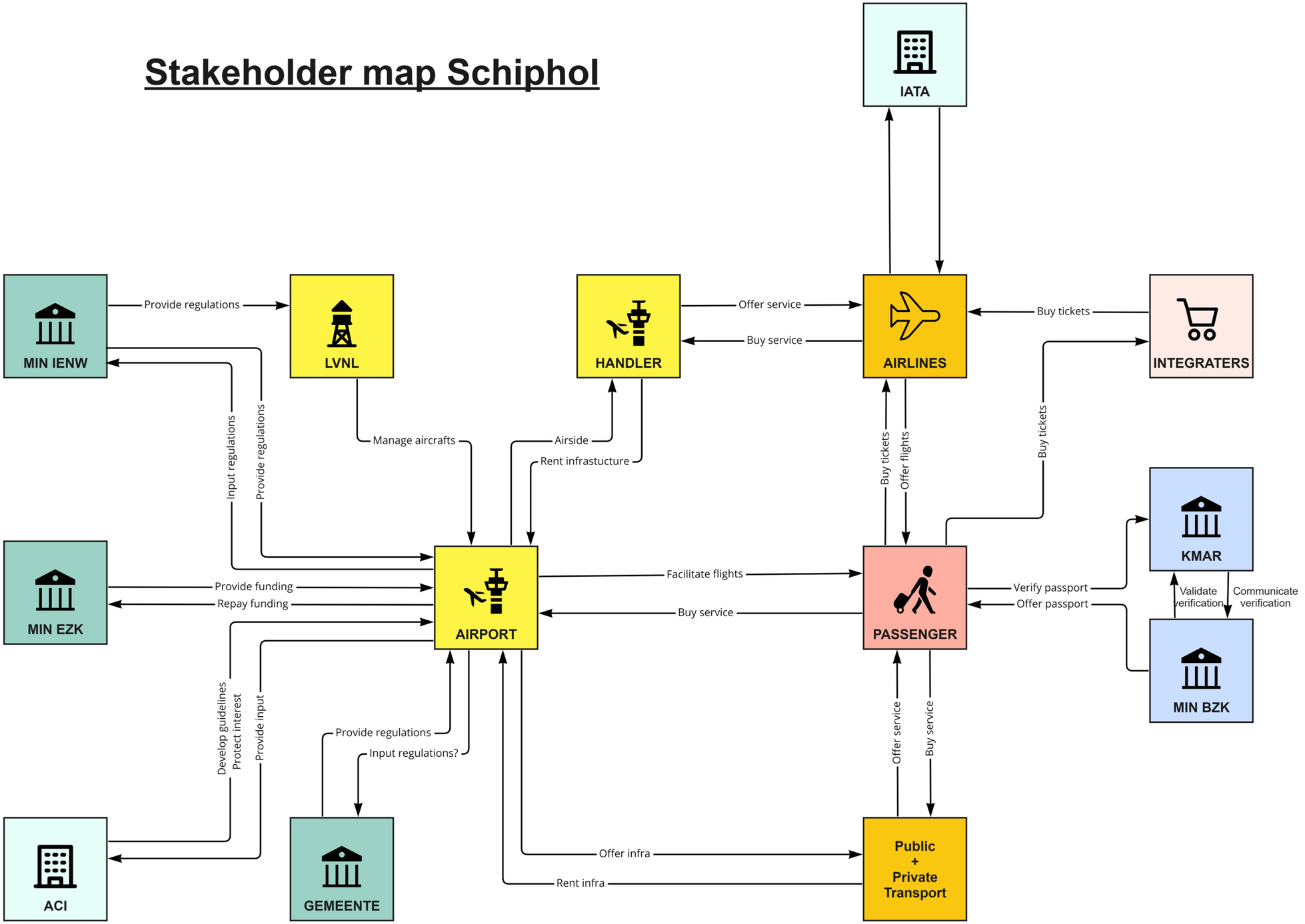
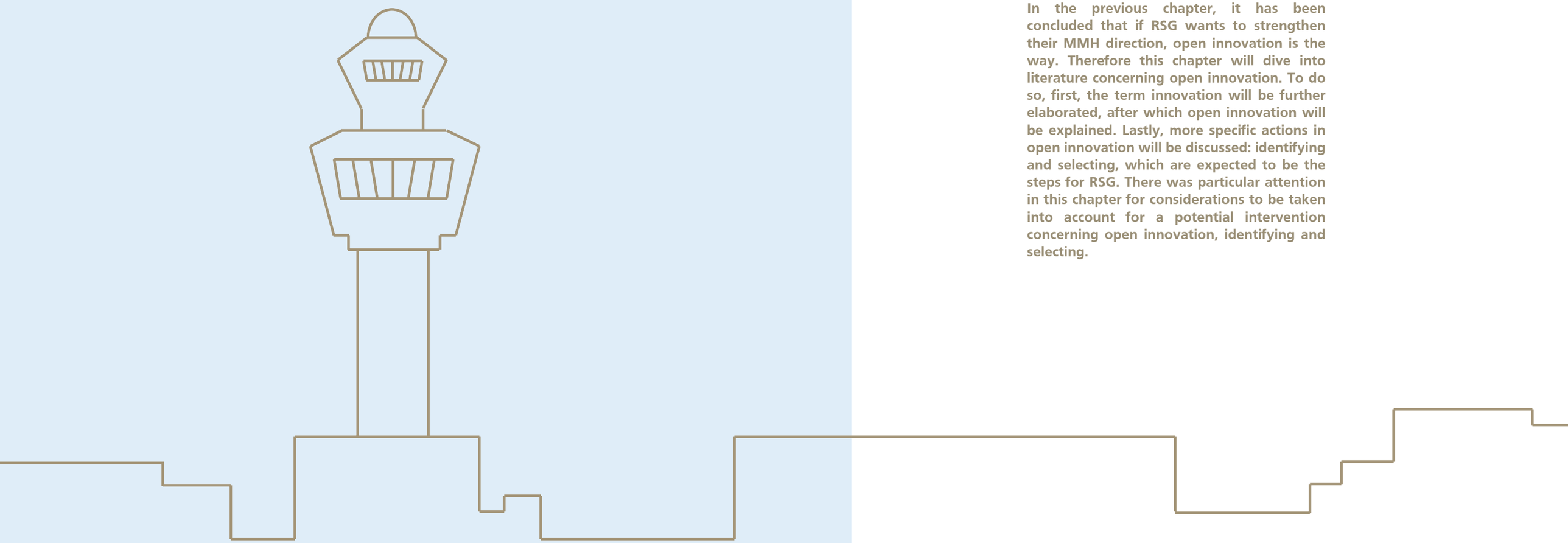


Figure 13. Stakeholders in Schiphol´s operation model

03

LITERATURE: THE THEORY BEHIND A MODALITY INNOVATION APPROACH



3.1 INTRODUCTION

In the previous chapter, it has been concluded that if RSG wants to strengthen their MMH direction, open innovation is the way. Therefore this chapter will dive into literature concerning open innovation. To do so, first, the term innovation will be further elaborated, after which open innovation will be explained. Lastly, more specific actions in open innovation will be discussed: identifying and selecting, which are expected to be the steps for RSG. There was particular attention in this chapter for considerations to be taken into account for a potential intervention concerning open innovation, identifying and selecting.

3.2 Innovation and its potential outcomes

When talking about innovation, literature describes numerous definitions. Innovation can be seen as a novel combination of knowledge or resources in an attempt for commercialisation (Schumpeter, 1934). He states that it is about the process of how ideas are generated and the way they are being put into practice. This is being empowered by Kenneth B. Kahn (2018), who states that ''innovation should be thought of as both an outcome and process.''. In this report, the term 'innovation' will be used in two ways: (1) as a process and (2) as the outcome of this process. As most of the time, the outcome will be meant, specific designation will be given when the process is intended.
With the overall definition of innovation named, the term innovation will now be decomposed into different kinds of innovation. This has been done to show what kinds of innovations are relevant for RSG concerning the MMH direction. To explain this, the theory of Henderson (1990) is used to decompose four different kinds of innovation, as visualised in figure 14. These are: Incremental innovation, Architectural innovation, Disruptive innovation, and Radical innovation. Innovation should be found which can disrupt the market. In the context of identifying and selecting modalities with potential, three of the four quadrants capable of disrupting the market, which are described hereafter.

Disruptive innovation
New technologies in the existing market can disrupt the current market because of a focus on new product features. An example would be hyperloop, a new technology (CNN, 2019), partly taking over the aviation industry.

Architectural innovation

In architectural innovation, existing technology in an existing market is used to create new business models. An example would be international trains (existing technology) partly replacing aviation (existing market) (Greenpeace, 2021).

Radical Innovation
The shift uber is making towards adopting its own new vehicles, like helicopters in Vietnam (Thanh Nien Daily, 2017). In this way, a shift to radical innovation has been accomplished.

Incremental innovation focuses on improving existing products in existing markets and is therefore normally not suitable to disrupt current modalities.

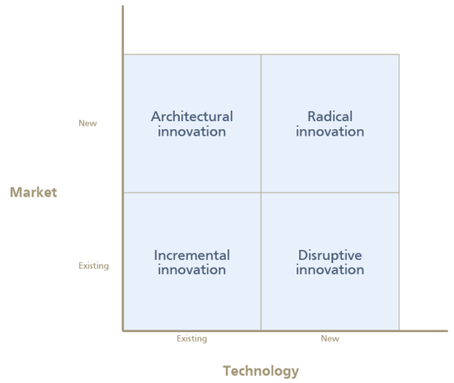


Figure 14. Innovation. (Adopted from Henderson, 1990)

3.3 Open innovation: What is it, and what are steps proposed in literature?

The different kinds of innovations stated in the previous subchapter will have to be realised by open innovation. Therefore, following the different kinds of innovation suitable for the MMH direction, open innovation will now be explained, as for the considerations to be taken into account for a potential intervention.

Process of open innovation
Open innovation was introduced in 2003 as a new imperative for creating and profiting from technology (Chesbrough, 2003). Since then, open innovation has developed further, and it can now be described as ''a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organisation's business model'' (Chesbrough et al., 2014). Open innovation can best be explained by comparing it with 'closed innovation', which is visualised in figure 15 (Höllmöller, 2008). Here, the innovation funnel is used to visualise the difference between open and closed innovation. In closed innovation, only internal ideas are considered, whereas in open innovation also, external ideas are being taken into account. As shown, this can be done in different ways: either by including internal and external ideas by external collaboration, or by focusing on alternative markets.

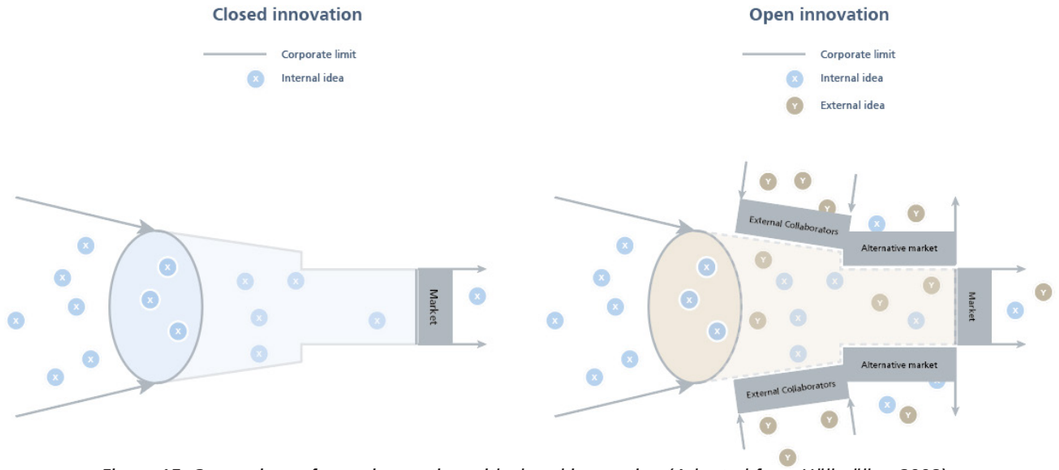


Figure 15. Comparison of open innovation with closed innovation (Adapted from Höllmüller, 2008)

Considerations in open innovation
Firstly, external ideas mostly are not 'plug and play', which is reflected in the fact that open innovation is based on a combination of external ideas and internal knowledge. Organisations should adapt significantly to be successful; ideas alone are not worth anything. Herein is being stated that companies successful in open innovation are characterized by organizational flexibility, which is necessary if current business models are changed to allow an open innovation strategy (Bogers et al, 2019)

Secondly, organisations should be aware that there is a certain mindset needed to let open innovation succeed. This can be best explained according to the not-invented-here syndrome (Chesbrough, 2006). This refers to people tending to have a negative attitude towards external knowledge and ideas. Chesbrough states that open innovation desires a culture in which companies should recognize and have a mindset that 'not all the smart guys work for us'. Possible ways in which this can be accomplished are organisational practices like well organised lateral and vertical communication and reward knowledge sharing (Foss, et al., 2011).

Lastly, West, et al (2006) describes that to be successful in open innovation, as many tools as possible or strategies should be used. West describes that if open innovation is to be succeeded, a maximum number of tools or methods must be used to maximise the organisation's success. An overview of such strategies to be used is given in the following chapters.

Now that open innovation and considerations to be taken into account are discussed, the question arises which activities are linked to open innovation. For RSG, two activities are interesting. Firstly to identify potential modalities, and secondly, to select the modalities with the most potential. Therefore literature has been consulted, which led to the main activities of searching (Nicholas, 2013) and selecting (Nicholas, 2015), which will be elaborated on hereafter.

3.4 Identifying: considerations and inspiration

In open innovation, organisations are dependent on external innovations. The focus in identifying is on actively searching for innovations and technologies, as being informed cannot be fully controlled by RSG. Therefore identifying can also be called ''searching.'' Nicholas did research in search strategies and how organisations use these search strategies. (Nicholas, 2013). Apart from an overview of potential search strategies, the research concluded considerations that the organisations encountered in implementing these strategies.

Considerations in search strategies
Nicholas also stated that, in searching, the major challenge for incumbents, which RSG is in the market, is that they usually have a narrow search behaviour with a bounded space based on their prior experience. This leads to a limitation in search space and, therefore, new propositions (Leonard-Barton, 1992). It, therefore, is vital for RSG to have a variety of

search strategies and make sure to look outside RSG's current business to prevent this. RSG should be aware they will not only investigate directions they already know but also open its eyes and technologies new for them. In other words, RSG must have a broad mindset. This mindset will be hard to measure in practice, though valuable to consider. The research that was done by Nicholas also shows that companies looking at the edges of their current product portfolio and new areas, combined with a wide variety of search techniques, perform best on innovation. This implies RSG should not limit itself to one search strategy but focus on variable approaches.

Secondly, companies and their employees tend to be afraid of failure; consequently companies are not willing to take risks, which leads to less diverse searching. Besides, in management teams, in contradiction to research done by IBM (2012), there is the perception that innovation is mostly not required unless their current business is in danger. They tend to fear innovation will kill existing businesses. An intervention for RSG should be aware of cultural barriers in organisations and try to embrace them.

The third consideration identified by Nicholas is the fact that there were not enough resources allocated. Organisations tend to see searching as too expensive, and organisations have difficulties seeing the value of innovation and searching in specific. An intervention for RSG should be aware of resource barriers in organisations and emphasize the importance of innovation and searching in specific.

Lastly, companies do not know how, where, and when to use search strategies. Across organisations, there is a lack of awareness of search strategies and uncertainties on where to apply them across organisations. An intervention for RSG should be aware of knowledge barriers in organisations and help organisations understand how and where to use tools.

Inspiration of search strategies

The research of Nicholas et al. (2013) on search strategies has been used and adopted, visible in figure 16. Nicholas made a division in explorative and exploitative search strategies. Exploitative strategies are based on searching for improvements or refinements of current processes or skills (Holmqvist, 2004), whereas explorative innovation strategies are based on challenging existing approaches and the search for new products or services (March, 1991). The initial scope for this project is mainly explorative. However, at this point, it is used as inspiration and therefore also exploitative search techniques might be interesting and will therefore be considered.

Search strategies

Primary focus	Strategy
Exploratory	Sending out scouts
Exploratory	Exploring multiple futures
Exploratory	Corporate venturing
Exploratory	Corporate intrapreneuring
Exploratory	Brokers and bridges
Exploratory	Deliberate diversity
Exploratory	Idea generators
Exploitative	Using the web
Exploitative	Working with active users
Exploitative	Deep diving
Exploitative	Probe and learn
Exploitative	Mobilizing the mainstream

Figure 16. Search strategies Adopted from Nicholas et al. (2013)

3.5 Selecting: considerations and inspiration

After searching, an image of the (emerging) technologies is expected to have been created. It is expected that the next step is to select which modalities would fit RSG. Apart from searching, also research has been done on selecting early-stage ideas (Nicholas et al., 2015). This has been used to identify considerations for a potential intervention as well as a source of inspiration for potential strategies for an intervention.

Next to the discussed search-phase, success of innovation can be reached with decisions made in the selection-phase. (Frishammer, Florén, Wincent, 2011). Nicholas et al. (2015) state this selection phase as follows: ''The selection phase is concerned with creating and maintaining a funnel of ideas for radical projects that guides the best ideas through a process that develops them in preparation for the more formal development process''. As already stated, this definition does not describe a single event. It should be seen as an iterative process in which all identified modalities will continuously be selected and evaluated. In every evaluation, it should be decided to continue with the selection process or to terminate the selection process. In the context of this project, selection will be done on whether to engage with an external part and to what extent. No positive or negative association should be made with the outcome of the selection process. The outcome that something will in a certain way be selected is as positive as when something will not be selected. Besides, something which is being assessed as not valuable now, could be seen as valuable in two years. Just as in identity, after having ´selected´ this phase does not end. There is no saturation rate to be reached; it is about an ongoing process.

Considerations in select strategies

Nicholas et al. (2015) state two main challenges during the selection process in the early stage of the innovation process. Firstly, companies have limitations concerning their decision-making system. Nicholas (2015) states that companies should be able to overcome the limitations of this system. This means existing cultures where this system operates in, should be challenged. An intervention for RSG should fit in the existing decision-making system, should be easy to implement in the current decision-making system, or the current decision-making system will have to adapt to the intervention. In all ways the intervention should not be separated from the decision-making system. A second challenge is that companies should be able to take risks to select new innovations. This is mostly being reflected in a lack of trust or support base throughout the company, which is hard to overcome (Schmid, Druehl, 2008). Therefore, sufficient support base throughout the organisation should be pursued by an intervention.

Inspiration of select strategies

Bessant, Mosslein et al. (2010) documented on an extensive research done by Discontinuous Innovation Laboratory (DILab), which did research in a network of over 250 companies in 14 different countries. According to this research, select strategies can be divided into two main categories: culture challenging and risk-reducing. Culture challenge focuses on opening the eyes of companies to not just look at the direction of the established worldview of the companies. Risk-reducing, on the other hand, focuses on reducing uncertainty and quantifying the risk of innovations to cooperate with. (Turner 2005). Furthermore, a commonly made mistake is not to assess innovation (Jones and Samalionis , 2008). Each assessment of an idea is an informative step for a company, so this should always be done when selecting new modalities. The select strategies can be seen in figure 17.

