




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A ROADMAP TOWARDS A NEW LOGISTICS CONCEPT FOR AMSTERDAM SCHIPHOL AIRPORT IN 2030

BY CHER VAN SLOBBE

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GRADUATION THESIS

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Enjoy reading!

CHER VAN SLOBBE

EXECUTIVE SUMMARY

Amsterdam Schiphol Airport is the main international airport in the Netherlands, being the third busiest airport in Europe in terms of passenger volumes (Insideflyer, 2020). All these passengers spent most of their time behind the security check in the terminal, waiting for their aircraft to depart. In this area, passengers are encouraged to spend their money (Kaplan, 2018). Schiphol offers many different retail, and food and beverages stores where the passengers' needs can be met. The sale of goods in the terminal is Schiphol's largest source of income (Schiphol, 2020).

The passenger volumes at Schiphol have been growing in the last few years and are expected to keep growing in the coming years (CBS, 2018 and Schiphol, 2020). Growth in the passenger volumes causes both the passenger and goods flows to increase. In addition, there are many other streams in the terminal. In order to ensure that passengers are not hindered by these flows and all logistics processes take place in a safe manner, the logistics process will need to be set up differently. Schiphol is dealing with a complex environment, where there is no greenfield and solutions will have to be found within the current infrastructure. Therefore, the goal of my graduation project was to **develop a new logistics concept for Amsterdam Schiphol Airport in 2030 with a focus on the passenger experience and safety norms.**

Various design methods and tools have been used to research the current logistics process, the values of stakeholders and trends that may play a role in the future of the logistics process. Based on these results, a future vision for the logistics process has been designed for 2030. The future vision contains that Schiphol will have to facilitate and control the logistics process in 2030, using a connected chain and autonomous processes. In order to meet the passenger experience and safety norms, it is mainly important that Schiphol gets control over the logistics flows to Schiphol, control in the logistics streets and control over the logistics flows to the terminal.

In order to achieve the future vision, idea mapping sessions have been organised, from which the new logistics concept has been created. Both a strategic and tactical roadmap have been designed, in which service propositions work towards the new logistics concept in three horizons. These propositions take into account the various suppliers involved in the logistics concept and offer a new logistics concept for each of them.

The new logistics process centralises the logistics processes to a Logistics Centre in the Schiphol area, from where Schiphol takes full control with the Schiphol Logistics Service and delivers all goods to the terminal. By centralising the logistics processes and making one logistics party responsible for the logistics process, the number of logistics flows in the logistics streets and the terminal will be reduced, thereby benefiting the passenger experience and safety norms.

READING GUIDE

The reading guide gives an overview of how to read the report, an overview of words used in this thesis and frequently used abbreviations.

- 1 The report is divided into seven chapters. Each chapter starts off with introduction spread containing a picture and an introduction text to explain what will be discussed in that chapter.
- 2 Each right page shows which chapter you are reading indicated with the red block.
- 3 Every chapter is concluded with a conclusion by summarizing the most important findings in the grey blocks.



GLOSSARY

AIRSIDE	Schiphol area where all the aircrafts arrive and depart
LANDSIDE	Schiphol area outside of Schiphol Plaza
LOUNGES	The area between the security check and the gates, where all the stores are located
TERMINAL	The area after the security check
LOGISTIC STREETS	The area where the suppliers enter Schiphol to deliver their goods
ENVIRONMENTAL STREET	An area within the logistics streets where suppliers can recycle their waste

ABBREVIATIONS

SPL	Schiphol
F&B	Food and Beverages
TPI	Top Performance Indicator
NPS	Nett Promotor Score
OTP	On Time Performance
EPS	Employee Promoter Score
PRM	Persons with Reduced Mobility
CONOPS	Concept of Operations
SCM	Supply Chain Management
JIT	Just In Time
EC	Electronic Commerce
PoS	Point of Sales
QR	Quick Response
HCC	Heathrow Consolidation Centre

Departments

OPS	Airport Operations
PDC	Process Development & Capacity Management
SRA	Support & Resource Allocation
DDO	Day2Day Operations
PPM	Passenger Process Management
ASM	Asset Management
CRS	Consumers
SQC	Safety, Quality and Control
SRE	Schiphol Real Estate
CD	Corporate Development

Suppliers

SAR	Schiphol Airport Retail
WOD	World of Delights
SSP	Scandinavian Service Partner

Technologies

EV	Electric Vehicle
IoT	Internet of Things
IoT	Internet of Everything
AI	Artificial Intelligence
ANI	Artificial Narrow Intelligence
ML	Machine learning
DL	Deep learning
RFID	Radio Frequency Identification
AGV	Automated Guided Vehicle
AGC	Automated Guided Carts
FAV	Forklift Automated Vehicle
TAGV	Tugger Automated Guided Vehicle
AMR	Autonomous Mobile Robots

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01

INTRODUCTION

This chapter gives an introduction to the topic of this thesis. First, the problem has been defined, from which research questions for the thesis have emerged. Finally, the strategic design process of this thesis is explained and the final project deliverables are defined.

1.1 PROBLEM DEFINITION

Amsterdam Schiphol Airport is part of the Schiphol Group. Next to Amsterdam Schiphol Airport, the Schiphol group consist of Rotterdam The Hague Airport, Eindhoven Airport and Lelystad Airport. The Schiphol group plays an important role on a social and economic level with Amsterdam Schiphol Airport being the fourth best-connected airport of the world (AOG, 2019). The focus of this thesis is on Amsterdam Schiphol Airport, further referred to in this thesis as Schiphol.

Schiphol is the main international airport in the Netherlands, being the third busiest airport of Europe in terms of passenger volumes, see table 1 (Insideflyer, 2020). All of these passengers arrive at Schiphol and spent most of their time behind the security check in the terminal, waiting for their aircraft to depart. Schiphol offers many different retail and food and beverages (f&b) stores in which passengers are able to spend time and enjoy themselves. These shops want to offer the right products, at the right time to the passengers in order to meet the passenger's needs. Airports recognize that the time spent between security and departing is the only time airports can encourage the passenger to spend their money (Kaplan, 2018). The sale of goods in the terminal is Schiphol's largest source of income with 17,79 euro spent on average per passenger in 2019 (Schiphol, 2020).

The current logistics process will have to change in the coming years due to the growing passenger volumes. These volumes at Schiphol airport have been growing in the last few years and are expected to keep growing in the coming years, see figure 1.1 (CBS, 2018 and Schiphol, 2020). The growing number of passengers automatically means that more goods are needed to serve all passengers in their needs. At the moment, it is already crowded in the terminal due to the many different flows in the terminal. Next to the passenger and the passenger services, the logistic flows are the largest flows that obstruct the passenger flow. If more goods are needed, it also means that more logistics flows are needed to be able to supply the stores. This would mean that it will only become busier in the terminal and the logistics streets. In addition to the passenger experience, that is deteriorating as a result, it is also not responsible in terms of safety. Schiphol is a complex environment, where there is no greenfield and solutions will have to be found within the current infrastructure. All in all, the logistics process will have to be set up differently:

“How can the logistics process be organised differently in order to meet the passenger experience and safety norms?”

Airport	Passenger volume
London Heatrow Airport	80.900.000
Parijs Charles de Gaulle Airport	76.150.007
Amsterdam Schiphol Airport	71.707.144
Frankfurt Airport	70.556.072
Madrid Barajas Airport	61.734.037
Barcelona Airport	52.686.314
Istanbul New Airport	52.600.000
Moskou Sheremetyevo Airport	49.933.000
München Airport	47.959.885

Table 1: Passenger volumes at European airports

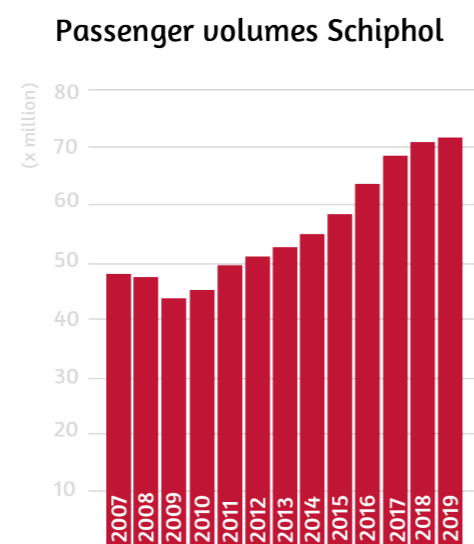


Figure 1.1: Passenger volumes of Schiphol

1.2 RESEARCH QUESTIONS

As stated in the problem definition, the main research question for this thesis is:

“How can the logistics process be organised differently in order to meet the passenger experience and safety norms? “

This research question is divided into sub-questions per chapter in this thesis, that will all together give answer to the main research question:

H2 Context

What does the current logistics process at Schiphol for supplying retail and f&b goods look like?

H3 Value mapping

What values are of importance for the logistics process?

- What are the main problems in the logistics process?
- What values are of importance for the stakeholders?
- What trends could be of value in the logistic process?

H4 Future visioning

What should the logistics process look like in 2030?

H5 Idea mapping

How could Schiphol gain more control in the logistics process?

- How Schiphol can take control of the delivery to Schiphol?
- How could Schiphol take control in the logistics streets?
- How could Schiphol take control over the deliveries to the terminal?

H6 Roadmapping

How can Schiphol achieve this?

All of these questions will be answered in the final chapter of this thesis.

1.3 DESIGN PROCESS

The design process used for this thesis is based on a strategic design process. According to Calabretta and Gemser (2016) strategic design refers to the ‘professional field in which designers use their principles, tools and methods to influence strategic decision-making within an organisation.’ The future vision and the business opportunities in the roadmap, that lead to the future vision, are typical examples of strategic decisions.

For this master thesis, a combination between the Double Diamond process of the British Design Council (2015), the Design Roadmapping process from Lianne Simonse (2017) and the Strategy Development Process of Coway (2014) have been used.

Double Diamond process

The Double Diamond process of the British Design Council (2015) consists of two diamonds that have a diverging and converging side. The first half of the double diamond is the discover phase, in which the problem and current context is researched. The second half of the first diamond is the define phase, in which the gathered insights of the discover phase will help define a challenge for the project. The second diamond starts off with the develop phase in which ideas/solutions will be generated to the defined challenge in the first diamond. The last half of the diamond is the deliver phase, in which these solutions will be tested, and one solution will be improved and eventually continued with.

Design Roadmapping process

The Design Roadmapping process (2017) consists of three diamonds, of which only the two first diamonds will be used in this thesis. The first diamond is about value mapping in order to create a future vision. In the value mapping process, trend research is performed and new opportunities for value creation are sought. The second diamond is about idea mapping, with as end result a design roadmap. The idea mapping phase consists of technology scouting, deeper research and time pacing.

Strategy Development process

The Strategy Development Process of Conway (2014) consist out of four phases named environmental scanning, strategic thinking, strategic decision making and strategic planning. This thesis is about the first three steps, after which PPM will be responsible for the fourth step. In environmental scanning it is all about ‘What can we see today?’ by gathering as much information as possible

about change as input for the next steps. The second step strategic thinking is about ‘What might happen in the future?’ by generating options for possible future environments for the organisation. The last step used in this thesis is strategic decision making. The strategic decision making step is about ‘Where will we go in the future?’ by defining a preferred future on which decisions about the strategic direction of the company can be based.

For this thesis, a combination has been made between these three processes. The process for this thesis is as follows:

- The first diamond contains value mapping, environmental scanning and strategic thinking in order to design a future vision.
- The second diamond revolves around idea mapping and strategic decision making, of which two design roadmaps are the result.

Phase 1: DISCOVER VALUES

The first diverging diamond looks at both the current and the future process. The current process looks at the strengths and weaknesses and defines problems that could form an opportunity for value creation. At the same time, attention is paid to what the stakeholders think of the current process and what value is most important for them in the future process. Finally, trends in the various areas of logistics, airports, retail, f&b and cities have been sought in order to define values that are important in the future of these industries.

Phase 2: DEFINE VISION

In the converging part of the first diamond, the future vision is designed. In this phase, all the values of the first diamond phase are connected to each other. Three vision themes are defined, out of which the vision is build up.

Phase 3: DEVELOP IDEAS

The second diamond starts in the diverging phase, in which many ideas have been generated by myself, students and the internal stakeholders. All the ideas have been clustered and plotted on the logistic journey to get an idea where these ideas could be of value. Thereafter, the ideas are plotted on the three horizons of the roadmap to determine where in time they would occur. Besides the idea mapping, technology research is done to technologies that could support the created ideas.

Phase 4: DELIVER ROADMAP

The design roadmap is designed in the final converging part of the second diamond. The concepts created in the last phase are elaborated in the roadmap and all the elements that have led to the future vision have been linked to each other. Two roadmaps have been created: A strategic roadmap for the stakeholders and a tactical roadmap for the management. Both of the roadmaps have been validated with the stakeholders of Schiphol.

See figure 1.2 for the visual strategic design process.

Project deliverables

This thesis consists of two different deliverables: a future vision and a design roadmap:

1. Future vision

A future vision of the logistics process in 2030 is designed in order to set a strategic reference point for the design roadmap.

2. Design roadmap

A design roadmap is displaying the road towards the created future vision. The design roadmap is divided into two different roadmaps: a strategic and tactical roadmap.

