A BaaS ecosystem for AAS

Nudging passengers to use early baggage check-in services to make optimal use of the baggage handling capacity at Schiphol

MASTER THESIS

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PREFACE

As the final part of my master Strategic Product Design at TU Delft, I wrote this thesis report 'A Baggage as a Service ecosystem for Amsterdam Airport Schiphol'. The project started in August 2021 and finished in February 2022. During these months, I got more insight into the baggage capacity problem Schiphol is facing and used my creativity and knowledge to develop an innovative solution. It was a fantastic and educational experience.

During my study, I became enthusiastic and interested in Schiphol since it is a world of its own: the busy excitement of an airport, the big airplanes that fly passengers to international destinations, and the many different parties involved to make this happen. It was a great experience to be able to work on an innovative project and get a taste of this complex stakeholder network. There is so much more to it than just taking your suitcase to Schiphol airport and getting on a plane to travel! Given the COVID-19 pandemic, I have noticed that the future is uncertain but can also be an opportunity to optimize existing processes.

I could not have done this project without my supervisors from TU Delft. Bart and Sicco, thank you very much for your support throughout the project, feedback, and instructive advice aimed at the project and to me personally. I have asked for your critical view from the beginning, and I am grateful that you have tried to push me and my project one step further. It was a great experience to work with you both.

In addition, I would like to thank the colleagues of the Innovation Hub, especially Larissa, who guided me during the project. I learned a lot from your knowledge and insights and got a bigger picture of the working methods and atmosphere at the Schiphol organization. In addition, I would like to thank the colleagues at Schiphol who gave me tours of the baggage handling basement, answered my many questions, and directed me to the right people. I am therefore grateful that Schiphol is such a helpful and supportive company, and I felt that as a graduate intern, I could make a difference. I would also like to thank the parties I interviewed, the airlines and commercial third parties, for your time, insights, and feedback to help me write this thesis.

Finally, I would like to thank my dear boyfriend Sebas, my study buddy Yhni, my parents, and my friends for your support and help throughout the project. Graduation is a rollercoaster with highs and lows, and I am glad you helped me through it with your advice and necessary distraction!

Enjoy reading!

14 February, 2022

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February, 2022

EXECUTIVE SUMMARY

By 2029, a baggage handling capacity shortage at Amsterdam Airport Schiphol is expected due to the foreseen growth in the aviation industry. Research has shown that the current method of baggage handling already puts pressure on the baggage handling system and its stakeholders, resulting in critical peaks during the day, especially in the holiday season. Schiphol wants to optimize the current baggage handling process with innovative solutions since expanding baggage capacity with implementing new assets is not sustainable due to governmental restrictions.

This thesis is part of the Future Baggage topic of the Innovation Hub department of Royal Schiphol Group.

Research stated that 20% of the check-in baggage must be inserted into the baggage handling system before peak hours to realize the desired spread of baggage handling throughout the day (peak shaving). Schiphol can realize this if the check-in baggage arrives at the airport earlier than in the current situation. Therefore, passengers need to be nudged to change their travel behavior with hold baggage. Commercial baggage pick-up services exist in the market, and such a type of baggage service (BaaS) was the starting point of this research.

The research question stated: How can we build a BaaS ecosystem in order to nudge passengers to use early entry baggage check-in services to make optimal use of the baggage handling capacity at AAS?

Conclusions from this thesis indicate that Schiphol should collaborate with existing commercial baggage pick-up parties to use their infrastructure as part of the ecosystem. Secondly, airlines are the key factor in offering the baggage pick-up service to their passengers since passengers prefer to book the service as part of the travel booking with the airline. The challenge of the project was to design a unique baggage service concept that will be attractive for airlines to offer to their passengers, that will be valuable for passengers to use, and that will realize peak shaving. The challenge included identifying the role of Schiphol in setting up this ecosystem.

A baggage home pick-up service is designed for passengers traveling with hold baggage, called the EASY TRAVEL service. The service is created to attract holiday travelers by responding to the need for convenient traveling without hold baggage to and at Schiphol. The EASY TRAVEL service consists of three features that provide extra value to passengers and help nudge them to use the service; a trustworthy and transparent baggage service, a reward & benefit system and personalized travel advice.

This thesis recommended that Schiphol should take the lead in building the ecosystem by collaborating with the necessary third parties to provide the baggage service. By introducing the EASY TRAVEL service, Schiphol can influence the timing of processing check-in baggage to shave the expected capacity peak. Airlines will be the interface towards their passengers and will offer the EASY TRAVEL service as an additional service on their booking platform. Schiphol will develop an Application Programmed Interface (API) that will serve as an interface tool to support this ecosystem where the backend of the three service features is arranged. This API can be easily integrated by the existing apps of airlines and can be adapted to their own brand, making it attractive for airlines to implement it.

An implementation roadmap is created for Schiphol, which emphasizes starting with a pilot of the EASY TRAVEL service and ecosystem with a few airlines who are interested in participating and one commercial third party. The evaluation and learnings from the pilot will help create a working and proven service that will attract more airlines and third parties to participate and realize the desired peak shaving on a larger scale by 2029.

LIST OF ABBRIVIATIONS

AAS	Amsterdam Airport Schiphol
AMU's	After Make-up Units
BaaS	Baggage as a Service
BHS	Baggage Handling System
CI	Check-in
DnA	Data, AI, and Analytics
EBCS	Early Baggage Check-in Services
H2's	How to's questions
IH	Innovation Hub
Labip	Landsided Baggage Infeed Point
PASSME	Personalized Airport Systems for Seamless Mobility and Experience
RSG	Royal Schiphol Group
TU	Technical University
SPD	Strategic Product Design
TRF	Transfer
XaaS	X-as-a-Service

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INTRODUCTION

1.

ROYAL SCHIPHOL GROUP

An introduction of the company Royal Schiphol Group is described in this chapter, including their mission and vision. The topic of this thesis is one of the innovative projects Schiphol is working on and is described in this chapter.

1. Royal Schiphol Group

Royal Schiphol Group (RSG) is the operator and owner of Amsterdam Airport Schiphol (AAS), Rotterdam The Hague Airport, and Lelystad Airport and has a majority share in Eindhoven Airport. AAS is the leading international airport of The Netherlands and provides direct connections to 316 international destinations, making it one of the best-connected airports in the world.

"Connecting your world" embodies the 'Why' of the Royal Schiphol Group. By 2030 RSG wants the airports to be emission-free and waste-free, with eventually an energy positive, circular business operation. Three cornerstones of this Vision are; Quality of Network, Quality of Life, and Quality of Service. Safety and a strong organization are the primary enablers to achieve this.

Innovation plays a crucial role in achieving the mission and vision. RSG collaborates with partners like TU Delft to explore new opportunities, develop digital products and services that improve daily challenges and make fundamental changes to existing processes. The Innovation Hub (IH) is the department that focuses on these innovations and collaborations. For example, one of the topics currently under study is 'Future Baggage'. This theme stands for optimizing the hold baggage flows at AAS.

2.

TOPIC INTRODUCTION

An introduction of the topic of this thesis is described in the following chapter. The topic introduction involves the problem Schiphol is expected to face in the Baggage Handling System by 2029. Furthermore, this chapter discusses the project and department with its hypothesis regarding the solution area of the problem and the interesting trends to explore.

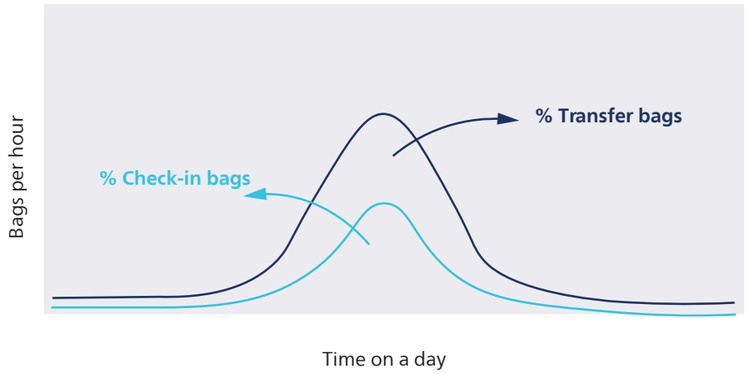


Figure 1: Peak shaving can be realized by processing CI baggage before peak hours and TRF baggage after peak hours.

2.1 Baggage capacity development at AAS

RSG estimates a 10% shortage of baggage capacity for handling the growth of the expected aviation industry by 2029. Schiphol's capacity is being determined by the number of baggage items it can handle through the Baggage Handling System (BHS) on one day. The shortage in capacity will mean that the baggage handle system will not be able to process all the baggage items on time. This will cause peaks in baggage entry, processing, and make-up, putting pressure on the total system.

This shortage is still expected to occur, alongside the developments in the baggage handling capacity: the implementation of a new asset solution in 2028, which increases the capacity, and the replacement of the D-pier in 2029, which decreases the capacity during the renovation. In addition, AAS has already experienced critical peaks during the summer months in 2018 and 2019. The baggage system could barely handle the high demand of baggage inflow, consisting of Transfer (TRF) and Check-In (CI) baggage. This indicates that the system is already under pressure and could become a more significant bottleneck in the future. Due to the new Dutch governmental regulations set in 2020, expanding the baggage capacity by building extra assets can only be realized if the climate burden can be reduced (Rijksoverheid, 2021). Possible alternatives need to be explored that improve the current baggage handling process and without implementing new asset solutions.

2.2 Future Baggage IH project

Optimizing the existing baggage handling process without realizing extra assets is desirable to be explored further and is the subject of the "Future Baggage" project by the IH department. The IH concluded from recent research that the current baggage handling method is not recommended during peak hours and leaves room for improvements on several aspects of the system.

The main hypothesis the IH wants to validate is realizing the desired spread of baggage handling on a day by 'hot-cold' separation of baggage. This means that the baggage with high urgency to be transferred to the aircraft (hot baggage) will get priority to be handled in the system over the baggage with less urgency (cold baggage). The spread of baggage handling on a day is called 'peak shaving', which could lead to more flexibility of handling baggage during summer times. The moment of cold baggage entry in the BHS must be influenced to realize peak shaving of the baggage inflow and could eventually cover the expected shortage in 2029. The IH indicated that this could be achieved in two different ways: exploring solutions for inserting CI baggage in the BHS before peak hours and inserting cold TRF baggage after peak hours, seen in figure 1. This thesis focusses on the entry of the CI baggage before peak hours.

2.3 Trends in remote baggage check-in

In order for Schiphol to have control over the timing of CI baggage being inserted into the BHS before peak hours, the timing of passengers handing over their hold baggage must be influenced. A possible direction is to separate the baggage journey from the passenger journey when traveling to AAS, which means checking in baggage remotely. Extending the terminal for remote check-in is something Schiphol has already been exploring since 2012 by setting up pilots for baggage check-in at train stations or a pick-up service by the parcel delivery company PostNL. Although these pilots were successful, PostNL decided not to pursue it further due to the focus on other priorities at that moment. Despite many attempts, successful endeavors, and positive customer feedback, none of these services have been realized, indicating its complexity. In recent years, a few commercial baggage pick-up services have entered the market, offering their services to travelers for a positive travel experience. These developments regarding remote check-in and passengers traveling separately from their baggage could indicate that it addresses customers' needs and is complex to realize at the same time.

3.

PROJECT ASSIGNMENT

The project assignment is described in this chapter which includes the scope of the project and the research question with its sub-questions.

3.1 Scope

Inserting CI baggage early into the BHS requires early handover of baggage and possibly traveling separately from the passenger. Currently, commercial service providers offer baggage services wherein baggage pick-up from travelers' homes is offered before departing. These providers make use of third parties to transport the baggage to the airport. Evaluating and learning from these existing services is essential to identify the peak shaving potential. This kind of service is called Baggage as a Service (BaaS). This topic was explored in a three-year project, started in 2015, called PASSME (Personalized Airport Systems for Seamless Mobility and Experience) in collaboration with TU Delft and, among ten other partners, Royal Schiphol Group. BaaS is a term that will be used for this thesis as BaaS stands for the focus on the following areas: the passenger experience, the hold baggage traveling separately from the passenger, and the significant change of business models for all stakeholders such as the airport and airlines (Bergema et al., 2016). Because BaaS fits the possible solution area, it is included in the scope and evaluated from a desirability and viability point of view.

The scope involves a multi-stakeholder environment of third parties and their logistic providers picking up the baggage, AAS, and the airlines. It is crucial to involve them in the exploration of BaaS and how a successful ecosystem can be built. Since passengers will be the main users of the service and their behavior in the baggage handover timing needs to be impacted, their attitude and expectations regarding baggage services are explored. This includes the most important factors influencing their behavior.

3.2 Research question

The defined research question:

How can we build a BaaS ecosystem in order to nudge passengers to use early entry baggage check-in services to make optimal use of the baggage handling capacity at AAS?

With the following sub-questions:

1. What are the drivers and barriers of each stakeholder to participate in the BaaS ecosystem?
2. What will the passenger and baggage journey look like?
3. How will the relationship between the incentives and the costs be in this context?

4.

INVOLVED PARTIES

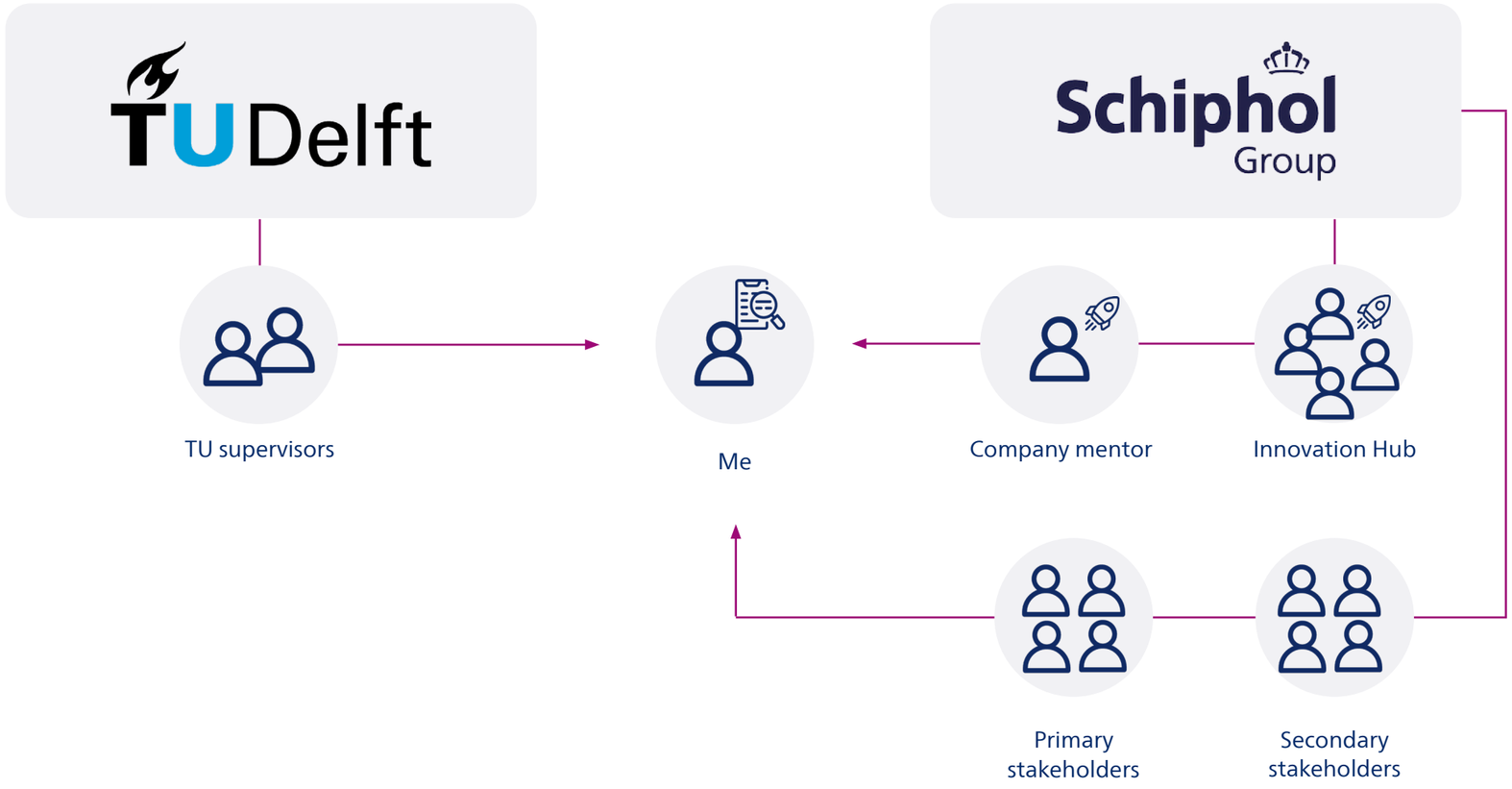
This chapter describes the parties who are involved in writing this thesis report. Furthermore, the involved stakeholders in the exploration of the problem and potential solution are addressed.

4. Involved parties

RSG and the Technical University of Delft (TU Delft) are the parties that are involved in this thesis. The supervisor of RSG is Ir. L.V. Plink: Innovation Lead of the subject 'Future Baggage' at the IH who's main interest lies in the knowledge development in the early entry of CI baggage field. The two supervisors of the project of TU Delft are Prof. Mr. Dr. Ir. S.C. Santema and Ir. R.G.H. Bluemink, both from the faculty of Industrial Design Engineering, Department of Design, Organization, and Strategy.

The IH is the department that initiated to explore the possibilities within the services for the early entry of CI baggage at AAS. In addition, the researcher of this thesis explored the scope with the supervision of the TU Delft and the IH.

Even though the focus of this thesis lies on the desirability of passengers regarding the change in baggage handling process, three other crucial stakeholders are part of this challenge: RSG, the airlines and the ground handlers. These four parties are the primary stakeholders in this thesis. Their perspectives were taken into account to explore the problem of the baggage handling capacity shortage and the current baggage handling process. Furthermore, the primary stakeholders' needs and values were taken into account for exploring the possible solution. The secondary stakeholders are the third parties, the knowledge institutes, and internal partners for exploring the potential solution.



5.

PROJECT APPROACH

In this chapter, the project approach is explained and illustrated. The combination of the work method of the IH at RSG and the Double Diamond Design framework are applied to this project. In this chapter, the three categories of Desirability, Feasibility and Viability in finding the sweet spot in innovation are explained.

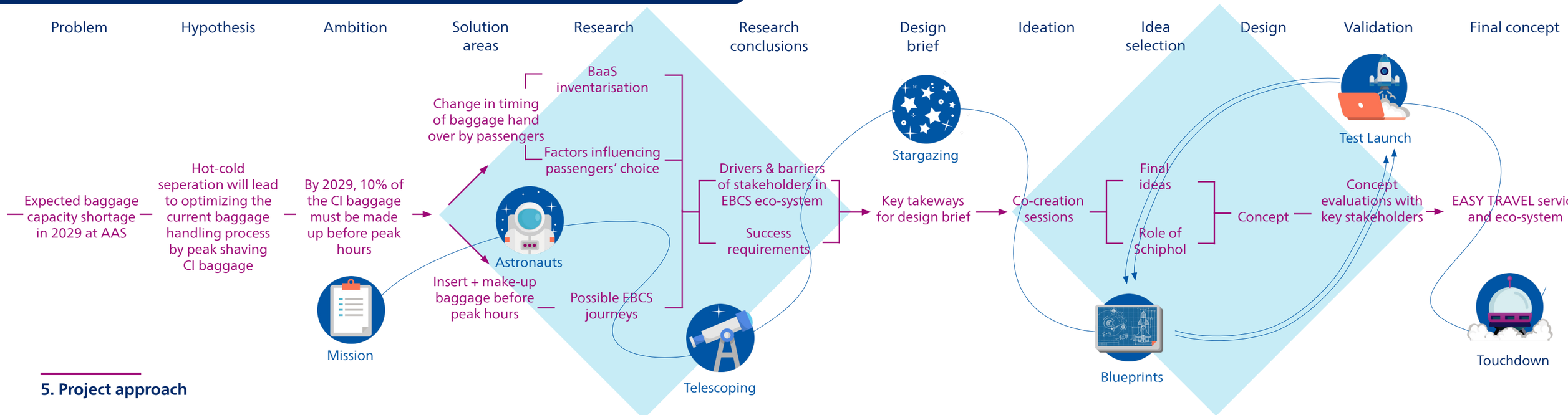


Figure 3: The project process of the thesis according to the Double Diamond Design method, which includes the work method of the IH.

5. Project approach

The IH works with a three-horizon model created by the management consulting company McKinsey & Company. Three types of innovations based on this model help them navigate the uncertainty ahead: Earth, Moon, and Mars (Figure 2 on the next page). Earth shots include improvements on day-to-day challenges to expand their current reality. Earth shorts are not the focus area of the IH since they look beyond the horizon but the IH actively pursues Moon and Mars shots by continuously aligning initiatives on all three levels of innovation. Moon and Mars-shots require a different approach as they are transformational and disruptive innovations where the future can or even can't be envisioned. Therefore, exploitative and explorative missions are needed to be able to look beyond the horizon.

The IH's way of working is creating its path to Moon and Mars by first setting up these missions to translate their ambitions. Then they connect to their stakeholders, so-called 'astronauts', who are their ecosystem of knowledge institutes, start-ups, and sector partners. The next step is 'telescoping' to research the problem, and later on, they create an alluring perspective which is called 'stargazing'. With this alluring perspective, the design phase starts by designing experiments or 'blueprints' to validate their hypothesis and the blueprints, called 'Test Launch'. This is an iterative process that will lead to 'touchdown' and the implementation phase. The IH follows this innovation path in all projects, including the Future Baggage project.

This thesis used the Double Diamond Design approach, a framework for innovation that helps designers and non-designers tackle some of the most complex social, economic, and environmental problems (Design Council, 2007). The first diamond represents a process of exploring an issue more widely or deeply by discovering and defining the challenge. The second diamond represents a process of taking focused actions by developing and delivering solutions. This thesis combined the IH work method with the Double Diamond Design method for the project approach, as shown in figure 3.

Both the IH and Strategic Product Design (SPD) courses focus on finding the sweet spot of innovation between the three main categories of Desirability, Feasibility, and Viability. According to the IH, successful innovation is based on hypotheses in these three main categories, seen in figure 4. Desirability tests whether the innovation is solving the right customer problem, feasibility tests whether the innovation strengthens their business, and viability tests their value chain for long-term sustainability (Innovation Hub, 2021). These three categories complement the courses of SPD and serve as the fundamental base of this thesis.

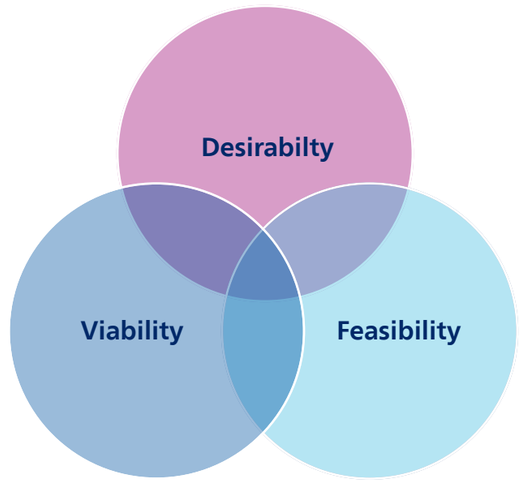


Figure 4: Desirability, Feasibility and Viability, the sweet spot of innovation

Figure 2: The three-horizon model of the IH.

We look beyond the horizon

Mars
Disruptive innovations

Moon
Transfomamtional innovations

Earth
Incremental innovations

RESEARCH PHASE

6.

RESEARCH APPROACH

The research phase is the first diamond of the Double Diamond Design approach. This chapter explains the research process and the used methods in more detail.

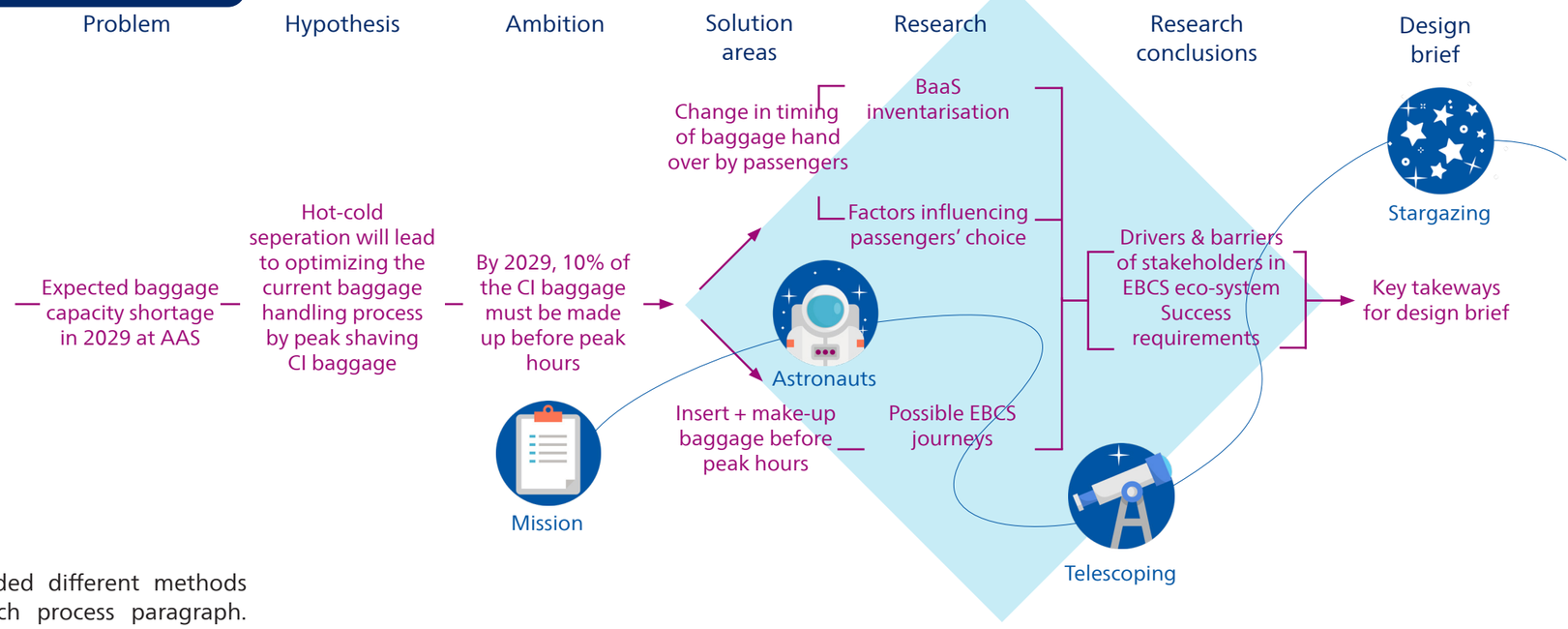


Figure 5: The first diamond of the project process, the research phase.