Select strategies

Primary focus	Strategy
Culture challenging	Building alternative visions
Culture challenging	Prototyping to build bridges in the selection process
Culture challenging	Mobilizing sponsorship and championship
Culture challenging	Using alternative implementation structures
Culture challenging	Mobilizing entrepreneurship inside + outside firm
Culture challenging	Using alternative decision-making pathways
Risk reducing	Deploying alternative funding structures
Risk reducing	Using probe-and-learn methods
Risk reducing	Applying alternative evaluation and measurement criteria

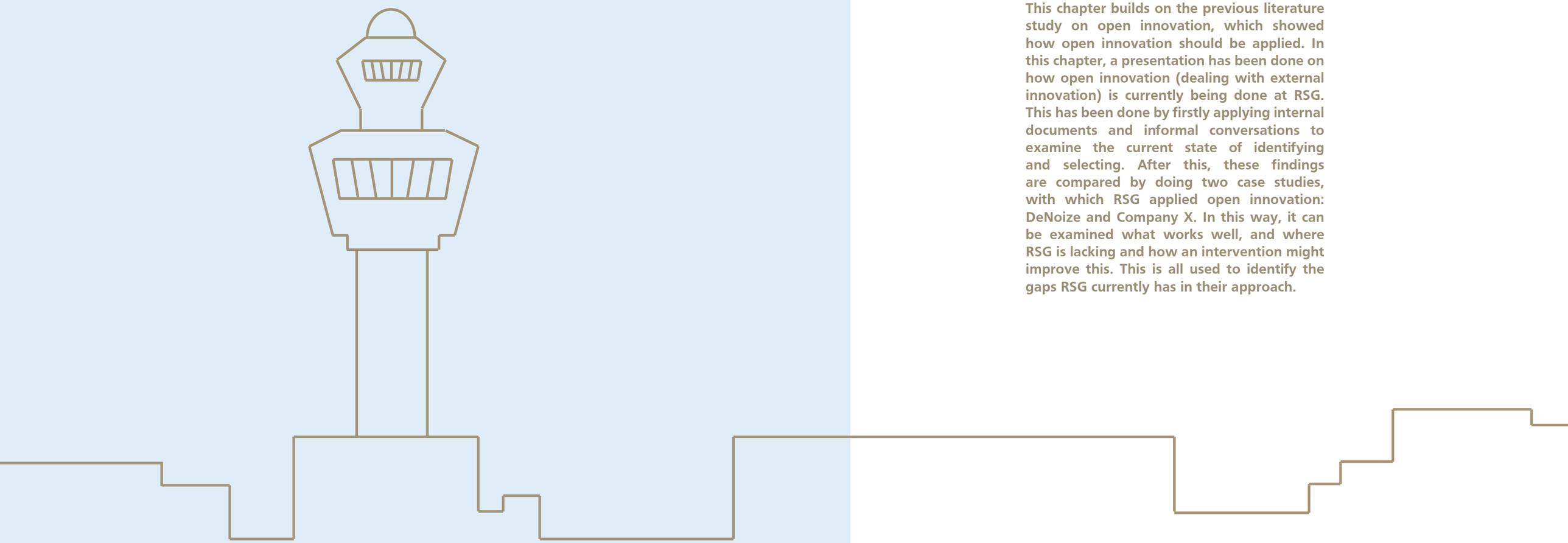
Figure 17. Select strategies Adopted from Nicholas et al. (2015)

3.6 Conclusion Literature

This chapter forms a theoretical foundation for a potential intervention. Open innovation, identifying and selecting have been examined. This led to considerations in open innovation, identifying and selecting which should be considered in a potential intervention. Furthermore, an inspiration of search and select strategies have been presented, which can also be used for a potential intervention. In this chapter identifying and selecting were discussed in terms of how this should be incorporated in an intervention. In the next chapter, on the other hand, there has been presented an overview of how identifying and selecting are currently being applied within RSG to see where RSG might be lacking.

04

INTERNAL FINDINGS: THE CURRENT STATE OF IDENTIFYING AND SELECTING WIHIN RSG



4.1 INTRODUCTION

This chapter builds on the previous literature study on open innovation, which showed how open innovation should be applied. In this chapter, a presentation has been done on how open innovation (dealing with external innovation) is currently being done at RSG. This has been done by firstly applying internal documents and informal conversations to examine the current state of identifying and selecting. After this, these findings are compared by doing two case studies, with which RSG applied open innovation: DeNoize and Company X. In this way, it can be examined what works well, and where RSG is lacking and how an intervention might improve this. This is all used to identify the gaps RSG currently has in their approach.

4.2 Current state of identifying

To define what the current state of identifying is, internal documents have been consulted. Furthermore, continuous informal conversations have contributed to the overview presented hereafter. According to the ecosystem in which the innovation hub is operating in, new innovations are normally acquired via one of the stakeholders of RSG's broader innovation ecosystem, visible in figure 18. In this way the can be shown how identification is done currently and where the Innovation Hub might be lacking. There appeared to be 5 origins of ideas, which are discussed in the following section.

1. Innovation board originated

There are situations where the innovation board innitiates innovation projects. This happens when the members of the innovation board or individually have come to an idea or have been identified by someone internally or externally. The innovation hub has a limited choice of whether or not they like these ideas, as the innovation board has a powerful say in the funding and allocation of projects.

2. Innovation leads originated

Innovation leads are responsible for one or more of the innovation families. There is being 'searched' for innovation within the 6 innovation families. At the moment, it is the responsibility of the innovation leads to search at the borders of their innovation families to decide whether or not exploration is necessary. However, a common approach on how to search is missing.

3. Knowledge institute originated

Knowledge institutions are used to gather insights around topics decided by the innovation hub. Currently, the insights obtained via these knowledge institutions are all designated to one of the six innovation families.

4. Start-ups & scale-ups originated

The innovation hub also has contact with start-ups and scale-ups, with which they are cooperating. These are primarily companies working on a solution in one of the innovation families. They are getting in contact with companies. RSG is getting in touch with these companies by coincidence, so the input is random.

5. Sector partners originated

The last category is partners in the sector that Schiphol can use. For example, Schiphol is part of the corporate venturing network. The CVN is described as ''a powerful tool to create new and disruptive business'' (CVN, 2021). In the CVN, an inquiry can be made in a certain domain, after which CVN will start looking for candidates. Another example of such a sector partner is MIF: MainPort Innovation fund.

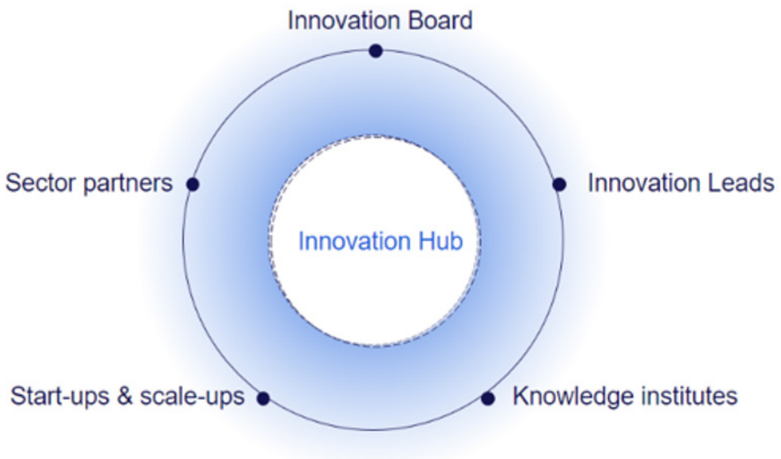


Figure 18. RSG's broader innovation ecosystem

Conclusion on identifying

This chapter has examined the current state of identifying of RSG. Despite that the input of innovation projects is all traceable to one of the 5 stakeholders in the wider innovation ecosystem, the way they reach these stakeholders is mostly random. It can be concluded that there is an input of ideas and that this input can be successful. However, a clear approach on how to search and where to search is lacking. In the case of the MMH direction, RSG would be dependent on specific ideas. Therefore, for the MMH direction, it would be valuable to control this input and the search, or at least find out where to search. This chapter also shows that the Innovation Hub already has a strong network when looking at the future. However, a clear approach on how to use this network is missing. The next chapter focuses on the current state of selecting to see where it might be strong and where it is lacking.

4.3 Current state of selecting

To give a more extensive overview of how selection currently is being done within RSG, internal documents on Company X were used, which gave an insight into how RSG currently works with innovations concerning mobility. These documents presented the workstreams executed on the Company X project to decide whether Company X would be a party with potential to engage with. This will later be added by the semi-structured interview on Company X in the case study part of this chapter.

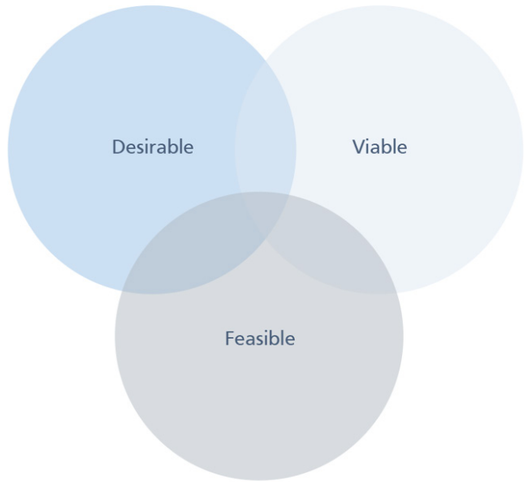


Figure 19. Desirable, viable, feasible

In the case of Company X, there seemed to be a structure in the process of selecting. The potential of Company X was evaluated among the three principles of design thinking: desirable, viable, feasible. The separate factors within these categories are visualised in figure 19. After this, stage gated go/no go moments were planned to evaluate the innovation. This seemed like a well-grounded approach to assess the potential of an innovation. In fact, it is a well-grounded approach. However, this is a time-consuming and expensive way to do this, as extensive research in the three principles of design thinking was done, which could also have concluded that there was no potential. Therefore, RSG would benefit from a way in which a quicker assessment could be made upfront. Especially with the future world of mobility in mind (Chapter 2.4), a huge amount of potential entrants will pass by. It will be very time-consuming and costly if the current approach is used for this. If an assessment would be made upfront, possibly unnecessarily executing these gates could be prevented. To give an overview of the workstreams and factors used currently at RSG, the factors evaluated in the case of Company X are presented hereafter, as these can be used in an intervention later.

1. Desirable

In desirable, there were two main stakeholders taken into account. Firstly, the passenger was taken into account. It was considered if the passengers would want to make use of the proposition. Apart from the passenger, it was also aligned with RSG's current strategy and vision. This was done with three pillars: Quality of life, Quality of network, and Quality of service.

2. Viable

To determine whether a proposition is viable, RSG looked at two main themes. Just as in desirable, it had to align with RSG's strategy and allocated funding and it had to have support base in the organisation. On top of that, a business case was formulated in order to determine if income could be generated from the proposition. Lastly, society was taken into account: it was considered if political and public support could be gained.

3. Feasible

When assessing feasibility, there were three factors taken into account. The infrastructure was taken into account to see if it was possible to integrate the modality in the current infrastructure of RSG, and what was necessary to change. Secondly, integration in the current airside or landside landscape was considered. In terms of airspace it was considered if it is possible to integrate it in the current taking off and landing procedures. In landside it should be considered if it fits in the existing landside modalities. Lastly, legislation was taken into account. It was assessed whether the required permits and approvals could be acquired.

Conclusion on selecting

All factors examined in the documents of Company X can be used in a potential intervention. One factor currently used will not be relevant in assessing the potential of a modality: formulating a business case. Potential modalities might still be in a stadium in which a business case can not be estimated, and it might therefore cause false red flags. All other factors named are relevant for this project and should therefore be considered in a potential innovation. In a potential intervention, an estimation will have to be made per factor, which will be used to assess the potential of an intervention.

4.4 Cases DeNoize + Company X

On top of the internal documents, two case studies were done on the recent cooperations of RSG with DeNoize and Company X, by doing two semi-structured interviews (appendix A). The focus herein was on how initial contact was made (identifying) and how they decided whether the party was interesting or not (selecting). These cases are described in figure 20,. The different insights of these cases for a potential intervention are now presented.

Identifying

Identifying, in both cases, happened in a random and coincident way. In the case of DeNoize, after they knocked on the door at Rotterdam The Hague Airport, they got money to test their hypothesis and show the innovation board that their principle worked. In the case of Company X, they were being told by the innovation board that someone would present in the next innovation board meeting. Therefore it can be said that in identifying a structured approach is missing.

Assessing

After the IB approved Denoize, they had a stage gated approach to testing Denoize's hypothesis. Each time the innovation board meeting occurs, project had to be presented to decide if there would be continued to the next stage. However, there was not a point where they assessed the actual potential of the modality. The innovation hub started immediately with setting up hypotheses and working on them. This is highly time-consuming, especially if, in the end, it seems that an innovation might not be as interesting as it looked. Therefore, it would be highly valuable to assess the potential of an innovation before starting working on hypotheses.

Selecting

Selection at the moment is being done ad hoc. However, opposite to identifying, in selecting, there seems to be a more structured way which is being applied, despite the fact that it is done based on intuition, as they did not have a predetermined approach for this. Their approach is to define uncertainties, and based on these uncertainties, they define workstreams. These uncertainties are mostly based on the desirable, viable, feasible.

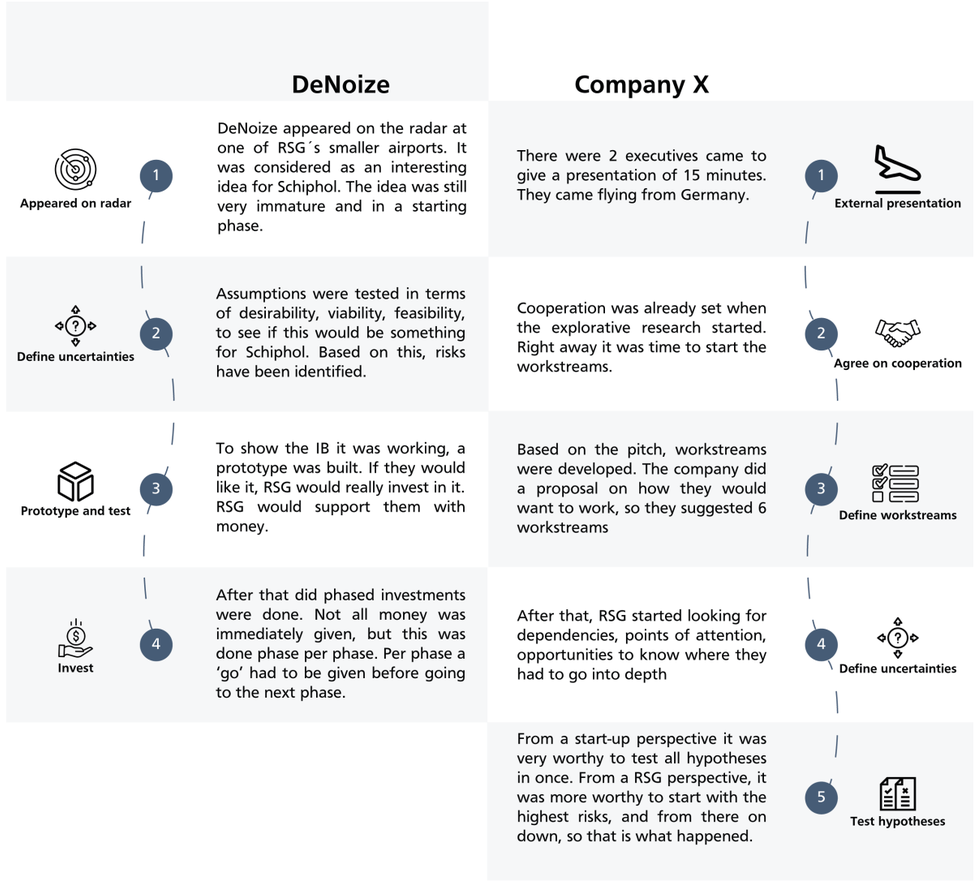


Figure 20. Case studies of Company X and DeNoize

Additional steps

When looking at these examples, it seems as if there are more steps necessary than just identifying and selecting, as the process is highly complex. Therefore, after introducing the two identified gaps for RSG, the steps of identifying and selecting will be further examined in chapter 6.2. Furthermore the cases presented are just two coincident cases. No continuous approach was discovered. If RSG wants to stay up to date in the changing environment around it, they should continuously identify and select potential modalities.

Limitations

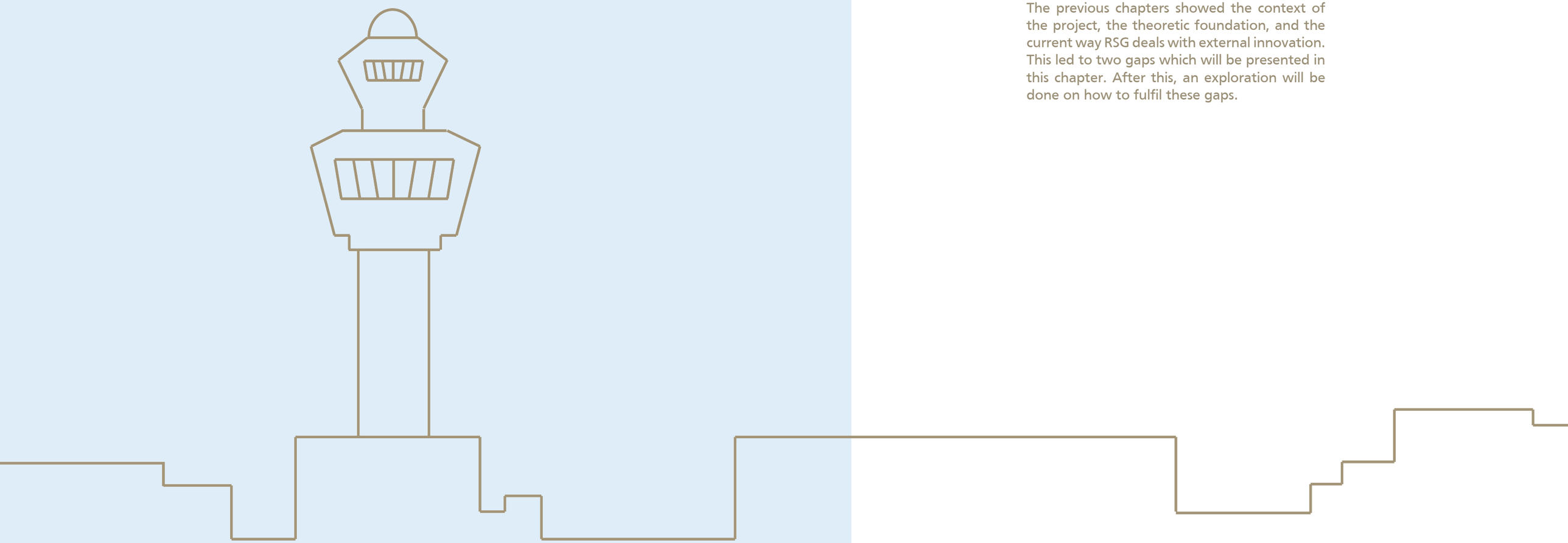
Obviously, these are just two cases, and there will be other cases within RSG. However, these cases are recent and the cases look like each other, which suggests this is the way RSG deals with external innovation. One came from the IH, one from the IB, and both show less structure. Besides, internal conversations in the past half-year did not show any signs that there is a different, more structured approach. Therefore, these will be taken as cases of reference on how innovation happens now within RSG.

4.5 Conclusion internal findings

This chapter illustrated and evaluated two examples of how RSG deals with external innovations. Herein it has been examined how these innovations were identified and how decisions were made concerning selection. This has shown that a structured approach concerning identifying and selecting is missing within RSG. The next chapter will illustrate that comparing literature to the internal findings, has led to two gaps within RSG concerning open innovation on modalities.