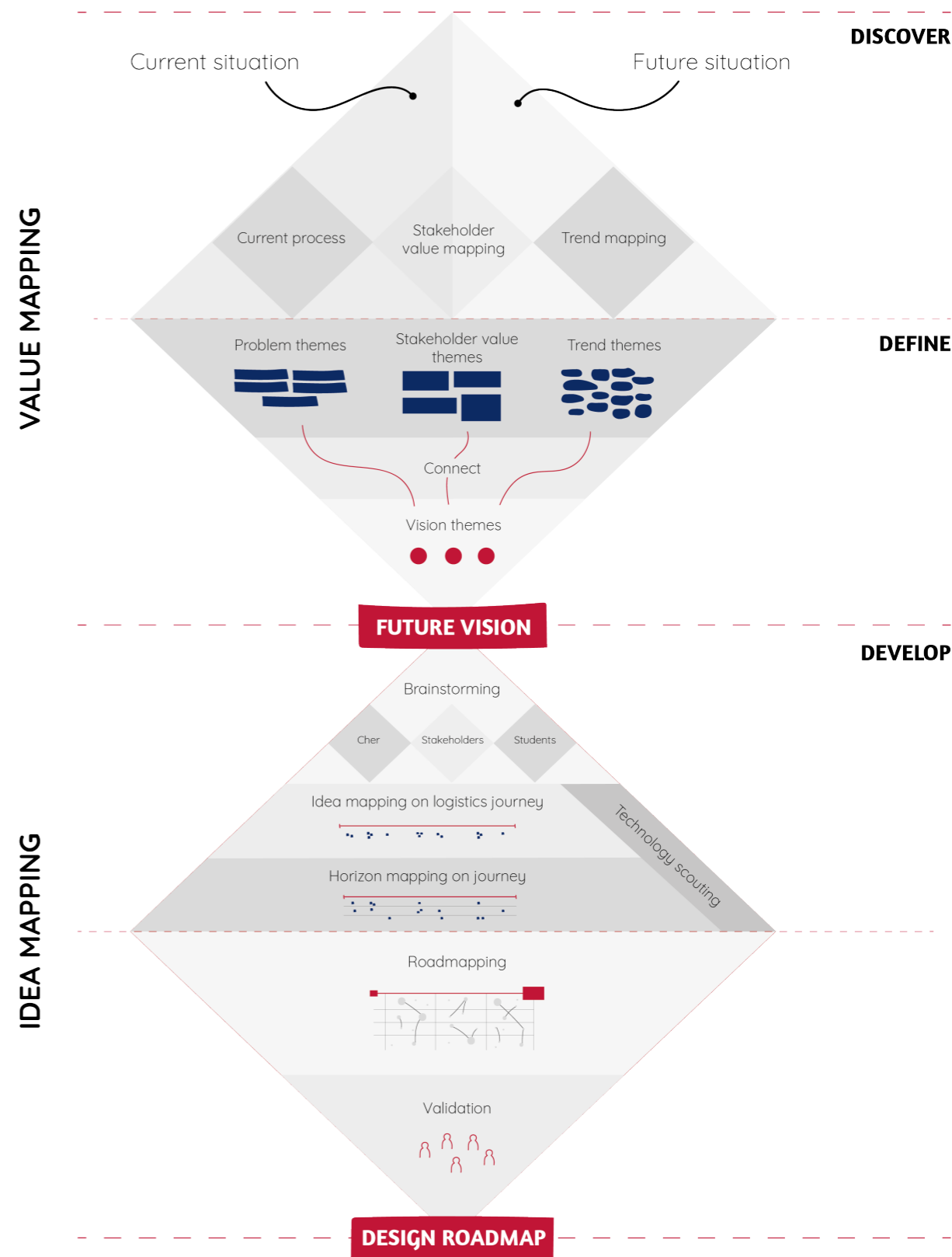


Figure 1.2: Strategic design process



02

CONTEXT

This chapter provides insight into the context of this thesis. First, the context of Amsterdam Schiphol Airport is explained after the logistics process context is further elaborated. Finally, a scope is set for this thesis.

2.1 SCHIPHOL CONTEXT

The Schiphol Group's mission is 'connecting your world' (Schiphol, 2020). The mission of Schiphol consists of three mission pillars: quality of network, quality of life and quality of service. "Quality of network by facilitating an outstanding multimodal international connectivity to the benefit of national and regional development, trade and well-being. Quality of life by caring about your life and health, Schiphol takes its responsibility to neighbours and future generations being a frontrunner in sustainability. Quality of service by making sure that all travellers, airlines and businesses prefer our airports for personal experience and high-quality service and products" (Schiphol, 2020).

Besides the mission, the Schiphol Group has the ambition to create the most sustainable and high-quality airports of the world (Schiphol, 2020). In 2030, they want their airports to be emission-free and waste-free.



Figure 2.1: TPIs of Schiphol

2.1.1 TOP PERFORMANCE INDICATORS (TPIs)

Leading towards 2030, the Schiphol Group will have to face the challenges of growing passenger volumes and a limit on aircraft movements set by the Dutch Government. Schiphol defined eight Top Performance Indicators (TPIs) (Schiphol, 2020) that allows Schiphol to monitor their performance to stay on the right track:

Safety

This index is based on the change in the number of lost-time injuries among Schiphol employees compared with the previous year and the change in the number of runway incursions at Amsterdam Airport Schiphol compared with the previous year.

Passengers (NPS)

The Net Promoter Score (NPS) measures how likely passengers are to recommend Schiphol as an airport. Customers are asked: "On a scale of 0 to 10, how likely would you be to recommend this airport to friends, family and colleagues?"

Network

The number of direct intercontinental destinations for passengers and cargo.

Sustainability

CO2 emissions taking into account a) natural gas and fuels used by own vehicle fleet, b) electricity, and c) diesel fuelled at airside, commuter traffic and business travel by own car or aircraft

Airlines (OTP)

The punctuality of outbound traffic is the percentage of commercial flights that depart on time.

Shareholders

Financial return for shareholders based on net result adjusted for fair value gains and losses on investment property, divided by average equity.

Employees (EPS)

The Employee Promoter Score (EPS) measures employee engagement, employership and commitment.

Local residents

This score is based on reputation and engagement surveys and the number of people that filed one or several reports with Bewoners Aanspreekpunt Schiphol.

2.1.2 SCHIPHOL DEPARTMENTS

Schiphol consists of many departments. The focus of this thesis is on the Airport Operations department (OPS). OPS is responsible for the daily operations at Schiphol. Airport Operations directs and facilitates everything related to the handling of flights and aircrafts such as luggage, bus transport, take-off and landing of aircrafts, snow and slippery control, accessibility of the airport and passenger flows. These processes continue 24 hours a day, 7 days a week with the focus on the customers: airlines and travellers. The logistics process falls under these operations. The mission of OPS is: "every aircraft departs on time with a satisfied passenger and suitcase on board in a safe, trustworthy and carefree way" (Schiphol 2019). Therefore, the three most important TPIs for OPS are OTP, NPS and safety.

Within OPS there are three departments:

- PDC (Process Development & Capacity Management)
- SRA (Support & Resource Allocation)
- DDO (Day2Day Operations)

See appendix 2.1 for a more elaborate overview of the different departments within OPS.

Passenger Process Management (PPM) is the department within PDC that deals with the various passenger processes in arrival, transfer and departure: check-in, security, lounges and boarding, baggage reclaims, douane, cruises, Persons with Reduced Mobility (PRM), assets and facilities, information provision, wayfinding, and logistics. Logistics has been added to the PPM department since January 2019. For many years, no attention has been paid to the logistic processes until Schiphol discovered that the logistics flows do actually disturb the passenger processes in the terminal. In addition, there has never been a policy that managed the logistics processes. A logistics policy will be in place from May 2020 onwards. Operations is not the only department involved with the logistics processes. In chapter 2.3 more information can be found about the stakeholders.

2.1.3 CONCEPT OF OPERATIONS (CONOPS)

The department OPS within Schiphol is working with an operating model, named Concept of Operations (CONOPS). The CONOPS gives substance to the realization of OPS goals, in which the OTP plays a key role. All kinds of large and small factors ensure that the OTP is under constant pressure. With the help of CONOPS, Schiphol can take control in order to increase predictability and influence in the chains. The current CONOPS ensures that the passengers, aircraft, and baggage processes are synchronized with each other, see appendix 2.2 for the CONOPS overview. Unfortunately for the crew, personnel, and logistics are not actively incorporated in the CONOPS, what would be the ideal goal.

CONOPS deals with developments within 5 years with a focus on five development paths, see figure 2.2:

- Staff independent continuity (efficiency in scalability)
- Process capacity (cutting loss)
- Spatial capacity (relieving nodes)
- Process simplicity
- Control (process predictability and influenceability)

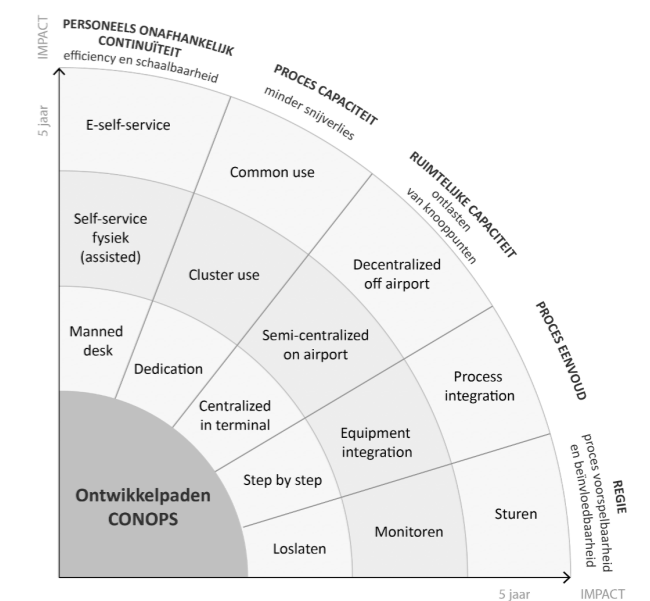


Figure 2.2: CONOPS developments path

2.2 LOGISTICS PROCESS

All passengers travelling through or via Schiphol pass the stores in the terminal and probably spend time in the terminal by shopping in several stores or having breakfast, lunch or dinner in one of the restaurants. All these stores and restaurants must be supplied in order to serve all these passengers. But how exactly are these stores supplied?

Schiphol floor plan

Schiphol consists of many different areas, in which a distinction can be made between public and secured areas. Schiphol Plaza is the public area on the ground floor, where passengers arrive or leave by train or bus. At the same time, Schiphol is a shopping centre. The area outside at Schiphol Plaza, where the cars, buses, and taxis are located, is called landside. On the first floor, travellers can check-in and go through security, after which they are in the protected area of the terminal. The terminal consists of four lounges (1, 2, 3, 4) and eight gates (B, C, D, E, F, G, H, M). Airside is the area where aircrafts are positioned at the gates and where the runways are located. An overview of Schiphol's floor plan can be found in figure 2.3. A more extensive floor plan can be found in appendix 2.3.

Horizontal and vertical movements

The logistic process at Schiphol is quite sophisticated because of the many possible variations. The logistic process can differ in terms of physical space (horizontal) and the levels of the building environment (vertical). There is not one standard route. On the horizontal level, there are four logistic streets where suppliers can supply their goods: Koeriersplein (0), Laad en Loskade 1 (0), Expeditiestraat (-2), and the Transportstraat (-2). The logistic streets are located at different vertical levels and the goods can be supplied at different levels: Schiphol Plaza (0) and the four lounges (1, 2, 3) in the terminal. Secondly, the horizontal movements between the lounges are of importance as well since there is a distinction between Schengen (lounge 1) and non-Schengen (lounges 2, 3 and 4). Switching between Schengen and non-Schengen requires another identity check. See figure 2.4 for an overview of the logistic streets.

Next to these horizontal and vertical movements, the logistics process will also cross different areas: external, landside, security, and the terminal. All these areas and the different floor levels are visualised in the logistics journey in figure 2.5.

Logistic streets

As already mentioned, there are four different logistic streets at Schiphol: Koeriersplein, Transportstraat, Expeditiestraat, and Laad en Loskade 1. Figure 2.4 is giving an overview of the logistics streets and pictures of the Transportstraat and Expeditiestraat can be found in appendix 2.4.

Koeriersplein

The first one is Koeriersplein, located on the ground floor next to Schiphol Plaza. Koeriersplein is used for multiple purposes including the delivery of stores to Schiphol Plaza

Transportstraat

The second logistic street is Transportstraat. It is located underneath the terminal (-2) and can be accessed via a driveway from the Sheraton hotel side. The two most used elevators in the Transportstraat are leading towards lounge 2 and 3 and therefore lounge 2, 3 and 4 are mostly supplied via the Transportstraat. The Transportstraat only has normal parking spots and no loading dock.

Expeditiestraat

The third logistic street is Expeditiestraat, also located underneath the terminal (-2) and can be accessed via the Havenmeesterweg. There are multiple elevators in the Expeditiestraat. Two elevators are leading towards lounge 1 and one elevator is leading towards Schiphol Plaza. The stores in lounge 1 and some of the stores in lounge 2 are supplied via the Expeditiestraat. The Expeditiestraat consists out of two parts: the first part is mainly used for storage rooms and the second part for unloading goods at a higher loading dock.

Laad en Loskade 1

The last logistic street is Laad en Loskade 1, located at the ground floor. Laad en Loskade can be accessed at the same location as the Expeditiestraat. The Laad en Loskade 1 can be entered directly from the Havenmeesterweg, where the Expeditiestraat can be entered to the left down the slope. The Laad en Loskade 1 connects immediately with Lounge 1 and also has a higher unloading dock. The Transportstraat, Expeditiestraat and Laad en Loskade 1 all have an environmental street of SUEZ.