6.1 Research process

The research phase consists of three categories: Topic Background, Baggage as a Service, and Identification of Early Baggage Check-in Services (EBCS) at AAS. The research process included different and multiple methods for each research category to identify a design challenge and formulate a design brief for the design phase. In figure 5 is the first diamond of the process illustrated. Information about the topic background, the context of BaaS, and the identification of EBCS at AAS are obtained by the performance of desk research and internal and external stakeholder interviews. The performance of an internal analysis gathered insights on the baggage handling process. This thesis used the insights from the personal survey and market research to assess passengers' current view of their pain points while traveling with hold baggage and explore the context of BaaS. In addition, these methods were used to identify the needs and values of passengers regarding the possibilities in building an EBCS ecosystem at AAS.

6.2 Research methods

The research phase included different methods mentioned in the research process paragraph. These are described in more detail in the following section.

Desk research

Existing literature and recent reports regarding the topic were studied, including the PASSME project and the research report on the baggage handling process at AAS of L. van Wieren. These served insights into BaaS and its stakeholders, the problem background regarding BHS and stakeholders at AAS. In addition, the performance of desk research ledd to insight for nudging passengers to use services.

Stakeholder interviews

Current and future stakeholders were interviewed along the process since the BaaS ecosystem has many stakeholders with different values and needs. These interviews had multiple follow-up meetings with airlines, the baggage process experts of RSG, and the secondary stakeholders to gain broad insight into the ecosystem. These interviews were organized by the researcher or by the IH department in means of (bi-)weekly meetings. Stakeholders held discussions during these meetings, which the researcher observed to form insights for this thesis.

Personal survey

In November 2021, quantitative research was performed to get an insight into the problem passengers face regarding traveling with hold baggage and into the possible solution. This survey was created based on the research method of 'Path of Expression', which includes the four phases: observe the present, recall the past, reflect on the past and dreams (Sanders& Stappers, 2012). This helped the respondents to analyze the present and the past to get reminded of the topic of traveling with hold baggage and till what extend they want it to change. In total, 94 people responded to the survey, and the details of who the respondents are, are listed in Appendix B. The pain points when traveling with hold baggage were validated and discussed. The insights gained on the possible solutions were used as a starting point for the factors respondents find important influencing their choice for the possible services. The respondents were divided into three groups based on their interest in the potential services. The 'Promoters' were interested in the potential solution services and existed of 36,6%. The 'No Go's' were not interested and was 21,5%. The 'Possible Persuaders' were hesitated in their interest and was 41,9%.

The gained insights of this thesis were used to identify the factors that influence passenger choice to understand nudging. In chapter 9.3. the conclusions are described and referenced in this thesis as a Personal survey. More details in this study are listed in Appendix B.

Market research – interviews and survey

Commissioned by the IH, an external research agency performed qualitative and quantitative research in November 2021. This research focused on retrieving insight into the problem and the potential solution services. This involved small qualitative research to set up the more extensive quantitative analysis. The small study included fieldwork at AAS of 10-minute interviews with 14 respondents arriving at and departing from AAS. These respondents were business and leisure travelers, Dutch and Origin and Destination travelers, and of different ages, flight frequency, and gender. In addition, the interviewee gave a short description of the potential solution services and asked for feedback. These insights were used as the first indication and a set-up for large-scale quantitative research. This survey existed of 30 questions and 1118 respondents of a divided gender and age, and more leisure travelers (n=913) than business travelers (n=205). This thesis report used these results to get insights into the passengers' needs and values.

In addition to using the insights from the Personal survey for the identification of factors that influence passenger choice, it was used to provide merged conclusions along with the market research. In this thesis, it is referred to as 'Passenger insights'.

Peak analysis

Within RSG, an internal analysis was done in November until December 2021 by the Data, AI, and Analytics (DnA) team for gaining insights in the CI baggage peak at AAS. The DnA team analyzed the potential of peak shaving when a percentage of CI baggage is made up before peak hours during summer holidays. This analysis was used for this thesis which airlines and baggage handling areas in BHS have the biggest share in the peak of CI baggage. The results of the analysis are discussed in chapter 7 and an overview of the main results are listed in Appendix C.

7.

TOPIC BACKGROUND

In this chapter, the stakeholders at AAS are explained with their roles and needs. This is followed by describing how the current baggage flow results in peaks. Furthermore, the impact of the peak on the baggage handling system and the stakeholders are evaluated. Finally, the potential of peak shaving and the possible timing of handling the baggage is highlighted, and conclusions were drawn.

7.1 Stakeholder map

The primary stakeholders and their roles and needs are evaluated in the following section. (Ottens & Bergema, 2015). RSG, passengers, airlines, and ground handlers are the core stakeholders involved.

	RSG	Passengers	Airlines	Ground Handlers
Role	Owner of the baggage handling system (BHS) at AAS for security and transporting baggage through the system.	User of the aircraft to travel to destinations.	Providing international connections to their passengers.	On behalf of the airlines responsible for checking in and inserting baggage into BHS, and baggage make-up to be ready for the aircraft.
Needs	To facilitate services that will make optimal use of the capacity of the baggage handling system.	To have a hassle-free and trustworthy journey experience by not worrying about their hold baggage.	Want to provide a hassle-free journey to passengers, create optimal usage of counter capacity, and want to provide a reliable baggage process that includes on-time boarding and safe and secure baggage handling.	To deliver high on-time performance, smooth processing, and good communication with partners.

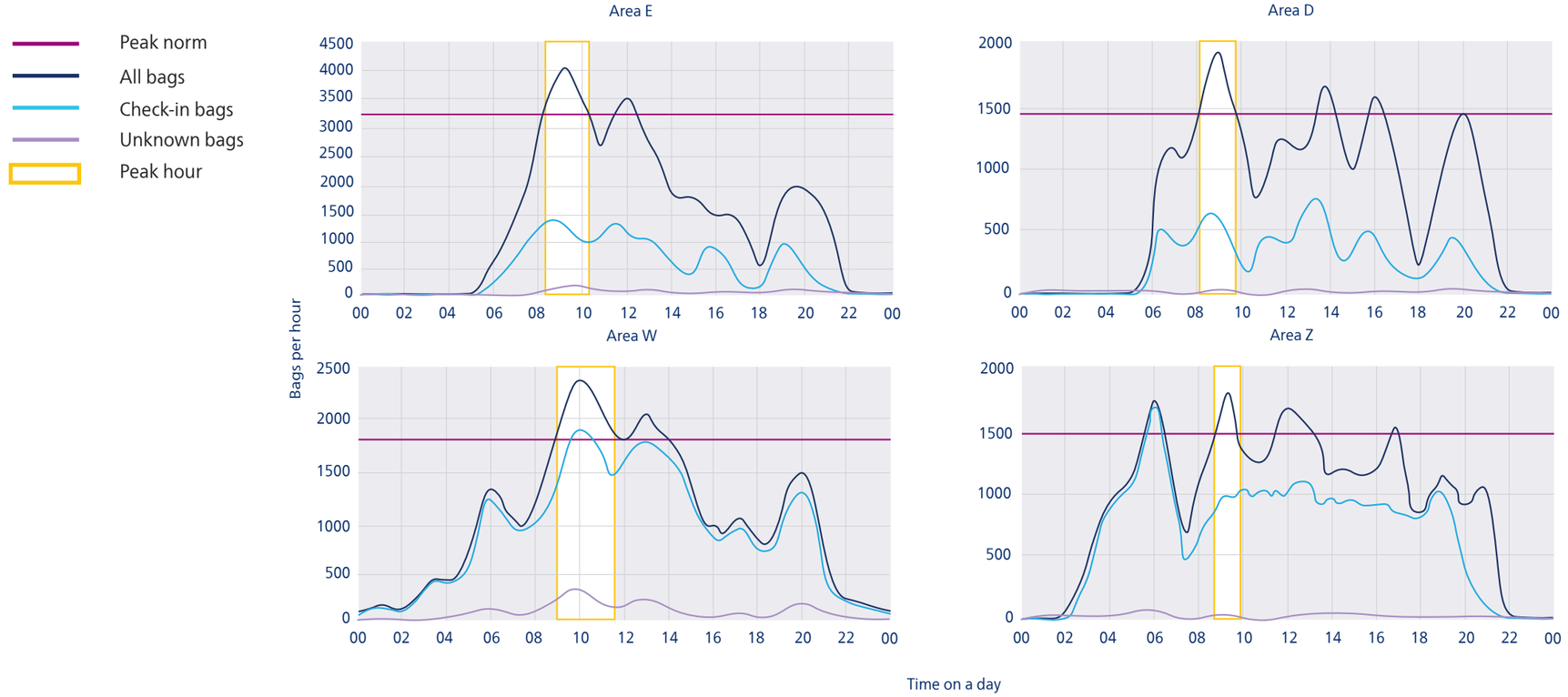


Figure 6: The baggage handling peaks of area E, D, W and Z at Schiphol. Each area has its own defined peak, peak hours and CI baggage share.

7.2 Baggage flow resulting in peak

In the current situation, the transfer (TRF) and check-in (CI) baggage arriving at AAS will go immediately in the baggage handling system (BHS) and are prepared to be transferred to the designated aircraft, called 'first-in-first-out'. During the summer holidays, Schiphol adds extra flights to the standard schedule due to the higher demand for flights. This resulted in a higher demand for baggage inflows during the summer months June till September in 2018 and 2019 (DnA, 2021). Using the first-in-first-out method, led to a pressure of handling hot baggage on time because the system is unnecessarily processing cold baggage while hot baggage should be prioritized to be processed. This resulted in critical baggage handling peaks in the morning.

At AAS, there are multiple baggage handling areas, area E, Z, W and D, to process and load the baggage onto the aircraft. As seen in figure 6, each baggage handling area had its own peak in baggage handling capacity and its share of baggage in the system leading to the sum of a large peak during the busy summer months. The peaks took place in the morning from 8:30 till 10:30 and these peaks were based on the pressure on the make-up area, explained in the following paragraph.

As a result of using the first-in-fist-out method of baggage handling during the summer months, both the BHS and stakeholders' performance were severely experiencing pressure for handling baggage with urgency (hot baggage) (Van Wieren, 2021).

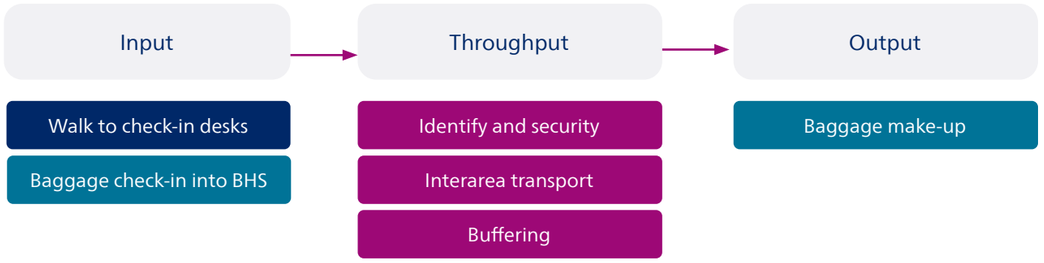


Figure 7: The input, throughput and output phase of the baggage handling process at AAS.

7.3 Impact of peak on BHS

The first-in-first-out method has its limitations during summer peak times, as described in the following phases of the baggage handling process. The phases are illustrated in figure 7, including the roles of each stakeholder according to their given colors, seen in chapter 7.1.

Input

Input is the phase where a passenger hands over the baggage at the check-in desk at the airport, where it is inserted in the BHS. Sitting at the check-in desk on behalf of the airline, the handler receives the baggage, checks it in by weighting and labeling the baggage, and pushes it into the system. The system will transport the baggage to the baggage area, where the handler will load it into the aircraft. There are two main reasons for extra pressure on the BHS system. Firstly, additional flights are added to the standard schedule during summer holidays because the demand for flights to holiday destinations increases. The amount of baggage that needs to be handled at the same time increases, leading to a high amount of baggage in the BHS. Secondly, when passengers arrive early at the terminal to ensure they catch their flight on time, a high amount of CI baggage will be inserted in BHS well before the flight departure, becoming cold baggage.

Throughput

In the 'throughput' phase, the baggage is transported from a specific area to another area in the BHS. This includes the identification and security check of the baggage. Cold baggage needs to be transferred to the buffer area for storage until it is ready to be transported to the output area and loaded on the aircraft. More storage capacity is needed when more cold baggage is inserted into the BHS during peak hours. The extra transfers create more interarea connections and longer throughput time than necessary. This leads to an increased risk for delays of hot baggage that needs to be transferred on time.

Output

In the final 'output' phase, the baggage is transferred from the baggage carrousels to the loading units (LUs) by the ground handlers of the airlines, so-called 'baggage make-up'. These LUs are the trolleys with stacked baggage and will be transported and loaded onto the designated aircraft. When the BHS is overloaded, hot baggage becomes at risk of arriving at the make-up area too late, leading to mishandled baggage. The peaks seen in figure 6 illustrate the consequences of the pressure of baggage make-up, and they will be at their maximum when the expected shortage in 2029 is reached.

7.4 Impact of peak on stakeholders

The high amount of baggage handling, especially during the holiday season, also impacted stakeholders like airlines and handlers operating at AAS. Due to the limited opening windows of check-in desks scheduled to handle the added flights on a day, the work pressure was high for handlers at the check-in desks, which led to a decrease in operational capacity (van Wieren, L. 2021). This resulted in long waiting lines and time at check-in desks, which had a negative effect on the passenger experience in the terminal towards the airline and the airport. Moreover, due to the overloaded BHS, the risk of hot baggage arriving too late in the make-up area increased the pressure for ground handlers to realize baggage make-up on time.

To conclude the impact on stakeholders:

1. Passengers: negative experience when traveling with hold baggage due to long waiting lines at CI desks resulting in stress for catching their flight.
2. Ground handlers: High workload in the input and output phase of baggage handling increases the risk of mistakes.
3. Airlines: negative passenger journey effect on their brand image and service.
4. AAS: low level of service for airlines to operate and negative passenger experience in the terminal.

Peak reduction

Location	%	Bag. items
Area W	15,3	856
Area Z	9,4	253
Area E	5,1	525
Area D	4,7	128
Total	8,2	1.550

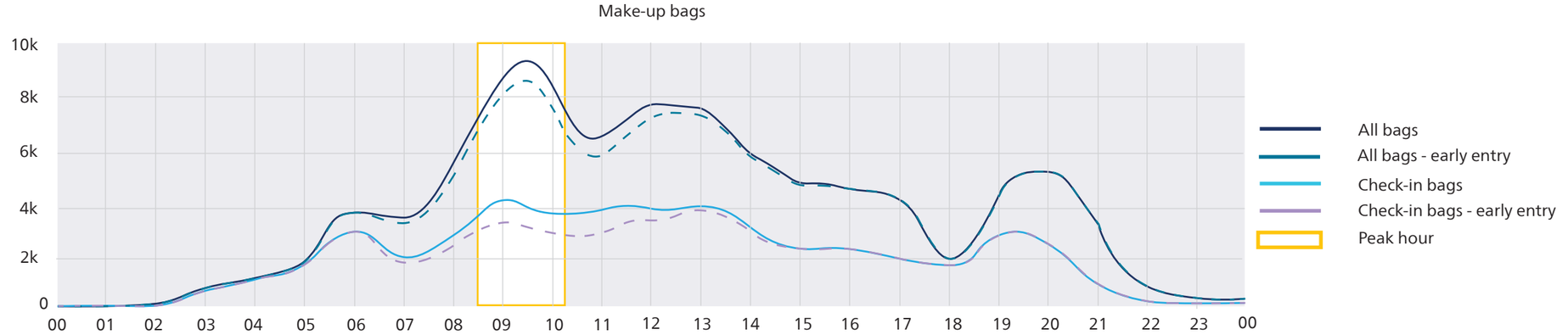


Figure 8: The peak reduction of 8,2% when 20% of CI baggage will be removed from the peak, including the share of each baggage handling area.

7.5 Peak shaving CI baggage

As explained in the previous section, the current way of processing CI baggage, first-in-first-out, is not desirable during peak times in the summer holiday season and could lead to the expected shortage. The main hypothesis stated by the IH for the 'Future Baggage' topic is to prioritize the baggage flows by looking at hot-cold separation instead of first-in-first-out. This separation means that the hot baggage will get priority to be inserted in the BHS over the cold baggage during peak hours. The cold baggage will be inserted and made up before or after peak hours, decreasing the amount of baggage during peak hours. This will lead to the system's baggage spread over the day, and the peak will be flattened: so-called 'peak shaving'.

The moment of TRF and CI baggage entry in BHS must be influenced to realize peak shaving of the baggage inflow. This involves baggage inserting the BHS before or after peak hours. Based on previous research, the IH stated that to realize peak shaving, the best time to enter cold TRF baggage into the BHS is after peak hours. This is because the TRF baggage arrives at AAS at a scheduled time so entering TRF baggage before peak hours is not possible. To realize this change of timing, technology is required for exploring this solution area. At the same time, the most desirable timing of inserting cold CI baggage into the BHS is before peak hours. Inserting CI baggage after peak hours will result in scenarios where the baggage will not be on the passengers' flight and will arrive later than the passenger at the final destination.

RSG assumes that the system should handle 20% of the CI baggage before peak hours to cover the shortage of 10% baggage capacity (Royal Schiphol Group, 2021). This means that CI baggage must arrive at AAS before the passenger arrives at the airport. The desirability, viability, and feasibility for the early entry of CI baggage need to be explored for each stakeholder.

7.6 Impact of early entry CI baggage on peak shaving

With peak shaving, 10% baggage handling capacity must be covered. The DnA team calculated different scenarios to explore how much baggage should be checked in remotely and which airlines were most prevalent in the summer peaks of 2018 and 2019. Figure 6 illustrates that the baggage handling areas W and Z had the biggest share in CI baggage that the system handled during the peak. The analyses indicated that these baggage handling areas also contribute as the largest share to the potential for peak shaving.

In figure 8, the potential in peak reduction of baggage handling is illustrated when a percentage of CI baggage is removed from the peak. An 8.2% peak reduction (1.550 baggage items) can be achieved if 20% of the baggage is checked in early. For each baggage handling area, a detailed peak reduction is calculated. Area W will have a peak reduction of 15.3%, which is 859 baggage items, and area Z will have a peak reduction of 9.4%, which is 253 baggage items. Area E will have a peak reduction of 5.1%, which is 425 baggage items. Area D will have a peak reduction of 4.7%, which is 128 baggage items.

This indicates that 20% of the remote baggage check-in will affect area W the most, which will be enabled by the airlines with the biggest share in the summer morning peaks. In figure 9, an overview of the airlines that will have the most potential in realizing peak shaving is illustrated for each baggage handling area. In areas W, these airlines are TUI, United Airlines, and Turkish Airlines, respectively. The airline that has the most potential to realize peak shaving is KLM in areas Z, E, and D.

The DnA team calculated two other scenarios to indicate the range of the potential for peak shaving of baggage on the whole baggage handling system. A 3,9% peak reduction of the baggage make-up is achieved if 10% of the baggage items are checked in early. When 40% of the baggage is checked in early, a 16.6% peak reduction is achieved.

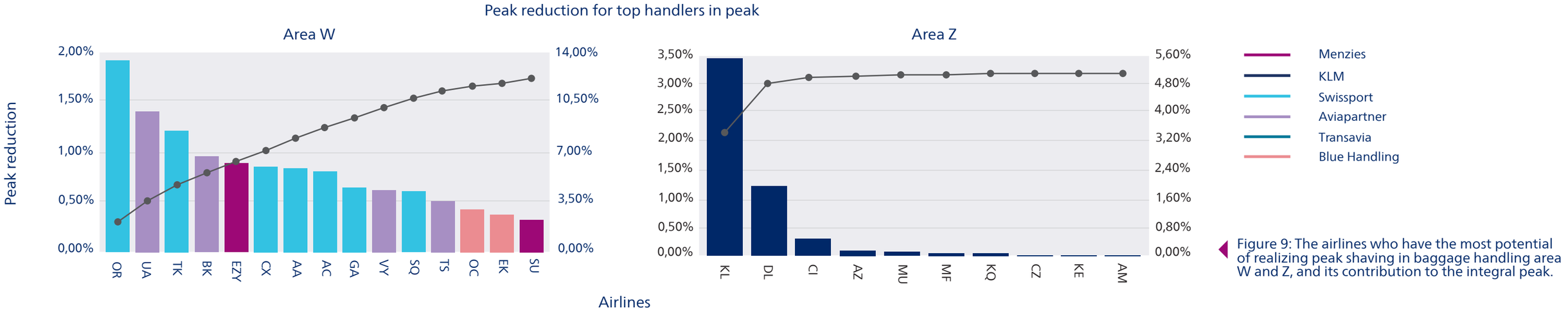


Figure 9: The airlines who have the most potential of realizing peak shaving in baggage handling area W and Z, and its contribution to the integral peak.

7.7 Timing of early entry of CI baggage

Next to exploring the impact on peak reduction, it is also essential to highlight the impact of inserting and making up the baggage before peak hours. This involves the timing of the baggage in the system and whether this does not create an additional peak in the morning.

The baggage process expert of RSG estimated that the BHS could handle the 1.550 baggage items mentioned in chapter 7.6, in one hour from check-in to make-up. This will only occur if no baggage storage is needed because then the baggage process will take longer due to transportation to the buffer area. The timing of inserting the baggage and spending in the buffer area is dependent on enough available ground handlers and enough buffer and make-up space for handling the baggage. Furthermore, the timing is also dependent on the time windows when the baggage conveyors are out of order due to maintenance, which is called 'maintenance windows'. Each baggage area has its own maintenance window. It is important that the baggage is made up outside the maintenance windows and before the peak starts in the morning, which means stakeholders must find the right timing. Furthermore, a shift in the schedule of active ground handlers is needed to handle the baggage before the original check-in and make-up time. The right timing is described below for areas West and Z since these two areas have the highest potential in peak shaving CI baggage.

In area W, the maintenance window occurs between 21:00/22:00 and 02:00. The right timing for baggage insertion and make-up will apply between 02:00 and 04:00 in area W. This timeslot is chosen because this has the slightest chance of the emergence of an additional peak, seen in figure 6. From 02:00, two baggage conveyors are available in area W, and the morning peak starts at 04:00.

In area Z, the maintenance window occurs from 22:00 till 02:00. To avoid additional morning peaks, the right timing for baggage insertion and make-up is before its maintenance window because the morning peak starts at 02:00 seen in figure 6. This means that the baggage must be inserted and made up before 22:00.

7.8 Conclusion

The current baggage handling method first-in-first-out is not optimal because this leads to an unnecessarily high amount of cold CI baggage in the system, which puts pressure on the BHS and stakeholders for handling hot baggage on time. This pressure translates into the problem of peaks in baggage make-up in the morning, which are critical during the summer months from July till September. These peaks threaten to reach their maximum due to the expected baggage handling capacity shortage by 2029. The problem starts with the input phase, where the additional baggage load is received due to the combination of added flights (holiday season) and passengers checking in (too) early.

Solving the problem without the need to expand the capacity by building assets can be achieved by hot-cold separation of CI baggage. This thesis focuses on handling a percentage of CI baggage before the expected capacity peaks, including the input, throughput and output phase of the baggage handling process. For area W, handling CI baggage must occur between 02:00 and 04:00, and before 22:00 in area Z. When 20% of the CI baggage is handled before peak hours, an 8,3% peak reduction can be realized, releasing the pressure on the BHS and stakeholders. Inserting baggage before the original check-in time windows leads to possible scenarios that the hold baggage must be checked in well before departure time and the passenger is traveling to the airport without hold baggage. It is essential to explore how a service can convince passengers to hand over their baggage well before departure.

8.