05

5. SYNTHESIS: GAPS IDENTIFIED FOR A MOBILITY INNOVATION APPROACH



5.1 INTRODUCTION

The previous chapters showed the context of the project, the theoretic foundation, and the current way RSG deals with external innovation. This led to two gaps which will be presented in this chapter. After this, an exploration will be done on how to fulfil these gaps.

5.2 Gaps presented

There is no clear approach on searching for new kinds of mobility. RSG's current approach is rather ad hoc and unstructured. In this way initiatives concerning new modalities being imported in the company is chaotic and not predetermined. By not having an approach on searching for new modalities, RSG is in danger of missing (high potential) modalities. This means they might miss opportunities to improve the product portfolio concerning mobility. In times where aviation is under big pressure, and RSG's strategy towards strengthening their MMH direction, valuable innovations can not be overseen.

On top of that, at the moment innovations are not continuously and in a structured way assessed. Immediately after identification RSG starts some kind of a cooperation when a modality seems to have potential, after which the Innovation Board decides whether or not to continue. In this way RSG might spend too much efforts in cooperations with parties that have too less potential. Therefore it is of importance for Schiphol to have a way to assess modalities in a structured way. Summarising, the following two gaps have been identified:

1. From the research done, it appeared that RSG does not have a structured continuous approach on identifying and selecting new modalities. Therefore Schiphol will need an strategy and approach to do this.

2. On top of that, it became clear that Schiphol is not able to make an assessment on the potential of modalities in an early stage. An application should be thought of to assess the potential of a modality.

Gap 1: Strategy

To deal with potential new modalities at Schiphol, there should be developed a strategy

Gap 2: Assessment tool

To assess modalities, a toolkit, in whatever form, is necessary to give RSG the opportunity to assess the potential of modalities.

5.3 Conclusion

This chapter showed which two gaps RSG should overcome. Firstly, RSG is missing an overall strategy concerning new modalities. At the moment it happens rather ad hoc and they do not have structured way to deal with this. Apart from a missing strategy, the other gaps is that RSG does not know how to assess the potential of modalities. Therefore in the next chapter an extra exploration is presented to show how these gaps could best be fulfilled.

06

EXPLORATION: A SEARCH ON HOW TO SOLVE THESE GAPS

6.1 INTRODUCTION

This chapter seeks for an answer concerning the two identified gaps. Interviews, literature, and continuous informal conversations have led to the essentials which should be incorporated into the strategy and the toolkit. First, the criteria for a strategy are examined, after which research is presented on what to include when assessing a modality. Lastly other considerations are presented when thinking of a long term modality approach. These are afterwards translated into design principles in the design brief.

6.2 Strategy exploration: The actual steps of identifying and selecting

6.2.1 The steps of identifying and selecting extracted

To define what a strategy might look like for RSG concerning new modalities, the theory of identifying and selecting in chapter 3 was put into practice. In the case studies of chapter 4, it seemed that the processes of dealing with external innovation concerning modalities consisted of more than just two steps. Therefore together with an expert in the field of corporate venturing and open innovation, there have been identified more than two steps (Corina, 2021). These steps have afterwards been reviewed internally at RSG. This resulted in an extraction of the steps of identifying and selecting. The outcome is visualised in figure 21 Identifying appeared to consist of two steps: identifying and identified, with a potential step in between: pre-assessment. Selecting appeared to consist of 2 steps: assessing and choosing. Lastly, it might be valuable to consider what happens after selecting: therefore, engaging is also discussed. These steps are now discussed more extensively.

Extra steps in identifying
What is meant with identifying, is purely the way in which an innovation reaches RSG. This can either be by actively searching by which an innovation appears on the radar of RSG. The other way an innovation can appear on the radar at RSG, is when RSG is in a way being identified: either by an organisation directly or by an intermediary. After identifying, the next step is identified, in which the identified innovations will have to be captured in some way so that they will be saved within RSG. Between these steps, there can even be a third step: a pre-assessment. If there are too many results in searching, a quick pre-assessment can be done to filter out first innovations which do not seem to be interesting.

Extra steps in selecting
In selecting, assessing is the step in which an attempt should be made in order to quantify the potential of an innovation. Important herein is to consider how this can be done. In the second step, choosing, a decision has to be made on what kind of engagement fits the assessment best. Then lastly, RSG will engage with an organisation in a certain way.

Extra step after selecting
After having ran through steps 1 to 4, engaging will be the fifth and last step to consider. Therefore, the next chapter will dive into engaging to see what happens after identifying and selecting and what might influence the potential of an innovation and should therefore be taken into account in an assessment. Engaging is the step that happens after choosing. However, it cannot be seen as something separate as it is the direct output of the assessment: a decision on what to do next. As engaging has not been discussed yet, this will be done in the next section.

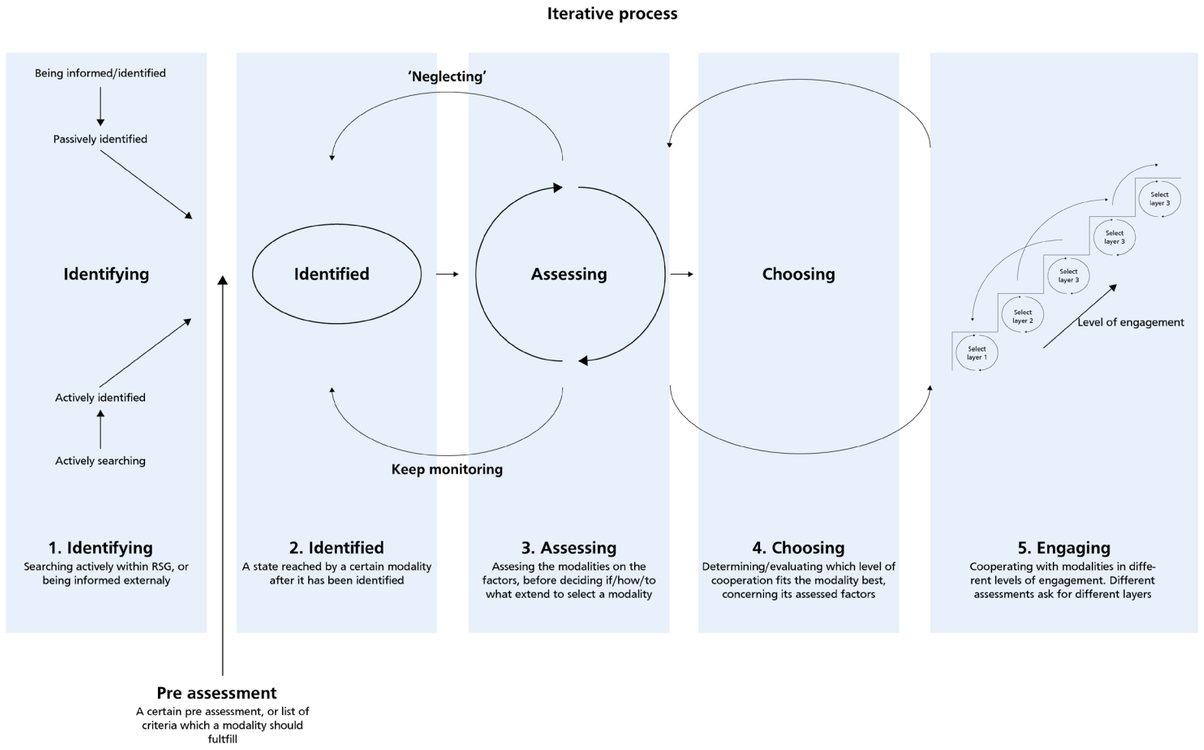


Figure 21. Overview of the identified steps in the identify select process

6.2.2 Engaging explained

Multiple levels of engagement are expected to be possible with a potential modality, as visualised in figure 21. ´Level´ of engagement refers to the amount of commitment and interference which is applied within an engagement. When deciding on engaging with a party, several different levels of engagement are possible. However, little research was found on the different levels of engagement and it was therefore hard to come up with a predefined set of different kinds of engagements. In practice engagements with an external parties generally are very abstract and tailor-made (interview Jan, 2021) However, there should be a way to categorise the potential of modalities. Therefore the following set of levels of engagement has been set up, with the help of Corina (2021), that could be used in a potential intervention later in this project. It must be said, though, that these engagements are simplified and in practice, engagements will be more ´custom made.´

1. Neglect
2. Date
3. Monitor externally
4. Test certain hypothesis
5. Monitor internally
6. Invest
7. Pre-feasibility study

6.2.3 Risks in engaging

As stated, engaging initially is out of scope for this project. However, it can be valuable to look into this step and cast the insights back to see what future actions might influence the decision making of today. This can be used to identify risks, which can be incorporated in assessing a potential modality for RSG. The book 'The wide lens' by Ander (Adner, 2012) have been used to do so. He identified 3 major risks in innovation, which he obtained from studying the causes of failures or success of innovation. The three risks, also applicable to the situation of RSG when looking at innovation concerning mobility, will be explained hereafter

1. Execution risk

The execution risk is the most obvious risk and consists of all factors that influence whether RSG can successfully adapt to an innovation and execute it. In other words, this refers to the ability to create or execute a certain innovation (Adner, 2012).

2. Co innovation Risk

The co-innovation risk refers to the amount that other parties need to innovate for your innovation to be successful (Adner, 2012). As innovation changes a situation, it might require change from more parties than just the party innovating. These co innovations can be diverse, from new technologies to slight improvements in current products. In the context of RSG for example, the risk is that if they would cooperate with hyperloop, they also need infrastructure, fuel, stations, etc.

3. Adoption chain risk

Lastly, there is the adoption chain risk. This risk is about anyone else who needs to buy in to enable the adoption of the innovation. The situation often is that multiple parties need to agree on a certain innovation (Adner, 2014). Herein the difficulty lies in the fact that different parties involved will all make their own choices whether to participate and adapt to an innovation. These parties will compare their own costs and benefits to decide whether to participate. For RSG, it might be important to look at precursors in which they can invest to mitigate the adoption chain risk.

To conclude, the execution risk, co-innovation risk, and the adoption chain risk are three factors that should be considered when selecting a modality. Corina (2021) stated that the last two risks often are being examined too late, which results in redundant failures.

6.2.4 The moment to engage

Now that we know the risks of engaging, it is also valuable to look at what is the best moment to engage. To show the complexity of mobility innovation and what that means for the moment to engage, literature has been consulted and internal interviews have been held. The main question to be answered in this subchapter is if there is a first-mover advantage in mobility-innovation, and if not, if something can be concluded to define the best moment to engage.

Implementing new kinds of mobility is highly complex due to the extensive ecosystems, which is reflected in a case study on broughel, 2021). This case gives an impression of the complexity of a modality-driven innovation, and things can work out differently than expected. Furthermore, this case suggests that the first-mover advantage might not be high in implementing new modalities, as there are numerous factors still undiscovered. On the other hand, implementing something first normally results in knowledge because of learning-by-doing and other benefits of such new modalities. On top of that, it is preferable to engage with a party before competitors do. Otherwise, there is a position in which you also have to trump the competitor rather than only pursuing the party.

Apart from this case study, interviews within Schiphol have also been used to question the first-mover advantage. This resulted in interesting insights. In the case of Schiphol, for example, if a new mobility with potential arises and they have the choice to implement it before or after Frankfurt, a first reaction might be that Schiphol would want to implement it before them. However, they could also choose to let Frankfurt implement it first, let them make the first mistakes and costs, and implement it when the maturity of the technology, the market, and the team has gone up. The question herein is what the risk is what they are missing. Because on the other hand, if a hyperloop-track will be built from Amsterdam to Rotterdam, Schiphol will miss the opportunity, which is probably worth more than the money lost due to immature costs.

All in all, there are definitely advantages to being the first mover. It means you are the one first in contact with a company, possibly with potential, and a lot can be learned. However, it must be said that a lot can go wrong, and costs can be high. There is an option to let competitors do these first learnings. It can be concluded that the moment to engage it is a point of discussion when assessing a modality. However, the key insight gained, is to do regulatory assessments to assess the potential of modalities and to talk with stakeholders about potential and potential risks. In this way, the risk on whether or not to engage can best be estimated.

6.3 Toolkit exploration: Factors influencing the potential of a modality

Now that we know regular assessments should be made, now the more specific risks in modality innovation at AAS are examined. Continuous conversations, literature and interviews have led to a set of factors influencing the potential of an innovation. Throughout this report, factors have already been identified, for example, in the chapters of the context and internal findings. This chapter presents the last factors found and will elaborate on them. The factors presented in this chapter will be the foundation for the toolkit with which the potential of a modality can be assessed.

6.3.1. Market

To start, Schiphol should be aware of the market. Herein the development of the market. It is valuable to do market research and analyse the market in order to identify possible strategic (dis)advantages compared to other airports/ hubs/competitors.

Literature has been used to identify the variables to look at in a market analysis.
Examples of where to look at could be: (Tim Berry, n.d.)

- Potential market size
- Potential market share
- Potential market segments
- Customer mix
- Competitors
- Market maturity

There might be situations in which the service is ready but where the market is not yet, for example, trains taking over a part of aviation. There will also be situations when the market is ready, but the product is not. In conclusion, both the market and the market maturity influence the potential of a modality for RSG. In other words, RSG should raise the question if they will engage with certain modalities and if this might result in a strategic advantage compared to competitors.

6.3.2. Competition

Within the market, competitors' activities concerning a potential modality requires specific attention, as this also influence the potential of a modality for RSG. There can be identified two potential competitors for Schiphol when Schiphol is trying to engage with a certain modality.

1. Current hubs

These are the current hubs that compete with being the best connected airports or hubs in Europe: Heathrow, Frankfurt Airport, Paris Charles de Gaulle, Munich Airport and Madrid Airport.

2. New hubs

Hubs that do not yet exist is the other category to look at. It is important to constantly consider these. Obviously, airports are already junction points for modalities, but if airports will not adjust to changing travel demands, places we can not imagine yet might be able to take over airport's current function as a travel junction point.

Concluding 6.3.1 and 6.3.2., a way to make an assessment on whether a modality has potential in the market is with Porters Five forces. (Bruijl, 2018)

6.3.3 Customer Experience

Customer experience is something that should always be considered in thinking from the customer perspective (KPMG, 2019). Besides, with the trends of being connected and IoT, there is a demand for an optimised customer experience. Travelling should, among other things, become more connected and more fun. Therefore, new modalities should fit the (desired) customer experience of the customer of the future. This is already being done when looking at the current state of selecting within Schiphol and might be considered even more in the future.

6.3.4. Mobility trends

The mobility trends should be known and constantly be monitored. These have already been stated earlier in this chapter. As stated earlier, currently, these trends consist of globalisation, climate change, urbanisation and technological developments and the Internet of Things. The most important trend now is climate change which has to be addressed by a company like Schiphol. This is also reflected in Quality of Life, which is represented in the strategy of Schiphol. In aviation, this is being illustrated the route to net-zero European aviation (destination 2050, 2022)

6.3.5. Technical maturity

The maturity of the to be identified and selected modality should be considered. The maturity of a technology or innovation gives an indication of the range of uncertainties to expect of the modality as well as the time it will take to truly start pilots or even launch it on the market (time-to-market). Ways to assess the maturity of technologies are Technological Readiness Level assessment (NASA, 2012), the Bit Maturity Wave (Bit, 2021), time-to-market assessments, or qualitative questionnaires (WU Vienna, 2014)

6.3.6. Team maturity

Apart from the technology, also the readiness of a team to cooperate with a corporate has to be assessed (KTH Stockholm, 2022). A technology can be highly mature; however when a team is not ready to cooperate with an external company or the team has no capabilities or competencies of taking the next step, a potential modality has low change of succeeding. A way the team maturity level can be measured is the Team Readiness level. (KTH Stockholm, 2022)

6.3.7 Funds and subsides

Apart from the players within Schiphol, it is important to notice that the aviation industry is operating in the public sector. In this entire ecosystem, funds and subsidies can be provided for certain projects, which influence the decision making and the potential of a modality within Schiphol. Allocated funding might mean that Schiphol will financially be supported, which means a modality can have preference over a modality that will not be funded. Therefore, within the identify and select process, funding and subsides have an important share. Mostly these programmes are already known for the next 5 years. There are different kinds of subsidies. For example, in terms of cash, loan or board agreements. Moreover, the could be on EU-, national-, provincial-, or on regional level and are in different themes like infrastructure, innovation, sustainability and more.

6.3.8 Intellectual property and legal considerations

On top of the potential of subsides and funds, also intellectual property has to be owned over a technology to be able to use it. Within the organisation, there has been conducted an interview with an internal legal expert to define Schiphol's approach herein. The conclusion of this interview was that at the moment, there is not yet a standard approach concerning legislation and IP with start-ups and other external parties. The main legal goal RSG has, is to have the right to use it. Furthermore, the procurement law should be taken into account. Because the Dutch government is the majority owner of RSG, there should be an open and honest approach concerning investments. This has to be set up if RSG is going to pay for something, which is not the case for investments or shares. Legal issues and intellectual property should be taken into account when assessing the potential of a modality in a future intervention.

6.4 Opportunity exploration: what else to consider with long term modality innovation?

Now that the factors have been identified that influence the potential of an innovation, this part of the report presents the opportunities and considerations found for the toolkit and the strategy as a whole, when thinking of a long term modality approach.

6.4.1. Dealing with uncertainties: a qualitative approach

When talking about the future and potentially assessing modalities, uncertainties are inevitable. How to deal with them is the question. The reason why assessing potential modalities is so complex and different from other innovations is because of its long development times. As long development times (Kemp et al.,2000) are associated with high uncertainties; this chapter will elaborate on how to deal with uncertainties. It is impossible to predict how everything goes, but it is vital to have an overview of the variables of the prediction. Besides, constant changes in the environment can occur, which might influence a prediction. Forecasting can go wrong. Therefore it is important to know external factors might also influence the moment to engage, like context factors, competitors, policy changes, etc. This is visualised in figure 22. When speculating about such futures, in the direction of the long-term future, it should be considered that qualitative approaches are more appropriate (Kosow et al., 2008).

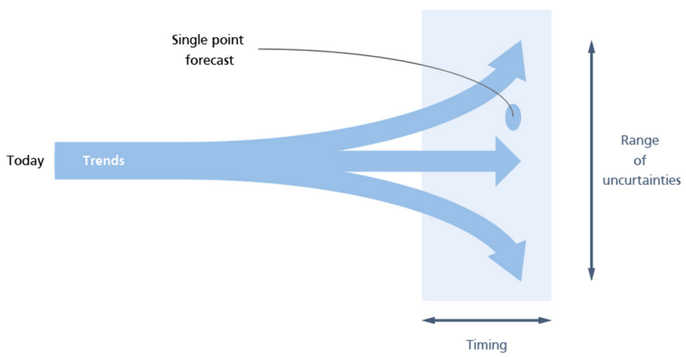


Figure 22. Dealing with uncertainties

6.4.2 Method as toolkit

As stated in chapter 6.4.1., a qualitative approach is necessary. I have chosen that a toolkit is the best way to provide this. Therefore, this chapter presents insights in how such a method can best provoke a discussion. Jaap Daalhuizen (2014) did extensive research on how methods function as tools for designers. There are numerous ways in which methods can be used in relation to cognitive systems (Daalhuizen, 2014). Herein the focus is to explain the working of the toolkit on ´´Assisting in framing conceptual representation''. Daalhuizen´s explanation of ´´Assisting in framing conceptual representation´´ is the way this toolkit will assist the participants. It is being described as the need to have a situation framed to have a thoughtful perception of the situation. This will support the actions hereafter. In the case of the toolkit, it will assist in structuring the problem and separating all facets of the problem. Besides, it is being stated that the main problem which is being prevented by creating such consciousness with a method to avoid the common mistake of jumping to conclusions too early, if the problem has not been investigated thoroughly (Hubka, 1982, p. 28)

It should be said that Daalhuizen's theory focuses on designers, however, it can be said that cognitively the same steps happen for a designer as for other people. If non-designers are using these methods meant for designers, probably the same will happen. On top of that, the innovation hub consists mostly of designers.