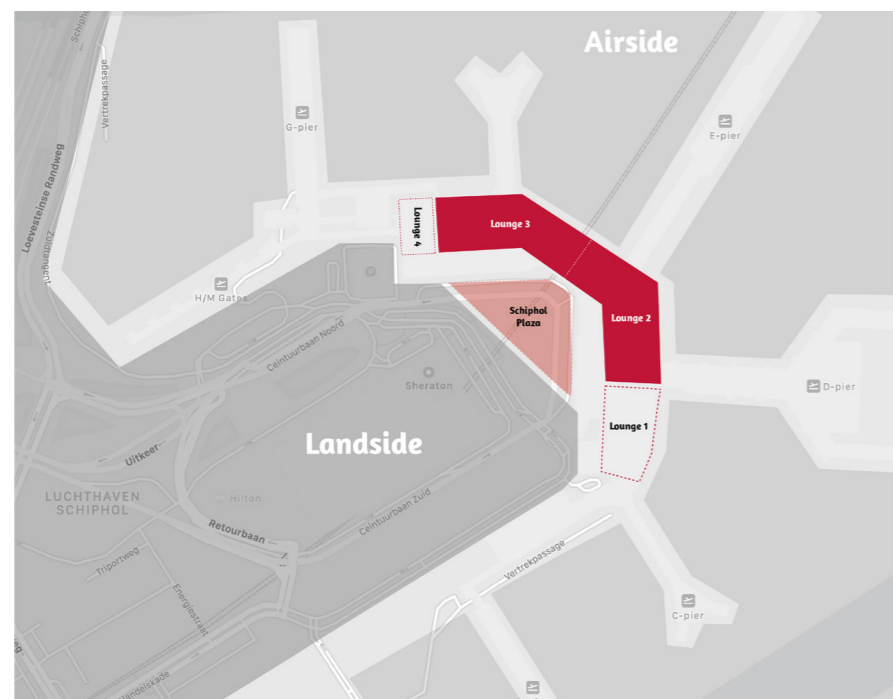


Figure 2.3: Floor plan Schiphol

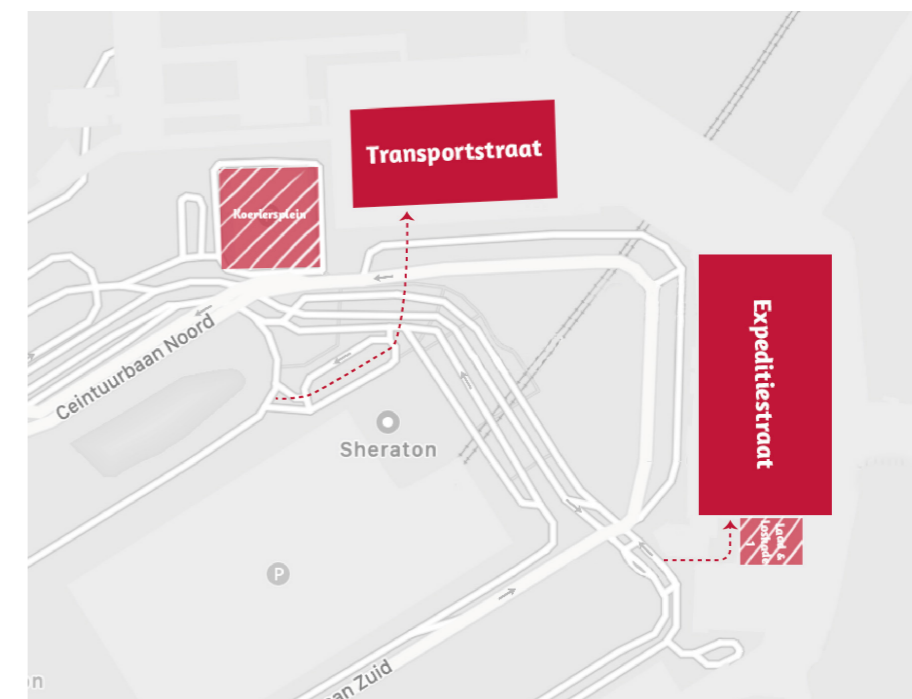


Figure 2.4: Overview of logistic streets

Known and unknown suppliers

Besides the horizontal and vertical movements, Schiphol makes a distinction between known and unknown suppliers. Known suppliers are suppliers that supply Schiphol on a daily basis. To become a known supplier, the supplier needs to meet the security regulations of Schiphol. The benefit for known suppliers is that their products are already security checked at their warehouse. These products do not have to be checked again at the security of Schiphol, which makes the process more efficient. Unknown suppliers are most often suppliers that deliver something to Schiphol once in a while. Another difference between known and unknown suppliers is that most often known suppliers have logistics workers that transfer the goods to the stores, while with unknown suppliers the driver himself transfers the goods to the store.

Load carriers

All the suppliers in the logistics journey make use of load carriers to transport their goods. Every supplier works with its own load carriers ranging from pallets, carts, cages and crates to custom made carts. Every load carrier has a deposit of 200 euros. The carts are transported through the terminal manually or with an Electrical Vehicle (EV). There are two types of EVs used in the terminal: a bull or a Movex.

Interviewee	Company	Function
1	HMS Host	Logistics Worker
2	HMS Host	Manager Interne Dienst
3	Schiphol	Service Owner Logistics
4	Schiphol	Service Owner Logistics
5	WOD	Logistics Manager
6	WOD	Logistics Manager
7	SUEZ	Side Manager Schiphol

Table 2: Interviewees for logistics journey

2.2.1 LOGISTICS JOURNEY

This chapter describes the logistics journey shown in figure 2.5.



The logistics journey starts in the store at Schiphol, when there is a need for a new product. The shop worker places an order at the supplier, which will be sent to their warehouse either automatically or by hand depending on the supplier. The order will be picked at the warehouse. A known supplier needs to security check the carts according to the Schiphol regulations before loading the truck, after which the truck will be sealed with three labels to show that the goods are security checked. An unknown supplier does not have to seal the truck. The goods only need to be security checked when the store is located after security.



The truck arrives at Schiphol, where the driver has to choose one of the logistics streets. Most of the time, the driver is already familiar with Schiphol and supplying the goods to the stores and therefore knows which street to enter. How a truck enters a logistic street is confidential information and will not be discussed in this thesis. When the truck has entered one of the logistic streets, the driver has to search for a parking spot and unloads the truck. Depending on the supplier, the truck driver himself or a logistic worker supplies the carts to either their storage or the shop immediately. Only when the store is located at Schiphol Plaza, the supplier can immediately supply the store and does not have to go through security. When a store is located after security, the goods need to be transferred through security.



Before a truck of a known supplier can be unloaded, the logistic worker needs to check the three labels and the papers on the following: the truck driver needs to match the driver on the form, the truck needs to match with the licence plate on the form and the number of carts in the truck need to match with the amount on the form. After this check, the logistics worker will place a green cover over the carts to indicate that the products in these carts are already security checked. For an unknown supplier none of this is necessary. For

a known supplier, this is the moment that the truck can already leave the logistic street since the logistic worker is taking over from here. However, the driver of the unknown supplier most of the time leaves the truck in the logistic streets while he supplies the goods to the shop himself.



After unloading, there are three options possible: 1) the carts are stored in a storage place before security for later distribution to the terminal, 2) the carts are transferred through security and directly delivered to the store or 3) the carts are transferred through security and stored in storage after security for later distribution to the shops. Most of the suppliers do not have a storage place and when they do, they mostly use the storage place for the storage of assets and resting place for their workers instead of storing goods. Only HMS Host does have cooled storage after security for their f&b.



The green cart of the known supplier needs to be transferred through security immediately and can only be stored in a storage place after security or need to be directly delivered to the store because of security regulations. The carts of known suppliers only need to be checked on the outside, after which the green covers will be removed. However, all the goods at the cart from the unknown supplier need to be manually placed on the conveyor belt one by one, after which they will go through the CT check and manually be placed on the cart again. Both for the unknown and known supplier, the driver or the logistics worker always needs to go through the security check.



After the security check the shops are located on a different floor and different lounges. All the carts have to go up with the elevator to the right lounge and floor. The logistics worker is able to carry two or three carts at the same time.



When arrived at the right floor, the logistics worker has the choice to either transfer the carts manually or with an EV. This is only possible when the supplier has authorisation for an EV. An EV can transfer three carts maximum at the same time and is not allowed to drive faster than 8 km/h. The logistics worker transfers the carts to the right store and hands over the cart to the shop employee, who will sign a form indicating that the order has been delivered. The shops, most of the time, do not have a storage place and the cart will be placed either just outside of the store, or somewhere in the store to unload the cart. After the first delivery, a logistics worker often still has to deliver other carts to other stores. These stores can be located in the same lounge and floor, but sometimes it is also needed to switch lounges or floors. Lounges two and three are in the same area but switching to other lounges requires another identity check before being able to enter the lounge.



When the logistics worker is done with the delivery, the logistic worker will transfer the empty carts, residual waste or left-over products back downstairs to the logistic street. In the logistics streets, there is a possibility to recycle goods or waste in the recycling centre of SUEZ. A logistics worker will recycle the goods and starts a new delivery, while the truck driver goes back to his truck and leaves the logistic street. SUEZ is promoting recycling waste through their pick-up service. They pick up separated waste at the stores, which they then bring to the recycling centre in the logistic street. As long as the stores are recycling their waste, the logistics worker only has to take back residual waste.

This journey is created based on seven interviews with the stakeholders in table 2.

2

1

0

-1

-2

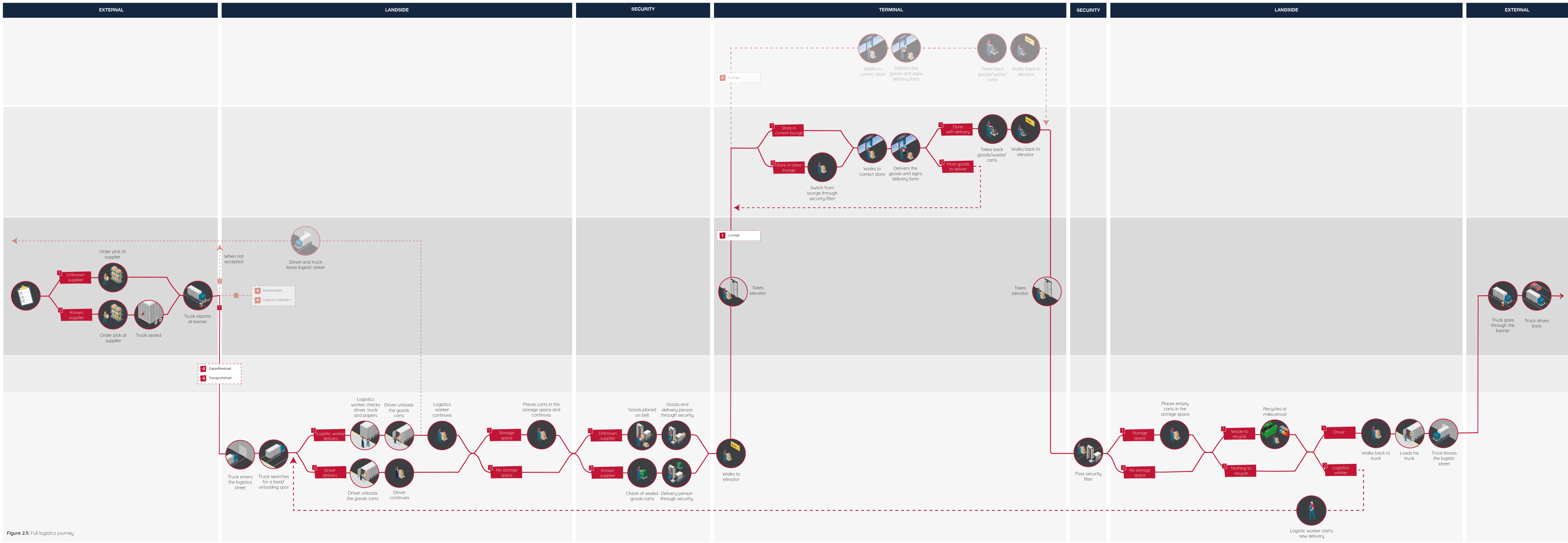


Figure 2.5: Full logistics journey

2.3 STAKEHOLDERS

The logistics journey crosses multiple areas with different stakeholders. This chapter describes all the stakeholders involved in the logistics journey. An overview of all the stakeholders is visualised in figure 2.4.

2.3.1 INTERNAL STAKEHOLDERS

The logistics process at Schiphol crosses multiple departments. With the logistics process being new since January 2019, a logistics workgroup has been introduced to gain more awareness within the departments. One person per department had been appointed to represent the logistics workgroup. The workgroup comes together once a month to discuss the logistics process. The departments involved in this workgroup are:

PPM (Passenger Process Management)

ASM (Asset Management)

The Asset Management department at Schiphol ensures optimal availability of assets in order to deliver value for customers, passengers and airlines. Assets that are important for the logistics process are the elevators and EVs.

CRS (Consumers)

The Consumers department is responsible for all the non-aviation incomes of Schiphol. CRS devise and develop new retail and f&b concepts and have contracts with the suppliers.

SQC (Safety, Control, Quality)

The department Safety, Quality, Control is responsible for the process safety of the passenger (crowd management and fire safety), manuals and work instructions, supervision and enforcement in the Schiphol building. The biggest logistics concerns for SQC are collisions with passengers, the storage of stock for the stores, parking of vehicles in the terminals and logistic halls, and the fire safety in both the terminal as the logistic streets.

SRE (Schiphol Real Estate)

The Schiphol Real Estate department is responsible for the layout of buildings in the Schiphol area and the rentals of all the buildings in this area. For every company that wants to rent a building in the Schiphol area, SRE will find the right location.

Security

The department Security is responsible for the surveillance, security checks, control room and landside security at Schiphol. Security is busy with how the supply of goods could be done more safely.

Next to these departments, there is CD (Corporate Development), that is responsible for longer-term development from 5 until 10 years. Until January, there was not one specific person responsible for the logistics processes of Schiphol.

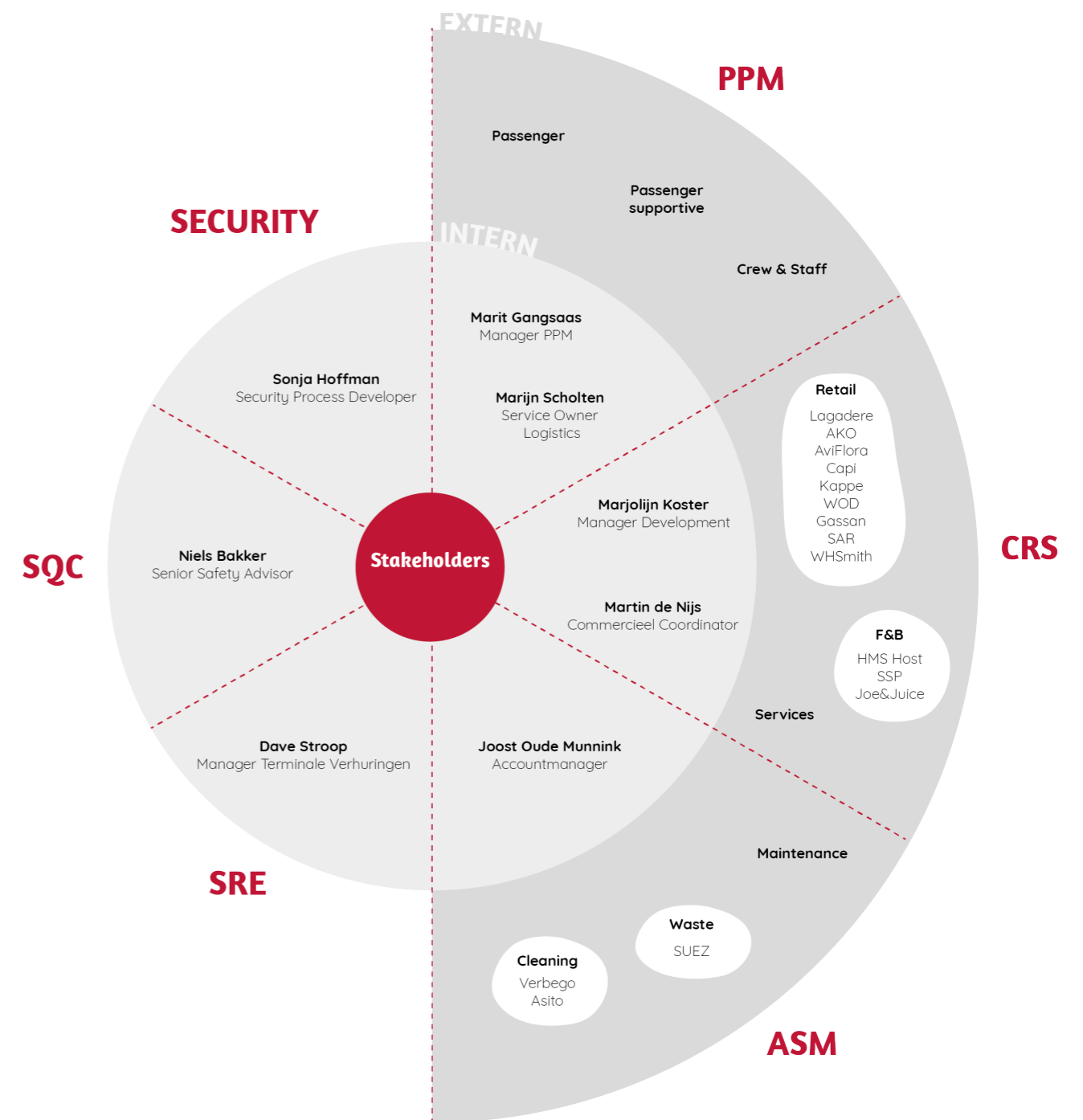


Figure 2.4: Stakeholder overview

2.3.2 EXTERNAL STAKEHOLDERS

Besides the stakeholders within the Schiphol company, there are other stakeholders like the suppliers of the stores at Schiphol. Lounge 2 and 3 have 89 stores in total, of which 55 retail stores and 34 f&b stores. The retail stores are supplied by nine different suppliers: Lagadere, AviFlora, Ako, Capi, Kappe, Gassan, SAR (Schiphol Airport Retail), WOD (World of Delights), WH Smith. WOD and Lagadere are the biggest retail suppliers with the most stores and delivery flows at peak moments. The f&b stores are supplied by three suppliers: HMS Host, SSP (Scandinavian Service Partner) and Joe & the Juice. HMS Host is the biggest supplier who delivers all the f&b stores except for 4 stores. An overview of all the stores in the lounges and the corresponding suppliers can be found in appendix 2.5.