BAGGAGE AS A SERVICE

The passenger is responsible for the timing of handing over the baggage at the CI desks and is an essential stakeholder in the ecosystem to be convinced. Existing commercial baggage services allow a passenger to hand over the baggage to a pick-up person before departure day. The baggage will be checked in on the passenger's behalf on the day of departure. This service is called Baggage as a Service (BaaS) and is an interesting focus area to explore if this could be a solution area for peak shaving. First, this chapter discusses the existence of BaaS and the role of the BaaS stakeholders. This is followed by highlighting the existing parties and their journeys. Finally, this chapter discusses the challenges of BaaS and evaluates the key takeaways.

8.1 BaaS existence

It is being considered that one of the most radical innovations in future air transport is the dissociation of passenger travel and baggage delivery (Al-Hilfi et al., 2018). Business models have emerged to increase efficiency and flexibility by merging and sharing existing infrastructures to deliver services, so-called X-as-a-Service (XaaS). In the scope of baggage handling, XaaS is translated to BaaS because a service has been initiated whereby the baggage travels separately from the passenger and is transported from home to the airport on behalf of the traveler using existing parcel services. BaaS responds to pain points in the journey of traveling with hold baggage and makes it a more convenient travel experience. Passengers find it a hassle to carry their baggage to the airport, especially when traveling with public transport by continuously lifting and stowing luggage and maintaining supervision in between (Van Winsen & Bergema, 2015). Furthermore, the check-in moment at the check-in desks can be skipped by having baggage checked-in remotely, avoiding long waiting lines, and the stress of catching the flight on time while waiting (Personal survey, 2021).

8.2 BaaS stakeholders

To better understand the existence of BaaS, the roles of each stakeholder are explained in the following section.

Passengers

End-users of the baggage services.

Airlines

Offering the baggage service to their passengers on their travel platforms as an extended service for a hassle-free travel experience. The booking of this service can be done together with booking flight tickets. With certain airlines, it is also possible to book the service later in the process, together with other offers such as car rentals or hotels.

RSG

Owner of the BHS and enabler of the baggage services.

Third Parties

Offering and executing the baggage service. The backend of the service is realized by making use of existing (own) infrastructures and parties such as parcel delivery services.

Logistic Providers

Responsible for the baggage pick-up and the merge of the collected baggage items in a distribution center. The merged baggage items will be dropped off in a truck at the airport and checked in on behalf of the passengers a few hours before departed flight at the check-in desks. Logistic Providers are often parcel services that have existing resources and infrastructure.

Ground Handlers

Receiving the baggage from the Logistic Provider and inserting the baggage into the BHS. The baggage will be made up together with the original CI baggage and loaded together into LUs to be ready for loading in the aircraft.

Figure 10: The different BaaS journeys, including the examples of parties fulfilling these services.

8.3 Active BaaS parties

A few companies around the world and in The Netherlands offer BaaS to respond to the passenger needs of convenient and time-saving traveling with hold baggage to and at the airport. For instance, in The Netherlands, pilots have been conducted with the parcel delivery company PostNL. It is interesting to explore which services they offer, who is involved, and how it works. The described parties in the following section and their journeys are seen in figure 10.

In the world

Airportr has been active since 2014 at some key airports in the UK and Switzerland. They pick up baggage at any home, hotel, or office and have checked in over 150.000 bags to nearly 400 destinations around the world (AirPortr, 2021). Passengers can book this so-called 'home-to-airport' service at the AirPortr website. In addition, passengers of British Airways, American Airlines, and Finnair can book this service at their airline website since they collaborate with AirPortr to offer the baggage service.

Pilots

PostNL has struggled for years with declining letter volumes and tried to keep its head above water by blurring its sector and offering alternative services such as a baggage service (Merlijn van Dijk, 2017). Despite a lack of enthusiasm and high costs at the end of the last century, PostNL has tried to set up a profitable baggage service with Schiphol through a pilot in 2017 (Merlijn van Dijk, 2017). This pilot was set up to test the baggage pick-up service for home-to-airport at Schiphol and Eindhoven airport for €20 for each suitcase. The pilot in 2017 was successful due to the positive passenger reactions, and PostNL indicated to see perspective and a future in this service. Still, PostNL did not want to pursue the scale-up because they wanted to focus on other priorities (Klaas-Jan van Woerkom, 2019).

In The Netherlands

The theory that off-airport baggage check-in and transport fulfill the passenger needs is supported by the fact that in recent years a few start-ups offered BaaS in The Netherlands:

LuggageCare, launched in 2019, offers the same home-to-airport service as AirPortr, which can be booked by passengers directly on their platform or can be provided by airlines to their passengers. The Logistic Provider is FedEx who realizes the baggage service and transport from different homes to AAS for €35 for one or two suitcases and every suitcase an additional €10. Furthermore, FedEx weights, seals, labels the baggage at the passengers' homes and transports the merged baggage to AAS to hand over to the designated ground handler for check-in at the CI desks. Corendon and Transavia are the airlines that are currently in collaboration through a pilot agreement to test the service.

Bagpoint, founded in 2017, offers a pick-up service and the possibility to drop baggage at a Bagpoint HUB. A self-service drop-off unit is placed in a hotel or local parcel shops such as the RAI Amsterdam, where passengers can drop their baggage. Passengers can book this service for €25 for one suitcase and an additional €10 for each added bag. Bagpoint uses its own pick-up vans for pick-up and delivery at AAS, and they actively look for franchise partners for locating the HUBs and logistics (Bagpoint, 2021). TUI is currently collaborating with Bagpoint on a pilot agreement to test the service.

Bagbooking is launched in November 2021 and offers a pick-up service just like LuggageCare in Europe. In addition to this service, they have an extended service where the baggage is delivered at the accommodation of the final destination. The baggage is not traveling in the passengers' aircraft but via the road in FedEx vans. This requires a handover time of two to seven days in advance. This service is currently realized for €39,95 for each suitcase with an order of a minimum of four bags. Currently, no airlines are collaborating with Bagbooking yet since they first want to be reassured that the service works due to their recent launch (Customer Service Agent Bagbooking, 2021).

These services and the collaborations with airlines indicate interest in offering the service to their passengers for an optimized passenger experience when flying with hold baggage.

8.4 BaaS challenges

Even though some companies have been offering commercial baggage services since 2014 and are still existing, there are still some challenges that BaaS is facing that are important to keep in mind.

COVID-19 pandemic

Due to the COVID-19 pandemic, the growth of these Dutch BaaS companies has been impacted since flights to and from AAS have been reduced (Co-founder LuggageCare, 2021). It is uncertain when flights will be able to take place at the capacity before the pandemic. Furthermore, since personal safety has become more important and passengers are aware that long waiting lines and overcrowded terminals will increase the exposure to COVID-19, passengers are likely to be interested in services that will decrease the time spent in check-in lines (KLM baggage process representative, 2022; Bagpoint, 2021).

Logistics and security

Because the baggage is earlier in the hands of a third party and is traveling a longer distance compared to check-in at the terminal, the operations must run smoothly. The baggage must be collected and merged at central distribution centers for both pick-up and drop-off services, requiring additional handover moments, people involved, space, and money. The additional involved people and handover moments increase security issues and the complexity of baggage ownership and accountability that must be clearly defined (Al-Hilfi et al., 2018).

Furthermore, each airline's baggage needs to be delivered separately to the check-in desks, leading to many traffic vans driving to and from AAS (Co-owner LuggageCare, 2021). Merging baggage from different airlines increases security risks and must be avoided.

Environmental impact

Although the existing infrastructure is used with BaaS, there is a need for an extensive infrastructure to realize the dissociation of passenger baggage (Al-Hilfi et al., 2018). Picking up baggage at different locations throughout the country by vans could have a negative impact on the environment. Already, companies offering XaaS are looking into the possibility of combining delivery and picking up goods in the same run to decrease the environmental impact, such as the grocery delivery service Picnic. Picnic combines the delivery of groceries with the collection of return packages of the parcel company DHL in their electric vans (Retailtrends, 2020).

Financials

Due to the need for an extensive infrastructure for realizing BaaS, additional costs are likely to arise, increasing the system complexity (Al-Hilfi et al., 2018). Because a significant change in the current baggage handling is needed, which cannot be instantly demonstrated, it is challenging to clarify if the expenses outweigh the offered benefits directly (van Zundert, 2010). Furthermore, there is not one clear funding strategy identified which indicates that there is a need to develop new business models for not only supporting the dissociation of baggage and passengers but also sustaining it (Al-Hilfi et al., 2018)

Data sharing

Because baggage check-in is outsourced to Third parties, these parties need to receive passenger information from the airlines' Departure Control System (DCS) to scan baggage items and verify passengers for issuing the boarding pass during baggage pick-up (Co-founder LuggageCare, 2021). In terms of privacy, airlines tend to be reluctant to share passenger data, especially with unknown Third parties (KLM baggage process representative, 2022). Furthermore, since the baggage is being transferred over a longer distance by a third party, it raises concerns with both airlines and passengers regarding mishandled or unsafe baggage (van Zundert, 2010). Nevertheless, since 2017, it has been mandatory to track important baggage handling steps and hold all involved parties accountable (IATA, 2017). This has helped the acceptance of monitoring and sharing steps in the baggage process between stakeholders.

8.5 Key takeaways

Based on the above research, the following takeaways are noted:

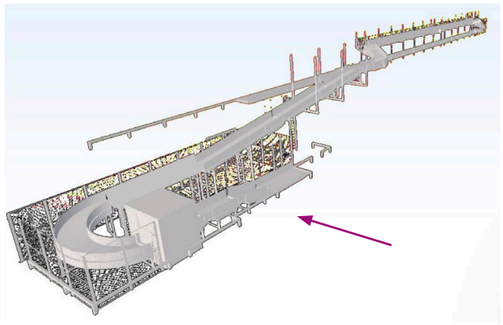
- First, BaaS is an interesting focus area for Schiphol to learn from since there are currently operating, indicating the desirability and feasibility of these services.
- The current BaaS parties operating in The Netherlands at AAS are still in their starting up phase due to pilots that have been on hold because of COVID-19 and have yet to prove themselves towards passengers and airlines to be successful. They are interesting to work with and learn from and could potentially be the astronauts Schiphol could connect with to realize peak shaving of the baggage capacity.
- Multiple BaaS journeys cover the handover moment in advance of departure and are opportunities for Schiphol to influence the timing of CI baggage entering AAS.
- BaaS faces challenges that involved parties must address; the unfolding of the COVID-19 pandemic, the logistics & security adjustments, reducing environmental impact, privacy and data sharing.

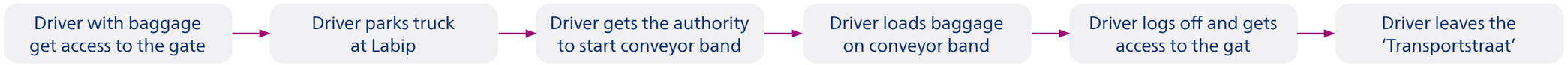
Concluding, to have the desired effect of peak shaving and optimizing the BHS, CI baggage needs to be handled before peak hours through all the baggage process steps from check-in to baggage make-up. Furthermore, existing companies offer BaaS and are interested in discovering how they can play a role in effecting peak shaving at AAS. Therefore, using BaaS for early check-in is in this thesis translated into Early Baggage Check-In Service (EBCS).

9.

IDENTIFICATION OF EBCS AT AAS

In this chapter, the exploration of the potential of building an EBCS ecosystem at AAS is evaluated where the existing BaaS has been integrated. The possible EBCS journeys are outlined with the stakeholder roles and interdependencies between the journey steps. Several points needed to be considered in this study while setting up these possible EBCS journeys. Since passengers need to be nudged and convinced to use EBCS at AAS, this chapter will highlight the most important factors influencing passengers' choice for EBCS and indicate the passenger profiles with interest in EBCS. Finally, the drivers and barriers of each stakeholder will be explained, resulting in key takeaways for creating a successful EBCS ecosystem.





▲ Figure 12: The step-by-step process of how a pick-up driver will use Labip and how it designed to look like.

9.1 Consideration points in EBCS

The identification of EBCS at AAS involved the exploration of possible journeys. This generated insights into the possible responsibilities and touchpoints of each stakeholder in the EBCS ecosystem. The passenger and baggage journeys are illustrated in Figures 13, 14 and 15. These journeys were sketched to demonstrate the interaction and interdependencies between the needs of the stakeholders and the feasibility of the service. First, two aspects needed to be considered while identifying these possible EBCS journeys; Labip and the timing of certain steps in the journey.

Labip

Since 2017, Schiphol has been exploring the realization of Labip (Landsided Baggage Infeed Point), an on-land-side location at AAS for inserting CI baggage directly into the BHS without the need of check-in desks. The initial reason Schiphol wants to implement Labip is because it can allow baggage to be inserted into the BHS on behalf of passengers, which will reduce the congestion in the terminal and at the check-in desks. In addition, in cooperation with the airport, airlines want to reduce costs by setting up self-service drop-off points in the terminal (Castillo-Manzano & López-Valpuesta, 2013). This shows that there is interest in using fewer ground handlers. Due to money, time, and COVID-19 concerns, the realization of Labip has often been postponed. Currently, Labip is targeted to prepare for a pilot phase in the summer of 2023 (Process developer of Labip, 2022).

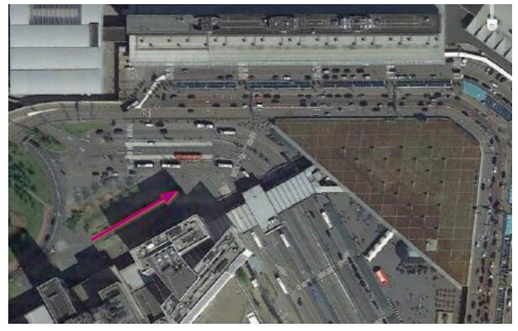
Concerning peak shaving, Labip will be able to provide two positive outcomes: saving time and avoiding additional ground handlers for check-in. Firstly, Labip will provide fast baggage insertion into BHS because Labip will eliminate a current BaaS journey step of handing over baggage to the ground handlers, who will insert baggage into the BHS (Baggage process expert RSG, 2021). Secondly, Labip will ensure that no additional ground handlers are required to work outside the current check-in opening hours. This is beneficial because without Labip, this would have taken place late in the evening or during midnight, given the best timing of baggage insertion, explained in chapter 7.7.

This thesis will include the use of Labip in the exploration of possible EBCS journeys because Labip could increase the feasibility and viability of the EBCS ecosystem.

Labip will be able to process an estimated 600-800 baggage pieces per hour, which means that handling the 1.550 baggage items will take approximately two hours. The driver of a truck with baggage will get access and drive into the 'Transportstraat' at Schiphol, which is an entrance like a parking garage, close to Schiphol Plaza, seen in figure 11. The driver will park in front of the baggage carousel and get the authority to start the conveyor band to load the baggage. After all the baggage is loaded on the conveyor band, the driver will log off and access the gate opening on the way back. Finally, the BHS will transfer the baggage to the designated baggage area for make-up. A step-by-step process is illustrated in figure 12 and what Labip looks like.

Timing of journey steps

When passenger needs have an impact on certain steps at the backend, this will determine how stakeholders must operate. The other way around, requirements at the backend of the service might affect how the service will perform at the frontend for the passenger. This could change the desirability of the service. The timing of certain steps in the backend of the journey depends on internal and external factors; the maintenance windows (the operational break mentioned in chapter 7.7) for each baggage area, the transport to the distribution centra depending on storage space and people, the transport to AAS depending on the specific insert moments, and enough storage space in the make-up area. These are possible dependencies, indicate the critical points to remember when setting up an optimal infrastructure, and are discussed in the drivers and barriers listed in chapter 9.5.



▲ Figure 11: The location of the Transportstraat at Schiphol.

9.2 Possible EBCS scenarios

The two explained consideration points were integrated into generating possible EBCS journeys at AAS. The journeys were based on existing BaaS journeys and are sketched to show the steps in the process and the role of each stakeholder. These steps are highlighted in the colors of the stakeholders, seen in chapter 8.2. Furthermore, the interdependencies concerning the passenger and baggage journeys are included.

The journeys are visualized with the following explanation:

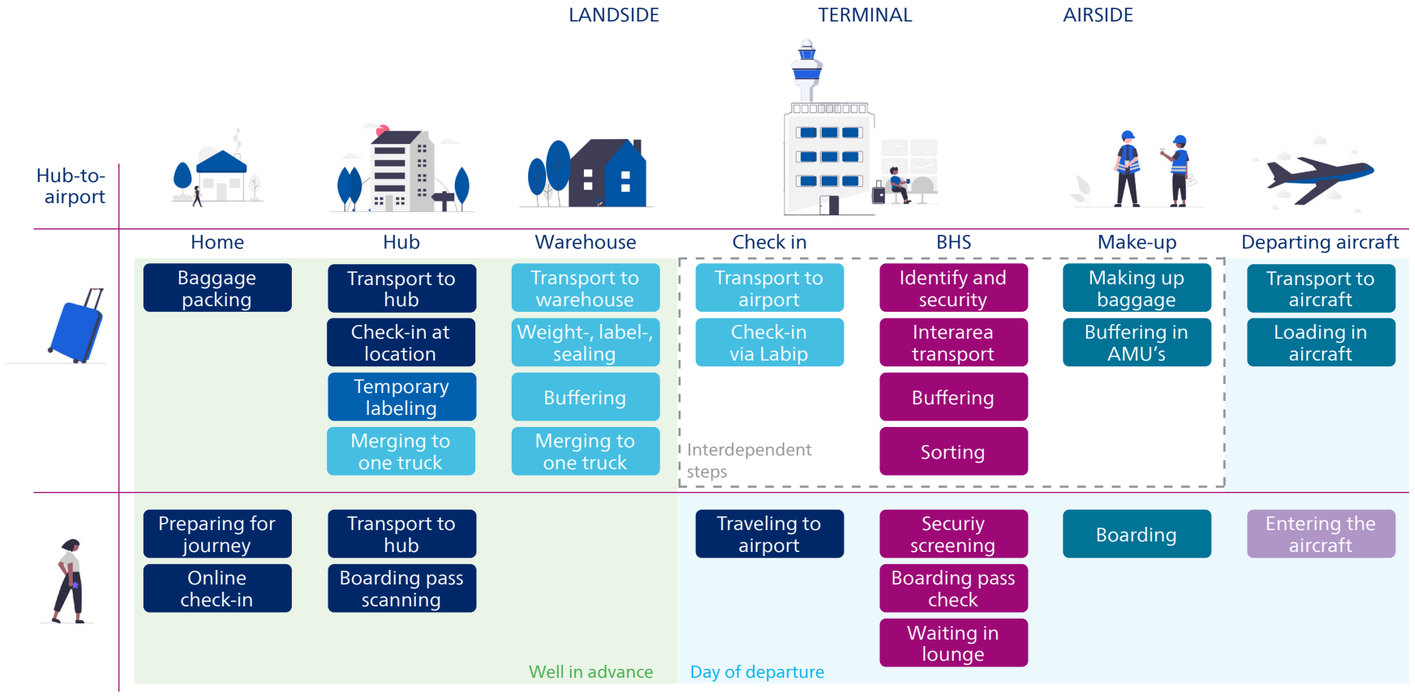
- The journey starts when the passenger packs the baggage and ends when the baggage is being loaded onto the aircraft.
- The green area indicates the steps before the departing flight.
- The white area indicates the dependent steps on internal and external factors.
- The blue field indicates the steps taken on the day of the departing flight.

Possible home pick-up journey

As seen in figure 13, the passenger's home is chosen for this journey, which is the same for starting the journey at an office or rental stay. The baggage will be picked up at the passenger's location in advance by the Logistic Provider. The baggage will be transported to a distribution centrum, a warehouse, to be merged with the other collected baggage. The Logistic Provider will transport the merged baggage to Schiphol and insert the baggage through Labip into the BHS. The baggage will follow the steps such as security and transport to the designated make-up area. Depending on the available storage space and maintenance window, it will be stored or directly transferred to the make-up area. The passenger will travel to the airport on the day of departure and follows the steps of security screening, boarding pass check, and spending time in the lounge.

Possible drop-off journey

A possible drop-off journey is illustrated in figure 14. The Logistic Provider will pick up multiple baggage items at a central drop-off location, a hub, where passengers will transport the baggage to a day or more in advance. The passenger will hand over the baggage to a staff member or insert it into a system on itself. The baggage will be checked in and temporarily labeled when the drop-off location does not enable definite labeling. The baggage journey steps starting from the transport to the airport are the same for the possible drop-off journey as for the possible home pick-up journey. The passenger will travel to the airport and follows the same journey mentioned in the possible home pick-up journey.



▲ Figure 14: A possible drop-off journey in the EBCS ecosystem.

▼ Figure 13: A possible home pick-up journey in the EBCS ecosystem.

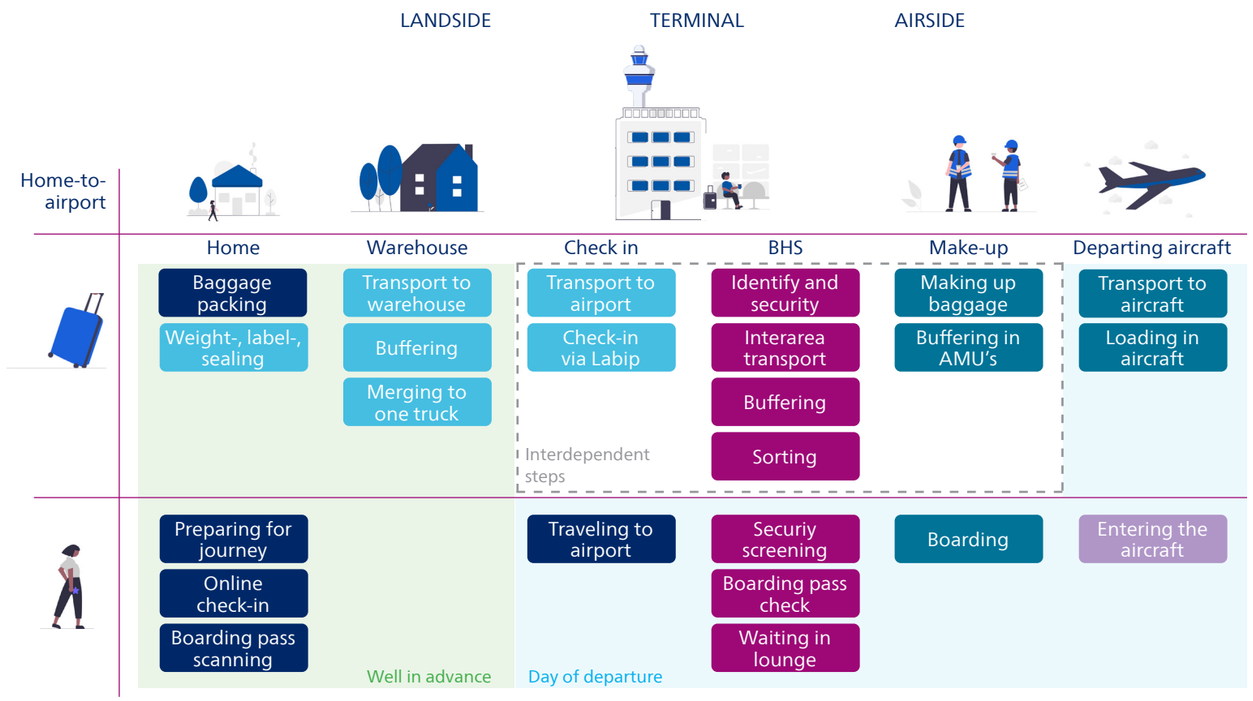
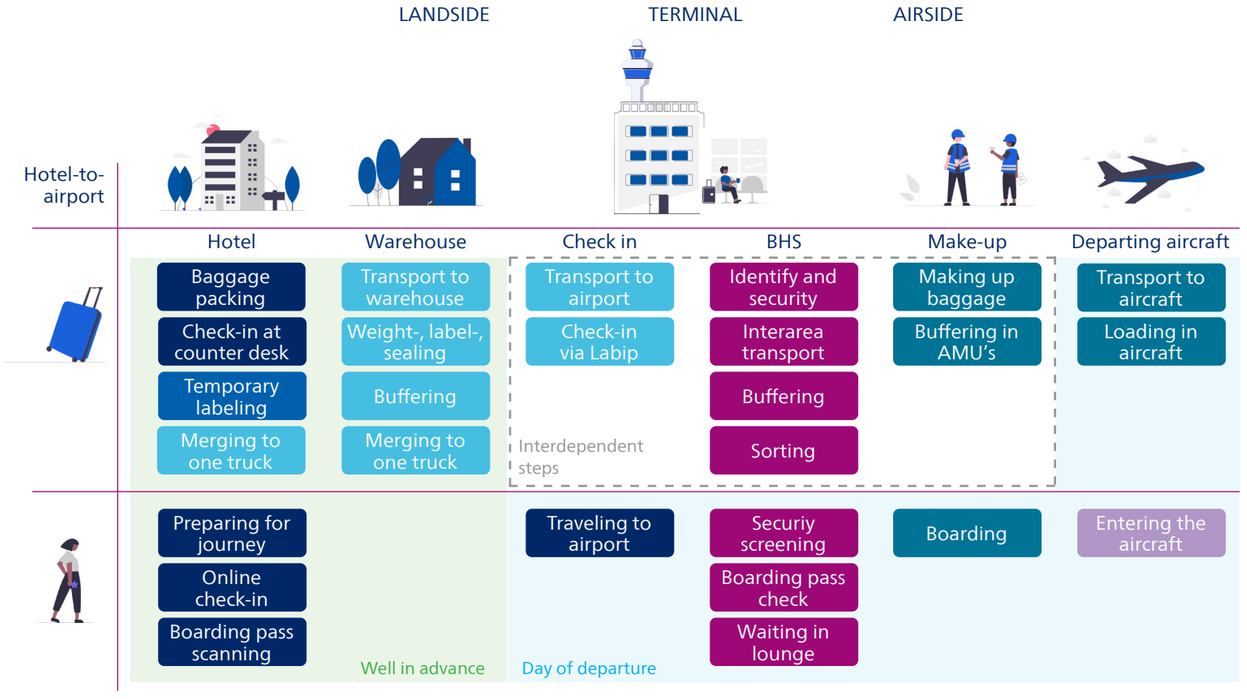


Figure 15: A possible hotel pick-up journey in the EBCS ecosystem.