Possible end situation

Users of methods might develop a 'method mindset' (Daalhuizen, 2014). This mindset refers to the situation in which the method has a 'scaffolding' function. This happens when the method develops expertise of the user. This then results in the expertise of the users taking over the method by its intuition. In this situation, the user has acquired knowledge and beliefs which relate directly to the use of the method. With the relevant experience a user has with a method, the method will be followed more according to the theoretical and practical experience of the users (Andreasen, 2003). In the end, this is not a bad side effect, as the users can add their practical experiences to the theoretical method. Therefore, at all times, it should be realised that not the toolkit is the end product, but the discussion is the end product. The method is not the result; the structured way of assessing modalities is the desired result.

6.4.3. Connect to the future world of mobility

As the most important hub in The Netherlands, Schiphol is a junction point for all different kinds of travel. To succeed in the future of mobility, Schiphol should align its business processes (KPMG, 2019). Therefore, Schiphol should align its way of working at the innovation hub more with the world of mobility and the future stakeholders by finding a way to connect more to the future of mobility. As reflected in chapter 4.2, the current state of identifying, their current attitude is rather waiting, and a more connected and active way of working with the future world of mobility is therefore required. This is empowered by the interview done with Corina, emphasising that to be successful in open innovation , connection with the market should be made. This is visualised in figures 23 and 24.

Figure 23. Current situation RSG and the world of mobility

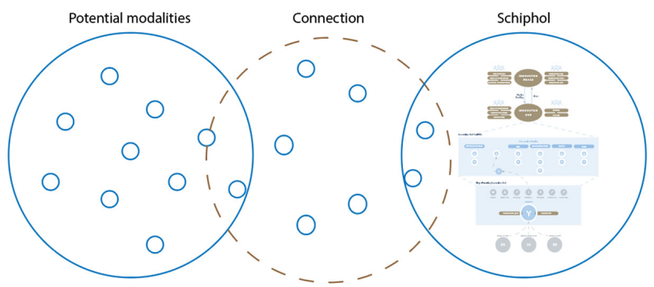


Figure 24. Desired situation RSG and the world of mobility

8.3.2 How to connect with the future

As stated, RSG will have to connect with the future. For the toolkit, this is done to substantiate a method as means to evoke a discussion. For the strategy, I have chosen to work with a technology scout. This in consultation with an expert (Pieter Paul, 2022). This is here substantiated with literature. This chapter will provide guidelines for organising scouting and proposed scouting activities.

Based on chapter 3, on identifying, I have chosen that sending out scouts will be the most efficient because there has to be found a way in which Schiphol can connect to the future. I have decided that 'sending out scouts' is the most efficient way to do so and will therefore be the foundation of the strategy. The goal of technology scouting is mostly to obtain a competitive advantage. This is done by identifying threats and mostly opportunities that arise from technological developments at an early stage, and this should be provided with the technological capabilities needed to face these challenges.

Ways to do this are to assign part of your staff or employ external consultants that can then gather information and execute technology scouting (Wolff, 1992). Information channels used by such a scout can be divided into formal and informal sources. Informal information sources are networks, workshops, trade fairs and conferences. Formal information sources are technological reports, journals, magazines and trend studies. (Bürgel et al., 2005). This basis has been used in the proposed activities for an intervention later. As stated, the technology scout is either someone from current staff or an external consultant. Bürgel et al, also state such a technology scout should have characteristics that should include lateral thinking, knowledgeable in science and technology, respected inside the company, cross-disciplinary oriented, and imaginative.

6.4.4. Learn from failure

Lastly, despite that Schiphol and the intervention should do everything to make sure the problem-solution fit is as perfect as possible, the intervention should not be leading. Unfortunately, the to be designed intervention will not be a stand-alone thing and can not be solely relied on. Therefore, for RSG, it is vital to learn from failure, as also named in interviews. This is being empowered by Harvard Business Review. Big companies like Coca Cola, Netflix and Amazon have already proven this (Bill Taylor, 2017). There have to be dealt with uncertainties. For Schiphol, it is essential to realise that this is the case and that the success herein lies in a probe and learn approach and to learn from failure.

'' small failures can help avoid big failures.'' - Peters (1988)

6.5 Conclusion

In this chapter, the essentials for the strategy and the toolkit have been examined. In terms of the strategy, this has led to the five actual steps to run through in the strategy. Furthermore, the factors that should be considered in the toolkit have been identified. In terms of the toolkit, this has led to the last factors influencing the potential of a modality at Schiphol. Lastly, also extra considerations have been found, that should be included in a long term modality innovation approach. With this, the next chapter will present the design brief with the design principles, which will conclude the first part of the research and will be the foundation for the creative part of this report.

07

EXPLORATION: A SEARCH ON HOW TO SOLVE THESE GAPS

7.1 INTRODUCTION

The first part of the research is concluded with this chapter of the design brief. This chapter concludes all findings done so far, which have been translated into design principles. This chapter will form as an introduction to the second part of this report, where the insights will be used to design an intervention for RSG.

7.2 Problem statement

Following on the identified gaps previously and the exploration done afterwards, here the problem statement is presented consisting of 2 layers. Firstly the strategy concerning new modalities is missing. Secondly, the assessment of modalities which Schiphol does not do in a structured way currently. Therefore the problem statement is as follows:

''Currently, Schiphol does not have an approach to get a sufficient image of potential modalities, nor do they know how to assess them. This means RSG is in danger of missing modalities with potential. To address this problem, Schiphol needs an intervention that will help them identify and select new modalities. This intervention should assist them in the decision-making process by providing a structured way to handle new modalities.''

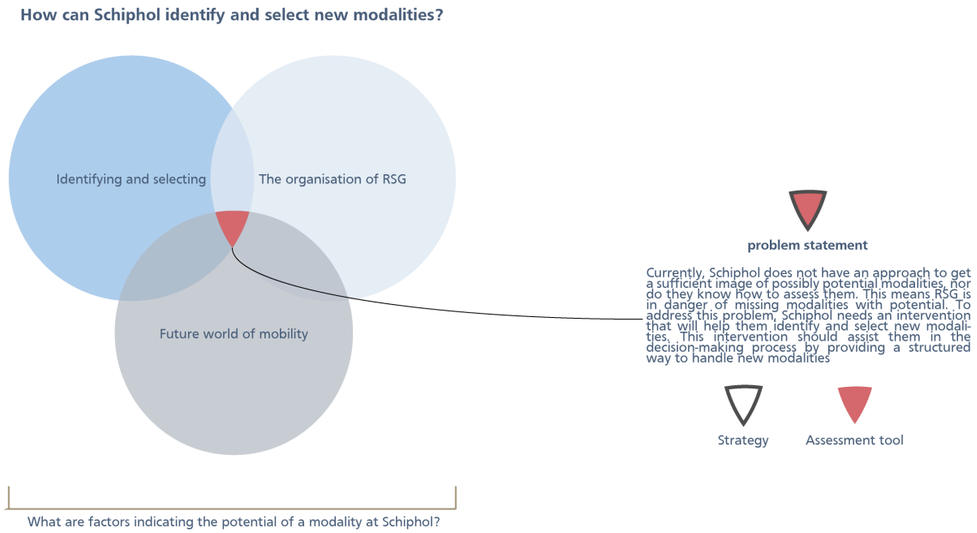


Figure 25. Problem statement presented

7.1.1 Scope

In terms of the scope, the intervention should consist of (1) a strategy which covers step 1-4, and (2) a way to assess modalities, which is a detailed process for step 3. The attention of the solution can be described as a T-shape, wherein steps 1-4 are treated, with an emphasis on step 3. Step 5, engaging, will be left out of scope as I have chosen that 'choosing' will be the last step of the intervention. 'Engaging' will be taken into account, but not directly handled. This is visualised in figure 26.

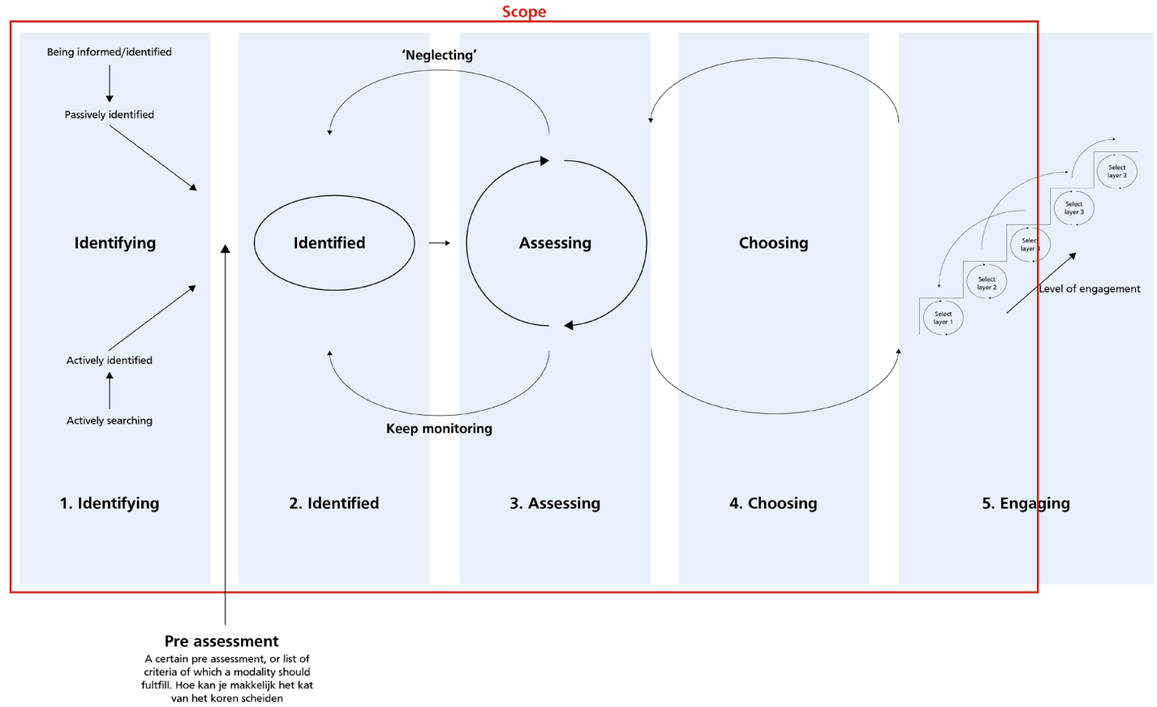


Figure 26. Scope

7.1.2 Expected outcomes

The problem statement consists of two parts. Therefore is important that these two parts are solved separately, but they should add up to each other. It should be considered how the assessment-tool could be incorporated in the strategy in a way the two can benefit from each other. This to, in the end, create coherence between the two parts of the problem statement. The expected outcome is visualised figure 27. The two different layers of the problem will have two different expected outcomes which are described hereafter:

1. An overall strategy and corresponding approach should be developed on how RSG can continuously identify and select new modalities, according to the identified steps (identify, identified, assess, choose, cooperate). With this approach, Schiphol should connect more to the future world of mobility and its companies
2. A tool should be developed to assess modalities according to the factors found in the first part of this report. The tool should connect to the strategy. The tool should guide Schiphol in having a structured way in which discussion concerning potential modalities can be held.

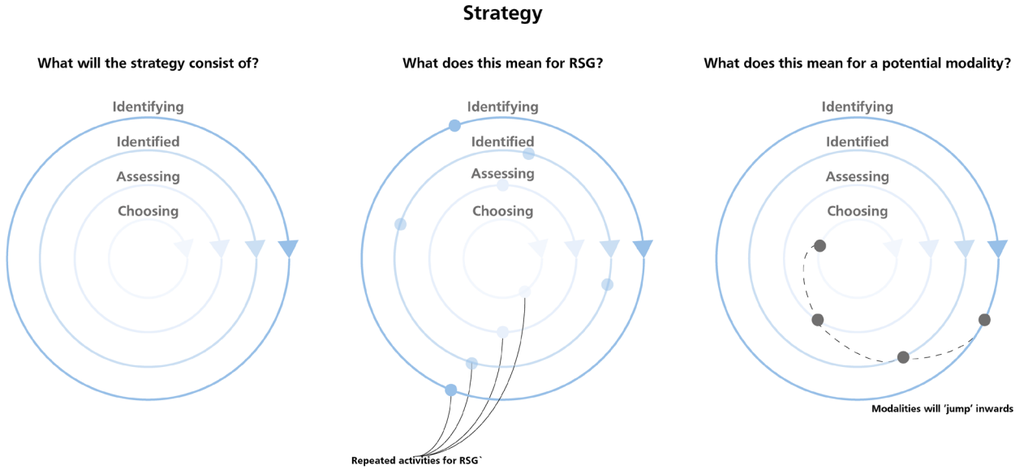


Figure 27. Strategy and toolkit outcome

7.1.3 Target group

For the project, RSG is the main problem owner. They are in danger of 'losing' part of their travel traffic if less people will be traveling from Schiphol. Within the organisation of RSG, the Innovation Hub is the department for which the solution will mainly be created. They are in the end responsible for the long term MMH-strategy and are dedicated to execute the developed strategy as this is in their scope of working. Within Strategy&AirportPlanning, more individuals will however make use of the intervention. People responsible for long term strategy planning and people with a specific interest in certain modalities from other business units (BU) will be incorporated. Therefore, also S&AP as a whole will be targeted. Outside of Schiphol, the potential modality is also incorporated.

7.3 Design principles

Now the design principles are presented. Criteria have first been formed, which have later been formed to design principles, which is a way in which it is easier to use in the creative phase (Ideo, 2021)

General

1. **The steps 4 steps (identify, identified, assessing, selecting) should be incorporated in the approach**
   - **a. The four steps need to represent a strategy/approach**
   - **b. The step assessing need to represent an application**
2. **In both parts, the intervention should be able process modalities. When possible also other new technologies in terms of mobility.**
3. **All identified factors influencing the potential of a modality should be included**
4. **An open innovation mindset should be pursued in the 4 steps.**

Strategy

- **a. In which Schiphol proactively monitors potential modalities**
- **b. In which there is structure in searching**
- **c. In which Schiphol will be connected to the future world of mobility**
- **d. With which Schiphol can strengthen its current network**

Toolkit

- **a. The application should connect different stakeholders within Schiphol**
- **b. The application should facilitate a discussion**
- **c. Should be the basis for a structured discussion**
- **d. Should assist in decision making / should substantiate decisions**
- **e. It should help in assessing potential**
- **f. Assess qualitatively**

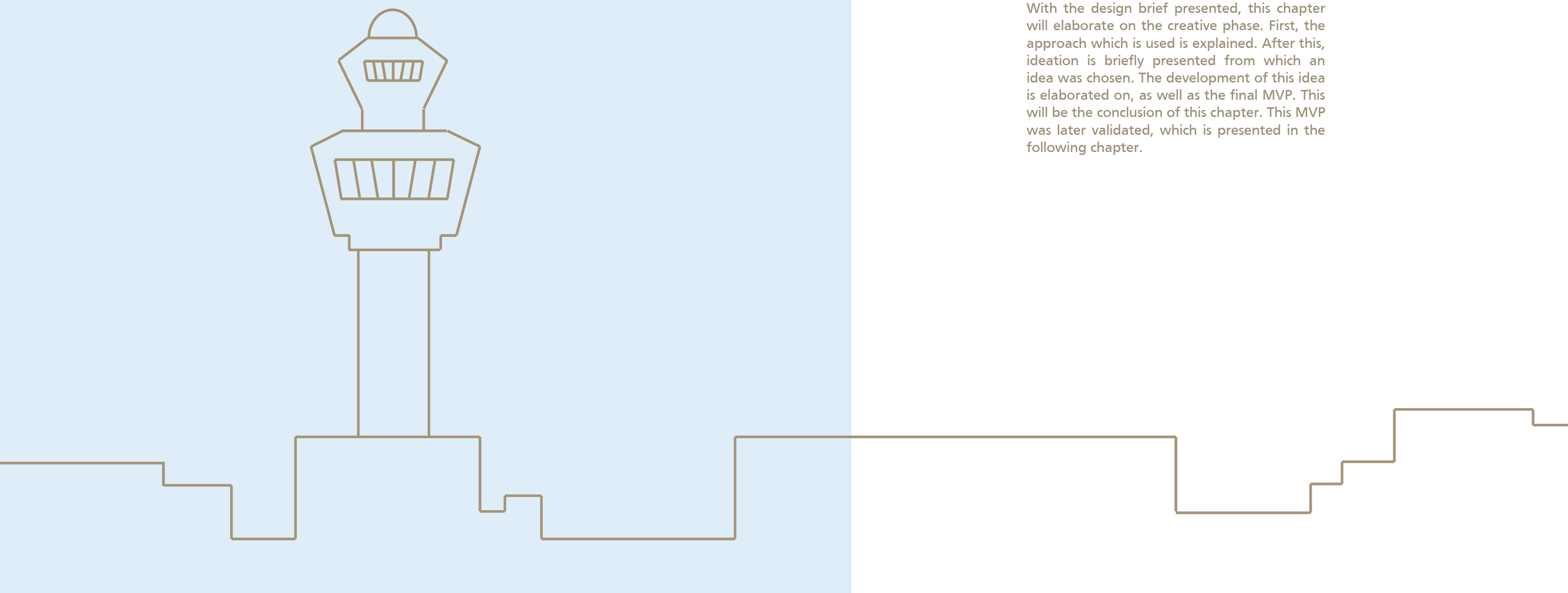
7.4 Identified factors

There are the factors that have been found influencing the potential of a modality at Schiphol. These were used as a basis for the toolkit, and are sorted here with the corresponding chapters they are documented in.

1.3.1	Strategy Schiphol (QoN,QoS,QoL,SRO)
1.3.2	To what extend can a modality benefit to the hub-function
1.3.5	Influence on stakeholders
4.3	Desirable (future customer, Aligned with strategy Schiphol)
4.3	Viable (Allocated funding, support base organisation, business case)
4.3	Feasible (infrastructure, airside/landside, permits/approvals)
4.3	Political and public support
6.2.3	Execution risk
6.2.3	Co innovation risk
6.2.3	Adoption chain risk
6.3.1	Maturity and potential of market
6.3.2	Competitors
6.3.3	Customer experience
6.3.4	(Trends of) future world of mobility
6.3.5	Technological Readiness Level
6.3.6	Team Readiness Level
6.3.7	Funds/subsides
6.3.8	Intellectual property and legal issues

08

8. IDEATION AND CREATIVE PHASE



8.1 INTRODUCTION

With the design brief presented, this chapter will elaborate on the creative phase. First, the approach which is used is explained. After this, ideation is briefly presented from which an idea was chosen. The development of this idea is elaborated on, as well as the final MVP. This will be the conclusion of this chapter. This MVP was later validated, which is presented in the following chapter.