Next to the retail and f&b suppliers, there are cleaning, waste and maintenance flows. SUEZ is responsible for all the waste in the terminal and Verbeego and Asito for the cleaning in the terminal. There are way more flows present in the terminal of which an overview can be found in in appendix 2.6.

The scope has been set to one retail supplier (WOD, most flows per day), one f&b supplier (HMS Host, most stores and flows) and one waste processing company (SUEZ, environmental street in logistic streets). But what are these external stakeholders doing on a daily basis?

World of delights (WOD)

World of Delights is the largest supplier for retail. WOD is a known supplier and has a warehouse in Leijnden, next to Lagadere, from which they deliver to Schiphol. WOD does not have a storage place at Schiphol for their goods, they only have a storage place for their EVs and team to have a break. WOD has eleven stores and mainly supplies the Fine Foods stores in the terminal. Their best-selling products are cheese, snacks, cake, caramel waffles and water bottles (Schiphol, 2020). WOD works with ten logistics workers at Schiphol in which they make a distinction between a merchandise and sales team. The merchandise team is responsible for the unloading of the trucks, supply to the stores and the filling the shelves. The sales team is responsible for the sales in the stores. The merchandise team takes around two hours to unload the truck and be back downstairs in the logistic streets with empty carts, ready for a new delivery. WOD mainly delivers its goods in the morning.

HMS Host

HMS Host is the largest f&b supplier. HMS Host is a known supplier of Schiphol and has its own distribution centre, where multiple suppliers deliver their goods like Bidfood, Sligro and Heineken. HMS Host is a facilitator of the logistics process for these subcontractors. After these subcontractors have supplied their goods, HMS Host arranges the carts for the stores in their distribution centre and transports the carts to Schiphol. HMS Host has 33 stores and delivers multiple times a day. HMS Host also has to deal with cooled products. The cooled products are not allowed to be outside of the cooling for longer than 15 minutes. Therefore, HMS Host has a cooled storage place after the security check, so that the carts can be transferred through security to the storage place immediately before they are supplied to the stores in the terminal. The cooled goods are measured on temperature when having arrived at Schiphol and when the goods are not at the right temperature, the products cannot be supplied to the stores. HMS Host works with logistic workers that take over the logistic process when the truck arrives in the logistics streets. Because of the secured goods, the truck driver, the truck and the number of carts are checked on arrival after which they can supply the carts to the stores in the terminal.

SUEZ

SUEZ is responsible for the waste flows in the terminal and the recycling in the logistic streets. The two different waste flows in the terminal are passenger waste and waste caused by stores. The passengers in the terminal are able to recycle their waste in bins with three compartments: residual, paper and plastic. SUEZ collects this separated waste with an EV and three containers, one container for each compartment of the dustbin.

The stores in the terminal are encouraged by SUEZ to recycle their goods. The stores are able to recycle their goods in their stores or certain wall cabinets. HMS Host is mostly making use of these wall cabinets. SUEZ only picks up recycled waste at the stores and the wall cabinets. The stores need to bring their residual waste to the environmental streets in the logistic streets themselves.

SUEZ drives through the terminal with fixed routes and fixed time slots. These time slots have been determined in consultation with the stores. Because of these fixed time slots, data is gathered in this process. The bins in the terminal are considered critical if they are 50% full and

ideally are emptied before that percentage is reached. SUEZ comes to 70% of the bin locations more often than necessary to prevent the bin to be full at all times.

The containers in the environmental streets are of SUEZ as well. These are emptied every day. These containers have a sensor that measures how full each container is. When this sensor is activated, SUEZ directly sends a truck to Schiphol from their location at Schiphol Zuid. From Schiphol Zuid, the full containers will be transferred to the central recycling place of the Amsterdam area.

2.4 SCOPE

As explained above, the logistics journey is quite sophisticated and therefore a focus in the current context is needed. The scope of this thesis is focussing at the Expeditiestraat and Transportstraat, Lounge 2 and 3 and the retail, f&b and waste flows. Expeditiestraat and Transportstraat has been chosen because these are the two biggest logistics streets. Lounge 2 and 3 have been chosen since lounge 1 is currently being redesigned according to a research that was performed last year and lounge 4 is the smallest lounge with only a couple of shops. Lounge 2 and 3 are together the biggest lounges with the most stores, and thus dealing with the most logistic flows. The retail, f&b and waste flows have been chosen since not all the 40 flows in the terminal can be taken into account for this thesis. The retail, f&b and waste flows are the biggest flows in the logistics process.



03

VALUE MAPPING

This chapter provides an overview of all values that are important for the future logistics process. First of all, the current values in the logistics process are defined: What opportunities does the current logistics process offer? How are other logistics parties dealing with their logistics processes? What are the stakeholder values? At last, there is looked at what values might be of importance in the future of the logistics process with the use of trend foresights.

3.1 LOGISTICS JOURNEY VALUES

The logistics journey described in chapter 2.2 is researched, in order to discover the bottlenecks in the process. Interviews with experts of the logistics process and fieldwork have given insights into the weaknesses and strengths of the process. The interviewed experts can be found in table 3. All the strengths and weaknesses are placed on the logistics journey and can be found in appendix 3.1.

Interviewee	Company	Function
1	HMS Host	Logistics Worker
2	WOD	Logistics Manager
3	WOD	Logistics Manager
4	Schiphol	Operational Equipment Manager
5	Schiphol	Service Owner Logistics
6	Schiphol	Service Owner Logistics

Table 3. Interviewees journey values

3.1.1 PROBLEM AREAS

The bottlenecks over the whole logistics journey are clustered (see appendix 3.1) and six problem themes are created out of these clusters, see figure 3.1.



Figure 3.1: Problem themes

Too many users in the logistic streets

The first problem theme is that there are too many users in the logistic streets. Everyone with a Schiphol pass can access the logistic streets. With currently no policy in place, there are a lot of different users using the logistic streets while not knowing what everyone is actually doing there. An overview of who and what everyone is doing in the logistic streets is missing. Too many users in the logistic streets cause it to be very busy, especially at peak hours (7.00-10.00) in which it is hard to find a parking spot for truck drivers. The lack of overview also makes it hard to maintain the 20 minutes unloading rule, which causes trucks to be in the logistic street and the parking spot for longer than 20 minutes and causes that others in that time cannot unload. In every logistic street, there is one security point with two lanes, which all the suppliers have to pass to deliver their goods to the terminal protected area. Despite having lots of known suppliers, there are long waiting times at the security check because personnel and the cart itself still needs to be checked. Next to the users, there is also a lot of goods/materials and waste roaming around in the logistic streets, which makes it even busier.

An opportunity area for this problem is to gain **control over the suppliers**. Control over the suppliers ensures that only the people who need to be in the logistics streets are allowed to be there. It will be less busy in the logistic streets, which will make the entire logistic process more efficient.

Asset shortage and malfunctioning assets

The second problem theme contains an asset shortage and malfunctioning of assets. The assets are a sensitive subject in the logistics journey. When talking about assets, the elevators are the ones first mentioned. The elevators are crucial in the logistics process since all the goods need to be transferred from minus two to the first floor. Per logistic street, there are two elevators leading to the lounges and often one leading to Schiphol Plaza. The building infrastructure of Schiphol is already quite old, and it is hard to change or expand the current infrastructure. The elevators have been there for many years and were originally installed as normal passenger elevators, while they are currently used as freight elevators. The two freight elevators per logistic street are certainly not enough to facilitate the entire logistics process. Besides, these elevators are also used by staff because there is no staircase leading to the first floor. Next to the shortage, the elevators are often not working because of goods carts colliding with the elevator doors or crashing into the walls inside the elevators. The goods carts are quite heavy loaded, and this causes that there is often damage after a collision. The shortage of and not working elevators cause long waiting times, which cause the elevators being the largest bottleneck in the logistics process.

An opportunity for this problem is to **automate processes**. The current processes are all done manually. When processes are automated, the human error will be eliminated, and sensors can prevent collisions with lifts or other assets. Automated processes can also eliminate a peak usage of assets by spreading the usage equally over the day and night and avoid expensive human labour during the night.

Too many different flows in the terminal

The third problem theme is that there are too many different flows in the terminal. The logistics flows of retail, f&b and waste are not the only flows that cross the normal passenger flow, but they are definitely one of the most visible flows because of the bigger good carts. Next to that, there are a lot of different shops all being supplied by, at this moment, nine suppliers. Schiphol does not exactly know how often and at what moments they transfer their goods from the logistic streets to the shops in the terminal. Next to the known suppliers, there are a lot of unknown suppliers of which Schiphol has no overview at all. All of the different flows and suppliers in the terminal cause it to be a busier terminal than necessary and with that disrupting the passenger flow.

An opportunity area for this problem is to gain **control over terminal flows** by combining, and with that minimizing, the flows in the terminal.

Carts in front of the stores

The fourth problem theme is about the goods carts being in front of the stores in the terminal. The stores in the terminal do not have any storage place which forces the logistics workers to place the carts in front of the store when delivering or unloading the goods from the cart. The carts are blocking the passenger flow in the terminal, the entrance and view of the stores. The carts disrupting the passenger flow cause unsafe situations since escape routes are being hindered. The carts blocking the entrance or view of the stores do not give a good impression to the passengers. Passengers are not able to enter the stores or are not able to see what products are being sold. This might cause passengers to buy less and have a negative impact on the passenger experience.

An opportunity area for this problem lies in the **terminal and shops layout**. Changing the terminal or shop layout could make it possible to create storage places, back of the house routes/halls in order to minimize the carts in front of the stores.

No data gathering process

The fifth problem theme contains a lack of data gathering in the logistics process. In the whole logistics process, there is definitely data gathered but Schiphol does not collect this data. The logistic streets and other staff locations can only be entered by presenting your Schiphol pass, which ensures that a lot of staff/personnel data is collected. Unfortunately, nothing is currently done with this data. Next to personnel data, there are a lot of goods movements out of which also a lot of data can be collected. At this moment, Schiphol does not have any idea how many carts are being supplied per day to Schiphol, how many goods enter Schiphol and how many logistic flows are crossing the terminal. Data about the logistic processes could show Schiphol that it is needed to change or implement new things in order to optimise the logistics processes.

An opportunity area for this problem is to start a **data gathering process**. Starting with collecting all the data that is already unconsciously gathered by Schiphol, requesting data from suppliers and collecting new data in the logistics process will deliver data in the full logistics process.

CONCLUSION

The research into the logistics process led to problem areas that form the biggest bottlenecks in the logistics journey. For the future process, it is important that these problem areas are addressed by creating opportunity areas. For the future logistics process, it is important that (1) there are not too many people in the logistics streets by gaining control over the suppliers, (2) the shortage of assets and non-operating assets can be seen as an opportunity to move towards automated processes, (3) there are not too many different flows in the terminal by gain control over the flows in the terminal, (4) carts no longer stand in front of the terminal by looking at the terminal and shop layout and at last (5) a data collection process does since no data is collected in the logistics process. These problem areas and opportunities can be found in figure 3.2.

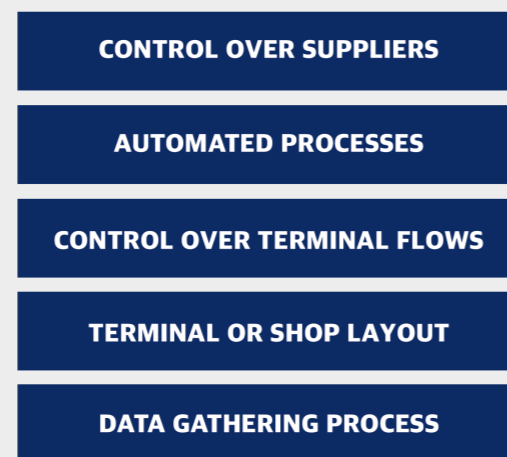


Figure 3.2: Opportunity areas

3.2 LOGISTIC INDUSTRY VALUES

Schiphol is not the only company that is dealing with a complex logistics situation. How did other companies set up their logistics process and what logistical problems are they facing? The Efteling, NS and the RAI have been visited. The interview results can be found in appendix 3.3.

NS Station Utrecht Centraal

The NS has a controlled logistics process since 2017. The suppliers of the stores deliver their goods at Utrecht Centraal, where the NS logistics workers are taking over to deliver the goods to the shops at Utrecht Centraal. The goods will be transferred to one big storage room in the basement, where all the goods of all the stores are stored. The stores pay an extra fee for the logistics service over their store rent. Store owners notice that this concept is cost saving, because the process is organized efficiently and the transport between warehouse and store is outsourced to the NS. The stores themselves can decide how often and when they would like their store to be supplied by the NS. The NS only does not deliver any goods in peak hours since the carts still have to cross the passengers in the station. All the flows, deliveries and invoicing are handled via an application, which also collects data.