9.3 Factors influencing passenger choice

Possible hotel pick-up journey

A possible hotel pick-up scenario is illustrated in figure 15. When a passenger stays in a hotel, a pick-up service will collect the baggage from the lobby. All steps are the same as the drop-off journey since a hub and a lobby are both seen as a centralized location to drop the baggage. The difference is that the passenger does not have to travel to hand over the baggage. The passengers will travel to the airport on the day of departure flight and follows the same steps as mentioned in home pick-up and drop-off journeys.

Concluding, the possible EBCS journeys show the possible steps of passengers well in advance, which needs to be explored from a desirable point of view. Next to the requirement of early baggage hand over in the journey, extra steps are needed in the three possible EBCS journeys: hub pick-up, warehouse storage, and merging baggage in one truck. In addition, the three possible journeys do not differ from each other from the steps of transporting baggage to the airport to baggage storage in the make-up area. However, they are still dependent on internal and external factors, mentioned in chapter 9.1.

In the described EBCS journeys, it is relevant to explore which factors determine if a passenger would like to use EBCS. These factors could differ in relevance and importance and should be addressed when making the final solution.

The EBCS requires a change in traveler's behavior, both in the timing of having the baggage packed and the timing of baggage hand over. This means that passengers need to be convinced and nudged to use it. In this thesis, the meaning of nudging is as follows: "gently persuading someone".

For passengers in the EBCS ecosystem, multiple factors will influence the choice between travel with or without hold baggage. Based on the air-rail journey of the Council for the Environment and Infrastructure, released in 2020, there are factors that influence travelers' choice for a particular transport modality to and from the airport. In this study, these factors were applied to the factors that may influence the choice for EBCS to gain insight into how EBCS can become more desirable so that passengers are nudged to choose this service rather than travel with hold baggage.

The factors of the Council for the Environment and infrastructure can be divided into two main groups. First is access to the system, which includes factors influencing travelers to become aware, find and book the service. Secondly, the appreciation for the system consisting of the factors influencing choosing the service: Travel time, costs, travel options, comfort, certainty, and sustainability. These factors were used as a common thread in the setup of the survey. In the following section, the main results from the personal survey amongst Promoters and Possible Persuaders are evaluated and conclusions were drawn, including the market research results. All the results of the personal survey are seen in appendix B.

Access to the service

Awareness

Being aware of the service means the availability of the service and knowing where to book it (Hendrikx, 2021). Creating awareness for EBCS can be accomplished by highlighting its benefits and value to the passenger through marketing and communication.

Findability

The findability of the service means where the passenger will be able to find and book the service. EBCS could be offered on the website of a commercial third party, an airline or an airport. Based on the survey, 50% of the Promoters and 33,3% of the Possible Persuaders expect that passengers can book the baggage service at the airline platform with whom they are flying. The Possible Persuaders care less about a specific location where passengers can find the service because 43,3% believe it does not matter as long as the service works. In conclusion, the majority prefer that the service should be offered on the platform of the airline whom they are flying with.

Booking

The booking of EBCS can be fulfilled together while booking the flight tickets or accommodations for the trip. 44% of the Promoters and Possible Persuaders expect that passengers can book the service together with the tickets to no longer worry about the baggage. Around 31% of these two groups believe that the service can be booked whenever they want or that it does not matter to them. Furthermore, 15% of the two groups believe it should be possible to book the service a few days before the departure flight. This indicates that it is important that passengers can book this service at different moments: together with the flight tickets or separately till a few days before the departing flight.

Appreciation for the service

Travel time

The travel time is one of the most important influencers (Hendrikx, 2021). In this thesis, travel time is regarded as the time it takes for the passenger to go to a specific location and hand over the baggage to a third party. According to the personal survey, around 30% of the Promoters and Possible Persuaders would like the baggage to be picked up from the passenger's location. Furthermore, 53% of these two groups would like to have the choice between the pick-up and drop-off location, depending on what the passenger is doing on the day of the pick-up.

Based on the interviews in the terminal, people tend to see both advantages and disadvantages of pick-up and drop-off. An advantage of a pick-up service is that the passenger can finish tasks at home or further prepare for the vacation without spending time and effort taking the baggage away. A disadvantage is that the passenger needs to stay at home waiting for the pick-up. An advantage of a drop-off service is that the passenger can determine the handover timing him- or herself. However, the disadvantage is that this activity is an additional journey to the original trip, which feels double. Out of this study, the majority prefer the pick-up service, which is supported by the market research.

Costs

Costs mean to what extent the passengers want to pay for EBCS regarding what they are getting in return. This could be different for each passenger, dependent on income and their price perception of the service. The passengers' income will not be taken into account in this study, only the price perception of passengers regarding the service. Almost all respondents expect to pay for a baggage service and, including the market research, passengers estimate that it will cost between €0 and €25 per suitcase, with an average of €10 per suitcase (Passenger insights, 2021).

Travel options

The travel options in EBCS mean the different options for when the baggage pick-up moment will take place. This includes the number of days before the departure flight and the number of timeslots on a day. 28,9% of the Promoters and 36,2% of the Possible Persuaders prefer a pick-up moment in the early evening between 18:00 and 21:00. Even 25,5% of the Possible Persuaders prefer pick-up after 21:00, which is a larger group compared to the Promoters. Concluding, passengers would like to hand over their baggage as late as possible to fit in their current hold baggage pack routine as much as possible. This is also confirmed by the interviews held in the terminal for the market research.

Comfort

Using EBCS, passengers can experience different levels of comfort. This includes hassle-free travel without hold baggage, saving money for taxi or car parking, saving time by skipping the check-in desks, peace of mind due to no worries about waiting times at check-in desks or catching the flight and being able to spend more time at home or at the airport for shopping, drinking coffee and visiting restaurants.

Certainty

Certainty is the assurance that the baggage is processed correctly, safely, on time, and securely. This involves all the steps in the baggage process, such as handover moment, being transported to the airport, and being loaded into the aircraft. In this thesis report, the certainty is divided into the trust in and the transparency of the service. Almost 50% of the Promoters believe that they will trust the service as long as their baggage can be locked or sealed. 41,7% of the Possible Persuaders don't have any trust issues regarding the service as they believe it is kind of the same as package delivery services. Trust can be increased since around 30% of the Promoters and Possible Persuaders would like to get a notification when the baggage is received at the airport and in the aircraft. Another 30% would like to have a Track&Trace link to check the status of their baggage. In conclusion, respondents tend to trust the EBCS service as long as the baggage can be locked or sealed. Furthermore, a notification or a Track&Trace link to see the status of their baggage can increase the feeling of certainty by trust and transparency.

Sustainability

Sustainability aspects could come forward in several parts of the EBCS, one of which is the efficient routing of the pick-up route. Some passengers find the factor of sustainability more important than others. 37% of the Promoters and Possible Persuaders will use the service as long as it is convenient even though it is not sustainable. The Possible Persuaders tend to find sustainability of the service less critical than the Promoters, which indicates that sustainability is not an effective factor for nudging the Possible Persuaders into using the service. If the service is more sustainable than passengers' current way of traveling with hold baggage, 50% of the Promoters will choose this baggage service. This indicates that sustainability is not a critical factor for (not) choosing the EBCS but could be a convincing argument when it is more sustainable and emission-free. This is related to all aspects of the logistics of the EBCS.

The priorities of factors influencing choice for the service

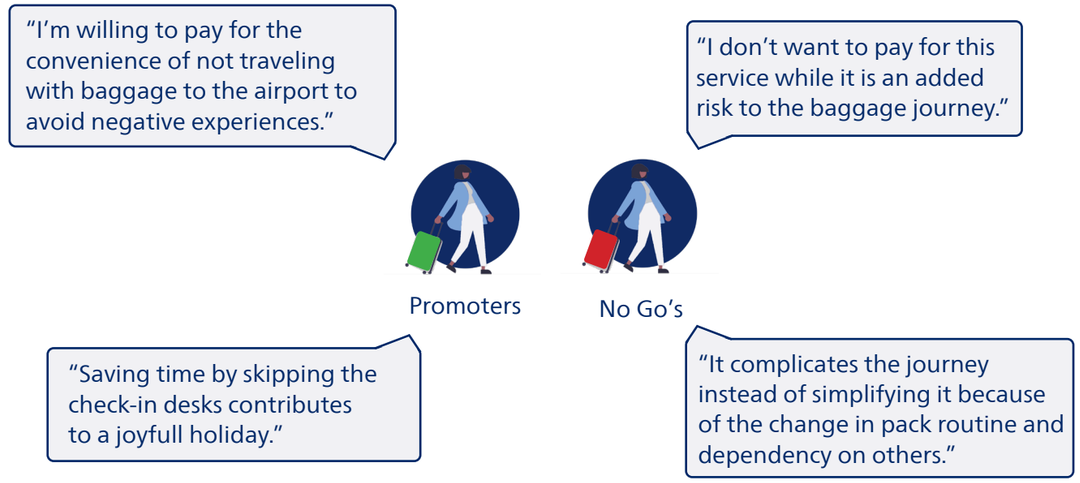
All factors that may influence passengers' choice for EBCS were evaluated for the Promoters and Possible Persuaders who are most interested in the service. There are some differences between the two groups that should be considered while making and marketing the final service. It is important to prioritize these important factors of each group that will influence passengers' choices.

Promoters

The three most important factors for the Promoters are, respectively, cost, trust, and the handover time. This means that the costs and passengers' price perception is the most important factor influencing the choice to use the baggage service. The benefits of using this service and the level of comfort it delivers need to be clearly explained in the EBCS proposition. Trusting the service is the second most important factor. The options to lock or seal the baggage during the baggage journey and receive information about the baggage status will increase trust even more. Finally, the third important factor is the handover time, where the most preferred time is as late as possible before departure day.

Possible Persuaders

The three most important factors for the Possible Persuaders are cost, location, and trust. The conclusions of the factors cost and trust are the same for the Possible Persuaders as for the Promoters. For the Possible Persuaders, the location where the handover moment will be taken place is the second important factor influencing the choice for using EBCS. Having the option to choose between pick-up and drop-off indicates the importance of being in control for 60% of this group. For 30%, the overall preference is for pick-up.



▲ Figure 16: Quotes of the two groups, Promoters and No Go's, regarding the baggage services.

9.4 Passenger profiles

Seen the important factors that will influence the choice to use the baggage service, it is interesting to zoom in on the passenger profiles and their interest in the baggage service. The Promoters and No Go's are evaluated with the support of the results of the market research. In figure 16, a few quotes are highlighted for each group to indicate their opinions about the baggage service.

Promoters

The market research indicates that the group of Promoters mostly exist of passengers who use public transport to get to Schiphol. They tend to see the added value of convenience of not traveling with baggage in the train or bus. Passengers who do not fly frequently are also interested in the service as they want to 'celebrate' their holiday with this extra convenience. They tend to go 'all out' for this special trip of the year and do not want to experience anything negative. This is related to the needs of the 'certainty seekers' and 'carefully planners' (Hendrikx, 2021). Especially the passengers of Corendon and TUI tend to fit in these passenger profiles since they are mostly holiday travelers (Baggage representatives Corendon and TUI, 2021).

No Go's

According to the market research, the No Go's feel unsafe due to the lack of control regarding the baggage service. For some passengers, their preference is to pack hold baggage as late as possible to have the opportunity to make last-minute changes to the content of their suitcase (Passenger insights, 2021). Therefore, ECBS does not fit their current routine, as this requires them to hand over baggage a day or more in advance. It is interesting to explore how the No Go's can be convinced to use the EBCS by fulfilling these needs, which will be addressed in the success factors for passengers in chapter 10. Research shows that people who do not experience the pain points when traveling with hold baggage are often the younger generation (Passenger insights, 2021). For that reason, they don't want to book the service.

9.5 Drivers & barriers

The reasons why stakeholders want to participate in the EBCS ecosystem are identified and are called 'Drivers'. The reasons why participating in the EBCS ecosystem is not desirable or will be complex are identified as well and are called 'Barriers'. Evaluation of the barriers will give insight into the challenges when realizing the EBCS at AAS. These are based on the personal survey, market research of Schiphol, and stakeholder interviews as described in chapter 6.

	Drivers	Barriers
Passenger	The convenience of hassle-free traveling from home to the terminal without carrying hold baggage (Passenger insights, 2021). The convenience of not standing in long waiting lines at the CI desks (Passenger insights, 2021). Another driver is saving time at the terminal by skipping the CI desks, so passengers have more time to spend personal time (Passenger insights, 2021).	Lack of trust and control due to unfamiliarity with the baggage service and offered by Third Parties they do not know (Co-founders LuggageCare, 2021). The change in their current pack routine and timing of having their suitcases ready. Travelers like to be able to change or add things to their suitcases at the very last minute (Passenger insights, 2021). Some passengers find that EBCS negatively impacts the environment when more transport movements are added to the journey (Passenger insights, 2021).
Airline	Opportunity to offer additional services and value to their passengers, resulting in an increased airline brand image (Baggage representative KLM, 2022) Additional revenue income when offering this service on their platforms (Baggage representative TUI, 2021). Providing a hassle-free journey to their passengers because of skipping the CI desks in the terminal (Baggage representative TUI, 2021).	Unfamiliarity with the new service leads to a lack of trust and fear of security issues regarding the baggage process and data sharing with third parties, especially for new start-ups that have not proved themselves (Baggage representative KLM, 2022). Doubts that the baggage service will fit in the overall sustainability journey goals of the airline due to the extra infrastructure needed to realize these services (Stakeholder observation KLM, 2021)
Airport	More optimal usage of the baggage handling capacity without building extra assets. Reduced CI baggage peaks during summer holidays. Provide passengers an increased travel experience in the terminal due to the reduction of waiting time at the CI desks and fewer crowds of passengers in the terminal (Baggage process expert RSG, 2021). Use the area that is not needed for long queues for something else (Bagpoint, 2021).	Fear for the lack of overview of all logistic parties operating at AAS (Baggage process expert RSG, 2021. Possible security issues on the airside of active commercial parties that will be inserting the baggage into Labip (Baggage process expert RSG, 2021). Expected complexity of setting up the requirements of a fair distribution of Third Parties and Logistic parties to operate to avoid monopolies (Baggage process expert RSG, 2021). Potential inefficient use of the baggage make-up area due to the storage of the after make-up baggage in Loading Units (AMUs), which can lead to less workspace for ground handlers to operate (Baggage process expert RSG, 2021).
Ground handler	Increase of turnover and profit by having more passengers, airlines, and airports using and offering their baggage services. More efficiency and less environmental impact when using Labip: the number of baggage delivery trucks will decrease because it is possible to merge the baggage into one or two trucks that the driver can insert into Labip together (Co-founder LuggageCare, 2021).	During peak hours, work pressure at the check-in desks will decrease because fewer passengers will be checking in baggage. Decrease of work pressure on baggage make-up during peak hours will decrease since a percentage of the baggage is already made up and waiting in AMUs. Logistic Parties will be inserting the early CI baggage by using Labip, which means that this percentage of baggage will not be needed to be checked in via the original CI manner. This could create less profit for the ground handlers directly. The number of AMUs parked in the make-up area could be standing in the way of ground handlers operating during baggage make-up. A possible barrier could be the lack of overview of the amount of baggage that needs to be made up earlier.
Third Party	Opportunity to use existing resources and infrastructure can be used for extra business (Co-founder LuggageCare, 2021). This growth will lead to additional revenues and profit.	Possible delays happen if passengers are not checked in online before the pick-up moment, which leads to scenarios that sometimes the baggage cannot be taken along (Co-founder LuggageCare, 2021). Passengers should have the baggage and passports ready at the door with all the passengers present, which is sometimes forgotten, leading to delays in the system.
Airline	The baggage service is too unknown, leading to airlines' lack of trust regarding the baggage services. As a result, airlines are unwilling to offer their passengers the services (Baggage process representative KLM, 2022). The baggage service is too unknown for passengers, and they also don't trust booking the service offered by a 'random' Third Party (Co-founder LuggageCare, 2021). Dependency on the time slots of AAS for making use of the 'voorrijweg' has a negative impact on the flexibility of inserting baggage at AAS (Co-founder LuggageCare, 2021).	

10.

CONCLUSION RESEARCH PHASE

The previous chapters in the research phase explored the background of the problem and topic and the context of BaaS. The possibilities at AAS for building an EBCS ecosystem and the drivers and barriers were addressed. The following conclusions and success factors are derived from the research phase and evaluated in the following section.

10. Conclusion research phase

Connecting to existing BaaS

The passenger needs to hand over their baggage well in advance to handle a percentage of the CI baggage before peak hours during summer holidays. Existing BaaS parties are responding to this change in handover timing, and therefore, Schiphol does not need to reinvent the frontend and backend of the service. It is an interesting solution to connect to existing BaaS parties to set up an ecosystem to realize peak shaving while taking the challenges, drivers, and barriers of EBCS into account.

Success factors for passengers

Most passengers are interested in EBCS since they gain a hassle-free journey while traveling to the airport. Especially the holiday travelers who want to avoid any negative experiences during the trip. Furthermore, the following aspects need to be taken into consideration for creating a successful EBCS: passengers would like to book the service during the flight ticket booking process, which means that airlines should provide the EBCS on their booking platform, the service must be clearly explained to avoid unexpected negative experiences and delays for passengers and the logistic providers during the baggage handling process, and the service must fit the original pack routine as much as possible regarding the pick-up timing.

In addition, passengers indicate that the most important factors that will influence the choice to use EBCS are cost, trust, handover location, and handover time.

- Current BaaS providers charge between €25-35 per baggage item, and market research indicates a preference of €0-25 per suitcase. The benefits of using the service need to be clearly explained to increase the fair price perception of the service.
- Trust can be increased by giving passengers a transparent baggage service and having regular status updates during the journey. This will give passengers the feeling of being in control over their baggage while traveling.
- In terms of the handover location, the preference is pick-up at home (or location of stay) and the choose between pick-up and drop-off is appreciated.
- Passengers want to have the flexibility of having a late as possible pick-up time slot on the day before departure to be able to change things in the suitcase at the very last minute.

Attract airlines

Currently, not many airlines are offering BaaS yet because they either don't trust the service or don't see the need to do so. KLM emphasized the challenge of building a sustainable infrastructure for such a baggage pick-up service and has not shown interest yet. Research indicated that passengers prefer booking the baggage service at the airline platform, during flight ticket booking or a few days before the flight. Therefore, airlines should be involved in nudging passengers to use EBCS. To successfully realize peak shaving by setting up the EBCS service, it is crucial for AAS to have airlines provide the baggage service to their passengers, especially the airlines who have a share in the morning peak, for example, TUI, United Airlines, Turkish Airlines, and KLM. For AAS, EBCS could solve the baggage capacity problem while for airlines it could mean additional revenues, a positive brand image, and an opportunity to provide more service to their passengers.

EBCS infrastructure

For setting up the backend of the EBCS infrastructure, this study indicated that the ideal timing of picking up CI baggage is as late as possible from the passengers' perspective. This implies that CI baggage handling before peak hours is best suited in area W between 02:00 and 04:00 to avoid additional peaks. Additional research must be done to find the optimal timing and storage window to utilize the storage capacity in the make-up area while fulfilling the wish of passengers to hand over the baggage as late as possible. Additionally, the baggage operation team of RSG and the process developer of Labip emphasized that the feasibility of the EBCS ecosystem will increase when Labip is used, which emphasizes the interest in Labip. Finally, clear arrangements need to be made to clarify the fair distribution of operating parties and guarantee privacy and security. However, these factors will not be in scope for the design assignment in this thesis.

11.

DESIGN BRIEF

Based on the key takeaways and conclusions described in chapter 10, a design brief is formulated to serve as the design focus in the design phase. A challenge is developed and translated into an assignment for the target audience. Key takeaways have been translated into design requirements and objectives for the ideation.

11. Design brief

Design challenge

The challenge of the project is to design a unique baggage service concept that will be attractive for airlines to offer to their passengers, that will be valuable for passengers to use, and that will realize the desired capacity peak shaving at AAS. Additionally, the challenge is to identify the role of AAS in setting up the EBCS ecosystem to realize peak shaving.

Design assignment

Design an attractive value proposition for AAS to nudge passengers to use EBCS, where Schiphol will act like a ??? , which airlines can offer to their passengers and be executed by all stakeholders in the ecosystem.

Target audience

The concept should be designed for holiday travelers who are non-frequent flyers, trying to avoid possible negative experiences. They are careful planners and certainty seekers with an age around 30 plus and traveling with a family.

Design criteria

The Design Specification (Criteria) consists of several requirements that need to comply with creating a 'good' design (Roozenburg and Eekels, 1995). A requirement is an aim that the design must meet in any design alternative. The program of requirements is a list of requirements and design goals based on the drivers and barriers of stakeholders in the EBCS ecosystem, listed in chapter 9.5.

The following design requirements are set, the concept must:

- Connect to existing BaaS parties.
- Integrate Labip in the ecosystem.
- Attract airlines to offer the service to their passengers on their booking platform, especially while booking flight tickets.
- Include the BaaS journey of a home pick-up service.
- Be designed for first-time users to incorporate the first-time nudging.
- Cost between between €0-25 euro per suitcase, depending on what the passenger will receive in return.
- Allow passengers to book a late as possible handover time slot: one day in advance of departing flight and an evening timeslot.
- Allow baggage to be sealed or locked.
- Be clearly explained.
- Provide baggage status updates.

Next to these requirements, there are six design criteria created based on the passengers' needs and wishes that are important factors that can influence their choice for the service. These design criteria are goals that need to be elaborated as extensively as possible and serve as a common theme in the design phase:

- Offer passengers the feeling of being in control during the baggage service.
- Offer passengers trust in the service.
- Offer passengers transparency in the baggage service.
- Offer passengers a good price perception regarding the service.
- Offer passengers the ultimate comfort while making use of the service.
- Offer passengers sustainable options in selecting the service.

DESIGN PHASE

12.

DESIGN APPROACH

Based on the completed research phase, the design brief is formulated. The design brief was the start of the design phase, the second phase of the Double Diamond Design approach. In this chapter, the design process is described as well as the methods that have been used for ideation.

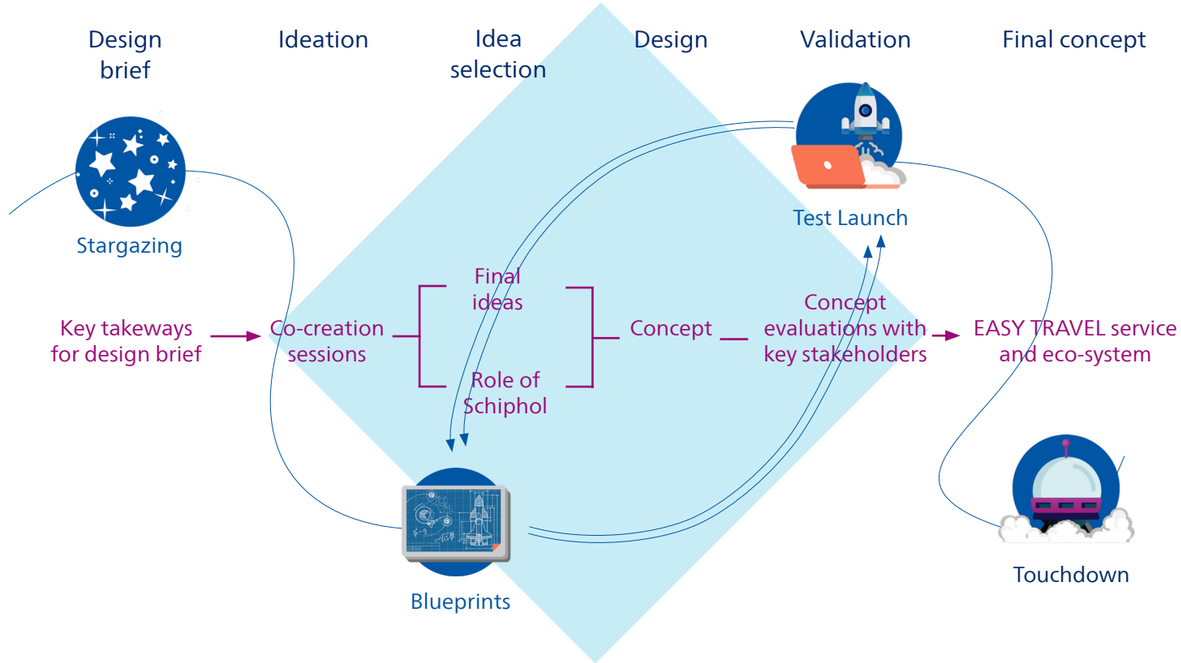


Figure 17: The second diamond of the project process, the design phase.