8.2 Design Approach

The creative processes of the two parts of the problem statement were done simultaneously to continuously make sure the two parts would match each other and even add up to each other. It should be said that the strategy adapted more to the toolbox than the other way around. In other words, priority was for the toolbox, as the toolbox was most suitable to test and therefore to optimise. The strategy is about creating an environment in which the toolbox can be used best.

1. Toolkit
The toolkit has been developed with constant iterations, which have been simplified as three iterations in figure 28. In the first evaluations, the toolkit was tested mostly on initial practical implications. Later evaluations focussed more on the detailed information on the cards of the toolkit and how the toolkit could be used in the environment of Schiphol.

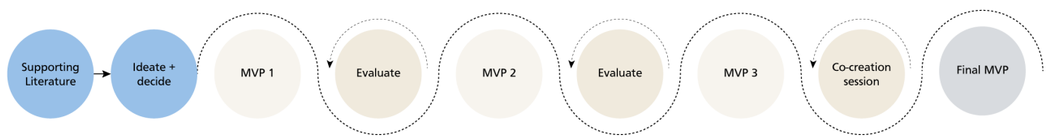


Figure 28. Creative process toolkit

2. Strategy
The strategy has been developed with the help of experts in the field of open innovation. The insights of these interviews were used as a foundation of the strategy (Appendix B and C). These insights were used to conceptualise the strategy, after which it was evaluated, and iterations were made.

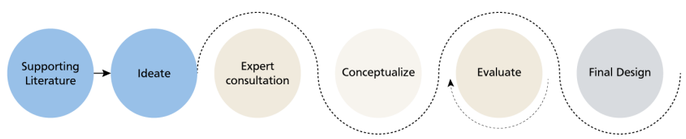


Figure 29. Creative process strategy

8.3 Ideate

To start, the findings of literature presented in chapter 6, exploration, has been consulted as an inspiration for the ideation. Ideas were generated for the two problem statements and the corresponding design principles. Short brainstorms were done, but the ideas mostly flowed from the research part.

As stated, creative sessions have been done in order to come up with ideas for the proposed design principles. This has been done individually, and after some initial sessions, quickly ideas were translated into three idea directions, which can be found in appendix D. These ideas have formed themselves from the research phase substantiated by the design criteria. After deciding on the direction of the idea, the first prototypes were soon made to step-by-step develop something, which evolved into an MPV discussed later.

The ideas have been created in an early stage of the process and have been discussed within Schiphol, and with experts (Corina, PP). These discussions have benefited the substantiation of the second idea: Qualitatively assess all factors separately. This decision has been made because this idea had the best emphasis on the actual problem which the factors address. In the other ideas, the focus would be on side-factors and nice-to-haves more than on the actual problem: the assessment of the factors identified in the first part of the research. The decisions for the toolkit has also been extracted from the design principles.

8.4 Create

After having decided on the idea direction, the creation phase started. With the help of the theoretical foundation on which the idea is built, the idea was further developed. In the end, this led to the first MVP for the toolkit (appendix E). I have chosen to do user testing on the toolkit only, as there is more interaction than in the strategy, and therefore more insights can be generated. Besides, it should be stated that initially, the toolkit will have more value than the strategy. The toolkit is something that can be developed and made ready for use for RSG. The strategy will be something that empowers the toolkit and defines the direction Schiphol is advised to go but remains an advised direction rather than an actual product. In the next chapter, an elaboration will be given on the co-creation sessions, in the form of an actual co-creation session and interviews, which helped develop the toolkit and the strategy.

8.5 Qualitative interviews and co-creation

In developing the idea to a final MVP, two qualitative semi-structured interviews have been conducted, and two co-creation sessions have been done. The semi-structured interviews were conducted with experts in the field of open innovation ecosystems. The co-creation sessions were conducted with two different groups. The first one was with fellow students to go through the workings of such a session. The outlines of these sessions are visible in figure 30. The other one was with stakeholders from Schiphol on the content of the toolbox and the content of the card deck. These stakeholders were people responsible for the long term planning within Schiphol, which resulted in interesting insights. In this chapter, a brief summary is given of the insights. For the results of the final co-creation with people from S&AP of RSG. see appendix F.

Figure 30. Outline of co-creation session

Co creation sessions:

Interview Corina	-	*Strategy*
Interview Pieter Paul	-	*Strategy + toolkit*
Co-creation fellow students	-	*Toolkit*
Co-creation S&AP Schiphol	-	*Strategy + toolkit*

Toolkit findings
During the sessions, an early version of the toolkit was shown, tested, and discussed. Besides, the premature outline of the workshop was discussed. Especially the session with the stakeholders from Schiphol helped in the translation of theoretical insights from the first part of the research to a way in which these insights could practically be used in a card deck. This was illustrated in insights in terms of the timespan of meetings, which was proposed to be annual or bi-annual. Furthermore, there were extensive discussions on the actual factors and whether they agreed on these. All these insights were implemented in the final MVP of the toolkit.

Strategy findings
Insights from experts from the field of scouting in combination with the internal knowledge of Schiphol has resulted in an interesting set of sessions and insights from the strategy perspective. Overall, the strategy and the fact that Schiphol should engage more in the (future) world of mobility was perceived as positive and necessary, especially by the experts in the field of open innovation. For example, the experts stated that one full-time scout looking at the future world of mobility would not be enough as the field of potential companies is probably huge and impossible to cover on your own. An extensive approach on how to get such an image was suggested. Besides, the stakeholders from Schiphol stated that the proposed strategy could be linked with the so-called MTP, MP and CLB, as stated in chapter 1.

Conclusion expert consultation
The insights gathered from the interviews and co-creation sessions were used in further developments. For the toolkit, up until now, the MVP consisted mostly of what to assess modalities on, which factors are right and how this can be translated into practice. This still had to be developed further, but the final MVP is presented hereafter.

8.6 Final MVP

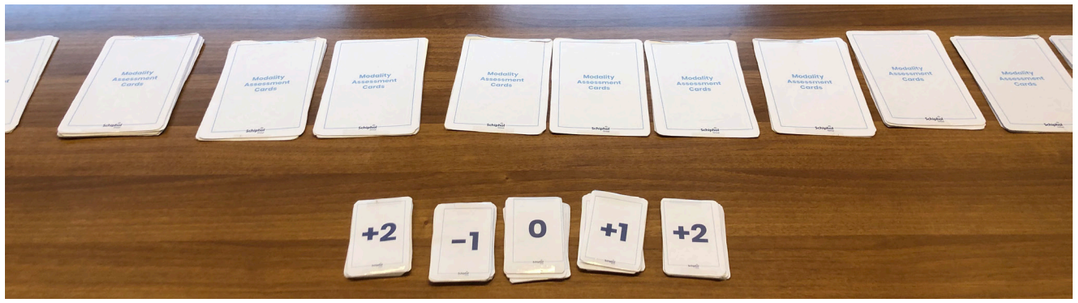


Figure 31. Final MVP

The final concept is a toolkit in which all factors identified in the first part of the research have been included. The toolkit will be used to assess early-stage external modalities. As is presented more extensively in the strategy later, the situation is that the orchestrator has searched in the market for modalities with potential for Schiphol. From this search, the orchestrator makes a shortlist, which will be used as input for the session. In this session, modalities will be assessed by having a structured discussion concerning all the factors, using the card deck visualised in figure 31. At the end of the session, a decision will be made concerning the engagement with the modalities.

As selecting modalities is a complex process, and the factors are hard to keep separated, it is important to realise that there is overlap in the factors. Some factors might influence each other, but it is valuable to assess them all separately to get an overview of the different facets of the potential of a modality. Besides, in this way, all modalities will be assessed in the same way.

Online versus offline
At first, the idea was only to make a physical toolkit, as this is perceived the best way to conduct a discussion. However, due to new COVID measures, also an offline toolkit had to be made. This is more difficult for discussions. However, it must be said that it is easier to gather stakeholders.

Facilitator
The toolkit will be used in the presence of a facilitator. He or she will guide the participants through the session by turning the cards, handing over the word, and making sure the toolkit will be used correctly.

Participants
Participants of a session should consist of: (1) people from the innovation hub and (2) other stakeholders with affinity to the modality. These will mostly be people from Strategy & Airport Planning because these people are responsible for the long-term planning.

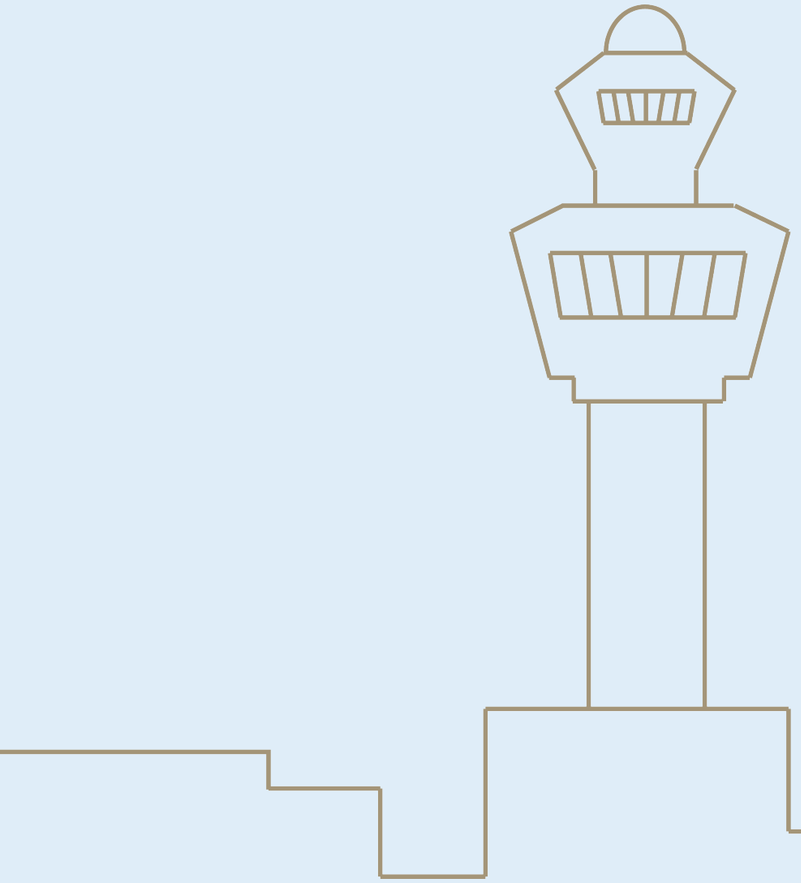
Poker assessing
For the discussion, there has been chosen to apply the concept of 'poker assessing'. In poker assessment, participants will individually decide on how they want to score a certain card, which represents a factor. Without consultation, participants show the card representing that score, reaching from -2 to +2. In this way, a discussion can be started while everyone has an idea on the perception of others while not being influenced by the perception of others. This kickstarts the discussion. When most people assess it in the same way, a discussion might be shorter. When there are big differences, it is interesting for the facilitator to ask them about the differences.

8.7 Conclusion

In this chapter, the process of the development of an MVP has been presented. The steps and main conclusions were presented, from the ideation phase to the early MVPs to the final MVP. This final MVP still consisted of assumptions and uncertainties, which had to be tested. Therefore, in the next chapter, these assumptions are introduced, and the evaluation of the MVP is presented. This evaluation is used to optimise the MVP to a final design.

09

9. VALIDATION



9.1 INTRODUCTION

With the MVP presented in the previous chapter, validation was done through user testing. This is done to get an overview of how the toolkit is being used if this fits the expectations, and what significant points of improvement are. As stated in chapter 8, the ideas have already been tested in earlier stages (MVPs). However, this was in a more 'informal' environment and not as structured as these final user tests. Besides, in previous tests the focus was more on developing a toolkit than to test actual hypothesise. During the user testing, the toolkit has been tested as a tool to assess modalities and to determine what level of engagement fits the modality best.

9.2 Assumptions and uncertainties

From the development of the MVP, several assumptions and uncertainties have been identified. These have been listed here. These are based on the discussions from the interviews, co-creation, and personal findings. In the following phase, these assumptions and hypothesise have been validated by user testing. The goal of the test is to test to what extent the tool fits its goal, which is substantiating and triggering a structured discussion on new modalities. The overall research question is:

''What are the strengths and weaknesses of the toolkit, and how could this be improved?''

This is done by testing (the interaction of) the prototype and see how it works in a workshop format. Iterative tests are executed, which improvingly imitated the actual situation in which the toolkit will be used. This is to make improvements to adjust it and match it with the target group. The underlying research questions are:

RQ1: How can structured discussion be encouraged to get the best result?
RQ2: How is the toolkit experienced and used by the participants?
RQ3: How can a workshop using the toolkit be best designed?

For testing, three main research questions were asked with corresponding sub questions, representing the assumptions and uncertainties:

1. How can structured discussion be encouraged to get the best result?

a. Simulated reasoning or hypothetical reasoning?
b. What are the boundaries of the toolkit?
c. Online or offline?
d. Risk vs. fit or not?

2. How is the toolkit experienced and used by the participants?

a. How extensive should the card deck be?
b. Are the experts encouraged to use their own expertise?
c. Are these the right factors?

3. How can a workshop using the toolkit best designed?

a. Is there enough substantiation for discussion?
b. How can the session best be executed?
c. How to facilitate? Up to what extent is a facilitator necessary?
d. Is there enough explanation?
e. How high can the speed be of assessing?
f. What if a factor can not be assessed?

9.3 Method

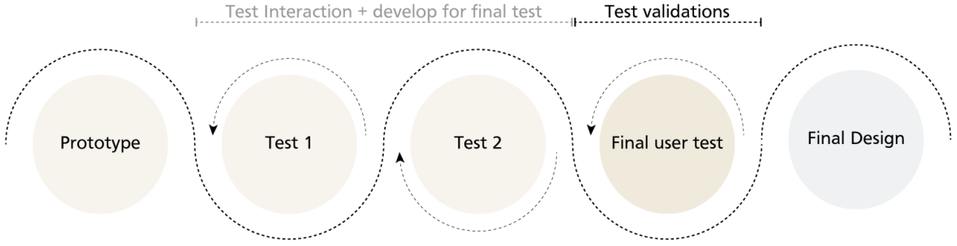


Figure 32. Process testing

To validate the assumptions and uncertainties, multiple tests have been done. The developed prototype was tested three times in three different settings. The first two tests were with fellow students and fellow interns at RSG, whereas the last test was performed with the actual stakeholders within RSG who would use the final toolkit. This is visualised in figure 32. These were, in the end, three people from the Innovation Hub and one from Strategy & Airport Planning.

As the toolkit represents a set of complex factors for which substantive knowledge is required, I have decided that the first two tests were mostly to test the interaction with the toolkit and the fluency of using it in a session. Learnings herein were used to improve the session so that in the third test session, the substantive insights of the toolkit could be obtained. This last test was therefore called the 'final user test'.

Test setup
The tests were executed by assessing one modality in a workshop format. A facilitator led the session, and afterwards, the participants were asked to fill in a short questionnaire. The situation was that the scouting team had done scouting in the (future) world of mobility, and the Innovation Hub, together with a stakeholder from RSG, were executing an assessment.

As stated, not in all tests, the innovation hub and stakeholders from RSG were present due to availability, so other people were consulted as well. Their instructions were to act as if they were people from RSG. There was an increasing degree of representativity. Iterations from the first tests were used to improve the test and prepare it for the final session. The toolkit (card deck) was be tested, which is a part of the whole strategy. For all tests, the explanation of the toolkit was done first, after which the toolkit was used. This represented the actual use of the toolkit best.

The final user test was executed with three people from the innovation hub, and one from S&AP. They assessed three different modalities within the category of Urban Air Mobility on its potential. Because of the time, I chose to let them assess on four different factors. The results of this and the other tests, is presented in the next chapter. The speaker notes and structure of testing structure of testing can be found in appendix G, as well as the detailed evaluation plan.

9.4 Results

As stated in the method part of this chapter, three tests were done with the toolkit. The last test was done with the stakeholders from Schiphol. During this test, and after analysis of the other tests, it became clear to me that the test done before were not as valuable as I expected them to be. Mostly in terms of the discussion. During the test with the people from Schiphol, I experienced that the difference in expertise had more effect on the discussion than expected. The lack of foreknowledge of the fellow students resulted in a superficial discussion. Therefore, I decided that comparing these results was not possible in terms of the discussions. Despite this, these sessions have been very helpful in the evolution of the toolkit, from a physical concept to a real session. For testing, three main research questions were asked with corresponding sub questions. A discussion of these assumptions and uncertainties is presented here.

1. How can structured discussion be encouraged to get the best result?

a. Simulated reasoning or hypothetical reasoning?
Due to the difference in level discussions between the people from RSG and the fellow students, it was not possible to conclude which kind of reasoning worked the best. As the students did not really have knowledge of Schiphol, is was not possible to compare these discussions.

b. What are the boundaries of the toolkit?
SAF, hyperloop, and UAM companies have been tested with the toolkit. With all of the tests, no major obstacles have been experienced. The only difficulty experienced is that the difference within a category might be too small, rather than the differences between the categories. However, the only modality tested with people from Schiphol was UAM, so it can not directly be compared with the other categories. It seems that the boundaries of the toolkit are in the small details, as the cards are quite general. Therefore decisions on details might be difficult with this card deck

c. Online or offline?
Two tests were done offline and one online. From the facilitators perspective, the offline session had more fluent discussion, probably because of the minor technical delays and the fact that it is difficult to interrupt someone online. Also, the Schiphol stakeholders preferred offline testing. However, it should be noted that online sessions are easier to host. All in all, it seems that offline sessions are perceived as more valuable by the facilitator and the participants, but online sessions have logistical examples.

d. Risk vs. fit or not?
The graduate interns preferred the separation of factors in the final overview. However, as this has not been tested with the people from Schiphol, no substantiated decision can be given here.

2. How is the toolkit experienced and used by the participants?

a. How extensive should the card deck be?
The card deck seemed to be extensive enough. During the testing, no signs where that factors or cards were missing. However, it should be considered that the world of mobility and Schiphol can constantly change.

b. Are the experts encouraged to use their own expertise?
From the sessions with people from Schiphol, the discussions seemed highly valuable. Especially the fact that there were people from different departments of Schiphol added up to this. It seems that people like to talk about their expertise, especially when there are people from different departments they can speak to.

c. Are these the right factors?
There has been done a last check on the factors. After the session, there has been asked if factors were missing. Also, there were added cards where participants could fill in different factors. These have not been used. Adding up to earlier validations, these seem to be the right factors for now. However, as stated the world of mobility is diverse and can change quickly, so there will most probably not be reached a situation where all variables have been taken into account.

3. How can a workshop using the toolkit best designed?

a. Is there enough substantiation for discussion?
The session with people from Schiphol seemed to suggest that there is enough substantiation for discussion. There were no questions asked to the facilitator concerning information on the cards

b. How to facilitate? Up to what extent is a facilitator necessary?
A facilitator seemed necessary, especially for explaining upfront. However after the session there was a discussion that the participants thought they might be able to do it themselves the next time. During the actual assessing, the facilitator did not say anything, which was no problem. Though, I believe it is still valuable to have one

c. Is there enough explanation?
The explanation done in the sessions was clear to everyone. It might, however, have helped if the participants would have read all cards in advance. Now, they had some difficulties in what the boundaries were per factor. If they had read the cards first, these issues might have been prevented.

d. How high can the speed be of assessing?
After the session, there was a discussion on the speed of assessment. The participants agreed that it took some time. It would probably take about an hour if an assessment would have been done for all factors. However, it has been said that this will become less when the toolkit is used more often as they would get experience. On top of that, they perceived the time pressure I gave them as positive. They preferred the flow of just making decisions. They also agreed that more time should be taken when more time is needed, as decisions are about a lot of money. It has also been stated that if an assessment for a modality took two hours, this wouldn't be too long.