RAI

The RAI is dealing with big events in which a lot of different partners are involved. These events are most often already planned five years in advance. The RAI is located in between a highway and a residential neighbourhood, which makes the delivery of the events harder. The delivery can only take place between 7.00h and 23.00h due to nuisance for the neighbourhood. During one event, a lot of different suppliers need to deliver their materials in a short period of time: the moment between the last event is completed and the new event will start. In this period the RAI makes use of a buffer at an external location, where trucks need to register and wait until they get a sign to actually supply their materials to the RAI. When trucks arrive at the RAI, they have a maximum parking time at the deck, and they have a towing away system. The only problem is that they cannot tow any big trucks away. At the event hall, the RAI makes use of one logistics partner that unloads, loads and transfers all the materials, also due to safety.

Efteling

The suppliers of the Efteling directly deliver to the Efteling. The suppliers must register at the security of the Efteling before entering the park. The suppliers can deliver from 7.00h until 9.30h. Before 7.00h the stores are not open yet and after 9.30h all the trucks should have left the park since the park is opening at 10.00h. The NPS of the Efteling is the most important factor in their operation and everything else comes second. The Efteling has chosen to not interrupt the guest during their visit to the park and let them experience the 'betovering'. This also ensured that there are no trucks/cars in the park during opening hours and only the EHBO and the breakdown services are allowed to travel by bike through the park. However, dustbins are emptied during opening times of the park, since they don't want their guests to experience full dustbins. The garbage will only be in sight of the guest for 25 meters at maximum because of making use of back of the house flows. The Efteling does have their own warehouses on sight for like example technical elements, clothing and packages. These warehouses are not optimized yet and a lot is done manually. The Efteling does also have a distribution centre in Tilburg for their own storage of parts. The transport from and towards the warehouse is done by the Efteling itself.

London Heathrow Central Distribution Centre

The new terminals at London Heathrow are developed in such a way that supplies are regulated with the use of a Consolidation Centre. All this information is obtained by a benchmark visit to the HCC by the PPM department.

The London Heathrow Consolidation Centre (HCC) had to be implemented because of a change in UK government legislation. The HCC is located at an outdoor area of London Heathrow. Suppliers must sign up in certain time slots in order to be able to deliver their goods to the HCC. The goods are then unloaded by the supplier, after which the security screening is done in and through the HCC. The goods are then prepared and loaded for transport to the terminal. The arrival and departure docks are located on the same side of the HCC, which causes the goods to travel in a U-turn covering a longer distance. This process could have been arranged more efficient.

The sealed goods are transported to the terminal, where they are delivered in the warehouses underneath the terminal. From there, empty carts and emballage (paper and cardboard only) return to the HCC. Deliveries to the

shops are done with back-of-house flows so that no passengers are crossed, and no deliveries are done during passenger peaks.

The HCC uses one contract party for cleaning, waste and bins, and one contract party for maintenance. The HCC has a Terminal Manager who is the direct contact person for suppliers regarding delay/changes. The HCC is also used to store emergency items such as water, food, field beds and blankets. HCC makes use of the services of DHL for their transport.

The number of transport movements has fallen by 40% since the HCC is in place. All deliveries from the HCC are made by means of the JIT principle because of the limited storage space. Besides JIT, cross-docking is used because no supplier is willing to pay for the storage of goods. All flows that cross the HCC are regulated and can be found in the systems.

The HCC operation is funded by the airport. The biggest drawbacks to the HCC are the higher costs and the biggest risks are fire and a breakdown of the IT server.

CONCLUSION

Besides Schiphol, there are other companies that are dealing with complex logistics processes such as the NS, RAI, efteling and London Heathrow. Interviews with these players gave insights in how they set up their processes and what could be taken into account in the future logistics process at Schiphol. For the future logistics process, it is useful to set up fixed time slots for suppliers to deliver their goods, one logistics party to be responsible for all logistics processes and setting up a buffer location outside the central point of the operation to take away processes in the central place. In addition, setting up time slots and making one logistics party responsible ensures that data will be collected centrally. The main findings from these interviews are summarized in Table 4.

	NS	RAI	Efteling	London Heathrow
Advantages	<ul style="list-style-type: none"> Full control of the logistics process Data collected via an application 	<ul style="list-style-type: none"> Buffer location One logistics partner responsible for the unloading and loading process 	<ul style="list-style-type: none"> No flows crossing the guests Fixed time slots for suppliers 	<ul style="list-style-type: none"> Fixed time slots in HCC One contract party responsible for different flows Logistics processes outside of the airport
Disadvantages	<ul style="list-style-type: none"> Carts are still crossing the passengers in the station 	<ul style="list-style-type: none"> Neighbourhood and the environmental zone around the RAI No data gathered in the process 	<ul style="list-style-type: none"> Everything is handled manually in the warehouses, which causes an inefficient process and long waiting times No data gathered in the process 	<ul style="list-style-type: none"> Higher costs Arrival and departure dock on the same side

Table 4: Positives and negatives of the process of logistics parties

3.3 STAKEHOLDER VALUES

The stakeholders of the working group, the shops and waste processing all have their own interests in the current process. What does each of these stakeholders do on a daily basis? How are they involved in the current logistics process? What do they think of the current process and how would they like to see the process in the future? An overview of the interviewed stakeholders can be found in table 5. A stakeholder canvas was used to obtain the same information from each stakeholder since a session with all stakeholders was not possible due to busy agendas. The canvas leads the conversation, making the meeting as efficient as possible. The canvas can be found in appendix 3.4.

3.3.1 INTERNAL STAKEHOLDERS

The internal stakeholders are involved in the current logistics process and were asked what they think of the current process and what they would like to see changed for the future process. The full interviews can be found in appendix 3.5.

Passenger Process Management (PPM)

The department PPM within OPS is responsible for the logistics process. The Service Owner of the Logistics at Schiphol is in the lead of all the logistic processes by writing a logistic policy that will be in place by the first of May 2020. For PPM safety in both the terminal and the logistic streets are of importance. This contains **no accidents in the logistic streets, no collisions with passengers and no carts blocking the passenger flows in the terminal**. Next to safety, the continuity of the logistic process is of importance as well in order to have the products on time in the stores. The continuity of the process lies in the **reliability of the assets**, especially the elevators, since these are the only transportation from the logistic streets towards the terminal.

Asset Management (ASM)

In the current process, there are not enough resources to facilitate the logistics process. The elevators are the biggest bottleneck in the entire logistics process. There is an elevator shortage and within this shortage, elevators are often broken down. These elevators are very small and are no special goods elevators. The **trustworthiness of assets** is important for the continuity and efficiency of the logistics process. Next to the elevators, there is not enough storage space and charging points for electrical vehicles (EVs). More **control over the EVs** is needed in order to prevent EVs roaming around in the logistic streets and terminal. A **clear logistic policy** is needed for all the logistic processes at Schiphol to prevent EVs, carts and waste roaming around everywhere. **Innovation in the current assets** could be of value for the future logistic processes by creating predictable, data gathering and automatic processes.

Interviewee	Department	Function
1	PPM	Service Owner Logistics
2	CRS	Commercial Coordinator
3	CRS	Manager Development CRS
4	ASM	Accountmanager
5	SRE	Manager Terminale Verhuringen
6	Security	Security Process Developer
7	SQC	Senior Safety Advisor

Table 5: Interviewees stakeholder value mapping

Consumers (CRS)

CRS is responsible for the development and design of commercial and residential areas in the terminal, and for innovative and profitable retail, hospitality, and service concepts. CRS is involved in the logistics workgroup since their suppliers are the cause of the logistic processes. The suppliers are renting a commercial space in the terminal in which they are able to sell their products. Next to the rent, the suppliers pay a concession over their turnover. This is Schiphol's most important source of income. In the past years, CRS have been a lessor which now causes CRS not having a lot of influence/control over their suppliers because of the long set contracts. CRS conclude contracts with these suppliers that have a duration ranging from five to ten years. Since last year, CRS decided to change its strategy in order to provide more direction and control to have an influence on what is happening in the terminal. They want to get rid of long contracts with traditional suppliers in order to attract new suppliers. This gives them more **control over the suppliers**, due to shorter contracts, and they can offer the passenger new shopping concepts that hopefully benefit the passenger experience. The only disadvantage is that there will be even more suppliers in the logistics streets and flows in the terminal. The way of shopping at an airport is changing, which causes shorter contracts to be important for changing the current shop layout in order to keep up with the shopping trends. For example, CRS will start a

trial with touchscreen shopping and vending machines in the coming year.

For CRS, it is all about the passenger experience. The suppliers are in full control over their own delivery processes. In the current process **carts are roaming around** everywhere in the terminal and are blocking the view or entrance to the shops, which definitely have a **negative influence on the passenger buying experience**. In the future process it would be ideal to change the current **shop/terminal layout** by creating back of the house (BOH) delivery with a logistic hall behind the stores to overcome the problem of the roaming carts. The suppliers experience an inefficient logistic process where they have to wait for elevators (broken or too few) and carts being in the way of their flow. More suppliers in the future will further deteriorate this situation which will require a change in the delivery of goods by combining orders to maintain a safe environment and the **continuity of the process**. Another solution lies in the relocation of processes outside Schiphol, which is more difficult in the short term because of the long-term contracts with the suppliers. Next to that, there is no data gathered in the whole process and data is needed to create a **data steering process**.

PPM

- Data gathering is needed in order to change the current situation
- Reliability of assets to have a continuous process (continuity)
- No accidents in logistic streets (safety)
- No collisions with passengers (safety)
- Carts blocking passenger flows (safety)

CRS

- Data controlled process
- Efficiency by combining orders
- Continuity of process with working assets
- Control over suppliers
- Innovation in shop/terminal layout
- Carts hinder passenger experience for buying goods

ASM

- Innovation needed to gather data and predict the process
- Control over EVs in the terminal
- Clear policy for logistics processes
- Trustworthy of assets

SQC

- Control over EVs in the terminal
- Carts blocking escape routes
- Roaming carts

SRE

- Working assets
- Convenient renting space for suppliers
- Hospitality by facilitating the right space and assets

Schiphol Real Estate (SRE)

SRE is responsible for facilitating the suppliers with the **right space and assets** to ensure the supply of goods to run smoothly. In the current infrastructure, Schiphol is not having enough storage spaces and is not able to offer a storage space to every supplier in the logistic streets. Only facilitating the renting space is not enough. Having a renting space close to the store for a convenient and efficient delivery can only be done when all the **assets are working**.

Safety, Quality, Control (SQC)

The most important factor for SQC is safety. The current process is cluttered and together with the busy logistic streets, it causes many unsafe situations. There are insufficient storage places for carts which causes **carts roaming around** everywhere and even **blocking escape routes** for both passengers in the terminal as the personnel in the logistic streets. A lot of suppliers make use of EVs to deliver multiple carts in one delivery to the stores. There are a lot of different EVs used in the terminal by different logistic parties that cross the passenger flows. Schiphol does not have any idea how many EVs are actually driving through the terminal, at what times and what routes they take. Schiphol should take more **control over the EVs** usage in the terminal. For the future process, it would be ideal to create a separation between the passenger flows and the logistics flows in the terminal.

Security

The current and future process of the security of goods is confidential and will not be discussed in this thesis but are taken into account in the vision and roadmap creation.

3.3.2 EXTERNAL STAKEHOLDERS

The external stakeholders are involved in the logistics processes of Schiphol every day. This chapter points out what the external stakeholders find of the logistics process and what they believe is of value for the logistic process in the future. The information in this chapter is obtained during interviews with these stakeholders. The full interviews can be found in appendix 3.7.

World of Delights (WOD)

WOD points out that the logistics process has become more complex over the last few years, mainly because of the growth in passengers and growth at Schiphol. This has caused a growth in sales as well, while the assets and the logistic services have all remained the same. The main obstacles in their logistic process are the long waiting times at the security check and the elevators. In the meantime, WOD and other known suppliers have figured out which supplier supplies at what time, so that they suffer as little as possible from each other's delivery. WOD thinks it is important that Schiphol gets more grip on the rules in the logistic streets and the number of carts roaming around. WOD believes that they are not limited by regulations but becoming stricter is always difficult.

WOD raises that the ideal situation would be to supply and clean the stores during the night. But it is very expensive labour and some stores are closed during night time which makes it impossible to supply the goods without having a storage place. Next to that, as a known supplier, it is not possible to deliver the goods the night before to Schiphol since they are not able to store their goods after the security check.

HMS Host

For HMS Host it is important that the whole process at Schiphol is as fast and efficient as possible, in which the assets play a big role. When the elevators are not working, their whole process comes to a halt. Besides that, there are a lot of people in the logistic streets that do not have any business in there. HMS Host is dependent on its subcontractors and points out that they limit innovations in their logistic processes. The current process at the warehouses of the subcontractors is all done manually, while HMS Host does see innovation possible in the automation of processes. There is a shortage of logistic workers, which automation could solve, even though it takes away jobs. But they are too dependent on their subcontractors for now.

Figure 3.3: Stakeholder values

SUEZ

SUEZ often has to deal with elevators that are often not working in the logistic streets and crowds in the terminal. Besides the passenger crowds, there are too many other flows crossing each other which make it hard for SUEZ to drive through the terminal. More and more stores are moving towards the gates at the end of the terminal, which causes the waste-collecting to be more time consuming and longer distances with have to be covered with more crossing passengers.

SUEZ aims to have zero waste in 2030. In order to make this possible, smaller recycle flows are needed for being able to recycle everything. Ideally, SUEZ wants to be circular by re-usage of materials or to create something new from the waste. SUEZ would like to work with press waste containers in the future. The only problem with these press containers is that it is harder to recycle waste. All the material in the bin needs to be one homogeneous stream in order to make recycling possible. In this case, SUEZ is dependent on passengers who may recycle incorrectly.