12.1 Design process

The formulated design brief is the starting point for the second diamond in the Double Diamond Design approach, seen in figure 17. The first phase is diverging and is called the ideation phase in this thesis report. First, this thesis used ideation techniques to gain a lot of ideas and as a next step, the participants of the ideation sessions clustered these ideas to create structure and overview. The best ideas were selected based on the design criteria, and final ideas were formulated. In the second phase of the diamond, called 'converging', the researcher translated final ideas into core features of the concept and identified the stakeholders' role. A customer journey was created to illustrate the interaction between the concept and the passenger. The key stakeholders evaluated and validated this concept, which led to the creation of the final deisgn of the service, 'touchdown'. Finally, the final concept is translated into a service blueprint and an implementation plan for the IH.

12.2 Design methods

The ideation techniques used were 'How To's', sketching future scenarios, and future value streams. Each method is explained below and how this thesis applied it in the ideation phase.

How To's

How To's (H2's) were used to start the idea generation and gain many ideas in a short time. In the H2's, the problem is reformulated in many different ways, and many ideas will come up quickly (Tassoul, M, 2006). Two sessions have been done, and for each session, a short introduction was given on the topic. Shortly after this introduction, the H2's were introduced, and an alarm was set for one minute for each H2. After that, the participants created as many ideas as possible, answering the H2 questions. Afterward, the participants discussed the ideas and made clusters.

Written future scenarios

The written scenario is a design method used throughout the design process to present ideas and concepts and is used in product concept evaluations (Jacko, J., et al. (2002). This thesis used this design method to create conceptual ideas and start a discussion among participants. Furthermore, this study used the method to sketch future scenarios of EBCS in 2028 to think out of the box and in the 'Moon' mindset. The group existed of six participants and was divided into two groups. One group was set to write a future scenario through the mindset of Schiphol in which they needed to play an active role. The other group was set to write a future scenario through the mindset of an airline and think of how the airline can play an active role. The other group was set to write a future scenario through the mindset of an airline and think of how the airline can play an active role. The setup is seen in Appendix D2 and the main insights derived from this sessions are discussed in chapter 13.2. The participants were given a starting point of the scenario they needed to think of while keeping the interests of every stakeholder in mind. Each participant got a template with the information they needed to fill in in 15 minutes individually. Afterward, each participant explained their future scenario briefly, and a discussion was started, in a total time of 20 minutes.

Future value streams

The design phase included an extended creative session of the future scenarios with the same six people mentioned in the setup of creating the future scenarios. This session was meant to generate ideas of possible value streams between stakeholders within the EBCS ecosystem. Creating future value streams was performed as a group assignment of 20 minutes, where an open discussion was held to create the most desirable setup.

13.

IDEATION

The ideation phase is discussed in this chapter. This includes creative sessions according to the design methods described in chapter 12, final ideas, and the ideation of the role of Schiphol. The main insights gained from the creative sessions were clustered into a concise group of ideas described in this chapter. The details of the creative sessions are listed in Appendix D. Finally, the final ideas and the role Schiphol should take in building an EBCS ecosystem at AAS were selected.

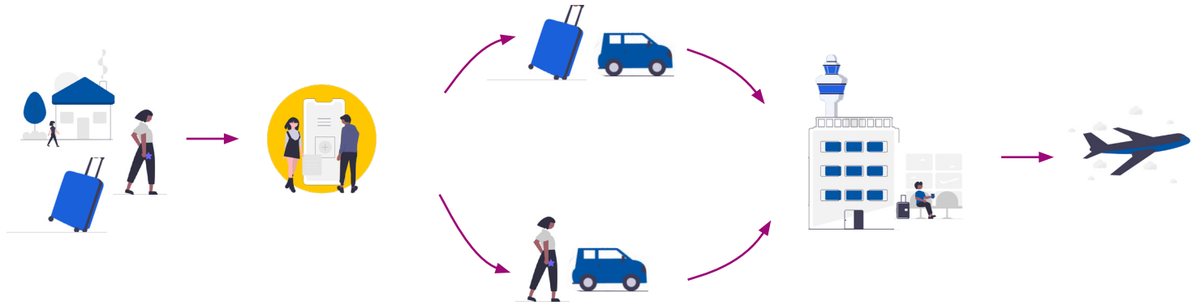


Figure 18: The outline of the passenger and baggage journey as the set up of sketching future scenarios in the ideation phase.

13.1 Creative session number 1

Session one was conducted live with the two supervisors of this thesis report since they have great experience regarding BaaS. The creative session's goal was to start the design phase by generating as many ideas as possible and new business propositions. In total, the participants filled in 12 H2's. These were based on the design goals set in the design brief: Price perception, the feeling of being in control, transparency, trust, ultimate comfort, and sustainability. The ideas derived from the H2's were discussed together and plotted on a whiteboard where the researcher listed the goals. Clusters were made and discussed. The passenger journey steps were outlined on a whiteboard for inspiration and to discuss the clusters' fit.

The main clusters that were derived from the creative session were as follows:

- Marketing the service creates trust and a feeling that the service is working correctly by showing reviews, example videos, and demos. This is a step before the journey step 'orienting' that could be included to take nudging a possible step further.
- Trust can be increased by informing the status and the corrections when the baggage journey changes and informing the passenger on time to continue to communicate with the user.
- Adding extra benefits to the service when using the baggage service creates a good value and price perception by giving rewards, vouchers, surprise bonuses, and optimal travel advice or upgrades in other steps in the journey. Giving rewards could also nudge passengers to use the more sustainable options in the journey.
- The service could be a digital twin for the explanation and assurance of the service for creating trust, the feeling of being in control, and transparency of the baggage journey.
- All the information must be in one app to create ultimate ease of use and comfort for the passenger.
- Personalization of the service could add to the ultimate comfort during the journey.

13.2 Creative session number 2

The participants in the second creative session were a group of two IH colleagues and four graduate students at the IH. The sessions existed of three parts: H2's, written future scenarios and future value streams. The details of the set-up and the results of the creative session are seen in appendix D.2.

Part 1: H2's

In the first part, the participants used H2's to gain ideas of which role(s) Schiphol can take in building the EBCS ecosystem and how Schiphol can spark interest for airlines to participate in the ecosystem. Then, these participants discussed their ideas, and each participant voted for the favorite three ideas. Afterward, the participants made clusters, and the votes were plotted to see the direct favors of the participants.

The main insights of the top voted clusters are the following. Schiphol must:

- Showi airlines the interest of passengers in EBCS.
- Show airlines the value of additional service for their passengers.
- Show airlines the complementing value to their loyalty program that can be filled in broadly.
- Show airlines the value of the opportunity for additional business propositions.
- Create the feeling of solidarity for problem-solving.
- Clearly show the solution for the problem.
- Set up an infrastructure for airlines to easily join the ecosystem.
- Actively connect stakeholders.
- Boost the ecosystem by being a catalyst and orchestrate.

Part 2: Ideal future scenarios

In part two, the group of participants was divided into two focus groups for creating the ideal future scenarios for EBCS in 2028. The first focus group needed to fulfill the passenger's needs through the mindset of Schiphol, and the second focus group was through the mindset of the airline. The set up of this creation session is listed in Appendix D2.

As seen in figure 18, an outline of the passengers and baggage journey was given to the participants to get inspired while sketching the future scenario. Then, the participants briefly described the future scenario, including the booking scenario and service payment. Furthermore, providing the baggage status is considered and where the information for the passenger is seen. At least, the value proposition is included in the future scenario. Each participant had 15 minutes to fill in the template, and afterward, the participants discussed the boards for 20 minutes in total.

Main insights for the value proposition for Schiphol:

- Creating a data-driven baggage handling system by adding the end-to-end journey of the passenger to get insights on the number of baggage items arriving at Schiphol.
- Adding dashboards for all stakeholders to get real-time data on passenger behavior to learn from and optimize the system.
- Adding the 'powered by' for creating a name.

Main insights for the value proposition for airlines:

- All the information for the passenger is integrated into the airline app, including the baggage status and service information.
- Create an extension of the baggage service and include the crowd data of Schiphol as well to give passengers advice in the travel journey to and at AAS. This data is also integrated into the airline app based on Schiphol's data already showing in the Schiphol app.
- A premium service for passengers will create loyal passengers who can book the service more often based on the premium model and loyalty points. This will create an extension in their business model, which can be added and changed iteratively.

Part 3: Future value streams

Part three created future value streams with the participants together in a group discussion. The participants explored the value streams between the passengers, an airline, AAS, and a Third Party. A few setups for value streams between stakeholders were created.

Main insights:

- The value streams between passengers and Schiphol for anonymously knowing the passenger behavior and informing passengers the crowds in the terminal.
- The value streams between the Third Party and the airline will support the baggage status information.

13.3 Final ideas

The main insights derived from the creative sessions were reviewed. The final ideas were selected based on the alignment of the six design goals set in the design brief (feeling of being in control, trust, transparency, price perception, ultimate comfort, and sustainability). Three main features were selected for the passenger: the baggage pick-up service, receiving rewards and receiving travel advice. These three features are described as follows and are meant to be included in the airline app to generate trust and convenience towards the service.

1. Baggage pick-up service

The idea is that the airline app will provide the passenger with clear information about the complete baggage journey from pick-up until loading onto the aircraft. Furthermore, the app will provide clear instructions on service usage. The airline app will give the baggage status updates, and corrections will be informed when needed. Passengers can book the service during the flight ticket booking flow as well as a few days in advance.

2. Rewards

To nudge passengers to use the baggage service, the passenger will receive rewards or discounts, for example, vouchers for coffee or snacks at the terminal or discounts for the next journey. Schiphol, the airline, or the Third Party, will support these discounts. This gives the passengers extra value when using the service and contributes to a "premium" journey.

3. Travel advice

The passenger will get personalized advice for the best transport to the airport and gate and time spent in the terminal as an extra service. This will create extra value and convenience and nudge the passenger to use the service.

13.4 Role of Schiphol

Seen the created future scenarios and value propositions for Schiphol and the airlines, two possible roles were defined: Schiphol can act as a service provider or a connecting adviser.

As a service provider, Schiphol sets up and facilitates the ecosystem by collaborating with Third parties, connecting to the relevant stakeholders, and providing a pre-programmed system with the three features described in chapter 13.3. These three features can be implemented in the existing airline app and be adapted to the airlines' own look and feel.

As a connecting adviser, Schiphol indicates passenger interest in the baggage service and additional features to the airlines and helps airlines connect to Third parties to set this up. In addition, Schiphol will advise the airline to include the personal travel assistant and rewards in the existing airline app to fulfill passenger needs.

Based on the design assignment, the fact that Schiphol is the owner of the BHS and has the challenge to optimize existing baggage capacity, it seems most logical that Schiphol will act like a service provider of the ecosystem. This will enable Schiphol to be the so-called 'spider in the web' by providing and orchestrating the service.

14.

CONCEPT

A concept was developed based on the ideation sessions and selected final ideas. The three features of the ideation are translated into the three core features of the concept: Baggage caretaker, the Reward & benefit system, and the Personal travel assistant. The chapter describes the concept idea with the role of Schiphol and details of the core features. Furthermore, a customer journey was created based on the airline TUI to illustrate the interaction of the concept with the passengers.

14.1 Concept idea

The concept is called the 'EASY TRAVEL' service to indicate that convenience extends not only to a baggage service but to the entire travel of the passenger. The EASY TRAVEL service is a baggage service for passengers where hold baggage is being picked up at the passengers' home before departing flight. This will enable passengers to travel hassle-free to Schiphol without their hold baggage and skip the check-in desks. The participating airlines offer the EASY TRAVEL service to their passengers via their own booking platform, and Schiphol provides the operational backend of the service via a baggage ecosystem. Multiple commercial Third Parties could collaborate with Schiphol to set up this baggage ecosystem that airlines could choose from to cooperate.

Schiphol develops a white label API (Application Programmed Interface) and provides this to airlines to integrate into their own airline app and design into their look and feel. This API includes the three core features of the Baggage caretaker, the Reward & benefit system, and the Personal travel assistant. This creates one convenient location for passengers with all relevant information about the journey and the baggage status, which is provided by stakeholder data.

14.2 Detailed explanation of the features

Each core feature has multiple designed sub-features, explained in the following section.

Baggage caretaker

Information about the whole service

The passenger selects the baggage service during the flight ticket bookings flow. Animation of how EASY TRAVEL service works will be illustrated when a passenger selects hold baggage for the trip. This information is in the app as well as the information of how to prepare for pick-up moment, including online check-in before pick-up moment and all passengers and passports present during pick-up moment.

Picking a timeslot

The passenger can choose a timeslot for picking up the baggage. By offering different prices, the passenger can be nudged to choose the most sustainable or convenient option. The sustainable option is a timeslot which is calculated based on the most efficient route. The sustainable option is free and the selection of a more specific timeslot, such as the latest window, costs extra money. Picking the timeslot can be done during the bookings flow so that the passenger does not have to think about the baggage service anymore until the day before the pick-up moment, which increases the ultimate comfort.

Payment

To nudge the passenger to choose this service, the baggage service is offered at a lower price when booking the EASY TRAVEL service during the flight ticket booking. The baggage service will be an additional service listed in the overview of the options chosen in the bookings flow. The airline can decide if the EASY TRAVEL service is paid for with cash, with loyalty points or offered for free for frequent travelers.

Bag status updates

The EASY TRAVEL service offers a Track&Trace in the app for communicating the baggage status with the passenger. By implementing the Track&Trace interface in the app, the passenger can always access the baggage status with a few clicks in the app. By adding a Track&Trace link for the passenger to see, the feeling of safety will increase by 50% for business travelers and 35% for holiday travelers when they mentioned the service's unsafety (Passenger insights, 2021). The information in the app will be used to inform the passenger about the baggage process: the pick-up person is on its way, the baggage is picked up, the baggage is in the warehouse, the baggage is at the airport, and the baggage is on the aircraft.

Corrections

When changes in the baggage journey are not regular, the EASY TRAVEL service can directly communicate the corrections and solutions to the passenger to avoid unexpected surprises and changes.

Reward & benefit system

Credits

The passenger receives credits when using the EASY TRAVEL service, which can be used during the trip. Each airline can decide how these credits can contribute to their existing loyalty program. The reward & benefit system's main focus is to give passengers a good price perception of the EASY TRAVEL service by spending these credits during their trip or saving them for the next trip. The passenger can use these credits for discounts on coffee, food, and restaurants in the terminal and drinks in the aircraft. The passenger could receive loyalty points if the public transport is used to decrease the number of cars arriving at the departure area for dropping passengers. The app creates a QR code that restaurants and shops in the terminal can scan for the passenger to receive the discount. The passenger will continuously have the 'premium' feeling while using the service, not only because of traveling without baggage from home to the airport but for the whole journey until being in the aircraft.

Personal travel assistant

Personalization

The passenger can specify personal preferences for traveling from home to the airport, given the mode of transport. In addition, preferences can be given in much time to spend on the total journey and in the terminal.

Advice

Based on their personal preferences, the EASY TRAVEL service will advise passengers the ideal time for leaving home, which means of transport is best, and how much time the passenger has to get from home to the gate. This could be based on Google Maps or the application 9292. Additionally, the app will provide a map with traffic in the airport terminals and routing recommendations based on the traffic in the terminal.

14.3 Customer journey

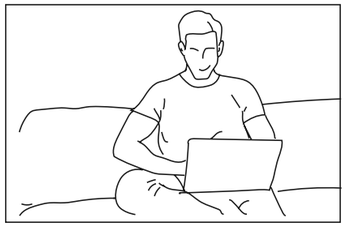
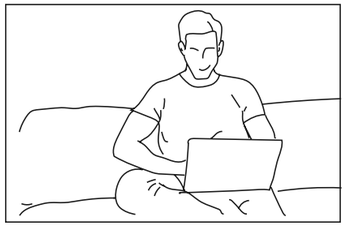
A customer journey is created to illustrate the interaction between the passenger and the service seen in figure 19. The airline TUI was chosen to elaborate the concept since TUI has a large share in the CI baggage peak in Area West, which enables late pick-up due to the possibility of baggage handling during the night. Furthermore, TUI is already working together with the BaaS company Bagpoint. The essential interactions with the TUI app are illustrated in the customer journey.

Figure 19: The customer journey with the interaction between the passenger and the implemented EASY TRAVEL service in the TUI app.

Day before pick-up moment

TIME

CUSTOMER JOURNEY

Orienting	Booking	Confirmation	Packing	Preperations
 Get inspired and search for tickets on booking platforms	 Select two hold baggage items to bring on the holiday	 Receive a comfirmation e-mail with the explained benefits to connect the documents to the TUI app.	 Seperate hand luggage with hold luggage and pack the hold baggage.	 Receive message of a more consise pick-up time slot
 Select the flight tickets	 Get informed by the EASY TRAVEL service and select the service	 Check the overview of selected bookings in the TUI app. Feeling excited about the super convenient journey ahead.		 Receive reminders of how to prepare the pick-up moment such as online check-in.
 Choose a pick-up time slot and a discount is given for the sustainable option.	 Look into detail how the EASY TRAVEL can be filled in for the trip.			
 Receive an overview of the selected options and fullfill the payment.				

Day of pick-up moment

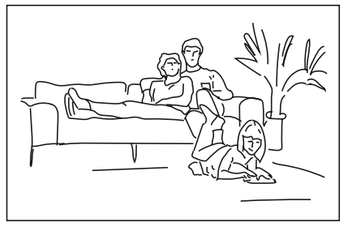
Day of pick-up moment

Evening before departing flight

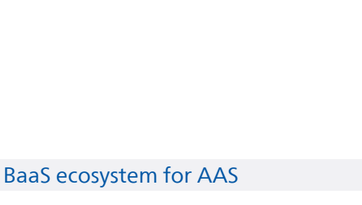
Day of departing flight

Day of departing flight

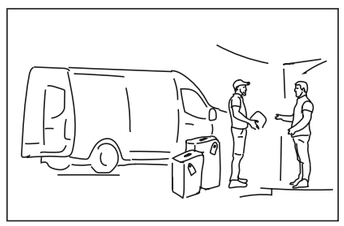
Baggage handover



Receive message that baggage will be picked up in 15 minutes



Ding-Dong! The pick-up service is here! Check boarding pass and passport.



The baggage will be weighted, sealed and labeled.

After baggage handover

Receive message that baggage is picked up and that the baggage is safely transferred to the warehouse.

Receive a notification that your personal journey can be further unburdend by filling in a few preferences.

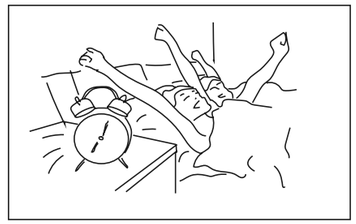
Final preperations

Look at the choices of how to spend the amount of loyalty points for the next day and select a few or save them.

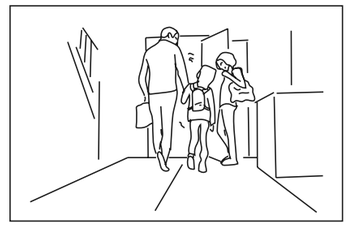
Filling in the preferences for the modality to the airport and spending time.

See an overview of departing times from home and advice in transport modality to the airport. Receive points when using NS train.

Leaving the house



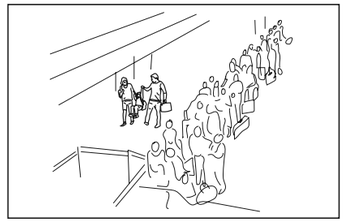
Travel day!



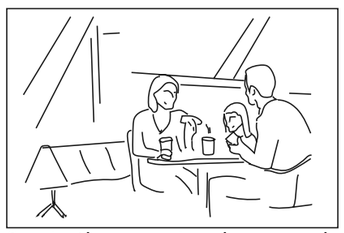
Lock the door and leave home with only hand baggage.

Receive a notification that baggage is at Schiphol and see the overview of baggage status.

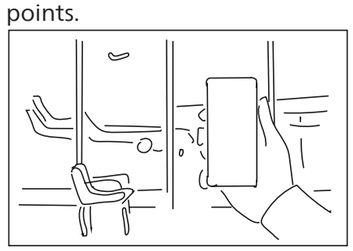
At the terminal



Skip the check-in desks and go straight to the security check.



See in the overview how much time you still have to spend spare time. Still some time to go for a coffee from loyalty points.



Receive a notification that the gate is opened and receive a map of how far the gate is.

15.

CONCEPT EVALUATION

In this chapter, the EASY TRAVEL concept is evaluated. Stakeholders were interviewed to validate the created concept on fulfilling needs and identify challenges. Key takeaways were selected based on the design requirements set in the design brief and translated into recommendations for optimizing the final concept.

15.1 Stakeholder evaluation

Stakeholders were interviewed to validate and finalize the concept. This involved the two airlines TUI and KLM with each airline one representative, the RSG baggage operation team (existing of four persons), and the two owners of the Third Party LuggageCare. The main topics discussed were the role of Schiphol, the use of the airline app, and a few details about the features 'Baggage caretaker' and the 'Reward & benefit system'. In addition, the service costs and the increased passenger experience when using the service were elaborated.

Evaluation method stakeholders:

1. Show the customer journey.
2. Explaining the added value for each stakeholder.
3. Evaluate the concept.
4. Discuss the challenges.

Schiphol as a centralized service provider

LuggageCare indicated that this concept would let their business grow due to the centralized offered service by Schiphol. Furthermore, they indicated that trust in the EBCS ecosystem would be increased by having a big trustworthy name as AAS to launch the baggage service and provide the baggage service centralized at AAS (Co-founder LuggageCare, 2021). TUI emphasized the flexibility of being able to choose their own Third Party for collaboration, which highlights airlines' need for control in this ecosystem as well (Baggage representative TUI, 2021). In addition, the baggage representative of KLM made the following statement: "For some airlines, it is a bigger risk to join the ecosystem than for others, for example, our sister company Transavia can better afford mistakes when the concept is still in its infancy, but KLM, for example, cannot." KLM indicated preferring to wait until the ecosystem is implemented and already working smoothly with other airlines. The threshold for KLM to join this ecosystem is lower than with the current BaaS because Schiphol would control the backend as a trusted party.

Use of airline app

The airlines TUI and KLM validated the added value of providing passengers an 'all-inclusive app' for the baggage process, flight information, and travel advice to avoid extra complexity and lack of overview for passengers using the baggage service. The third party LuggageCare already offers an API and has validated that the value of creating one information and communication point for passengers provides convenience and an easy implementation for airlines.

Baggage caretaker

The stakeholders emphasized the value of informing the passenger with the baggage status as well as the corrections. The co-founder of LuggageCare highlighted that the baggage status update of 'the baggage is loaded onto the aircraft' may cause complexity. This is because this step is not included in the IATA regulations for providing information, which means that airlines should be willing to add this in their tracking steps themselves.

Reward & benefit system

Since TUI currently does not have a loyalty program, this could be an excellent opportunity to start this baggage service by offering a loyalty program (Baggage representative TUI, 2021). KLM representative argued that the baggage service should be the main focus of the service and suggested implementing the Reward & benefits system when the baggage service has proven itself.

Costs of the service

The airline argued that the API of the EASY TRAVEL service should be provided fro free to the airlines since Schiphol is facing capacity issues and has the greatest benefits from shaving the peak (Baggage representative TUI, 2021). This indicates that TUI see the added value of offering the service to their passengers but still see it as an additional service instead of realizing the benefit of reducing pressure on the baggage handling process during peak times. On the other hand, the benefits for the airline and its passengers were clearly seen, but whether this would outweigh the problems Schiphol is facing was not yet clear for estimating a business case (KLM baggage representative, 2022).

Increased passenger experience

The baggage operation team of RSG highlights the added value for Schiphol, airlines and passengers of fewer terminal crowding and congestion during the summer holidays. They believed that the EASY TRAVEL concept will improve the passenger experience in the terminal which is important for Schiphol: "Passengers does not only hold the airline accountable for a bad experience in the terminal and Schiphol wants to provide a great experience for their passengers as well.", a baggage process expert of RSG.

15.2 Passenger evaluation

On behalf of the passengers, seven participants evaluated the concept. These interviews were held in person to be able to have an in-depth discussion about specific questions or remarks. The method used for evaluating passengers was focused on the six design criteria: the feeling of being in control, trust, transparency, price perception, ultimate comfort, and sustainability.

Evaluation method passengers:

1. Show the customer journey to the passengers.
2. Explain the added value for passengers.
3. Evaluate to what extent the needs fulfill every step of the journey according to the six design criteria.
4. Brainstorm how the service can be improved.

Feeling of being in control

"The biggest pro of this concept is skipping the line, which is my biggest uncertainty when traveling with hold baggage. With this service, I will have more control over my journey because that uncertainty is removed for me."

"The personal travel advice creates a thought-through planning which ensures no unexpected negative experiences."

"That this service also factors in the crowds at the terminal makes me feel better about my travel time expectations and preparations."

Trust

"When the travel agency is telling me when to leave my house or the restaurant in the terminal, I would trust that definitely because they also don't want me to miss the flight."

"I think I would like to know who the pick-up person is, like with Uber for example, where the license plate is shown or something like that." - This indicated the preference of an identity validation of the pick-up person.

Transparency

"I like that the baggage updates and corrections are always visible and I don't need to click on a link or check my e-mail."