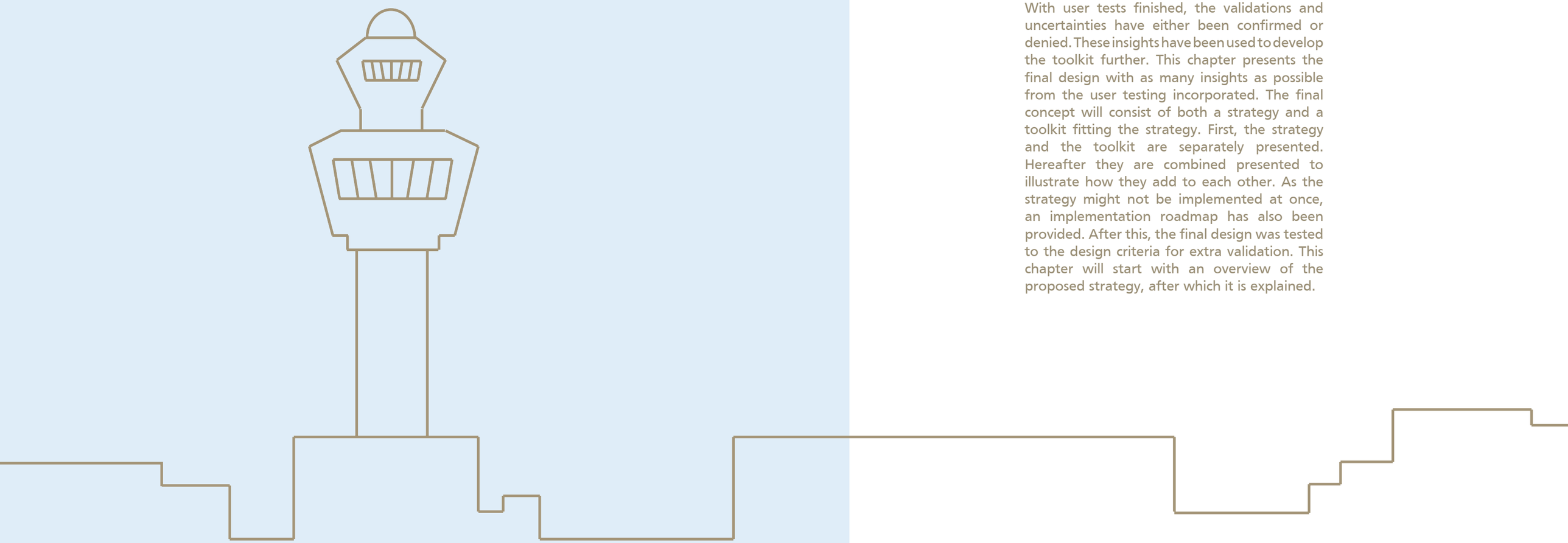
e. What if a factor can not be assessed?
During the session with people from Schiphol, it became clear that the 'Supplier Risk' could not be assessed, as they believed there was not enough prior knowledge. The group decided not to assess because otherwise, others could perceive it as if they were able to make an assessment, which was not the case. Not assessing when it is not possible seems to be the right decision.

9.5 Conclusion

In this chapter, the validation of the MVP is presented. Based on the MVP, assumptions and uncertainties have been listed, which were tested to improve the MVP. This has been done, leading to potential improvements and suggestions for the final design. These have been implemented in the final design, which is presented in the next chapter.

10

10. FINAL DESIGN



10.1 INTRODUCTION

With user tests finished, the validations and uncertainties have either been confirmed or denied. These insights have been used to develop the toolkit further. This chapter presents the final design with as many insights as possible from the user testing incorporated. The final concept will consist of both a strategy and a toolkit fitting the strategy. First, the strategy and the toolkit are separately presented. Hereafter they are combined presented to illustrate how they add to each other. As the strategy might not be implemented at once, an implementation roadmap has also been provided. After this, the final design was tested to the design criteria for extra validation. This chapter will start with an overview of the proposed strategy, after which it is explained.

Strategy on identifying and selecting new modalities at Schiphol

By the creation of the following open innovation ecosystem

The innovation hub will be actively adapting to the future landscape by being agile and open for change. Thi will be done by the scout orchestrator, who orchestrating the scouting process by connecting the Innovation Hub and scouting activities which will result in an overview of potential modalities for RSG and the possibility to assess them and to engage.

Stakeholders and components

- IH
- Orchestrator
- Scout Team

Innovation Hub

- Defining and communicating the strategy concerning new modalities
- Execute the assessments
- Instruct the orchestrator / Follow advice of the orchestrator
- Link between new modalities and the rest of RSG

Scout orchestrator

- Responsible for the new modalities open innovation ecosystem
- Intermediary between scouting team and innovation hub
- Makes reports manageable before reaching the Innovation Hub
- Determines on watchtowers together with Innovation Hub en scouting team

Scouting Team

- Execute the scouting activities based on the assigned watchtowers
- Deliver reports concerning the watchtowers to the orchestrator
- The team an be appointed internally of acquired externally
- The team can be scouting constantly or on demand

Watchtowers

- Are the directions in which is being scouted
- Watchtowers are determined by the orcehstrator + Innovation Hub
- Watchtowers arise from strategy RSG/Innovation Hub
- Insights from watchtowers can lead to new directions of watchtowers
- Watchtowers will have to be revised every year due to the fast changing ecosystem

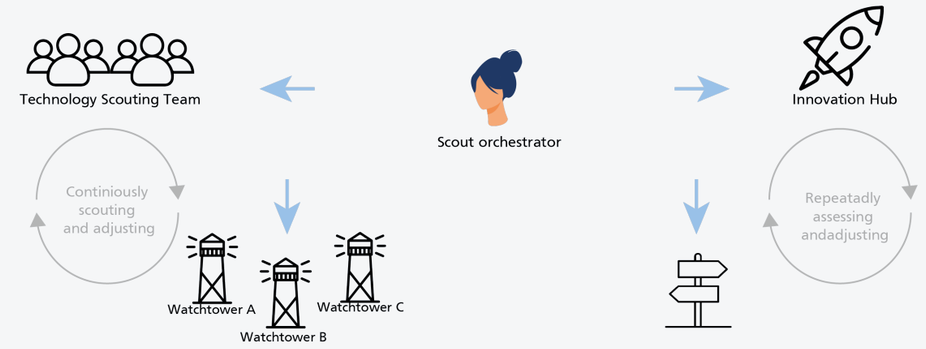
Assessment

- Assessments are done periodically or on demand
- The appropriate stakeholders per session will be required depending on the catagory to assess
- Assessments can be done on mobility catagories, or on specific modalities within a catagory
- From the assessments, potential engagements or new watchtowers can arise

Reports

- Reports consist of different modalities or tehcnologies within the direction of a watchtower
- Within a report, for example, 15 potential modalities arise. The orchestrator can determine on a pre selection for modalities with the most potential
- The reports as output of scouting, will be the input for assessing

All within the mid and long term planning of RSG



New modalities cycle

- IH
- Orchestrator
- Scout Team

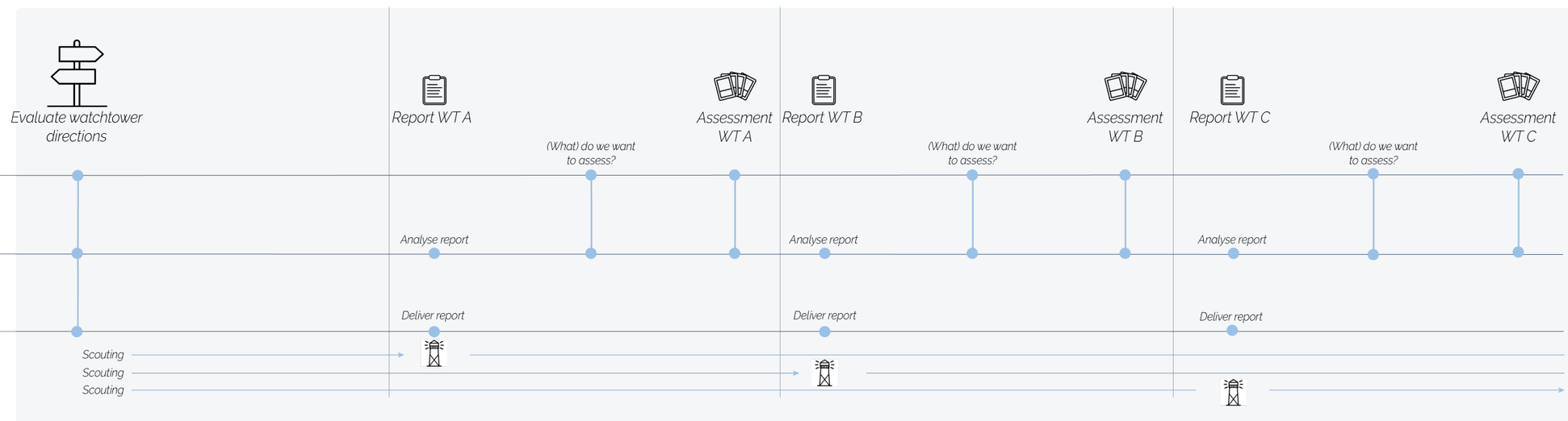


Figure 33. Strategy explained

10.2 Strategy

10.2.1 Overview of the strategy

As Schiphol is missing an approach to identify and select new modalities, this strategy provides an approach of how this can be solved. This is mainly done by really connecting to the future world, as stated in chapter 6.4. It is proposed that this will be done by acquiring a scouting team, whereas it is likely that one scout is not enough (PP, 2022). The end situation of the strategy and its stakeholders are presented in figure 33. On the left, the different stakeholders and explanations of these stakeholders are presented. On the right, the interaction between the stakeholders is illustrated. Lastly, a 2-year cycle is presented at the bottom, showing what activities are necessary to execute the strategy correctly, which is elaborated on later in this chapter.

10.2.2 The role of the orchestrator

Within the strategy, an orchestrator is present to lead the strategy. The orchestrator will be responsible for setting the exact strategy within the MMH direction, as he or she knows what happens in the market and within Schiphol. He or she will be building bridges between RSG and start-ups. It is important to give frames in which he or she should work. It should be made clear what is interesting and what is not and what the boundaries are in which he or she will work. The orchestrator will be a mediator of external parties. It is advised to give targets to the orchestrator to measure its success. During an expert interview, it became clear that such an orchestrator should have a clear goal to perform its task best. Therefore the following goal is formulated for the orchestrator:

How can Schiphol remain interesting in the future with the highly changing environment of the world of mobility?

10.2.3 Explanation of watchtowers

The watchtowers are the directions in which will be being scouted by the scouting team, which delivers reports concerning these directions. These can be exploratory reports, but they can also be more extensive. There are two kinds of watchtowers: (1) total market scan or (2); 'I already know I want to experiment with hyperloop so let's get to know what happens around the world; what are parties to cooperate or to quickly do experiments with'. Also, the output from the watchtowers can be used as input for future watchtowers. The watchtowers are valuable as Schiphol currently has no image of the future world of mobility. Watchtowers should be reviewed at least every year, as the ecosystem is constantly changing, quicker, and quicker. Lastly, it can be valuable to provide the scouts with some key factors that modalities are always assessed on as background information.

10.2.3 The 2 year cycle of the strategy

Cycles of two years are proposed. Within such a cycle, the first action is to determine the direction of the watchtowers. After this, the watchtowers are being scouted by the scout team, which periodically provide the orchestrator and innovation hub reports on the watchtowers. Hereafter, assessments are done on modalities with potential for Schiphol. Evaluations are done after the assessments on whether to continue on the watchtower or not (Verified, co-creation, 2022). This is all visualised in figure 33.

10.2.4 The workflow works both ways

Figure 34 describes the workflow of the strategy. Herein, it is visible that the workflow of the strategy works in two ways. On the left, it is visualised that the directions of the watchtowers are initially determined by the Innovation Hub, together with the orchestrator and potentially other stakeholders of RSG. Next to that, visualised in the middle, the next situation is that the scouting team is scouting in a certain watchtower. In this direction, they might find interesting new directions or more specific directions within such a watchtower. In this case, these insights will be communicated to the orchestrator and then the Innovation Hub and potentially other stakeholders within RSG. Then they can decide to change or specify the directions of the watchtowers. These workflows working both ways is visualised on the right in figure 34.

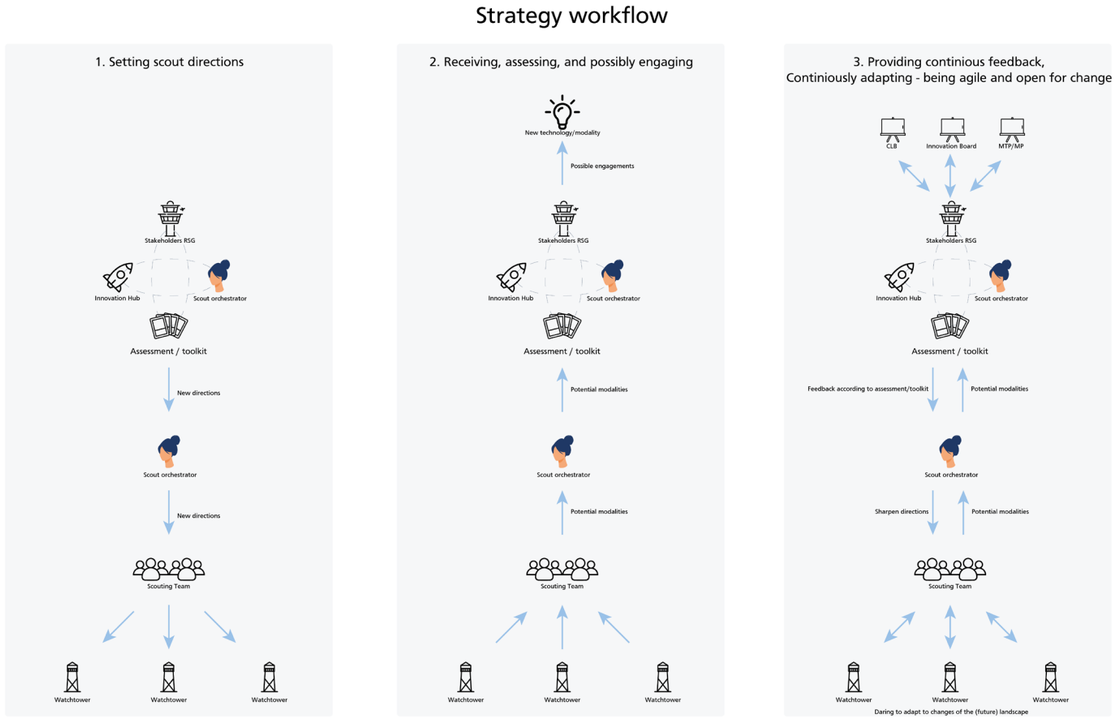


Figure 34. Strategy workflow

10.3 Toolkit

The New Modality Toolkit will be used for assessing modalities within Schiphol, for which there is no clear approach yet. The main goal of the toolkit is to create a way in which experts from Schiphol can have a structured discussion concerning new modalities. This discussion is a way in which modalities and companies can be assessed in the same structured way and might lead to possible engagements with parties. The toolkit consists of a card deck to assess modalities and canvasses supporting the session and the workflows after such a session. There is elaborated on them hereafter.

10.3.1 The card deck

The theory behind the idea builds on the theory of Daalhuizen (2014), stating that it is a method that supports the brain by giving guidelines. In this way, the card deck will facilitate a structured discussion. An overview of the cards can be seen in figure 35. The individual cards can be seen in appendix H. The cards consist of all identified factors influencing whether a modality has potential. Although extensive research has been done, there should not be the impression that these cards cover all factors possible. There might occur situations or modalities in which different factors come to mind. Besides, as already stated, the world of mobility is dynamic, and changes can occur quickly. Therefore, there have been included cards for potential missing factors. These empty cards can be filled in by the participants of the workshop. The cards generally explain the factor, potential questions to be asked, and sometimes a substantiating visual is added. In some cards, a tool is included that can help assess the factor. Factors consist of 1 or more cards. The explanation cards of a session can be seen in figure 36. The design of an individual card is explained in figure 37.

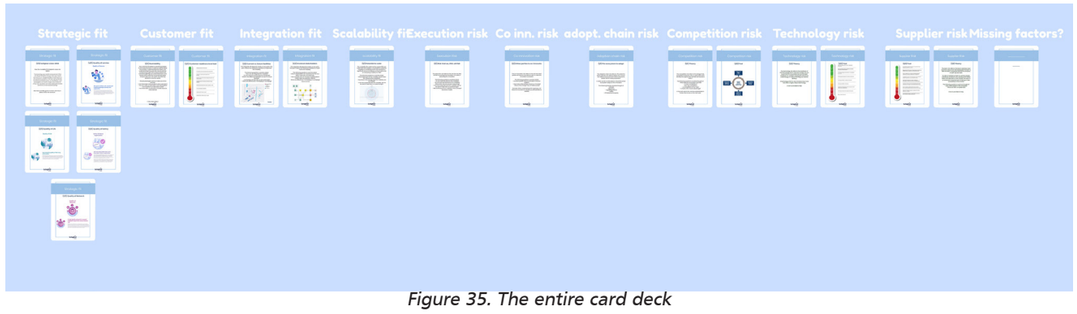


Figure 35. The entire card deck

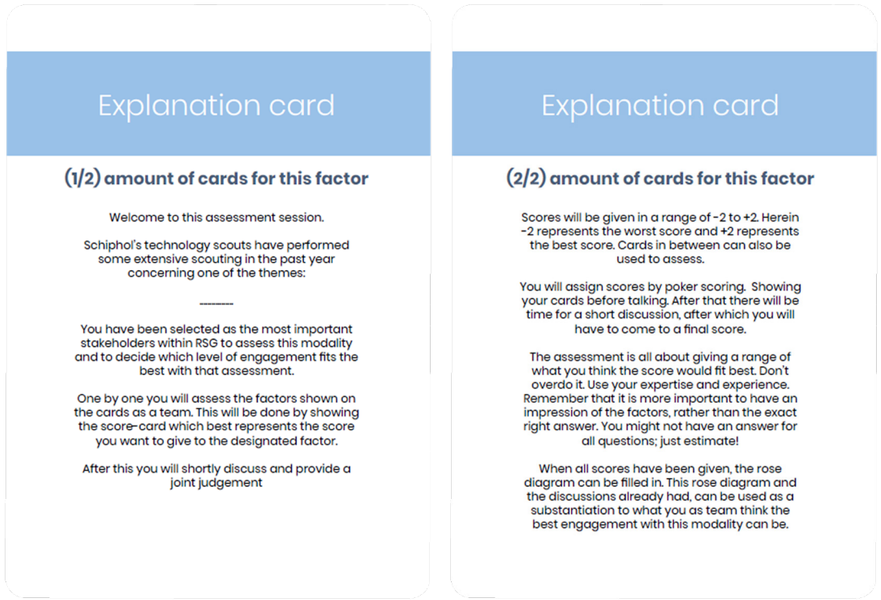


Figure 36. Explanation of the session

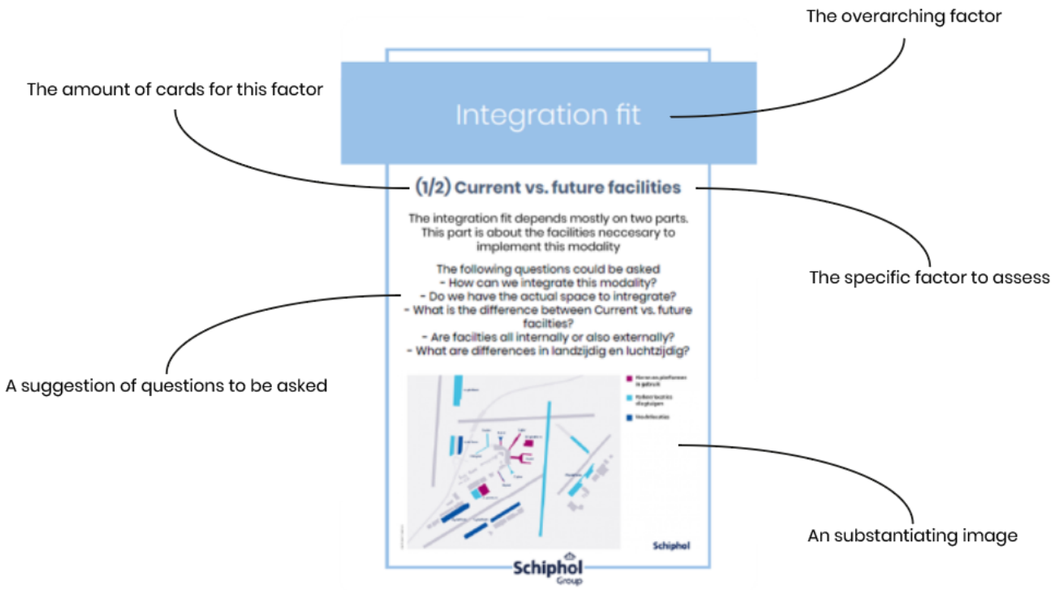


Figure 37. Explanation of cards

10.3.2 Canvases

There have been identified several opportunities for canvases to improve the output of the session. This has been done by analysing the workflow of the toolkit. When knowing what happens before and after such a session, I knew which canvases should be included in the toolkit to optimise its output. The four canvases are here presented as visible in figure 39.