CONCLUSION

The logistics process involves many stakeholders who are all involved in the logistics processes somehow. Interviews have been conducted with all these stakeholders to find out what they think is of importance in the logistics process and how they would like to see the logistics process changed in the future. All these results are clustered, from which stakeholder value themes have originated. The stakeholder value themes include (1) control which mainly includes control over suppliers and EV usage, (2) data gathering indicating the need for a data gathering process, (3) safety/security in which there should not be any accidents and the escape routes must be accessible at all times and (4) assets that are reliable to ensure the continuity of the process. These themes are visualised in figure 3.4

CONTROL

- ASM: Control over EVs in the terminal
- ASM: Clear policy for logistics processes
- CRS: Control over suppliers
- SQC: Control over EVs in the terminal

ASSETS

- OPS: Reliability of assets to have a continuous process
- ASM: Trustworthy of assets
- CRS: Continuity of process with working assets
- SRE: Working assets

DATA GATHERING

- OPS: Data needed to change the current situation
- CRS: Data controlled process
- CRS: Efficiency by combining orders
- ASM: Innovation needed to gather data and predict process

SAFETY

- OPS: No accidents in logistic streets
- OPS: No collisions with passengers
- OPS: Carts blocking passenger flows
- SQC: Carts blocking escape routes
- SQC: Roaming carts

Figure 3.4: Value themes of stakeholders

3.4 TREND FORESIGHTS

Trends foresights have been used as a part of the strategic thinking step in the Strategy Development Process (Conway, 2014) in which a deeper understanding of the possible future environment is developed by uncovering changes in the society over the longer term (Delft Design Guide, 2020). According to Foresight International (2005) foresight is “a university human capacity which allows people to think ahead and consider, model, create and respond to, future eventualities”.

The PPM department is responsible for all the passenger processes for one up to three years. This department is therefore focussed on the short term thinking and are not making use of any foresight methods. An extensive trend foresight research has been performed to push them out of their comfort zone and giving them a whole different view on possible future processes because innovative solutions do not emerge from staying in comfort zones (Conway, 2014).

Besides the lack of using any forecasting methods, managers often have the tendency to only scan within the existing market of the organisation (Conway, 2014). Therefore, trends have been sought in different search areas that are connected to the logistics journey of Schiphol. All the trends have been plotted into a trend map and clustered into interesting trend themes that could be of value for the future logistics process at Schiphol. As last, trend scenarios are drawn up on the basis of this trend themes.

3.4.1 SEARCH AREAS

The logistics process of Schiphol is crossing multiple industries: logistics, airport, retail, f&b, and cities as visualised in figure 3.5. It all starts in the **logistics** industry where an order is placed and the goods are picked in a warehouse. The goods are transported through **cities** to the right destination, in this case Schiphol. When the goods arrive at Schiphol, they enter the airport. An **airport** is a difficult environment with a lot of different movements happening at the same time and passengers wandering around everywhere. The main goal of the airport is to transfer people from A to B, with a focus on what the customer actually wants. At the airport, there are multiple **retail** shops and **f&b** places where customers can shop and buy f&b for on the way. Next to trends in these industries, general trends have been collected as well. The **consumer** has been taken into account as well but is categorised under all the other categories.

All the 105 found trends in these search areas have been clustered, in order to find similarities between the different search areas. The clusters can be found in appendix 3.8. Due to similarities in the clustered search areas, the clusters are re-clustered, from which trend themes arose. This clustering can be found in appendix 3.9.

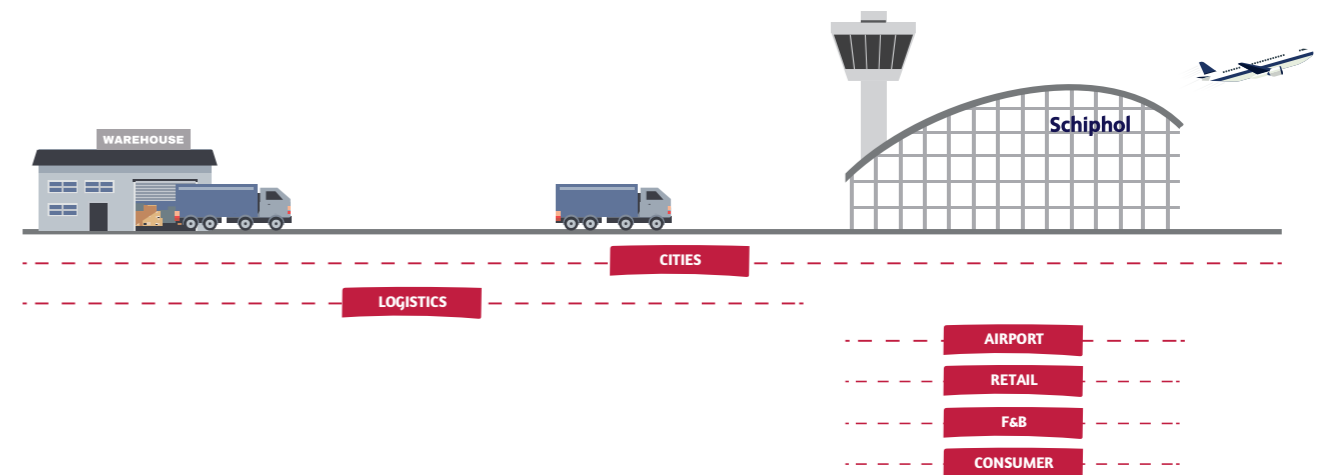


Figure 3.5: Trend search areas

3.4.2 TREND SCENARIOS

The trend themes, obtained out of the clustering process, are of importance in the future of the logistics process at Schiphol. The trend themes provide a clear picture of what the future could look like within these themes. The different trend themes are digitalisation, personalisation, sustainability, building environment and shopping.

Trend scenarios

The trend themes are elaborated in the following pages by a future scenario, the most important trends per theme and imaginary pictures sketching this theme future. All the trends belonging to the trend themes are elaborated in appendix 3.10. The sources in the trend scenarios are indicated with a number and can be found in a special section of chapter 8. The trends are explained by using the trends cards in figure 3.6.



Figure 3.6. Trend cards

DIGITALISATION

Digitalisation is changing the world of today. The paper processes will give way to digital processes, platforms and systems whereby the human factor will be minimized or fulfil other tasks. Many new technologies are under development and will definitely cause changes in several sectors. At airports, the passenger process will become as seamless as possible. Blockchain and IoT will ensure that data can be linked to each other so that, for example, biometrics, luggage tracking and invisible security checks can be realized (3, 6, 17). In addition, the passenger will be able to go through the airport process on their own by using self-check-in and robots assisting the passenger in various areas of the airport process (3, 5). In the field of logistics, everything will be more data driven (6). Logistic parties will start sharing data throughout the whole supply chain, making it clear what is happening at any time in the supply chain. (3, 4) Choices can be made on the basis of the collected and real-time data, so that processes can be predicted which ensures the logistics process will work more efficiently (6, 13). In addition, the logistics sector will be much more automated in the coming years by using picking robots in warehouses and autonomous car deliveries (5,31).



Robots replace humans
 Robots are increasingly being used to replace normal employees. Robots are cheaper than normal workers and increase productivity. Robots will take over a large part of the jobs in the future, but new jobs will also be created assisting the robots.
 Source 3 & 5

Connected chain
 Everything in the logistics chain will be connected with each other like vehicles, drives and customers. No separation is made between the private and business environment anymore. It becomes easier for logistics parties to make decisions and tailor their processes for both consumers as their own business operation. Next to that, connectivity makes it able for logistics parties to act more sustainable.
 Source 3 & 4

Data-driven decision making
 Logistics parties predict that data-driven decision making becomes crucial in order to improve the quality and the performance in their supply chain. Big data makes it possible to have an effective supply and demand forecast, inventory management, route optimisation and efficient labour management.
 Source 6

PERSONALISATION

Companies are realizing that the customer must come first in order to survive in the highly competitive market of today where companies also start offering online products and services (21, 22). In addition to that, customer expectations are rising due to digitization and new technologies. Companies will need to respond to this by offering personalized products and services (9, 17), whereby the customer is provided with his customer needs in order to create an excellent customer experience. Companies will work together to meet the customer needs (20). In order to find out what the customer actually wants, data is collected in various ways so that companies can respond to those needs.

Commercial partnerships

Airports are partnering up with other companies to serve their passengers best and create personalised passenger experiences. Commercial partnerships with Deliveroo and HMSHost have been trialled in order to give passengers freshly prepared food delivered to their gate.

Source 20

Hyper-personalisation

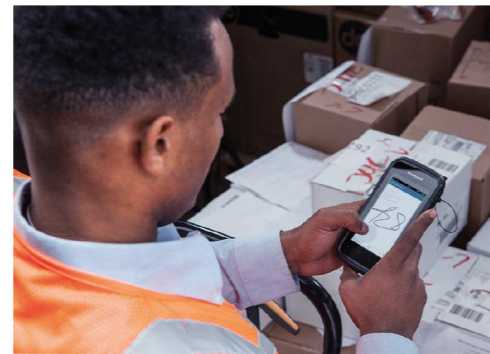
Retailers are obtaining more and more data about their consumers by making use of tools like online surveys, big data and machine vision. These tools will help retailers to better understand consumer needs. Giving retailers access to more data makes it possible to better meet customer needs and create as personal and unique experiences as possible.

Source 9 & 17

Passenger personalisation

The journey of the passenger at the airport is becoming more seamless and connected and the way how passengers interact with airports and airlines is changing. New technologies are empowering passengers to personalise their journey. Passengers are able to view and change their flight info, get their boarding pass and pre-order services before arriving at the airport. Retailers after security are offering personalised offerings, obtained out of data, that meet the passenger needs. Via an application passengers are able to order food, track their luggage and order a taxi to pick them up from the airport.

Source 22



SUSTAINABILITY

Nowadays, sustainability is an important element that every company should take into account since the CO2 emissions must be halved by 2030 according to the new climate law (European Commission). Companies will change their business model to create a more circular economy (46). For example, there is a cradle to cradle certification and the logistics sector will switch to green logistics (7). More attention is given to the packaging of products and foods in which plastic and polystyrene are prohibited and companies start working with more and more sustainable packaging to meet customer requirements (12, 26, 33). The customer is more aware of what kind of influence he/she has on the nature/environment and will make more conscious choices when buying products in order to be able to establish a better self-image. The customer therefore opts for brands that are transparent in communicating the origin of both the product itself and the packaging (9, 14, 16, 29).

Green logistics

Companies in the logistics industry are integrating more and more sustainability goals into their processes by focussing on the environmental burden of transportation and supply chains.

Source 7

Small-scale and local products/ingredients

Consumers are reevaluating small scale and local products/ingredients. They do not longer want to buy frozen food since fresh food is seen as a healthier option and start to produce everything (food, services, goods, news, culture etc.) locally and by oneself, which is called hyperlocalisation. Consumers are looking to fulfil their needs with locally produced alternatives.

Source 26

Social and environmental impact buying

Consumers will buy brands by looking at their social and environmental impact. They want to have better traceability of where the product is coming from and see how the product is contributing to a more sustainable world on the packaging. This does not only count for the packaging, but also how a product is sourced, manufactured and sold.

Source 9 & 14 & 16 & 29



BUILDING ENVIRONMENT

The cities are becoming increasingly populated. Cities will have to be designed and arranged in a different way by rethinking the use of the facilities within the city and even buildings (24, 42). The buildings themselves will be decorated differently. For example, more sensors will be used to measure and regulate everything in the building environment (52). This provides smart environments with which a lot of data can be collected. In addition to the sensors, the environment of the room itself will also play a greater role. There will be more focus on the environment and what feeling this environment evokes by the user (23, 24). The user finds it important how a room feels and what kind of experience he/she gets within the room.



Conscious facility usage

Airports are rethinking the usage of their facilities. The most valuable real estate is at most airports occupied by parking structures, while this space could be used for other purposes. Re-evaluating the facilities could lead to new services like for example Valet parking at Schiphol Airport.

Source 24

Atmosphere design

More and more focus is put on the environment in which consumers find themselves. The atmosphere of an environment is key in the consumer's product and service consumption. Especially companies that are competing with online shopping will need to put extra emphasis on their atmosphere design in order to increase customer satisfaction and with that returning customers.

Source

Smart environments

Smart technologies have already been applied in homes, entertainment and security solutions. In the coming years, smart technologies will start to assist the consumer by being implemented into structures and furniture creating smart environments.

Source 52

SHOPPING

The way of shopping has changed considerably in recent years, partly due to the rise of online shopping. Despite this rise, the customer still likes to gain a physical shopping experience in addition to online ordering. However, the layout and function of the physical stores have changed. The physical store will become smaller with more focus on a specific target group (25, 50). The stores will no longer have the entire range displayed, but will put more focus on gaining experience, also called retailtainment (9, 10, 11, 12, 26), with both the product and the brand: How does the fabric feel? What does the colour look like? What does the brand stand for? In addition to brands wanting to create brand engagement in the stores, companies will also advertise on social media and give the customer the opportunity to immediately purchase the products out of the advertisement (9, 12). As a result, customers will increasingly receive personalized offers. In addition, the customer also finds it important to be aware of the environment while shopping, called conspicuous conservation. On the other side, products will be offered as a service/rental basis whereby different users use one product at different times and not all have to purchase the product themselves (26, 29).

Retailtainment

Retailtainment, or experiential retail, is changing up the retail market. Consumers are valuing experiences over material possession and are more willing to spend their money on experience related products or services. Immersive experiences can attract a consumer to the stores and ensure they leave with memories.

Source 9 & 11 & 12 & 26

Brand engagement at airports

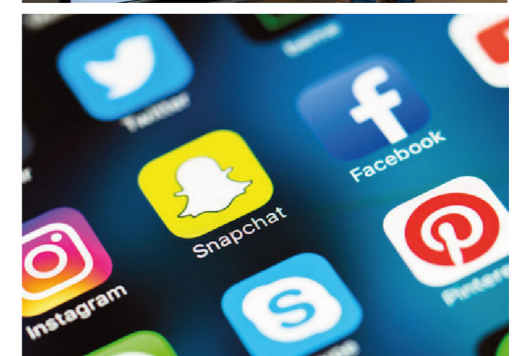
Airport shopping will all be about creating brand engagement, rather than forcing consumers to buy products in the stores. Companies will share their brand identity and values in the store to create a customer base.

Source 24

Smaller shops

The retail industry is changing towards smaller format shops. Smaller shops are placed on a strategically placed location where retailers can reach their specific target group with a smaller selection of products specifically aimed for that target group. Next to that, there is also a growth in pop-up stores where customers can experiment with products.

Source 25 & 50



3.4.3 TRENDS PLOTTED ON LOGISTICS JOURNEY

Not all the gathered trends are of value for the logistics process at Schiphol. All the trends are plotted on the logistics journey to find out if and where these trends can be of value. After plotting, trend clusters are created to create a better overview of the possible future opportunities in the logistics journey, named opportunity areas. The logistics journey mainly shows that there is much to be gained in the areas: external, landside and the terminal. The trends plotted on the logistics journey can be found in figure 3.7.