"What about if the baggage is still loading into the aircraft while the passenger is already on the aircraft? I can imagine getting nervous if the last update in the app 'The baggage is on the aircraft' is not checked yet." - This indicated the possible concern if the last baggage update has a delay in the process.

Price perception

"I like the idea that passengers can use the credits during the trip."

"Wow, is sealing included in the price of the service? So that is a bonus because that is like €5 extra right?" - This indicated the added value of including sealing in the price.

"I happen to know how the ING points works and often it is the case that I still have to pay extra even though the Dutch bank indicated that customers can use the number of points immediately." - This indicated that there were still questions about the usage of loyalty points.

"I get the idea of loyalty points, and I like it. However, the feeling of being rewarded is yet a bit unclear for me. Maybe include why these loyalty points are given." - This indicated that getting a reward for using the service should be emphasized more.

"I might be interested how the price is built upon because I am living in Amsterdam, but I can imagine that the price will go up when I will be living in Friesland." - This indicated the interest in the price formulation. After a discussion, the interviewee concluded that it will have its advantages and disadvantages for changing the price based on the living distance. The lack of price information will not influence the choice of booking the service for this interviewee.

"I find it a reasonable price, and I like the idea that I will receive a discount when I book the service during the flight ticket booking flow. Can I use the points for the next baggage service as well? - This indicated the desire to use the points for the second time, which was not listed between the possible loyalty points expenses.

Ultimate comfort

"Skipping the check-in desks is my biggest advantage of this concept."

"Because this service frees passengers' hands while traveling from home to the terminal, one respondent said: "It will make me forget that I am going on a holiday with hold baggage".

Another respondent mentioned the comfort of not going to Schiphol as early as usual: "I will be leaving my house at the time when I travel with hand baggage".

"Because everything is in one app, it makes it easy to manage the different pieces of information I will need during the trip."

"I like that I am being supported through the steps of using this baggage service and traveling from home to gate. This gives me a reassurance feeling."

Sustainability

"I like the idea of receiving loyalty points when people will be traveling by train."

"I think I can start to feel guilty if I will be the only one in my area who uses this service. I don't have that feeling when I've placed an order for a package because I know that I am not the only one. Perhaps something can be invented here such as indicating that my pick-up timeslot is the most sustainable and has been selected for that reason, or insights in reducing the environmental impact due to decreased taxi's arriving." - This indicated the hesitation regarding the environmental impact the service will have.

15.3 Discussion

Seen the evaluations of the concept with the key stakeholders, it is important to have a critical point of view regarding the interviews to name possible influences on the final outcome and indicate the limitations.

Online interpretations

Unfortunately, the evaluation interviews with airlines, RSG baggage operation team, and LuggageCare were held online. This could have led to misinterpretations between the interviewees and researcher of this thesis.

Target group interviewees

The researcher screened the interviewees for experiencing the pain points while traveling with hold baggage to receive targeted feedback. The evaluations with passengers were in real life, which was helpful to support questions and discussions while outlining the customer journey. In doing so, it was challenging to find participants who fit the target audience, and because of that reason, seven participants were interviewed and they needed to try to empathize with the target audience. Concluding, the evaluation is limited and should be expanded with further evaluation and validation.

Prototype usage limited

The created designs integrated into the TUI app were presented in PowerPoint. This could have limited the understanding of the interfaces and could have influenced the given feedback. Additionally, the focus was less on the designs when interviewing the airlines, LuggageCare and the baggage operations team because they were more interested in the set-up of the ecosystem.

15.4 Key takeaways

The EASY TRAVEL service and the designed backend of the concept were evaluated and discussed with key stakeholders. These points of interest are translated into key takeaways:

- The airlines indicated that their passengers could be interested in the concept.
- Both airlines, third party and passengers indicated that the integration of the features and information in the airline's app is of great value, including the use of an API.
- Overall, all interviewees were enthusiastic about the concept and saw many benefits in every area of the design goals.
- KLM indicated they would rather join the ecosystem at a later stage when there is more proof that it is valuable and viable.
- Sustainability remains an issue but will not be worked out in the final concept.
- Issues to be further worked out:
  - Transparency regarding the baggage process and -tracking of the latest step.
  - Trust regarding the ecosystem and parties involved.
  - The price perception of the passenger.

15.5 Recommendations

Based on the key takeaways, the following recommendations for optimizing the final concept are defined:

Be cautious about giving information about baggage

A passenger mentioned that the informing the step of 'baggage is loaded into the aircraft' could cause stress when the baggage is not yet on the aircraft while the passenger is. This shows that there is a need to be careful not to give too much information which can cause stress. In addition, LuggageCare mentioned that it might not become feasible or desirable for airlines to inform the passenger whether the baggage is loaded onto the aircraft since no airlines are tracking that yet, and it is not a mandatory track step in the IATA regulations. The step of 'baggage is loaded into the aircraft' will be excluded from the service. The other steps of informing the passenger about the baggage status was evaluated as an added value when traveling without hold baggage.

Increase trust during the baggage handover moment

According to the passenger evaluation, there was a need for increasing trust regarding the passenger handover moment. It was mentioned to include a form of identity check such as current taxi companies like Uber. Based on the brainstorming moment, it was concluded to include a verification method, such as an identification code, between the passenger and the pick-up agent.

Emphasize the feeling of being rewarded more

Passengers emphasized the added value of receiving rewards. It has been mentioned that it is still somewhat unclear why these credits are given and what the passenger can do with them. More emphasis is needed to highlight the explanation and use.

16.

THE EASY TRAVEL SERVICE

The recommendations are integrated into the final service design, resulting in the optimized EASY TRAVEL service. In this chapter, a summarized explanation of the frontend and backend of the service and ecosystem is given. This is followed by detailed service illustrations based on the airline TUI. After that, the service benefits for each stakeholder in the EBCS ecosystem and the corresponding value streams are described. Next, a service blueprint is created to illustrate the service's frontend and backend structure according to the customer journey. A proposed implementation plan for Schiphol follows this.

The
EASY TRAVEL
service

Lets you travel in ultimate comfort and without hold baggage

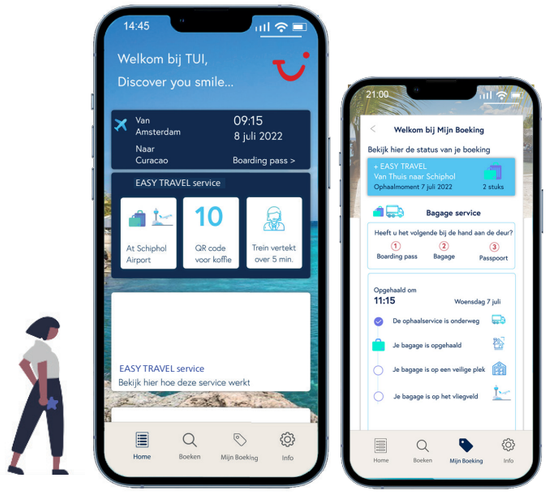


Figure 20: The EASY TRAVEL service ecosystem and the service for the passenger.

16.1 Explanation

The EASY TRAVEL service is a baggage pick-up service for passengers traveling with hold baggage. The service is designed to attract holiday travelers by responding to the need for convenient traveling without hold baggage to and at Schiphol. By introducing the EASY TRAVEL service, Schiphol is able to influence the timing of processing CI baggage in order to shave the expected capacity peak.

Schiphol will take the lead in building the EBCS ecosystem by collaborating with the necessary third parties to provide the baggage service. Airlines will be the interface towards their passengers and will offer the EASY TRAVEL service as an additional service on their booking platform. Schiphol will develop an API that will serve as an interface tool to support this ecosystem where the backend of three service features is arranged. This API can be easily integrated with the existing apps of airlines and can be adapted to their own brand, making it attractive for airlines to implement it.

The EASY TRAVEL service consists of three features; the baggage caretaker, the reward & benefit system, and the personal travel assistant. These features provide extra value to the passengers and will help to nudge them to use them. The EASY TRAVEL features are seen in the airline app, supporting the trust and convenience of having all travel information at one location. In figure 20, an illustration of the ecosystem and EASY TRAVEL service is listed. The following section summarizes each feature, the backend, and the passenger's interaction on the frontend.

Baggage caretaker

Schiphol will take the lead in connecting to Third parties that want to collaborate in the EBCS ecosystem. This will create a pool of Third parties and their infrastructures for airlines to choose from and to connect to. Schiphol acting like a centralized agent will create trust and make it as easy as possible for airlines to choose a Third Party to collaborate with.

The EASY TRAVEL service can be chosen during the booking process when the passenger selects hold baggage for the trip. The service provides the possibility to select a late as possible or sustainable timeslot, information about the preparation for pick-up, and the baggage status updates in the baggage journey with potential corrections to ensure a safe and secure baggage process. This will provide the passenger the feeling of being in control, trust, sustainability, and transparency regarding the baggage service.

Reward & benefit system

This service component consists of various opportunities to reward the passenger for using the service, such as discounts on stores, restaurants in the lounge, tickets for NS trains, or drinks in the aircraft. In addition, Schiphol can provide centralized updates through the app. At the same time, the airline can determine the additions of the loyalty points themselves that are suitable to their own loyalty program. The airline will have the opportunity to start a loyalty program if they don't have one already.

The passenger can use the provided discounts in the app during the trip. The app will generate a QR-code to scan and collect the discounts. This will create the feeling of being special and being rewarded for using the service to the passenger, resulting in a good price perception towards the service.

Personal travel assistant

Schiphol will connect to the public transport infrastructure and existing traffic maps in the Schiphol app to provide travel advice to the passenger. This advice will be a detailed route and map to and at Schiphol and will be an interaction between a passenger's travel and time preferences and the congestion at Schiphol to provide the best real-time advice.

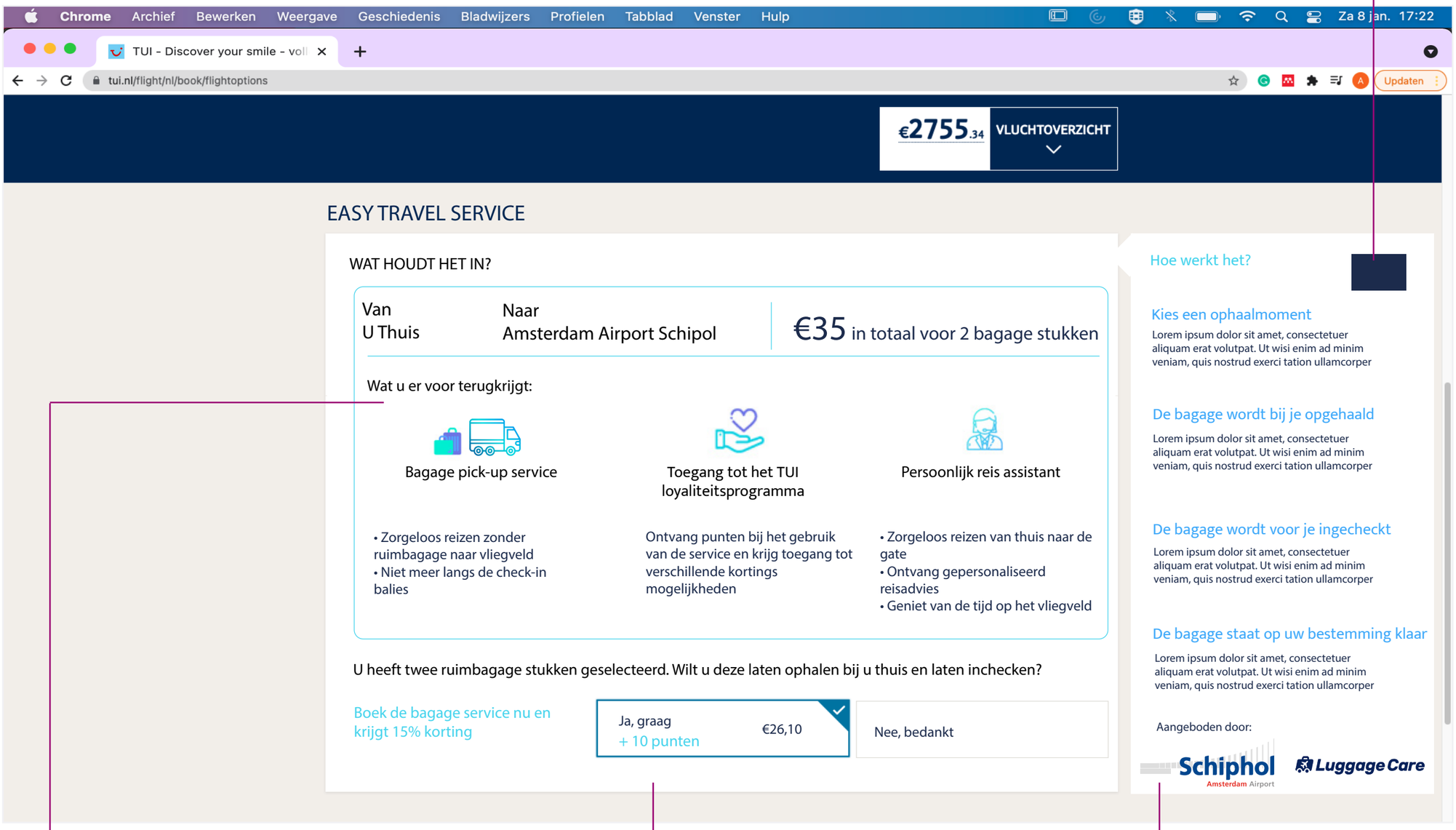
The passenger specifies the preferences on how and how much time to spend in the terminal and the transport to Schiphol. In addition, the app provides detailed travel advice that will create the feeling of being in control and transparency during busy summer days at Schiphol and the ultimate comfort of not worrying about being too late and missing the flight.

16.2 Service components

The service's features address the expected requirements and objectives of the passengers. These are highlighted through interfaces in the TUI app to demonstrate the interaction between the service and the passengers, seen in figure 21 on the next pages.

Figure 21: The EASY TRAVEL service integrated in the TUI booking platform and app.

Informing the passenger how the service works with an animation video explaning the steps in the process



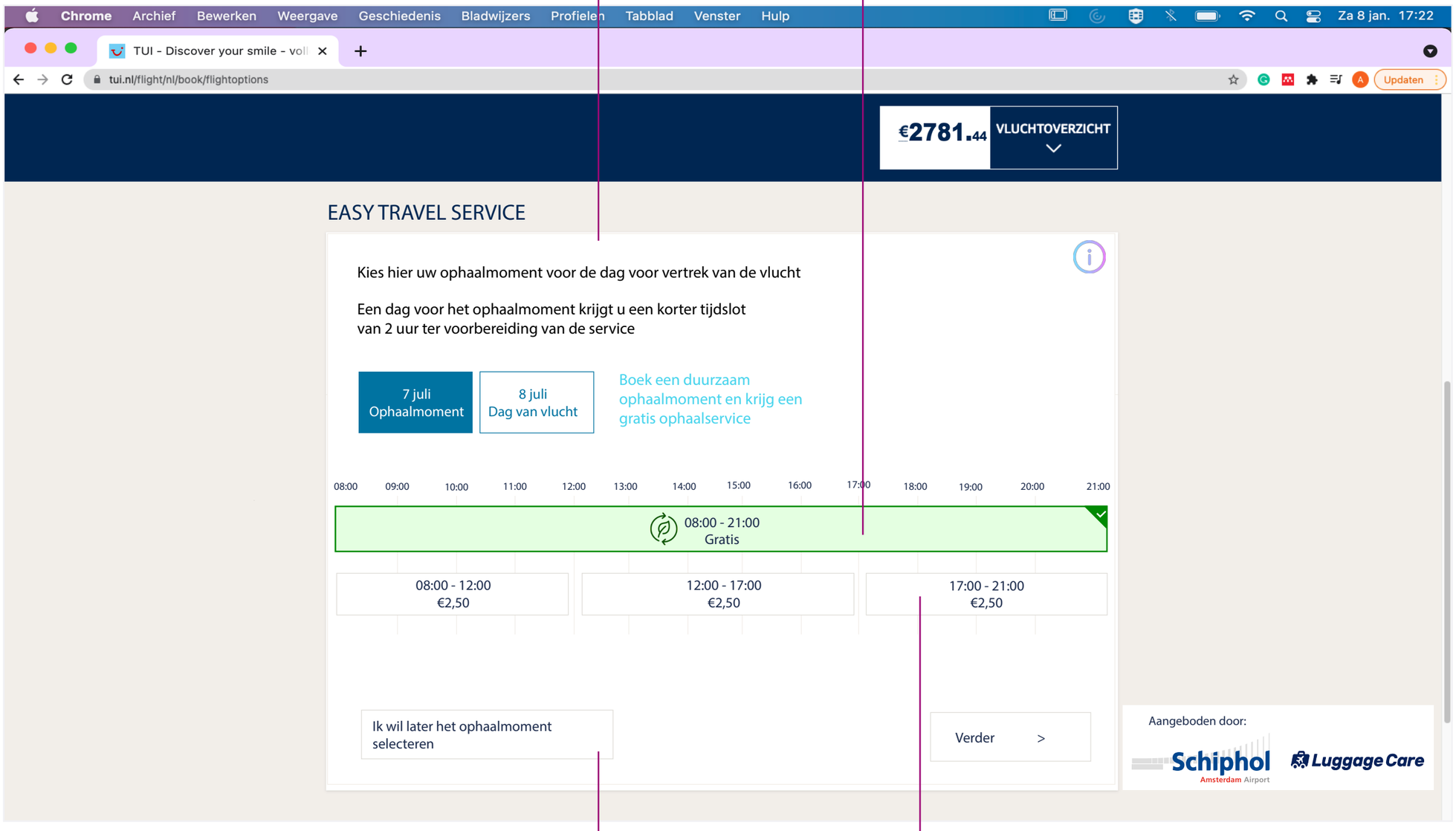
Informing what the benefits are of the service and what the passenger wil get in return

Nudging passengers to book the service together with booking the flight by making the service cheaper.

Naming the companies that are realizing the service

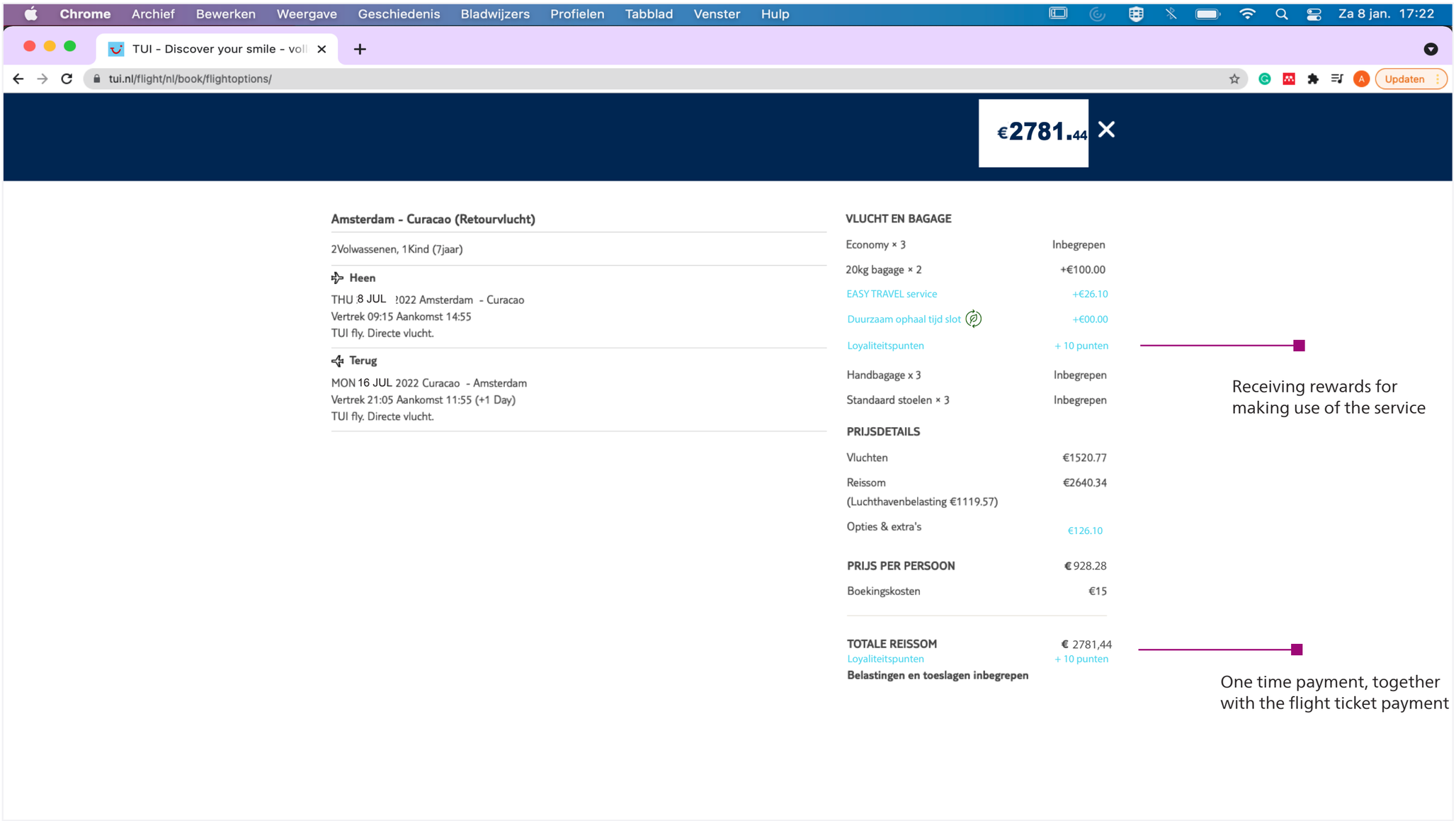
It is explained that the timeslot will be more concise when the best route is created.

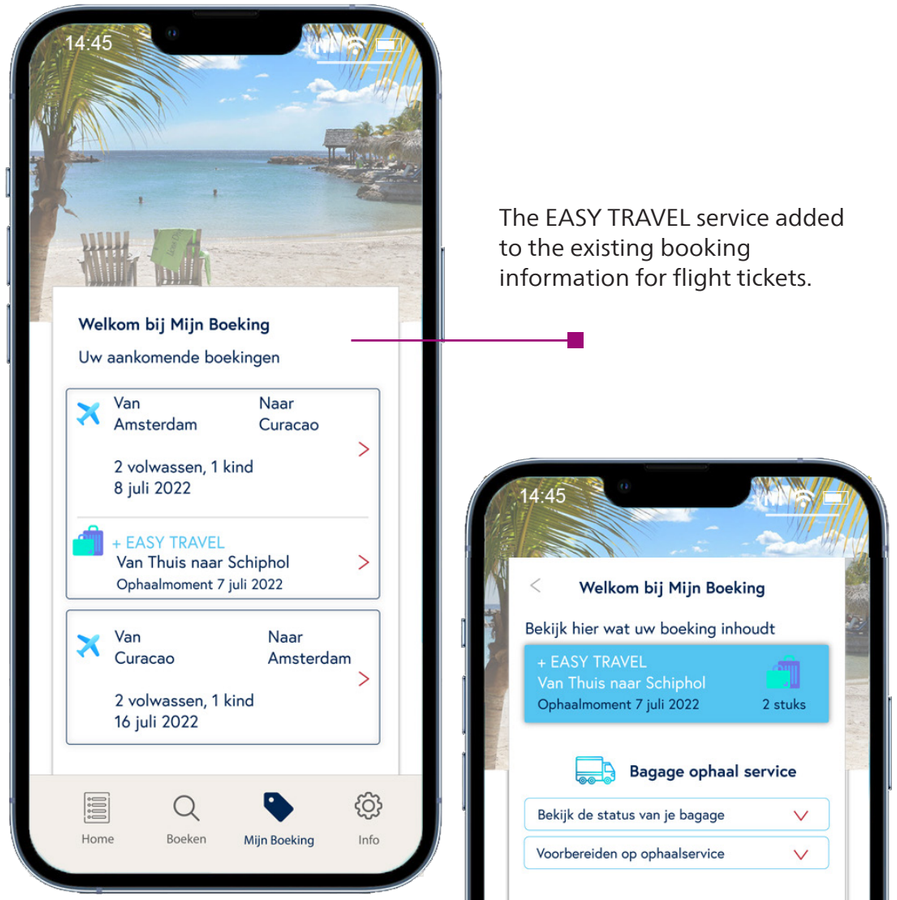
The passenger will be nudged to select the sustainable option or needs to pay extra for a more consice pick-up timeslot option.



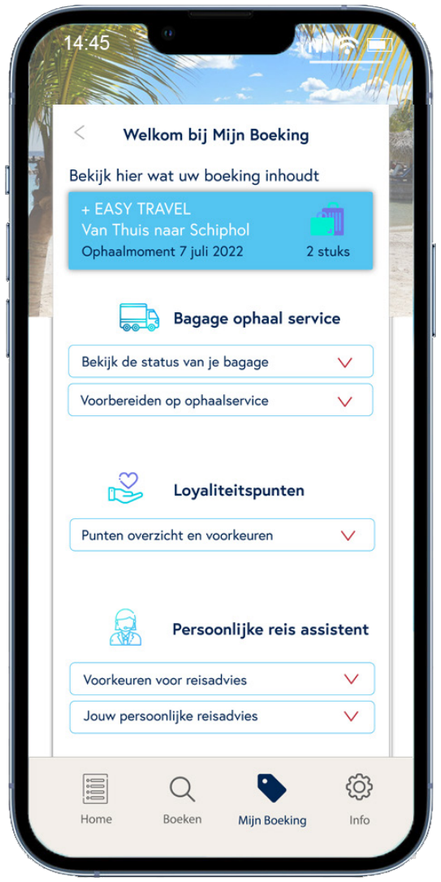
The option to choose the pick-up time slot later in case passengers don't know this yet.