1. Define workstreams

During testing, it became clear that the discussions were valuable and produced points to action for the potential modality which was assessed, or for potential feedback for the orchestrator, like determining upon new watchtowers. The workstream canvas can be used to address these matters and make sure this valuable information won't be lost.

2. Discussion engagement

At the end of the session, possible engagements will be decided upon. The engagement canvas represents the canvas with the potential engagements choose from.

3. Drawing scores

The score-canvas can be used to keep track of the scores per modality. Besides, this canvas functions as a reminder of the discussions and summary at the end of the session.

4. Feedback on watchtowers

In the entire strategy, it is important that feedback on the watchtowers' direction should be documented so that the orchestrator and especially the scouting team (as they are not present in the assessment session) know how they might adjust their scouting directions.

Toolkit workflow

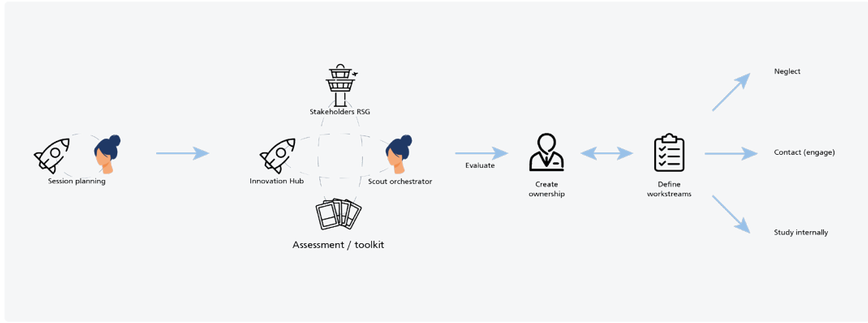


Figure 38. Workflow toolkit

Figure 39. Canvases

10.4 The session

The combination of the workflows of the strategy and the toolkit have been analysed to make sure no act is forgotten. Besides, the iterations made during testing have been incorporated. This results in a session of around an hour. There should be decided on either assessing multiple modalities within one category (different UAM modalities) or comparing different categories (UAM and Hyperloop). The detailed step plan of the modality assessment can be seen in figure 41 and will be further explained hereafter.

Necessities

1. Printed modality report(s)
2. Card deck
3. Canvases
   a. Score
   b. Engagement
   c. Watchtowers
   d. Workflows
4. Pen

Participants

The participants of the session will mostly consist of people from the innovation hub, as they are end responsible for the execution of the MMH strategy. On top of that, it is highly recommended to have someone from S&AP, accountable for the MidTermPlan and MasterPlan. Furthermore, a facilitator should be present. It is suggested that the orchestrator acts as a facilitator, as he knows what happened in the scouting process and knows some background of the stakeholders of Schiphol.

Moment

As the session relies on the output of the watchtowers, it cannot yet precisely be said how often such meetings will happen. However, an overview has been created with the help of external experts and internal stakeholders, which can be used as a strong recommendation. This cycle has already been shown in chapter 10.2.3.

Duration

During the tests, it has been experienced that it takes around an hour to assess a modality for all factors. However, it has been experienced that testing more modalities did not significantly increase the timespan. The discussions became just a little bit longer. For an entire session, around an hour is scheduled. Assing additional modalities will probably take around 10 minutes longer per modality.

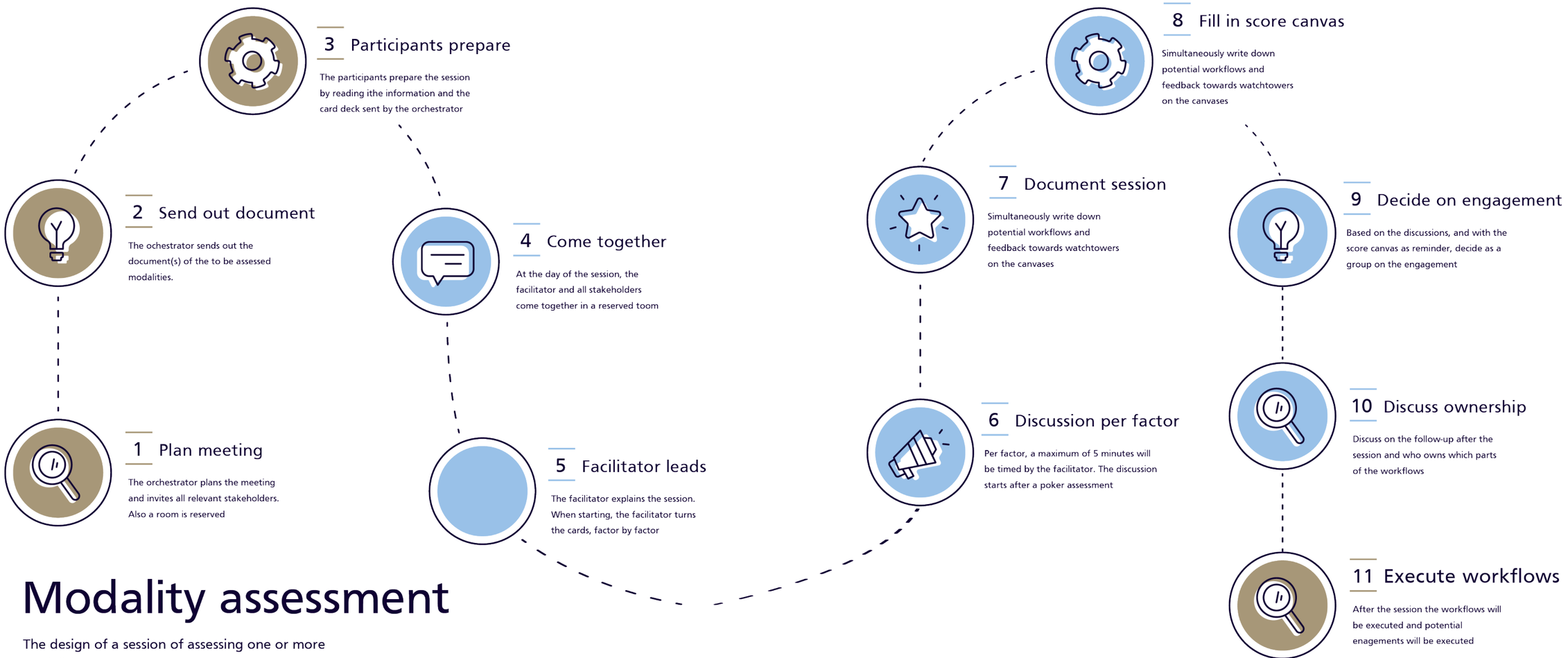


Figure 40. Detailed session overview

10.5 Strategy vs. toolkit

To show the interaction of the toolkit with the strategy, the workflows have been combined. In these workflows, it is also visible what should be taken into account during the session of assessing.

Combined workflow

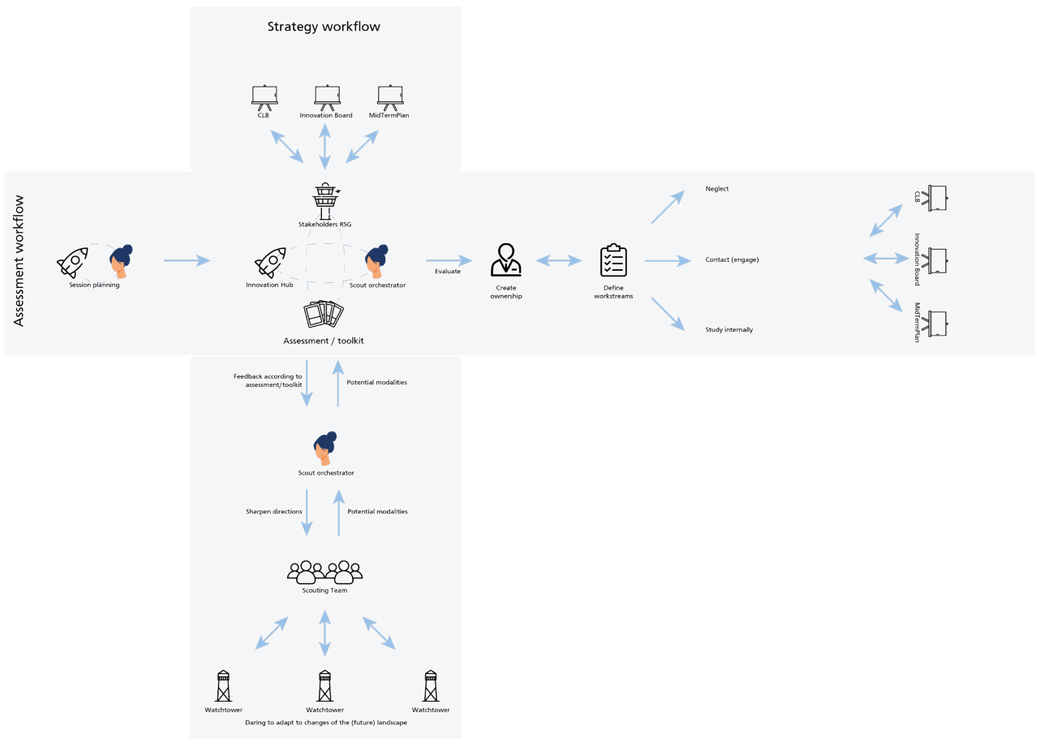


Figure 41. Combined workflows

10.6 Implementation

As for RSG, this might sound like a heavy change in their current way of working, and because they will have to adjust to this way of working, a step-wise implementation is being proposed. This, both to adapt to this way of working, and to be able to intervene if the desired results are not being met. Therefore a step-wise approach is proposed on how to implement the strategy. The toolkit can already be used immediately, however, the way it interacts with the strategy is expected to be at its best in horizon 3. This is visualised in figure 42.

1. Horizon 1

An orchestrator will have to be contracted. He or she will be the link between the Innovation Hub and the (future) world of mobility. The orchestrator should be someone with knowledge of the organisation of Schiphol and affinity with scouting. In this way, he or she can be the link between the scouting and the strategy of the innovation hub and Schiphol. In the first horizon it is proposed to contract an orchestrator, who will do the initial orienting scouting itself. In this way he can scan the market, decide upon the first watchtowers, and further develop this programme. Key activities will consist of compiling an end team, searching in one watchtower himself, and connecting with the future world of mobility.

2. Horizon 2

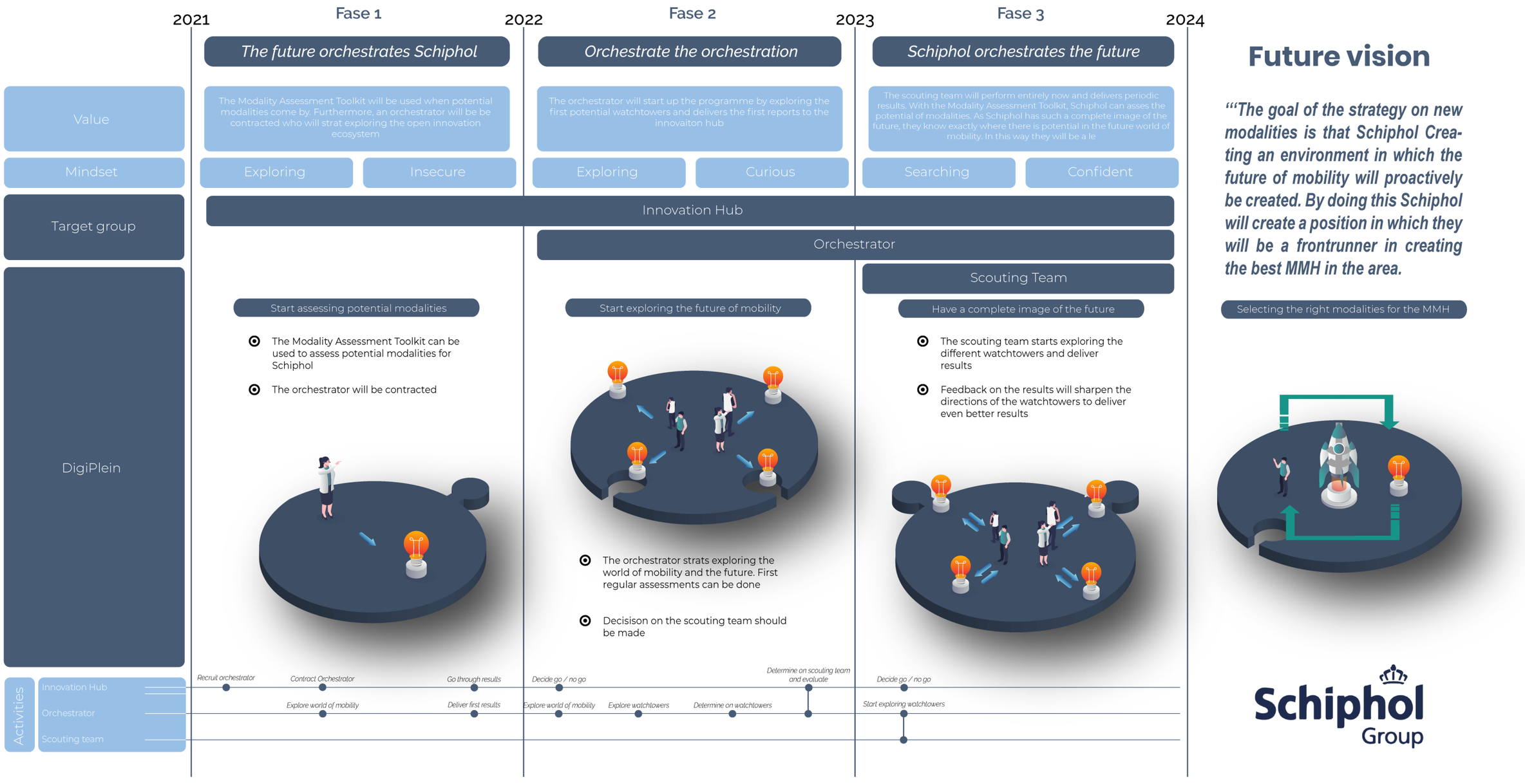
The orchestrator will start exploring the set watchtowers and will present the first results to the Innovation Hun on the watchtowers. This will be a glimpse of what might be discovered in the last horizon. This will be a go/no go moment for the innovation hub. If the input is perceived as positive and it fits within the workstreams, the programme can be expanded to the third horizon. Otherwise, it should be revised on why it is not yet satisfactory and how to continue.

3. Horizon 3

In the last horizon, the scout orchestrator will have compiled its own team, which will be divided over the watchtowers, and extensive results are expected. Herein the 2-year cycle is proposed in which regular assessment sessions are proposed based on the output of the scouting team. Besides, watchtowers can ultimately be adjusted regarding findings of the scouting team and changes in Schiphol's strategy.

Implementation Roadmap

Step-by-step preparing for a new future



Future vision

"'The goal of the strategy on new modalities is that Schiphol Creating an environment in which the future of mobility will proactively be created. By doing this Schiphol will create a position in which they will be a frontrunner in creating the best MMH in the area.

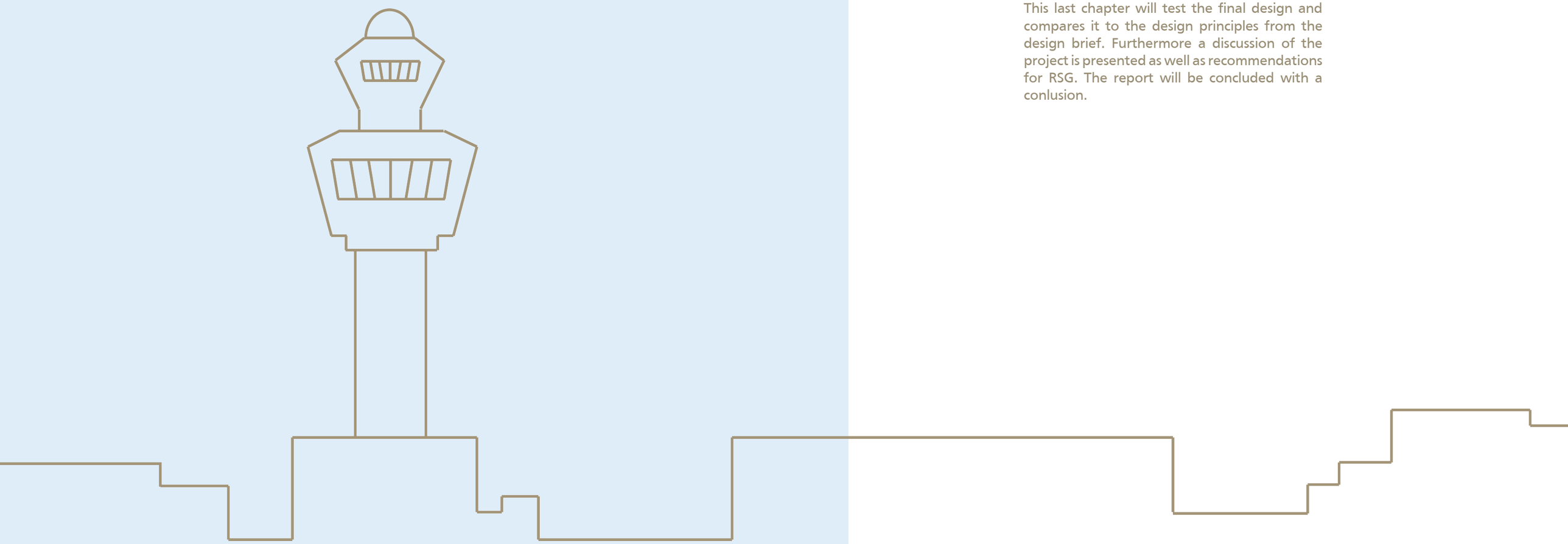
Selecting the right modalities for the MMH

Schiphol Group

Figure 42. Implementation roadmap

11

11. FULL CIRCLE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS



11.1 INTRODUCTION

This last chapter will test the final design and compares it to the design principles from the design brief. Furthermore a discussion of the project is presented as well as recommendations for RSG. The report will be concluded with a conlusion.