External

In the external field there is a lot to gain in the warehouses and the supply chain of suppliers. Much more emphasis could be placed on data and connectivity in the logistics process to ensure that the entire logistics chain can be connected in which data exchange takes place. In addition, there is also an opportunity to look at the use of the current facilities and how they could be refurbished within Schiphol.

Landside

On landside, or the logistic streets, there are mainly opportunities in the field of technology. Robots and smart environments can be used in the logistics process. Robots can take over the human factor in the logistics process in order to achieve a more efficient process. In order to make this possible, there will also have to be more connectivity in the logistics process, where smart environments can play a role. Smart environments will be able to perceive and store data to base logistics processes on.

Terminal

In the terminal, much emphasis could be put on a different way of shopping where it is much more about the passenger experience, personalisation, types of shops and the ways of ordering. For example, a lot can be gained by turning the shops into smaller experience stores where the passenger mainly creates a brand engagement instead of buying things on the spot.

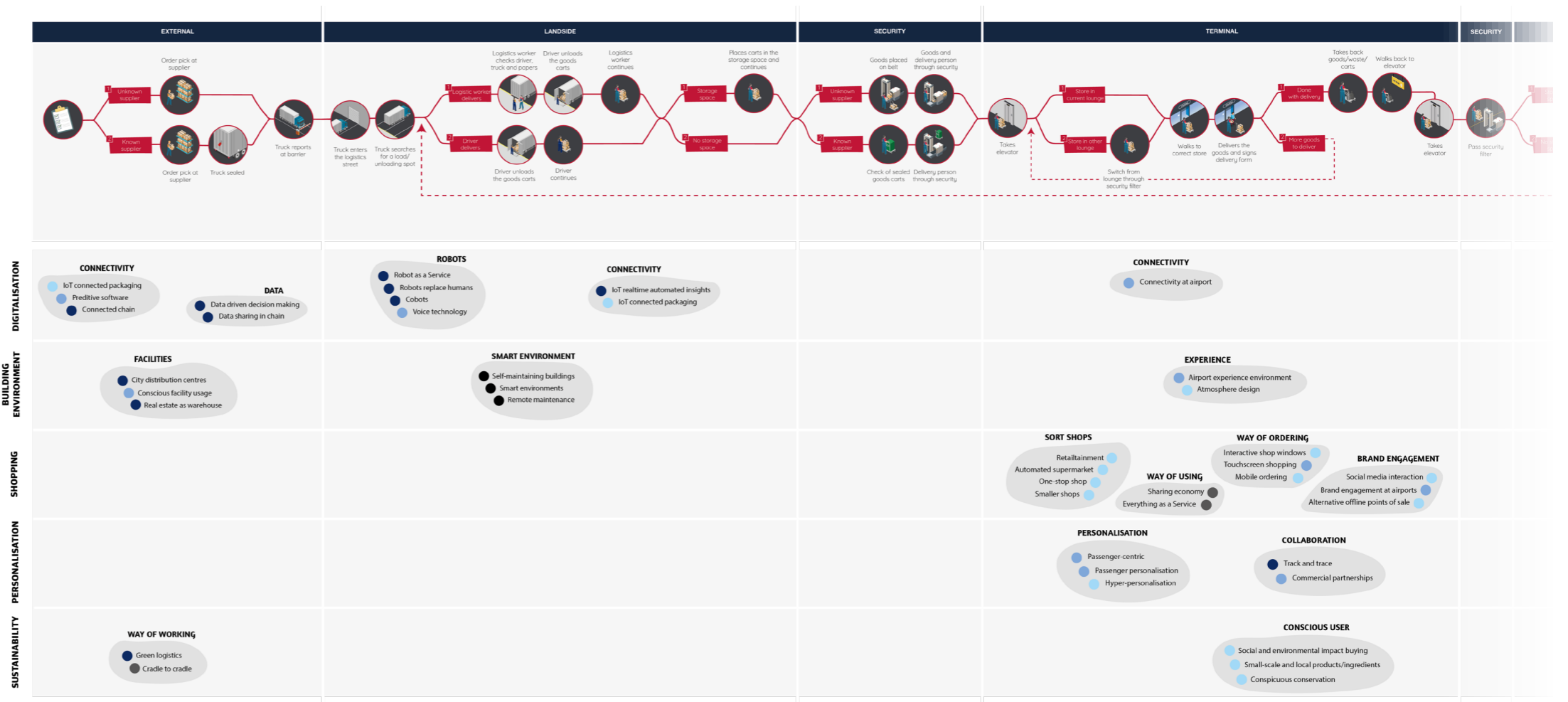


Figure 3.7: Trends plotted on the logistics journey

3.4.4 TREND MAP

The trends in the trend opportunity clusters will not all be happening at the same time in the future. A trend map has been created to visualise when the trends, within every trend theme, will occur in the future. For this map, an analysis is done of what is already happening in these industries and how this could develop in the future. The trends were first mapped per search area on the timeline, after which is looked at how the trends in these search areas stand together in order to sketch a realistic picture of the future. While plotting the trends, into account has been taken that the airport industry lags behind over time on the retail and logistics industry. In the retail and logistics industries there is more opportunity to experiment with various new innovative ideas. The airport environment remains a complex environment in which many long contracts run, processes are difficult to change, and many safety requirements play a role.

The trend map with all the trends that could be of value for the logistics process is visualised in figure 3.8. The circle in the middle of the map represents today, with three horizons further in the future: 2022 in the first circle, 2025 in the second circle and 2030 in the third circle. The choice for 2025 was made because the PPM department looks ahead for 5 years at most. The department Corporate Development looks ahead from 5 until 10 years, therefore 2030 have been chosen.

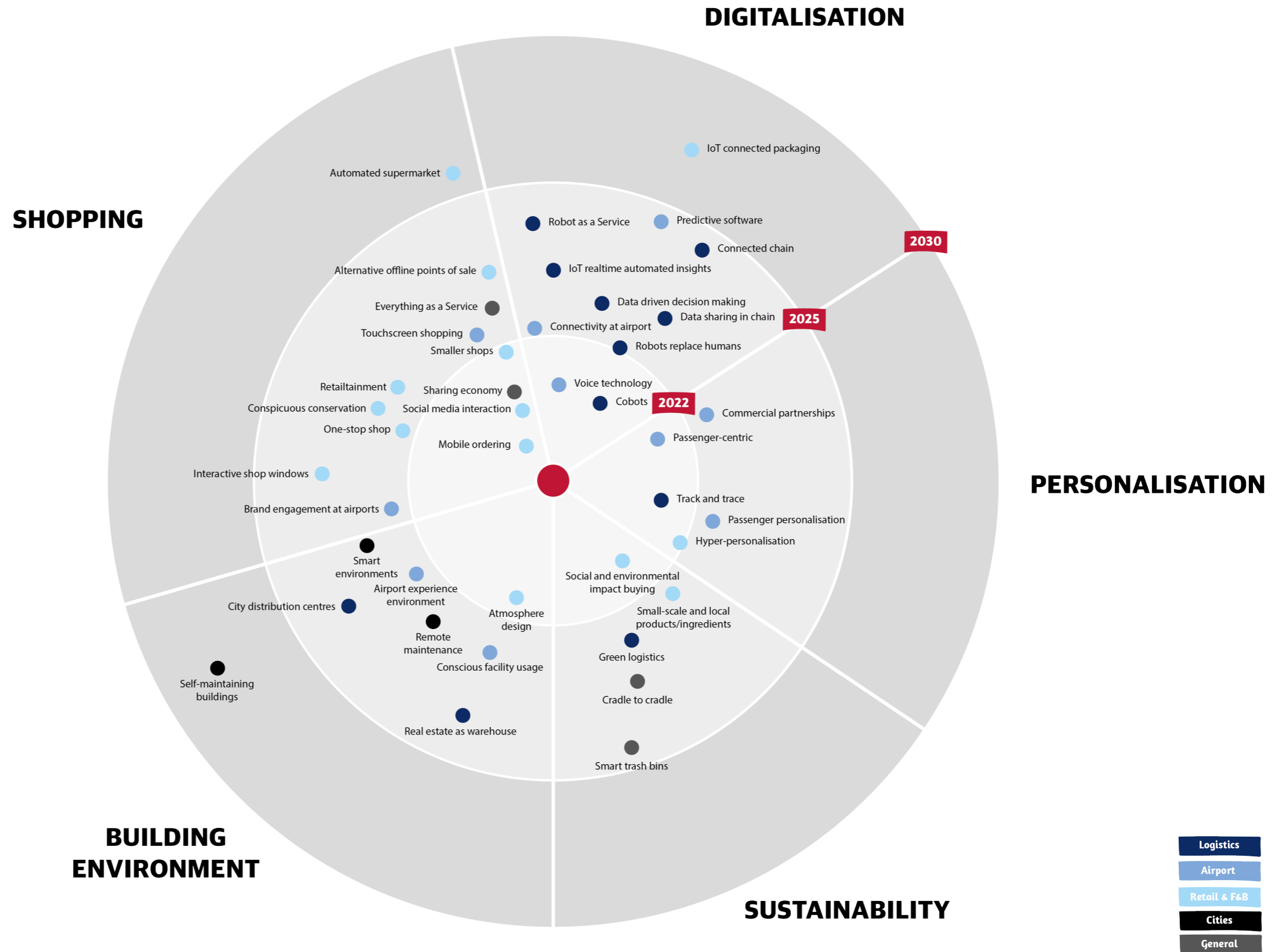


Figure 3.8: Trend map

CONCLUSION

Trend foresights have been used to get a better understanding of what might happen in the future of the logistics process. Trends have been sought in various search areas, i.e. industries involved in the logistics process at Schiphol. The trend analysis within these search areas has created the trend themes of digitisation, building environment, shopping, personalisation and sustainability. Trend scenarios have been created out of these trend themes to sketch a possible future. All trends are plotted on the logistics journey to find out which trends could be of value in the logistics process at Schiphol. The trends plotted on the logistics journey are clustered, from which opportunity areas are created in different parts of the logistics journey, see figure 3.9. In the external field, there are opportunities in the areas of connectivity, data and facilities. On landside there are opportunities to use robots and smart environments. In the terminal there are opportunities in the personalization of processes, the passenger experience, way of ordering goods and way of shopping, sort shops, brand engagement and commercial collaborations. Finally, the trends are plotted in a trend map to determine how the trends might develop over time.

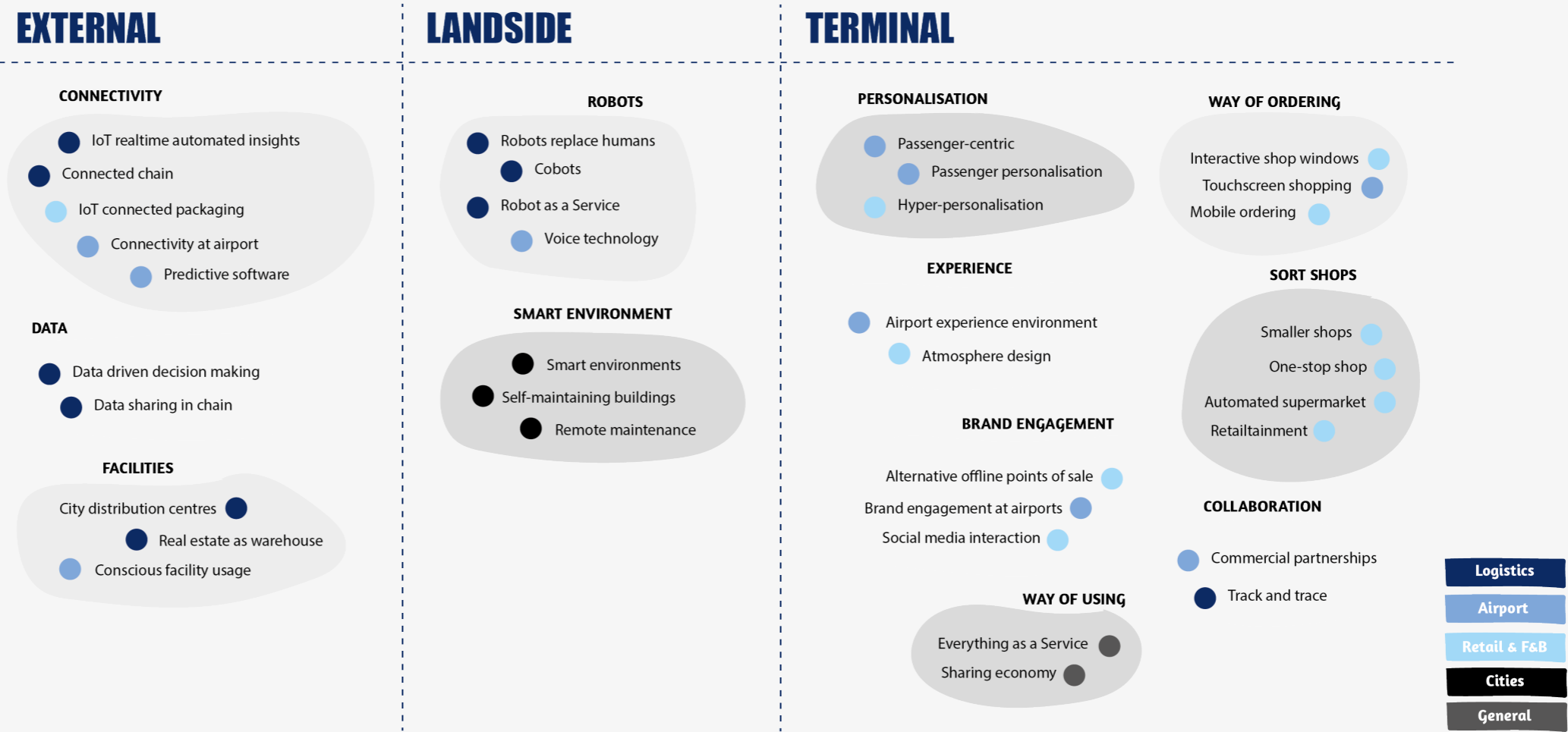


Figure 3.9. Trend opportunity areas



FINEFOOD

04

FUTURE VISIONING

This chapter presents a future vision for the logistics process in 2030. The future vision is defined on the basis of the results of the value mapping phase and validated with the stakeholders within the logistics process.