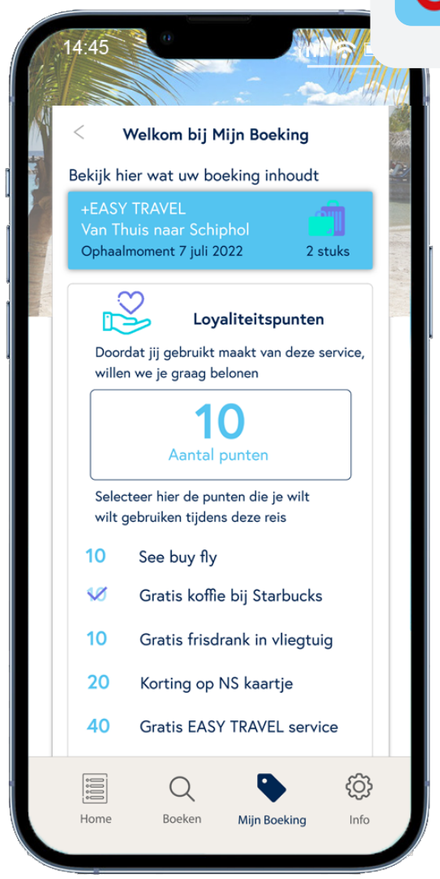
Option late pick-up time slot


Chrome Archief Bewerken Weergave Geschiedenis Bladwijzers Profielen Tabblad Venster Hulp
Za 8 jan. 17:22
TUI - Discover your smile - vol
tui.nl/flight/nl/book/flightoptions/
Updaten
€2781.44
Amsterdam - Curacao (Retourvlucht)
2Volwassenen, 1Kind (7jaar)
Heen
THU 8 JUL 2022 Amsterdam - Curacao
Vertrek 09:15 Aankomst 14:55
TUI fly. Directe vlucht.
Terug
MON 16 JUL 2022 Curacao - Amsterdam
Vertrek 21:05 Aankomst 11:55 (+1 Day)
TUI fly. Directe vlucht.
VLUCHT EN BAGAGE
Economy × 3 Inbegrepen
20kg bagage × 2 +€100.00
EASY TRAVEL service +€26.10
Duurzaam ophaal tijd slot +€00.00
Loyaliteitspunten + 10 punten
Handbagage x 3 Inbegrepen
Standaard stoelen × 3 Inbegrepen
PRIJSDETAILS
Vluchten €1520.77
Reissom €2640.34
(Luchthavenbelasting €1119.57)
Opties & extra's €126.10
PRIJS PER PERSOON € 928.28
Boekingskosten €15
TOTALE REISSOM € 2781,44
Loyaliteitspunten + 10 punten
Belastingen en toeslagen inbegrepen
Receiving rewards for making use of the service
One time payment, together with the flight ticket payment



The EASY TRAVEL service added to the existing booking information for flight tickets.

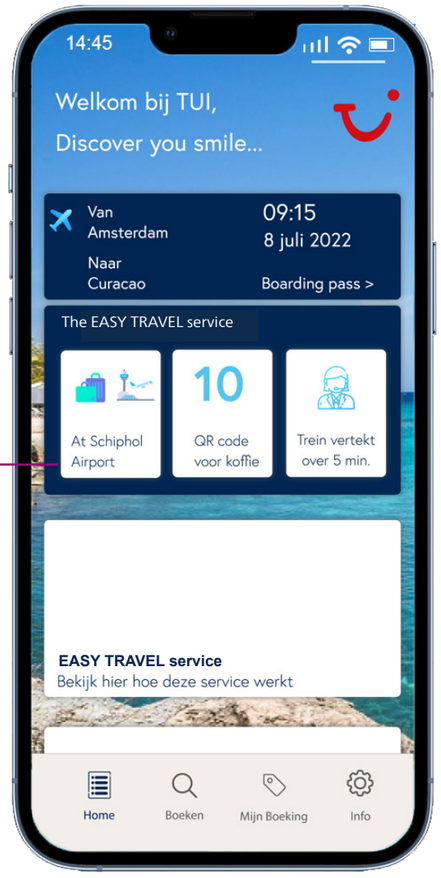


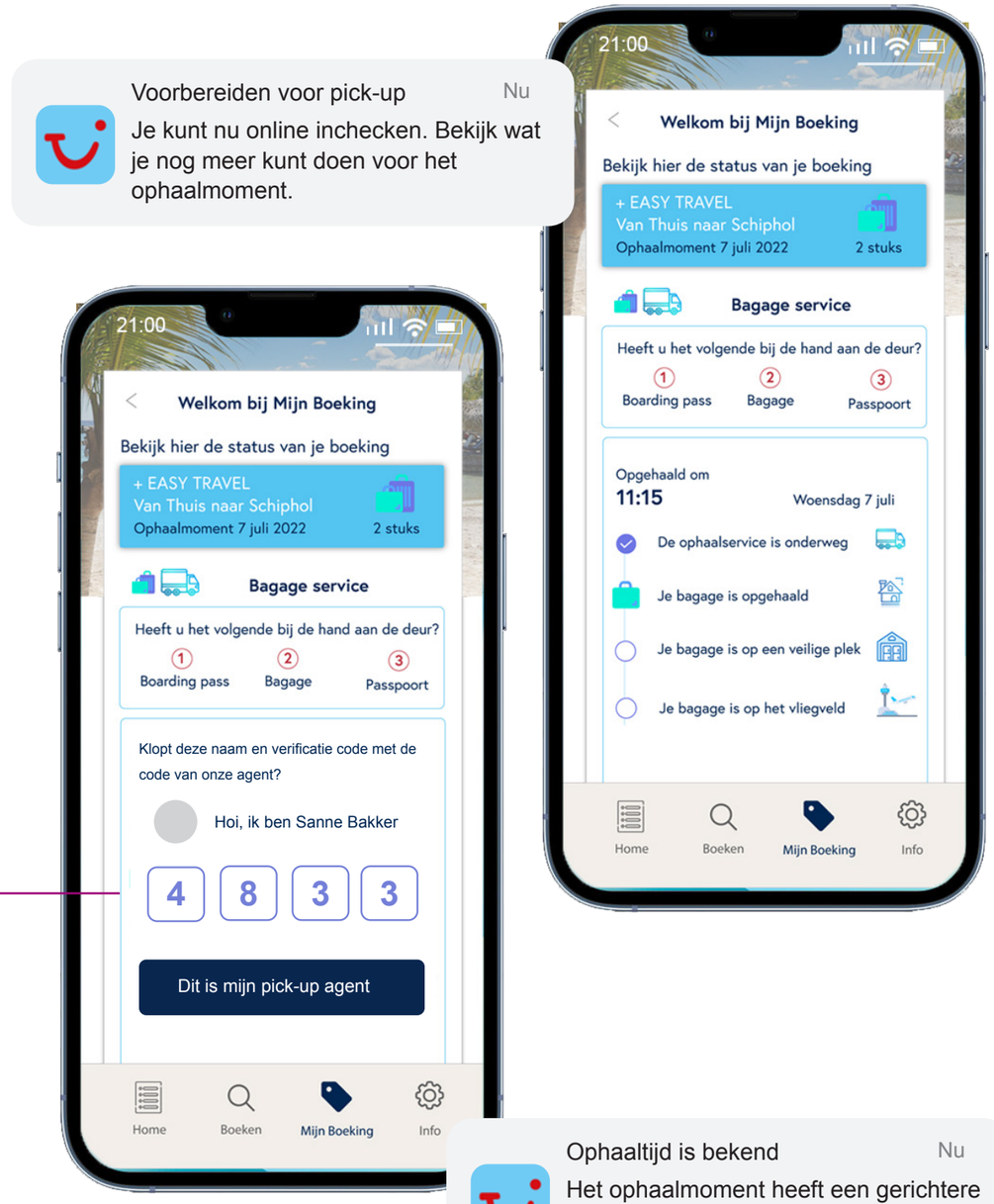


Punten inzetten voor de reis Nu

Bekijk de mogelijkheden hoe je de punten zou willen gebruiken tijdens je aankomende reis.

The homescreen including an overview of the three core features





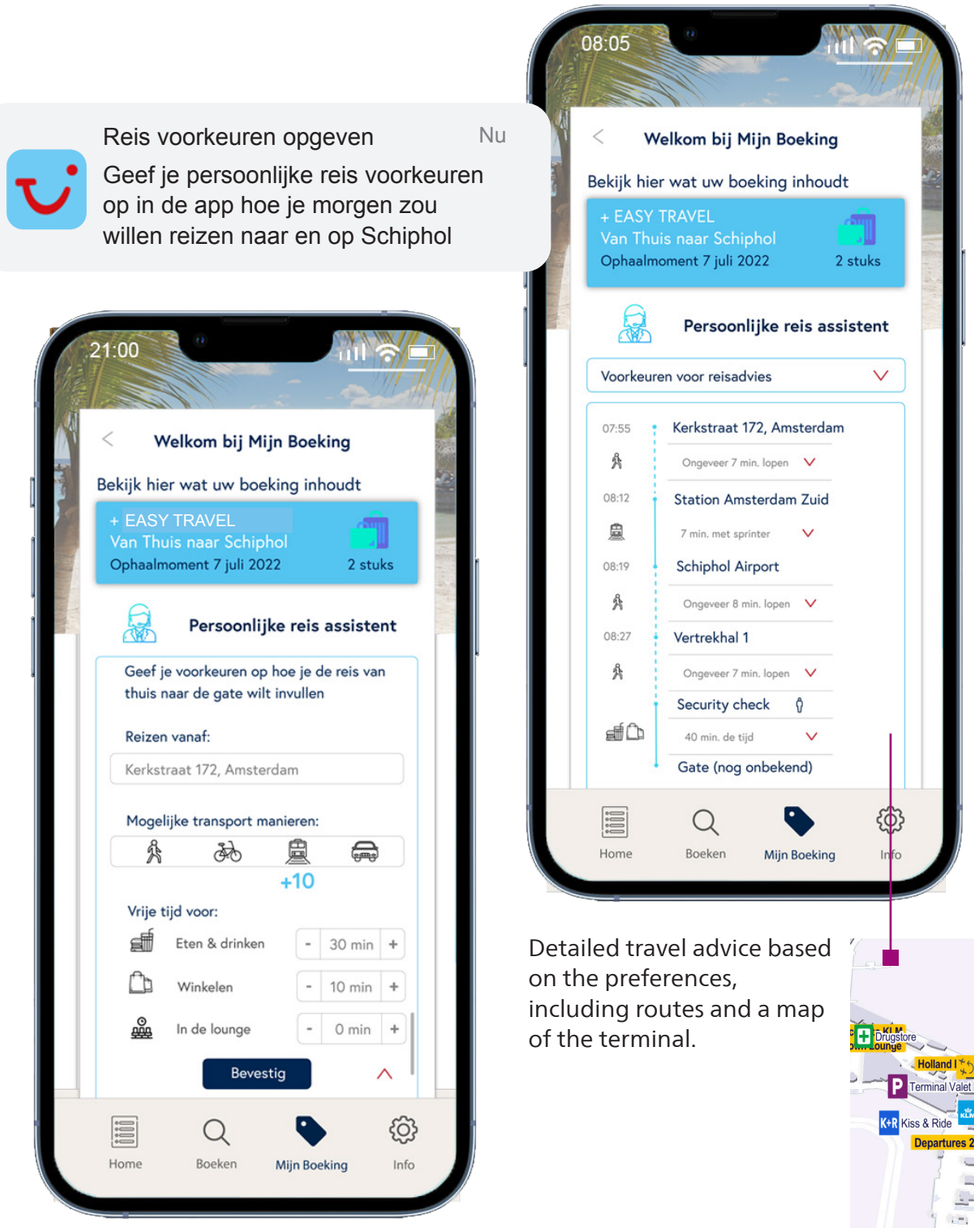
The verification code for the agent and the passenger to varify the identity

Ophaaltijd is bekend Nu

Het ophaalmoment heeft een gerichtere tijd gekregen, gebaseerd op de duurzaamste rit.

Baggage is opgehaald Nu

Je bagage is opgehaald en is onderweg naar een veilig plek. Bekijk de details in de app.



Detailed travel advice based on the preferences, including routes and a map of the terminal.

16.3 Value proposition

All actors in the ecosystem can capture value from the revenue stream that is jointly generated, which is a mutual benefit of collaborating with all partners in the ecosystem (Bluemink et al., n.d.). By combining the strengths of each stakeholder in the EBCS ecosystem, new business opportunities will arise and a value proposition for the passenger is created. Value streams between the stakeholders in the EBCS ecosystem are evaluated in the following section and seen in figure 22. Moreover, an example of the additional money streams between stakeholders is described to highlight the costs difference for Schiphol during and outside peak hours.

Value streams

This thesis created different value streams, including the data streams and the product between stakeholders and the outcome of this service, emphasized in the following section.

Data

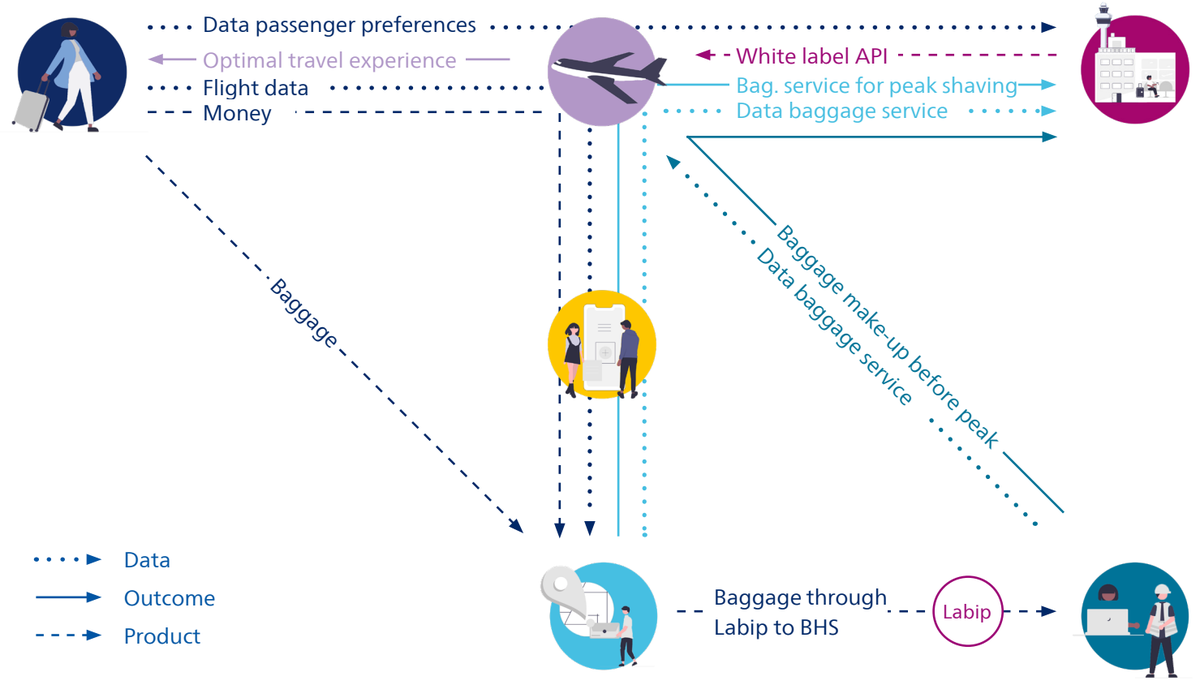
The flight data includes the boarding pass, number of passengers, and baggage included in the booking. This information is needed for the handover moment with the Logistic Provider. The data stream from the Logistic Provider is outlined through the Logistic Provider and airline towards Schiphol to highlight the information needed to interact with the passenger on the frontstage and for Schiphol to have insight into peak shaving. The data stream from the ground handler, through the airline towards Schiphol, highlights the current structured baggage information between these parties, which is also needed for Schiphol to have insight into peak shaving. Finally, the data stream, including the passenger preferences, is outlined through the airline to Schiphol, representing the gained passenger insight for the airlines and Schiphol.

Product

The passenger purchases the service from the airline, who in turn pays the Third Party for realizing the service, and the third party will be paying the Logistic Provider. A detailed overview of the possible money streams is illustrated in figure 23. An assumption is made that the API is offered for free by Schiphol to airlines to stimulate the early adoption of the EASY TRAVEL service and participation in the ecosystem.

Outcome

The figure included the outcome to indicate who is the interface towards the passenger and who realizes the backend of the service. The airline is the interface towards the passenger in offering the baggage service and providing the best advice for the travel to and at AAS for an optimized experience. The Logistic Provider picks up the baggage, transports it to the distribution center and Schiphol, inserting it into Labip. Ground handlers realize the baggage handling process at the airport, including make-up before peak hours and loading onto aircraft.



▲ Figure 22: The value streams between stakeholders, including the value of data, product and outcome for the EASY TRAVEL service.

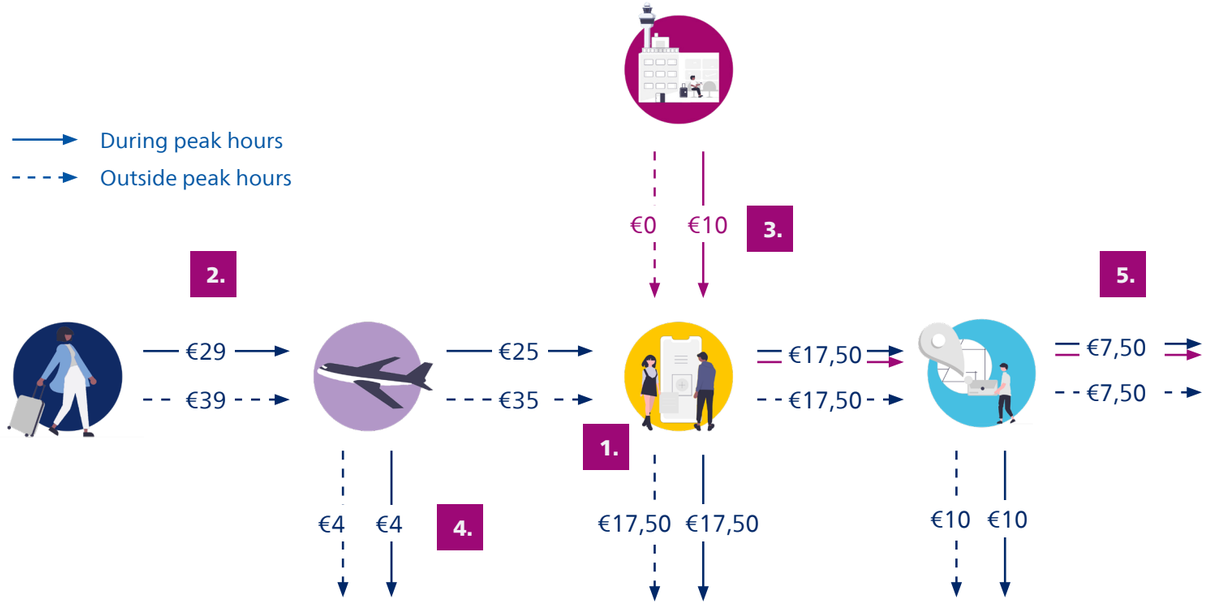


Figure 23: An example of the additional money streams between stakeholders in the EASY TRAVEL ecosystem, during and outside peak hours.

Money streams

A scenario is sketched of the expected costs and profit streams to illustrate the cost difference for Schiphol during and outside peak hours. An example of the money streams was made to indicate the transfer of money in this ecosystem, which are additional costs. The costs and profits were complex for parties to estimate since there is no insight into this yet.

A rough estimation was performed, based on the current €35 charges for one of two suitcases for the LuggageCare service. This amount was chosen because in the customer journey two suitcases were selected, illustrated in chapter 14. This scenario was created based on the early adoption of the service in the ecosystem, which means that it could be a starting point for launching the service on the market.

A further explanation is given according to the numbers illustrated in figure 23:

1. The €35 for two suitcases is the starting point in this scenario. A part of this amount of money is for paying the Logistic Provider FedEx, and a part is a profit for the Third party LuggageCare. The money streams towards the ground handlers are not considered due to the assumption that no extra costs will be made.
2. The costs for the passenger should be at the maximum of €29 for two suitcases during peak hours to nudge the passenger to make use of the service.
3. Schiphol will cover the remaining part of €10 to the Third Party because they want to create the incentive to book the service by passengers to shave the peak.
4. The amount each party will remain for profit is an assumption to indicate that the airlines, third parties, and logistic providers want to receive profit out of this ecosystem. Schiphol is in this scenario not receiving profit directly.
5. Because this is an early adoption scenario, the goal is that the demand for the service must increase during peak hours to shave the peak, and the costs for the logistic providers is expected to decrease with more demand. Therefore, it is recommended that the costs and profit distribution should be further discussed for the service to be adopted by the early majority.

16.4 Service blueprint

A service blueprint is a technique used for service design and provides insight into how the organization's customer experience is created for all channels and touchpoints (Essence, 2021). It shows the front stage (the user experience) and the backstage (the operations and processes). A service blueprint is created to illustrate how the passenger interacts with the EASY TRAVEL service and which functions of each stakeholder are integrated into the ecosystem, seen in figure 24.

An explanation is given how the service blueprint of the EASY TRAVEL service is built:

- Time: indicating the timing of each step in the journey.
- Physical evidence: the tangible elements support the passengers' actions.
- Illustrations: the customer journey steps illustrated.
- Customer actions: the passenger's steps as part of the EASY TRAVEL service.
- Line of interaction: the separation between the customer actions and the frontstage actions indicates the interaction with the physical evidence.
- Frontstage actions: the passenger's visible contact actions with the physical evidence.
- Line of visibility: the separation between the passenger's frontstage (visible) and backstage (invisible) actions.
- Backstage actions: the invisible contact actions that take place directly behind the visibility line.
- Line of internal interaction: the separation between the backstage actions and the support processes, which indicates the stakeholder support in the ecosystem.
- Support processes: activities that support the backstage actions.

This service blueprint is an example of how the passenger journey could look like with the supported processes of the stakeholders in the ecosystem. This means that the selected journey is not the only option how the service works and that some steps in the journey can be changed, described in the following section.

Booking flow

The passenger may visit centralized websites where the booking of flight tickets is arranged, such as vliegtickets.nl. When the passenger has fulfilled the booking on that kind of platform and receives a confirmation email from the airline, the EASY TRAVEL service could be offered together with the current extra offered services such as car rental and available accommodations. The EASY TRAVEL service could be provided on those centralized websites but was left out of scope in this thesis.

Notification versus email

This study chose the service blueprint to illustrate the interaction between the passenger and the service updates according to a notification message via the airline app. It might be that some passengers do not like receiving notifications and prefer to receive an email. It is possible in the app to indicate this preference but was not shown in the service blueprint.

Timing of filling in travel preferences

This study decided to let the passenger give their preferences for traveling to Schiphol after baggage pick-up moment. This was set in the evening while some passengers might like to have insight into their journey to Schiphol earlier. The service blueprint does not incorporate this option. Still, it is possible to indicate the preferences whenever the passenger wants them, just as how Google and NS allow the passenger to receive travel advice about a day later in the week.

TIME

FEW MONTHS BEFORE PLANNED VACATION

TWO DAYS BEFORE FLIGHT

PHYSICAL EVIDENCE	Website airline Computer	Website airline Computer	Website airline Computer	Website airline Computer	Website airline Computer	Website airline Personal e-mail Computer	Airline app Smartphone	Airline app Passport number Smartphone	Airline app Smartphone
ILLUSTRATIONS									
CUSTOMER ACTIONS	Search and select flight tickets	Select two hold baggage for trip	Receive information about EASY TRAVEL and select the service	Select timeslot for pick-up	Pay for the tickets and baggage service	Receive confirmation of the selected items and QR for the app	Receive message for reminder to online check-in	Online check-in and receive boarding pass	Receive message for more concise pick-up time slot
Line of interaction									
FRONTSTAGE ACTIONS	Provide options for flight tickets	Provide option for selecting hold baggage	Provide option to select EASY TRAVEL service	Provide options for available timeslots		Provide confirmation of booking and QR code	Notification with reminder	Provide boarding pass	Notification with pick-up time
Line of visibility									
BACKSTAGE ACTIONS				Receive available timeslots			Translate information into message	Translate information into confirmed baggage process for pick-up	Translate information into message
Line of internal interaction									
SUPPORT PROCESSES				Provide available timeslots Receive confirmation of selected timeslot	Payment process		DCS information of passenger		More concise pick-up timeslot available

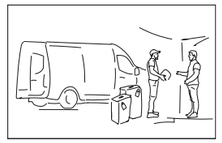
▲ Figure 24: The service blueprint for the EASY TRAVEL service.