11.2 Full circle

The combination of the workflows of the sTo verify the value of the final design compared with the research done, this chapter connects the final design with the design principles formed in the design brief. Each of the design criteria is discussed and compared with the final design.

General

1. The steps 4 steps (identify, identified, assessing, selecting) should be incorporated in the approach

a. The four steps need to represent a strategy/approach

In the end a strategy has been developed in which all of the steps have been included and in which alle steps are adding up to each other, which makes the strategy coherent. This is visualised in figure 43.

Figure 43. Proposed steps compared to outcome

b. The step assessing need to represent an application

The assessment-step has resulted in a toolbox, and a session as a whole in which the potential of a modality can be assessed. This step can not be seen entirely separate from the other steps, as assessing is input for the rest of the strategy, and the rest of the strategy is input for the assessment.

2. In both parts, the intervention should be able process modalities. When possible also other new technologies in terms of mobility.

The intervention is suitable for modalities. This was the main goal and is tested with stakeholders from RSG. It can not yet entirely be said if also new technologies can be included. I only did one extensive test with people with enough knowledge on modalities so this could be examined.

3. All identified factors influencing the potential of a modality should be included

All identified factors in the first part of the research have been transformed in the toolkit. There is even room for overseen factors, reflected in the blank cards.

4. An open innovation mindset should be pursued in the 4 steps.

An innovation mindset has been applied in the intervention in several ways.

Culture: There has been tried to create a culture in which is being emphasised that not all smart guys work for RSG, by actively looking for external new modalities. When this strategy will be executed, it should be examined if this is culture is really being complied.

Organisational flexibility: By incorporating multiple stakeholders from different departments in the sessions with the toolkit, and with the orchestrator in the overall strategy, I believe that knowledge flows sufficiently across the boundaries of the organisation of RSG.

Maximization: Both search and select tools have been used in the final intervention. There has been searched for multiple strategies in both identifying and selecting incorporated in the four steps. This is illustrated along the strategies used in the toolbox and strategy:

In the strategy the following tools have been used: Sending out scouts, Exploring multiple futures, Corporate venturing, Bridges, Using the web, Probe and learn

In the toolbox the following tools have been used: Building alternative visions, Using alternative decision-making pathways, Using probe-and-learn methods, Applying alternative evaluation and measurement criteria

Strategy

a. In which Schiphol proactively monitors potential modalities

The strategy is developed in a way that Schiphol will search for initiatives before they would normally be identified at Schiphol. The scouting team will be instructed by the orchestrator and therefore indirectly by the innovation hub. In this way there also is the possibility to adjust directions. The fact that there is a team designated to actively searching, would be a big win from Schiphol.

b. In which there is structure in searching

The structure is determined by so called ‘watchtowers’. These are the directions in which is being searched. The direction of these watchtowers is determined by the orchestrator, who combines the experience of the scouting team in combination with the strategy and input of the innovation hub.

c. In which Schiphol will be connected to the future world of mobility

By having a team constantly monitoring the future, Schiphol will have the actual connection to the future of mobility. At the moment they are missing this, but by constantly monitoring, Schiphol can know way earlier what (will) happen(s) in the world of mobility.

d. With which Schiphol can strengthen its current network

It must be said that Schiphol’s current network already is strong. The orchestrator, as well as the innovation hub, should be encouraged to strengthen this. It must be said that this had no priority in the final design, so there can be paid more attention to this.

Toolkit

a. The application should connect different stakeholders within Schiphol
As stated in chapter 7, the application should be executed with people from IH, stakeholders from S&AP and other stakeholders with interest. This has also been used in the final design and in this way different stakeholders will be connected by the application.

b. The application should facilitate a discussion
The different factors identified have been documented and are presented in a way that a discussion should be provoked in the form of a card deck. On top of that, the facilitator will encourage the discussion.

c. Should be the basis for a structured discussion
The different factors have been structured and documented per card. In this way the discussion will be structured. Factor by factor, the discussion will be held. In this way the relevant topics when talking about a modality will all be treated. Besides, for more structure it is valuable to let the participants read the factors up front. In this way the participants will know where the borders of discussions are.

d. Should assist in decision making / should substantiate decisions
The structured discussion will be the substantiation for future decisions. Compared to now, where there are no structured discussion concerning new modalities, this intervention will give more substantiation in decision.

e. It should help in assessing potential
As far as known at the moment of writing, the identified factors give a complete image of the dependencies if a modality has potential for Schiphol. Therefore by qualitatively assessing these factors, the potential will be assessed. It should be said that talking about future modalities might not give the true image of the future. However, it gives an impression of what the potential of a modality has, and what value it can have in the future.

f. Assess qualitatively
The potential of modalities had to be assessed qualitatively, as this is the way to assess for the long term future. The cards of the toolkit provide the base for a discission without trying to be quantitatively. The toolkit therefore fits this design principle.

11.3 Discussion

As a follow up on the concept and the conclusion, in this chapter the final concept and to the process towards it will be discussed. All in all, the final design consisting of a strategy and a toolkit, has matched the design brief in most criteria. However, there are certain parts of the final design which require extra attention. Therefore these will be discussed in this chapter.

Generalizable on other airports
In the beginning of this report it has been stated that Schiphol was the use case for which an intervention would be designed. Later it would be examined if the intervention would also be applicable for other airports. It should be said that it has not tested with the other airports within RSG. However when looking at the factors, it seems that most of them also fit other airports apart from the stakeholders and the specific integration at different airports. In the end the factors seemed to be reasonably universal.

Still, it should be considered if this will work in the way of working at other airports. The organisation of Schiphol is large and there is much capabilities. Smaller airports will have fewer people ready to work with the toolkit. On top of that, appointing a whole scouting team might be a heavy decision. Though, combing powers of airports within RSG would be the solution. Sharing insights of the scouting team and inviting people from other airports might even increase the value of the intervention, although this should definitely be examined.

Testing
Not all hypotheses could be tested. There have been done 3 user tests with different scenarios. The final user test was with the stakeholders from Schiphol. During this session I experienced how valuable this discussion was, and at the same time I realised that the previous tests with the fellow students were of minimal value in terms of its discussion. In terms of the development of the product they were useful, as going through sessions is useful. However, the difference in discussion was so big that the results in terms of facilitation of discussion of the toolkit are negligible. This can be explored further by extra tests within Schiphol.

Prototype
I had difficulties in deciding how to evaluate the prototype. I tried to do this mostly with discussion. The questions asked were more on the discussion and less on the actual card deck, as this had less priority in my opinion. This does mean the actual interaction of the card deck might not be of a maximum level. However I do believe it is of acceptable level and definitely fulfils its actual goals. It could be further tested if the content of the cards is enough for the discussion.

Strategy
The strategy has been developed with the help of experts. However it should be noted that this strategy should be tested within the organisation of Schiphol. Therefore more validations should be done within the organisation of RSG. This because it is highly likable that the innovation process in Schiphol is way more complex than assumed.

Sketching the future
Future is considered to be very important but this it is out of scope to incorporate it in this project. In future research it should be considered how this context factors of the future can be incorporated in more detail in the strategy.

11.4 Recommendations

This project has ended with a final design, presented in this report. In order to maximise the value of this final design in the future, recommendations are presented here. Points are listed in which the final design can be improved to more mature and future proof versions.

Implementation of modalities
It is recommended to do a case study on the implementation of a modality to see if the factors identified are right. Also this might help to gather other insights that can be used in the assessment phase. When implementing a modality, new factors influencing the potential at Amsterdam Airport Schiphol will most likely arise. Case studies have been presented in this report, but these look back on this period, whereas a new case study will probably generate more insights.

Use of factors
The factors should constantly be reviewed. It is now assumed that all factors have the same weight. However, expertise from stakeholders from Schiphol should be used to constantly review this. This can either be done per session, or by reviewing it for the toolkit as a whole. In this case the most important factors will have more value than other factors and a session can be adopted to this.

Stakeholders within Schiphol
It is advised to do further research on which stakeholders are should be involved in the process of selecting. Initial research and assumptions have been made, but it is considerable that stakeholders have been overseen in this research.

Development of toolkit
The toolkit is in its principle ready to use. There has been done a test which indicated that it was ready enough to use. However, it can not be said that the toolkit is optimal yet. Optimisation could be done in terms of using it repeatedly. This gives best insight in how this toolkit is used with different kinds of modalities and with different stakeholders. This can benefit to development of the (1) content of the cards and (2) the way a discussion can best be facilitated.

Strategy
Strategy should be further developed. It should be considered how much value an orchestrator can bring the Innovation Hub in practice. Besides it should be considered who could fulfil this in the best way. It is suggested that this is someone also with knowledge of the organisation of Schiphol. Therefore it is highly recommended to do more research on how to implement the strategy.

Stage gated
Furthermore, during testing it was suggested to implement some kind of a stage-deviation in the toolkit. It was stated that in the different phases of the innovation-phase of a potential modality, different demands were expected in the organisation of Schiphol. For example different colours per phase could be developed. This could be in the form of a self-learning system in which sessions are held, and at the end of each session the cards can be sorted in different phases of selecting.

11.5 Conclusion

To stay relevant in the future, RSG needed to become sustainable for changes in the world of mobility. A way should be found to constantly monitor this world of mobility to identify potential new entrants. On top of that, RSG wanted to know how they could structurally assess the potential of these modalities which could assist them in their decision making. In other words, the initial design brief was to find a way in which RSG could identify and select new modalities as part of their Multi Modal Hub strategy.

Extensive research has been done by consulting literature, doing internal and external interviews and consulting internal documents. During this research the steps of identifying and selecting have been specified. It has been found that Schiphol does not have a strategy yet on how to identify and select new modalities. Also, they do not know on which factors they should assess potential modalities. Factors have been found which indicate whether a modality has potential for Schiphol. The revised problem statement stated that (1) a strategy should be developed for Schiphol to identify and select new modalities, and that (2) a tool to assess modalities should be developed. This resulted in an overarching strategy to identify and select new modalities in which a toolkit has been developed to assess the potential of these modalities. There has been done user testing on this toolkit to validate the first assumptions and hypotheses, which resulted in a final design A strategy has been developed in which Schiphol shifts from reacting on modalities to proactively monitoring the world of mobility by providing structure in searching. In this way they can connect to this future world of mobility and by regularly assessing modalities, Schiphol can quickly change direction if necessary.

In terms of the toolkit, factors have been identified which have been used as the basis for a toolkit. These are factors indicating the potential of a modality. This has been processed in the practical application of a toolkit which is part of the strategy. Herein, a toolkit has been designed which facilitates a structured discussion to assess a modalities potential which can be used to substantiate decision making by RSG. Despite the extensive analysis and the tests with experts, it would be naïve to claim that all factors have been included for all kinds of modalities now and when this environment might change in the future. Therefore also blank cards have been included. Furthermore, it has been identified that valuable information might get loss in the session. Therefore, canvases have been designed and included in the toolkit, which can be used to document the discussion and document follow-up steps. These follow-up steps can propose new directions of the watchtowers, or document tasks which have been identified in the assessment session.

In the end, the combination of this toolbox and strategy give RSG the possibility to identify and select new kinds of mobility. This is done by connecting the world of mobility in the form of a team constantly monitoring (changes in) the world of mobility. In this way RSG will be early in the identification of potential new entrants in the world of mobility. On top of that, the toolbox will provide RSG the opportunity to structurally assess the potential of these potential new entrants. The assessment of potential will assist RSG in decision making and can substantiate decision making afterwards.
It should be said that this toolkit is not yet entirely ready. The initial factors which influence the potential have been identified, but a more detailed suggestion of which factors are necessary in which parts of engagements and decision-gates, can be figured out. Furthermore, the world of mobility is sensitive for change, so there should be constant awareness that the factors are up to date. Besides the proposal of a strategy have been validated with an expert, but it should be considered if this will work in practice. As proposed in the suggestion for implementation, this can be gradually tested to see if it actually works in practice and how this connects to the way of working of the innovation hub.

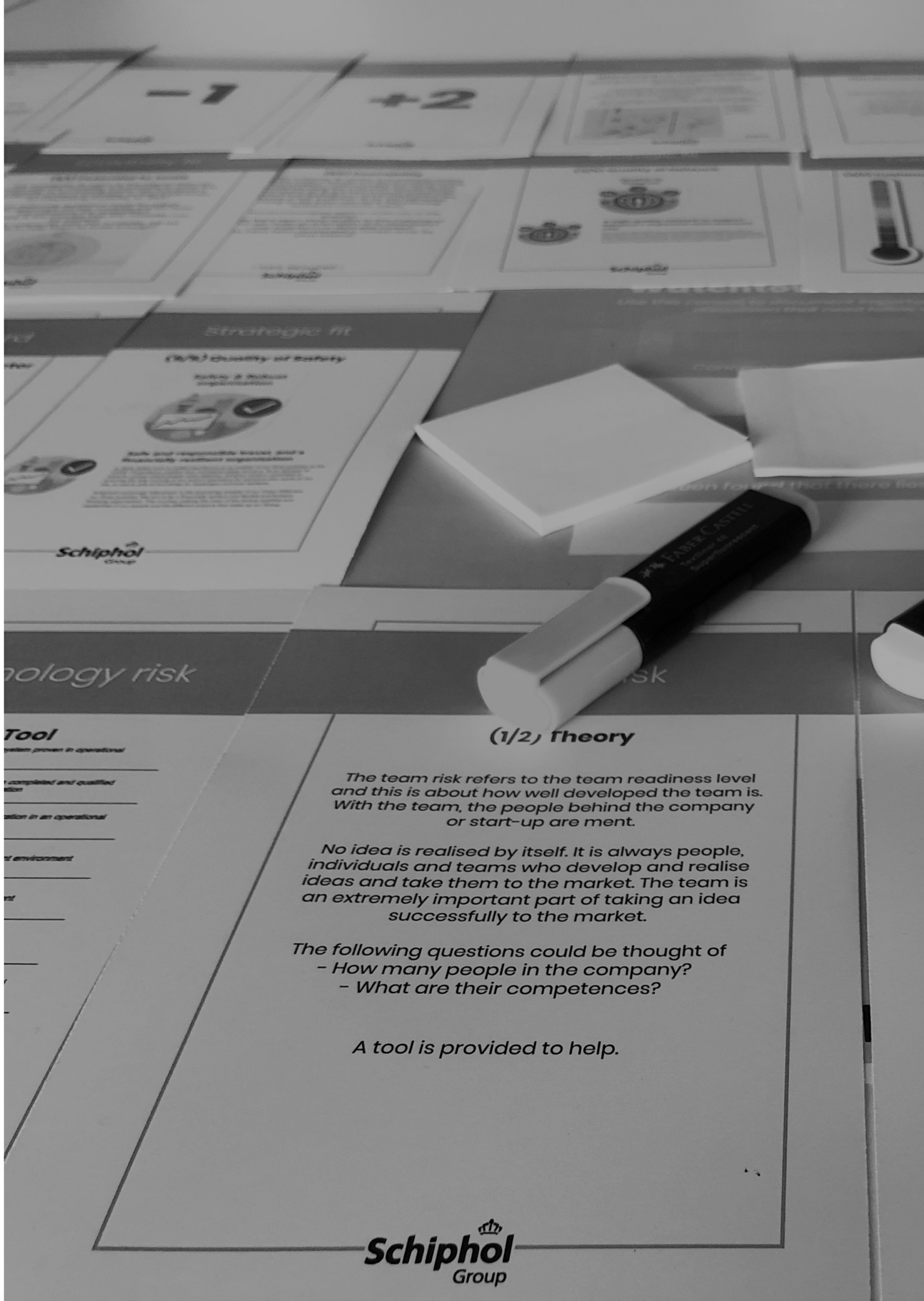
11.6 Personal reflection

The last half a year has been quite a journey for me personally. In this chapter I will look back on this period according to my ambitions, learning goals, and other learnings.

Key ambitions for me consisted of challenging myself, gaining professional experience, applying my design skills in a professional context, and becoming an expert in the world of mobility. When looking back at this project, I can say that I have achieved all of these sufficiently. The subject was a challenging subject, and a subject in which strayed quite a few times. However, in the end I think I managed to bring everything together into a strategy, toolkit and hopefully a structured report. Applying my design skills and working in a professional context have also been achieved. Especially in terms of the professional context and gaining professional experience, I am really glad that, apart from the winter period, COVID allowed me to go to the office regularly. As the world of aviation is something I aspire to for a long time, this really worked motivating and inspiring to me. Actual hard design tools is something in which I might have lacked a little. Probably part because of the characteristics of my project, and part of me not feeling the actual urge and ?maybe confidence??aanleiding? to use hard design tools. Lastly especially in the second part of my research I really feel as if I became some kind of an expert in the world of mobility. Literature, but mostly interviews, constant informal conversations and half a year observing at RSG helped me in this. Obviously there is almost infinite more knowledge in the world of mobility, but conversations with my future employee, klm, gave me the impression that I am already able to talk with them with quite some jargon.

Apart from ambitions, I also set some learning goals for myself in the beginning. Testing a working prototype, documenting in a professional way, handling different stakeholder. The first learning goal of testing a working prototype has definitely been achieved. I really succeeded in testing my prototype, and not only testing, also co-creating. This was really informative and I experienced that it is satisfactory to be able to test your ‘own’ prototype. Besides, a lot more is learned about a prototype than I could have expected in advance,. I set this goal because normally at SPD, products are only tested marginally in my opinion, and I always have the idea that end products of projects a very far from ready and from implementing. I noticed I was quite disappointed with the fact that even after testing a working prototype, there is a big change that you are still far from implementing. Nevertheless, I really enjoyed testing and it also did gave me more confidence that in testing, but also apart from testing, showing work that is not finished yet, is highly valuable. Something which I should really take as learning, as I noticed that even in this project when I wanted to pay attention to this, this is still a learning goal for myself. The second learning goal of documenting in a professional way has experienced as difficult. From the beginning I kept track of a document in which I tried to produce a visually attractive and clear report. On top of that, I developed a concept and made photos of them. Something I have never done before but seemed to work. I could have asked for more help from someone with actual expertise in graphic design, but this did not meet my priorities in the end of the project. I think I can still significantly improve on this. My last learning goal was to handle the different stakeholders. Here I learned a lot also about myself, especcialy in terms of involving people in my work. I think this will be something in which I can defenitely develop myself further

Apart from the preset ambitions and learning goals, I learned a lot more in the past period. Personally, I tend to ask much of myself, also when I might know that I can not always deliver the highest level. This appeared to result in not being able to stay calm and keep an overview of the project. Furthermore, I might have seen the project as my own project too much, and I should have asked for help more. Things I definitely will take as learning for the future. Lastly, I was able to continue my exploration of the world of mobility and found out I really like it, which is an important takeaway.



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