ONE DAY BEFORE FLIGHT

DAY OF FLIGHT

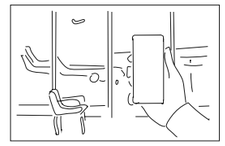
Smartphone	Airline app Smartphone Pick-up person	Suitcases Passports family Airline app Pick-up person	Airline app Smartphone	Airline app Smartphone	Airline app Smartphone	Airline app Smartphone	Airline app Smartphone Item to purchase	Airline app Smartphone	Airline app Smartphone









Receive call that baggage will be picked up	Check the provided code	Hand over baggage at the door	Receive message for baggage confirmation and next steps	Filling in personal preferences for travel journey	Receive message about baggage status	See overview of how much time left before train is leaving	Get a discount on coffee	Receive message that the gate is opened	See the map of the terminal and walks to gate
Call passenger for preparation for pick-up	Provide the verification code	Scan passport and weigt, label and seal baggage	Notification of confirmation and inform next steps	Provide options for travel preferences	Notification of baggage status update	Provide overview of travel advice	Provide QR code	Notification of opened gate	Provide map for walking towards the gate
Information of pick-up timing	Generate the verification code to match	Receive information about baggage		Personal travel advice Reward & benefit program	Translate information into message	Translate updates in real-time information for travel advice	Create QR code for selected expense of reward & benefit program	Translate information into message	Translate information into map of Schiphol to the gate
	Code to verify	Baggage in pick-up truck		Available discounts Google, NS and traffic at AAS info	Baggage transport to AAS, via Labip into BHS	Scan for updates		Available gate information	Map of Schiphol Terminal

Ease of travel because of hassle-free traveling from home to the airport without hold baggage, skipping the check-in desks, save time and not worrying about the baggage.

Ease of use since all the information about the baggage service, flight information, rewards and benefits, and the personal travel advice is included in one app.

Increased feeling of being in control and trust during the trip due to combination of a transparent baggage service and a personal travel assistant.

Feeling of being in control and increased comfort by explaining the preparations for the pick-up moment so the passenger will understand what to expect, ensuring a smooth handover.

Increased feeling of control by the ability to pick a timeslot as late as possible which helps towards the acceptance of the new pack routine.

More revenue and business opportunities by extending their business of offering their service commercial, like LuggageCare.

Increased trust regarding commercial third parties because a big name like Schiphol is taking the lead in facilitating the EBCS ecosystem, and airlines are the interfaces of offering the service to their passengers.

Reduced workload during CI baggage insertion and make-up during peak hours.

Additional revenue by offering extra services.

Increased brand image, trust, and loyalty by offering the EASY TRAVEL service to their passengers.

Increased insight in their passenger behavior to and at AAS, which can be used for personalized rewarding offers to passengers and possible new business opportunities.

Stimulate a kick-start for peak shaving by inserting CI baggage earlier into the BHS.

Decreases the fear for lack of overview of parties operating at AAS by a centralized offering of the baggage service. The service, rules, and regulations will be determined by Schiphol and will not take place between Third parties and airlines.

Offering passengers an improved positive experience in the terminal due to the reduction of waiting lines and offering personalized travel advice, including a map of the terminal.

Direct insight into the baggage service and passenger behavior which can create new business opportunities.

Increased influence on passengers arriving at Schiphol by advising and rewarding passengers to use public transport instead of arriving in taxis or drop-offs.

More revenue.

Higher demand in using the infrastructure.

Decreased risk of delays in the baggage pick-up process due to increased clarity for passengers to prepare for the handover moment.

16.5 Benefits of the EASY TRAVEL service

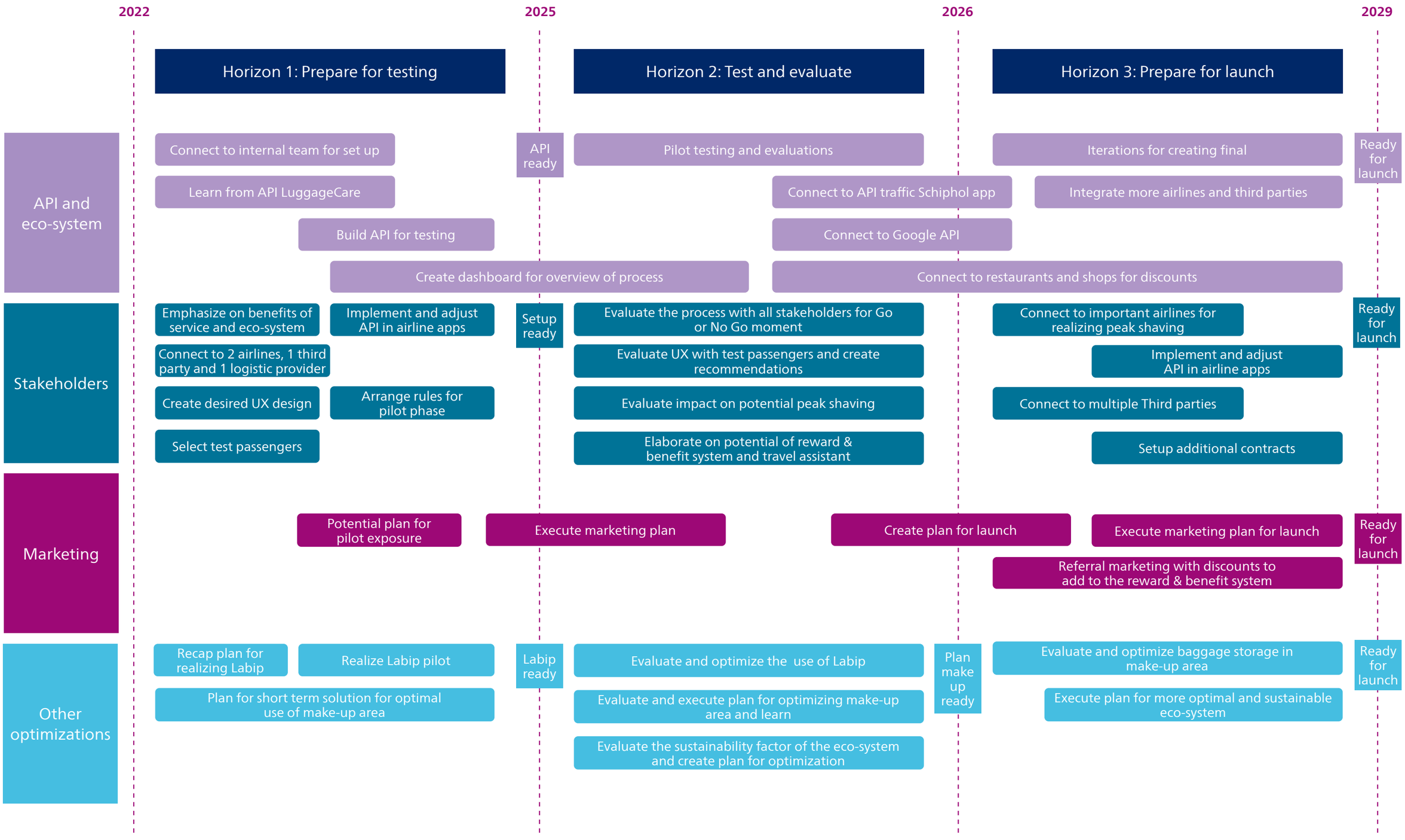
The EASY TRAVEL service has the following benefits for each stakeholder, listed on the left. These points strengthen the drivers and address barriers identified in chapter 9.5.

16.6 Implementation roadmap

All stakeholders in setting up the ecosystem are equally important. There will be challenges and uncertainties for each stakeholder, which are necessary to explore and address. Therefore, it is important to start small and test this concept together with all stakeholders involved to learn from it and build upon it further in order to realize the final concept. A strategic implementation roadmap for Schiphol is created to illustrate the step-by-step process to prepare for the final launch of the ecosystem. This roadmap is seen in figure 25 on the next pages.

Three horizons were created to indicate how to set up the EASY TRAVEL service and ecosystem test, evaluate and learn from it, and prepare for the final launch. The advice is to involve those stakeholders who are interested and willing in investing time and money to participate in the test.

Figure 25: The strategic roadmap for the implementation of the EASY TRAVEL service and its designed ecosystem at AAS.



17.

DESIGN REVIEW

The conclusions in chapter 10 were included as key success factors and requirements in the design brief in chapter 11. This chapter reviews the EASY TRAVEL service according to these success factors and requirements, and its applicability.

17. Design review

Hereby, each design requirement as described in chapter 11 is reviewed on its applicability for meeting the design assignment.

Connect to existing BaaS parties
The existing BaaS are part of the ecosystem since the designed service will use their infrastructure. Airlines have the option to collaborate with their preferred party.

Integrate Labip in the ecosystem
Labip is an important success factor in realizing the EBCS and will increase the feasibility and viability of the ecosystem. Labip is planned to be realized in the summer of 2023.

Attract airlines to offer the service to their passengers on their booking platform, especially while booking flight tickets
The API can be easily integrated into the airline's platform. The EASY TRAVEL service provides airlines additional revenue, enables them to increase their brand image and expand their business based on passenger insights. Schiphol is the backend service provider and provides the API, which is easy to integrate into their booking platform and their existing app.

Include the BaaS journey of a home pick-up service
The EASY TRAVEL service is designed and evaluated for home pick-up.

Be designed for first-time users to incorporate the first-time nudging
A reward & benefit system is designed to create loyalty and returning use. The extra benefit of a personal travel advise could nudge passengers as well. The service is clearly explained with animations to support the first-time use.

Cost between €0-25 euro per suitcase, depending on what the passenger will receive in return
The first estimated price is €29 for two suitcases during peak hours to nudge passengers, where Schiphol covers the actual expected costs. This price elasticity can be used in nudging passengers even more.

Allow passengers to book a late as possible handover time slot: one day in advance of departing flight and an evening timeslot
Since the ideal baggage handling moment in area W is between 02:00 and 04:00, it is possible to pick-up the baggage until 22:00 one day in advance of departure. Passengers will be nudged to use a sustainable timeslot through price setting. The implementation of Labip will enable this late pick-up timeslot through the fast insertion of baggage into the BHS.

Allow baggage to be sealed or locked
This depends on the Third party, LuggageCare provides baggage sealing on the doorstep.

Be clearly explained
The EASY TRAVEL app explains step-by-step how the service works, how to prepare and what the passenger can expect.

Provide baggage status updates
A Track&Trace and informing corrections are included in the app until the baggage arrives at AAS.

In addition to these specific design requirements, six design criteria were listed in the design brief that served as a common theme in the design phase. These criteria needed to be included extensively in the final design to nudge passengers, and its application is evaluated in the following section.

Offer passengers the feeling of being in control during the baggage service
The passenger feels in control due to the provided information of how the service works and how to prepare for the baggage pick-up moment (online check-in in advance and all travelers and passports present). This decreases the possibility of experiencing unexpected scenarios during pick-up, and a smoother baggage process will be achieved. Furthermore, the passenger is in control of the baggage due to baggage status updates and of its own journey to and at Schiphol because of the personal travel assistant who gives personalized and real-time advice about the trip.

Offer passengers trust in the service
Next to sealing the baggage to ensure a safe baggage process, the passenger can verify the pick-up person during pick-up by means of a verification code to ensure security and trust in the baggage process. Furthermore, passengers' trust regarding the service is gained because airlines and Schiphol are offering the service instead of an unknown Third Party.

Offer passengers transparency in the baggage service
From the moment the baggage is picked up, the passenger can see the baggage status at all times in the airline app. Additionally, corrections in the baggage journey are reported immediately via notifications. Furthermore, the passenger knows how the service's backend works because of the provided information of the service and which parties are involved.

Offer passengers a good price perception regarding the service
In addition to the benefit of traveling to Schiphol with only hand baggage and skipping the check-in desks, the reward & benefit system and personal travel advice provide extra value. These features are only available with the EASY TRAVEL service and give a 'premium' feeling and help nudge passengers to use it. Compared to the existing BaaS services, the EASY TRAVEL service can be offered at a lower price during peak hours, where Schiphol covers the costs.

Offer passengers the ultimate comfort while making use of the service
The EASY TRAVEL service enables passengers to travel hassle-free without hold baggage to Schiphol. The personal travel assistant gives personalized travel advice based on transport modality and spending time preferences at the airport. Furthermore, all the travel information is available at one location in one app, ensuring that the passenger has one overview to provide peace of mind and comfort.

Offer passengers sustainable options in selecting the service
Two sustainable options are included in the EASY TRAVEL service. First, a sustainable pick-up timeslot, where the most efficient route is calculated and assigned to the passenger. Secondly, public transport to AAS is encouraged by nudging the passenger with credits for rewards.

CONCLUSION

18.

CONCLUSION

In this chapter, the final conclusions of this thesis are evaluated based on the research question and design assignment.

18. Conclusion

This thesis aimed to explore how Schiphol can build a BaaS ecosystem to nudge passengers to use early entry baggage check-in services to make optimal use of the baggage capacity at AAS, in time for the expected shortage in 2029. Additionally, the challenge was to design a possible proposition and define the role for Schiphol in this ecosystem. This assignment is a part of the bigger picture of the 'Future Baggage' topic: making optimal use of the current baggage capacity.

Research has shown that the current way of handling baggage leads to pressure on the BHS and peaks. Especially in the summer, these peaks are the highest and threaten to reach their maximum due to an estimated capacity shortage in 2029. This negatively impacts stakeholders, making the search for a solution desirable.

Since Schiphol cannot expand its capacity because of environmental restrictions, handling part of the CI baggage before the peak is an alternative solution to make better use of the baggage handling capacity. An internal analysis showed that 20% of the CI baggage needs to be handled before peak hours to achieve an overall peak reduction of 8.9%. Two aspects are required in this situation: passengers need to hand over their luggage earlier, and the CI baggage needs to be handled before peak hours.

Passengers show interest in a baggage pick-up service since they appreciate the convenience of traveling with only hand baggage and skipping the check-in desks in the terminal. There are already commercial parties in the market who offer these baggage services, and pilots with airlines exist. Existing BaaS parties with its stakeholders are valuable for creating the EBCS ecosystem at AAS.

The airlines play an essential role since they are the prime interface towards passengers and must be convinced to participate in the EBCS ecosystem. In addition to the identified design requirements for passengers that will influence their choice, the design challenge was to make it as easy and attractive as possible for airlines to participate.

After the validation of the concept and key features with relevant stakeholders, these insights resulted in the EASY TRAVEL service. This is a trustworthy and transparent baggage pick-up service where the passenger travels in ultimate comfort to and at AAS due to the feeling in control through regular updates on the baggage, earning rewards using the service, and receiving personalized travel advice.

Schiphol has the role of the service provider by setting up and managing the ECBS ecosystem and offering an API to airlines to integrate into existing airline apps easily. Not only will the EASY TRAVEL service enable early pick-up and insertion of CI baggage, which signifies peak shaving, but it also provides new business propositions for Schiphol (insight in passenger behavior and opportunities in the use of gained terminal space), the airlines (insight in passenger behavior and contributing to a positive travel experience and brand image) and Third parties (extending current businesses).

An implementation roadmap for setting up a pilot advises Schiphol to focus on airlines who are already interested in BaaS and interested BaaS parties. From this, involved parties should draw learnings and conclusions to optimize the final ECBS ecosystem and service to passengers. Furthermore, having a working and proven service will attract more airlines and third parties to participate and expand the ecosystem, like KLM who has a big potential share in peak shaving. Ultimately, a successful EBCS ecosystem is built to realize peak shaving of CI baggage and cover a part of the estimated capacity shortage in 2029.

It is critical that Labip will be realized to make baggage inserting before peak hours feasible. Moreover, it is essential that all stakeholders share data, make security arrangements, and, more importantly, will work together out of shared interest to create a successful EBCS ecosystem.

19.

DISCUSSION

Due to the scope of this thesis, there are some aspects not elaborated in the outcome. These aspects are highlighted in this chapter to discuss the limitations and possible implications of the study and to make suggestions for future research. As mentioned in chapter 6 and illustrated in figure 4, the three aspects of innovation were used as the fundamental base of this thesis. The outcome is tested for desirability, feasibility, and viability that could influence the designed service.

19. Discussion

Desirability

Target group passengers

During this thesis, research and validation have been performed with a target audience of passengers who fly infrequently, seek certainty during the trip, and carefully plan to avoid negative travel experiences. The design of the service is based on the home-to-airport journey and has not been validated for other passenger journeys like (foreign) visitors using Airbnb or staying at hotels. The design and usage of the service should be further explored and validated with different audiences and passenger journeys to make it appealing for a larger target group.

Target group airlines

The EASY TRAVEL service has been designed and validated based on a number of interviews with airlines and mainly based on the passenger's needs. As well as for passengers, airlines may have other factors that are important to consider in order to participate in the ecosystem, which can influence the designed ecosystem. Further research can explore these important factors during the pilot phase of the service. Furthermore, the service validation with airlines has only been done with KLM and TUI, both home-based Dutch carriers for their passengers living in the Netherlands. Further research should also validate the desirability of the service with airlines that take foreign passengers on a returning flight. This could impact how the service is offered to their passengers (only for a return flight) and could lead to a different approach for involving airlines in the ecosystem.

New business model

Considering the 64% decrease of passengers visiting Schiphol in 2021 compared to before the COVID 19 pandemic, it remains to be seen whether the peaks and expected capacity shortages in 2029 will actually become a reality and EBCS will be needed to provide the intended solution. On the other hand, the EASY TRAVEL service is an added value proposition for passengers, airlines, and Schiphol. The service can offer new forms of business models, customer loyalty, and better use of existing assets.

Feasibility

Use of make-up area

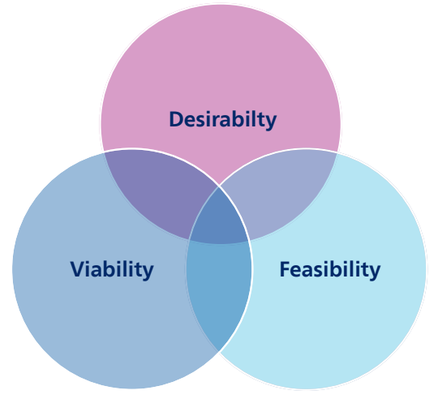
One of the concerns regarding EBCS, which needs to be addressed, is that the make-up area will be loaded with AMUs, waiting to be loaded. This could lead to impediments in the operation process. An analysis of the DnA team was made requiring a minimum of 25 baggage pieces in the AMUs to make efficient use of units and space. This might lead to a lower peak shaving potential than expected. At the same time, it has been discussed with the baggage operations team of RSG that this requirement is not the only solution and that further research should explore other solutions to make the best use of the make-up area to store extra CI baggage.

Labip

The realization of Labip is considered in this thesis, and is, in theory, a critical feasibility factor in building the EBCS ecosystem. This should be tested and validated in practice. Within RSG, an intern team discussed that the realization plan has been postponed multiple times. EBCS could enhance the understanding of the added value of Labip within Schiphol and kick-start the actual realization.

Ground handlers

As stated in this thesis, ground handlers have not been involved in the exploration of this service. Two areas will be impacted, the timing of baggage make-up and the baggage insertion using Labip. This should be explored.



▲ Figure 4: Desirability, Feasibility and Viability, the sweet spot of innovation

Viability

Incentive for Schiphol

One of the concerns for airlines and passengers is that EBCS is not seen as a sustainable option using existing and possibly extending infrastructure. Schiphol's ambition is to be emission and waste-free in 2030 and in 2050 CO2-neutral and circular. The CEO of Schiphol has stated that 2022 will be the year of sustainability, and the increased pressure from the Dutch Mileudefensie on large companies such as Shell makes this a top priority (Van Ammerlooy, 2022). This could mean that it is an opportunity for Schiphol as the provider of the EBCS ecosystem, to arrange the current BaaS infrastructure in an even more sustainable way. For instance, by including the combination of baggage delivery or collecting parcel packages that need to be sent via cargo, reducing overall environmental impact, or working together with Picnic who uses electric delivery trucks. Furthermore, the reward & benefits program could stimulate this by offering special discounts to passengers when traveling by train or electric taxi.

Costs

The costs of setting up and maintaining the ecosystem are not included in this scope. In addition, the following costs and investments for Schiphol need to be taken into account, such as developing the API, the cost coverage of the service during peak hours, realizing Labip, and the costs of the reward & benefits system. In the pilot phase, the involved parties should further explore these costs to conclude if setting up this EBCS ecosystem is a viable business proposition for the long run compared to the benefit of peak shaving.

Furthermore, there is currently no insight into the cause and effect of the unnecessarily high number of CI baggage that causes mishandled baggage during peak hours. This also concerns the failure costs related to the capacity problems.

20.

RECOMMENDATIONS

In this chapter, recommendations are given what Schiphol should pay attention to while setting up or and after the pilot. In addition, recommendations are written which actions Schiphol should consider to take based on this research.

20. Recommendations

Set up a pilot with stakeholders who are currently interested

The airlines like TUI, Corendon, and Transavia are already setting up baggage service pilots and some are offering baggage services. In addition, there are baggage service companies and start-ups that are eager to grow their business. So this will create a kick-start of setting up the EBCS ecosystem pilot to be able to learn.

Keep it passenger-centered

In setting up the ecosystem, many stakeholders' needs and values can obstruct or change the infrastructure. By maintaining a passenger-centric approach and listening to the success factors, the ecosystem will succeed, and stakeholders will need to continuously evaluate them since passengers have to embrace the EASY TRAVEL service and change their travel behavior.

Explore the most optimal integrated infrastructure

As explained in chapter 9.2, there are steps in the EBCS baggage journey that can be influenced by internal and external factors and determine the backend flow and timing. Further investigations are recommended to identify the optimally integrated infrastructure by exploring the best use of baggage storage at the distribution center and the makeup area. Furthermore, when the service is used for outside peak hours, Schiphol should hold the maintenance windows into account during night flights.

Explore other BaaS journeys

The EASY TRAVEL service is designed for home-to-airport pick-up and validated with Dutch residents going on vacation. Further research is needed to attract (foreign) travelers who have a returning flight as this requires a different way of creating awareness for the service and booking it. Additionally, more research is needed to have non-Holland-based airlines to be interested in offering the baggage service on AAS.

In addition, the research and interviews for this thesis have shown that there is interest in the service for airport-to-home for Dutch residents and that offering the service in combination with the home-to-airport journey could make the service more attractive. More research will need to be conducted to see if this is true and provide more peak shaving.

Lastly, BaaS journeys that allow baggage to travel via the road or cargo could decrease CI baggage at AAS during peak times. Exploring how these BaaS companies can contribute to the EBCS ecosystem is recommended since this was left out of scope.

REFLECTION

Over the past few months, I have learned a lot about approaching a large project like this. A scope is essential to delineate the bigger picture to do research in. I found it challenging to only address this defined scope in a multi-stakeholder ecosystem where many needs and values of different parties are involved. I had to accept some factors as given assumptions while I wanted to investigate the background to understand the total picture. This in-depth research was not always necessary, and therefore, I made it quite difficult for myself and put a lot of time into it.

In retrospect, I found it difficult to ask for help since the project is conducted alone. I like working together in groups and brainstorming with teammates. In a team, the threshold for discussing things and receiving feedback is very low. I should have brought my supervisors into the process sooner and seen us more as a team instead of putting myself on my own tiny island. Once I realized that, the project went much more smoothly.

In addition, I met my learning objectives of stakeholder management, smart sketching, and organizing project steps, and I learned even more. I am proud that I made meaningful connections in addition to my helpful supervisor from IH, namely with the colleagues at IH, the baggage operation team that I spoke with weekly, the DnA team where I wanted to run my own analyses, and with TUI and LuggageCare, who have all helped me.

Given time, I could only speak with a few parties to use their insights and feedback for my research. I am curious how many more insights I could have generated if I had spoken to more airlines. I think there are more issues and concerns to be taken into account, especially given airlines' different business strategies and their other priorities due to the COVID-19 pandemic. It's currently an uncertain and challenging time because of the pandemic, and you can feel that. Therefore, I am curious to know if the designed service might change and is applicable for the future.

The impact of the COVID-19 pandemic is unclear as well as the change to a more sustainable world. Therefore, passenger behavior towards flying and the future of the aviation industry could look different. This raises the question whether the EASY TRAVEL service is needed to solve the expected capacity problem in 2029. However, from a passenger needs point of view, I believe the service is a valuable proposition since it addresses passenger pain points.

I concluded from my research that Schiphol should use existing infrastructures of commercial third parties to build a feasible ecosystem. In the PASSME project, fulfilled in 2016, the value of these BaaS services was recognized based on passenger needs. Although pilots had been successfully conducted, the involved parties implemented no concrete plans. Recently commercial BaaS parties have entered the market, indicating that there is still a business opportunity. These parties are currently in their infancy and dependent on airports and airlines. Furthermore, Schiphol started to recognize the need to improve baggage capacity handling sustainably, and airlines are increasingly looking for opportunities to attract passengers. Therefore, I believe this is the right moment to work together, connect resources and jointly create value for the passenger, build a viable ecosystem, and develop new business opportunities for all stakeholders.

Labip's realization plans have been postponed a few times, and the priority within Schiphol is low. The EASY TRAVEL service is dependent on the implementation of Labip, because Labip affects the feasibility and viability of peak shaving. It is necessary for Schiphol to give Labip a higher priority and the EASY TRAVEL service concept might help in doing so.

I realize that the EASY TRAVEL service is not the only solution for realizing peak shaving. The conclusions drawn are not rigid but are based on the information I had gathered in the scope and timing of my thesis. I believe that the EASY TRAVEL concept answers the research question: "How can we build a BaaS ecosystem that will nudge passengers to use early baggage check-in services to make optimal use of the baggage capacity at AAS?".

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APPENDIX ABCD

Not included.