4.1 FUTURE VISIONING

As part of the graduation project, a future vision is developed. According to Fiegenbaum et. al. (1996) “a future vision is an expression of a desired future”. The future vision will serve as a strategic reference point for the design roadmap, as described in chapter 6. The future vision of the roadmap is focussing on long term directions for innovations and future value experiences (Dunne, and Dougherty, 2016) while trying to create tension between ‘what is’ and ‘what could be’ (Simonse, 2017). A future vision and corporate vision are often mixed up with each other. However, the corporate vision and the future vision can be related to each other and a future vision could be equally embedded in the corporate vision. According to El-Namaki (1992) “Corporate visions have a larger, company-wide scope, covering raison d’etre, overall positioning and goal setting of the company”. Corporate visions are strategic statements that cover the strengths, weaknesses, values and beliefs of the company (Kantabutra and Avery, 2010). The logistic future vision is mainly about sketching long term directions of innovations in the logistics process instead of the raison d’etre and the corresponding goal setting of the entire company. The logistics process is a small part within Schiphol and is not covering the company-wide scope.

4.2 VISION THEMES

The future vision for the logistics process is created with the results of the value mapping phase. The problem opportunities, stakeholder values and trends showed an overlap in values, out of which three vision themes are created. The future vision is built up out of three vision themes control, connected and autonomous. The three vision themes are not all equal to each other in the vision. The control theme has the focus in the vision, in which the connected chain and the autonomous processes are means of getting that control.

Control

At first, it is important for Schiphol that they get control over the full logistics process. Currently, Schiphol itself has no control over which supplier delivers when and how the goods are delivered to both Schiphol and the terminal. Ideally, Schiphol should have full control over the logistics chain:

- Control the supply of goods at Schiphol
- Control in the logistics streets
- Control over the supply of goods in the terminal

Connected

Secondly, a connected chain would be of value for Schiphol. At this moment, no data is gathered in the process and Schiphol has no idea how efficient or inefficient all the suppliers work and how the flows are moving through the terminal. By creating a connected supply chain, a more efficient logistics chain can be created in which flows could be synchronised, predicted and become more transparent.

Automated

As third and last, the logistics process should be more automated in order to create a continuous process. Currently, everything is done by hand in the logistic streets which causes human errors and expensive manpower during the night. Automated processes, like AGVs (Automated Guided Vehicles) and robots, can continue 24/7 and with that reduce the flows in peak hours by performing work during the night. Automated vehicles or robots could even save data and improve the process itself with the use of new software and technologies.

Each vision theme is linked with the results of the value mapping phase, as shown in figure 4.1, with the problem opportunities in the blue elongated blocks, the stakeholder values in the grey squares and the trends in the grey clouds. See appendix 4.1 for all the problem opportunities, 4.2 for the stakeholder values and 4.3 for the trends linked to the vision themes.

4.3 FUTURE VISION

The future vision for the logistics process is set for 2030, since CD is responsible for the logistic processes up to ten years. The vision is visualised in figure 4.2.

The vision is:

“In 2030, Schiphol facilitates the logistics process by making use of a connected chain and autonomous processes.”

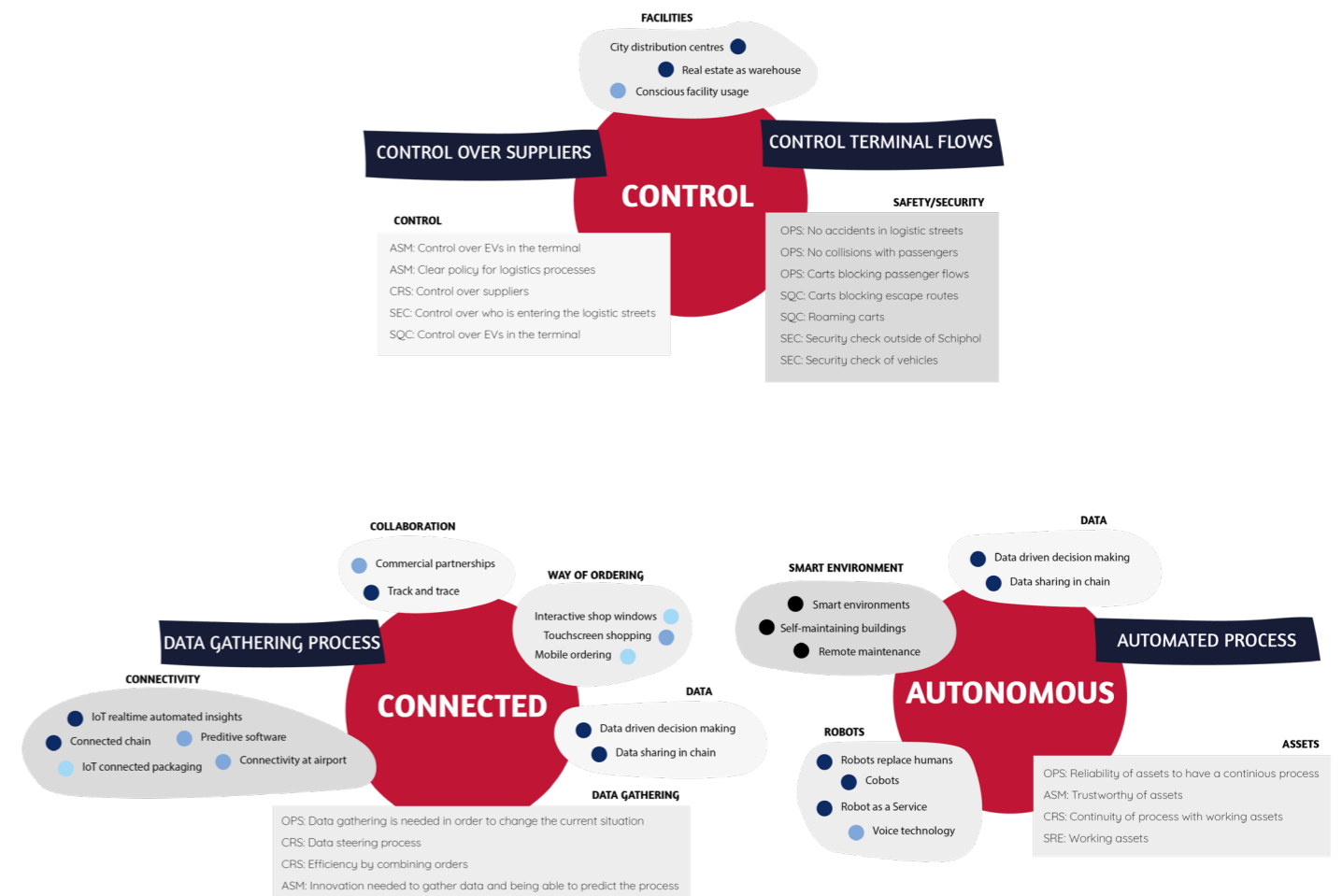


Figure 4.1: Vision themes linked to research

Vision linked to TPIs

The vision is linked to four TPIs of Schiphol. The preconditions for the vision are safety and sustainability. These are important during the entire process and should always be met. It is also important to comply with the OTP (On Time Performance) and the NPS (Net Promoter Score) for the logistics process. Although, the definition of these TPIs differ from the normal process. It is important for the logistics process that all goods are delivered on time and according to a fixed schedule. For the NPS it is important that the passengers can be served at any time anywhere in the terminal, which means: a good supply of goods, on time in the store when the customer wants or needs it. What will ultimately result in a positive customer shopping experience.

Interviewee	Department	Function
1	PPM	Service Owner Logistics
2	PPM	Manager PPM
3	ASM	Accountmanager
4	SRE	Manager Terminale Verhuringen
5	Security	Security Process Developer
6	SQC	Senior Safety Advisor
7	HMS Host	Manager Interne Dienst
8	HMS Host	Logistics Worker

Table 6: Interviewees of validation vision

4.4 VALIDATION

The vision has been validated with logistics stakeholders in order to create a shared vision that everyone agrees with and supports. The vision is validated by doing interviews with eight stakeholders, see table 6.

Control - All the stakeholders agreed that Schiphol needs to take more control over the logistics process. Schiphol facilitating the logistics process for the suppliers is seen as a good future direction since Schiphol is already facilitating the airport processes for airlines that pay port dues being able to use the services at Schiphol. Schiphol is in this process having control over how airlines are able to use the services.

Connected - Besides that, the stakeholders agreed that a connected logistics chain would definitely be a future goal to strive towards. Having a connected chain also ensures that data is gathered in the process, bottlenecks are easily found and to create an efficient and transparent process.

Autonomous - The autonomous theme is a more sensitive topic. Most of the stakeholders realise that it is time to take one step further in the logistics process and do see that the world around us is becoming more automated. Only seeing these autonomous solutions being applied within Schiphol is an obstacle because of safety being the main vision pillar. Besides that, it takes a lot of time to implement new innovations at Schiphol. However, multiple stakeholders mentioned that they did like the innovative autonomous theme in the vision and saw it as a goal to strive towards since it definitely could be of value for the logistics process at Schiphol. Otherwise, Schiphol will never try to implement any new solutions.

All the results of the validation can be found in appendix 4.4.

CONCLUSION

The future vision for 2030 is based on the results from the journey value mapping, stakeholder value mapping, and trend foresights. From this, the three vision pillars control, connected and autonomous are created. The vision is 'Schiphol facilitates and controls the logistics process by making use of a connected chain and autonomous processes'.

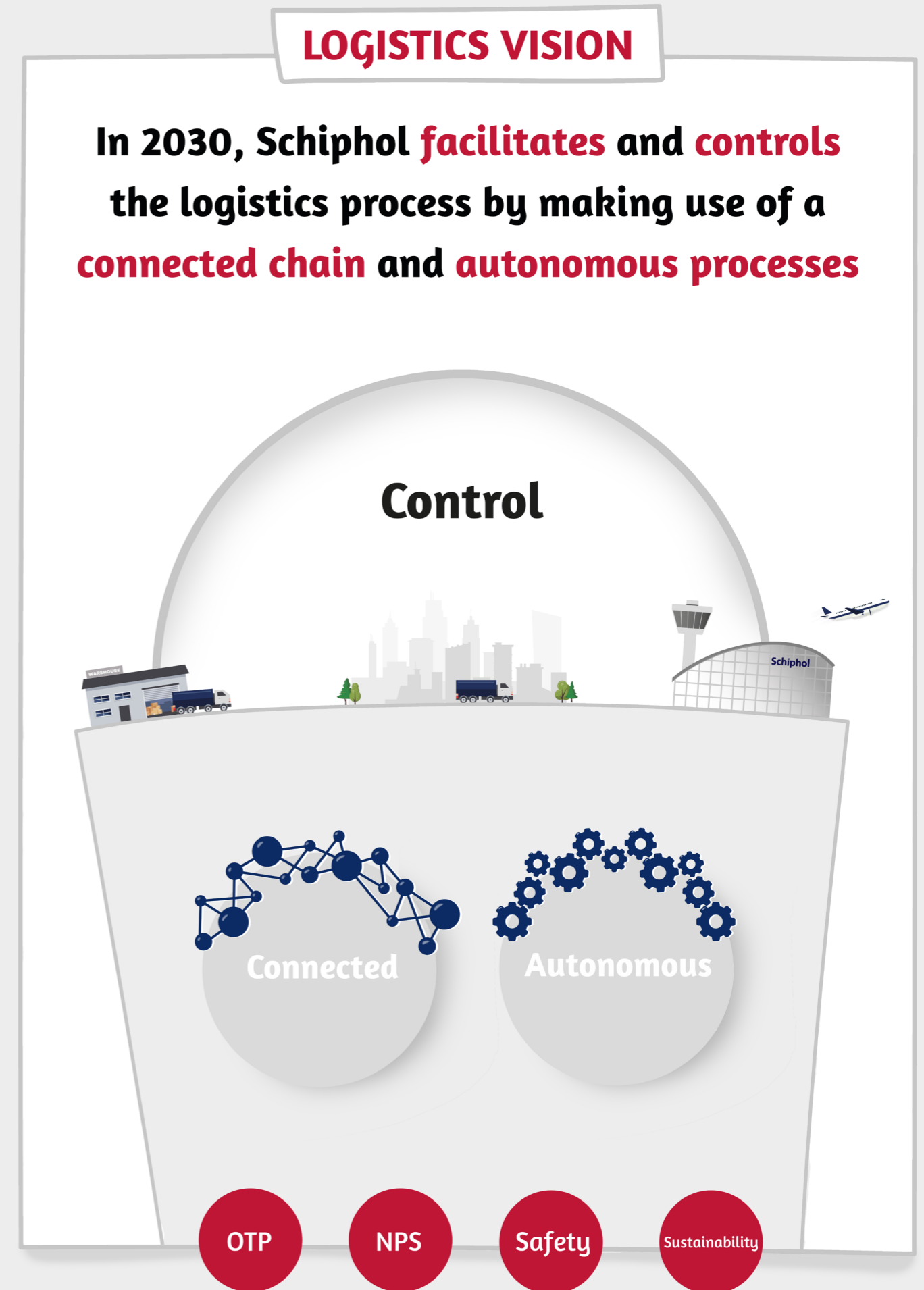


Figure 4.2: Visual vision



05

IDEA MAPPING

This chapter gives an overview of the idea generation phase. Three different idea mapping sessions have been organized, out of which idea clusters for the future logistics process emerged. The idea clusters are plotted on a timeline, after which service propositions for the design roadmap are created for the future logistics process. Finally, the use of technologies for these service propositions are explored.

5.1 IDEA MAPPING SESSIONS

To come up with new ideas and to have investigate future possibilities, three different idea mapping sessions were organized. All three different idea mapping sessions are divided into two parts. The first part is about creating ideas on the problems of the logistics journey and the second part about sketching the logistics process in 10 years. All the idea mapping sessions are performed with post-its in order to re-use the results of the brainstorm for the clustering process. The idea mapping process is visualised in figure 5.1. All the steps are elaborated in this chapter.

Participants

The first idea mapping session is done individually to put all the ideas that I had acquired in the research phase on paper, see appendix 5.1 for all the results. The second idea mapping session was with four students from TU Delft, who were not familiar with the logistics process. The aim of this second idea mapping session was to allow students to look at the logistics process with a neutral view to generate out of the box ideas and not being hindered by the current situation at Schiphol. See appendix 5.2 for all the results. The third idea mapping session was with four stakeholders who are involved in the logistics process at Schiphol. The purpose of the third brainstorming session was to involve stakeholders in the ideation process while using their expertise of Schiphol. See appendix 5.3 for all the results. All the idea mapping materials can be found in appendix 5.4

Part 1: HCW to problems in the logistics journey

The first part of the three idea mapping sessions consisted of creating ideas to the current problems in the logistics journey by creating 'How can we'-questions (HCWs). In each idea mapping session, different HCW-questions were used. The HCW questions for the first and the second session were already defined beforehand to focus on creating ideas instead of defining the problems. The HCW questions for the third session were made up during the session itself since I wanted the stakeholders to choose their own HCW based on a problem in the journey that impacts their work.

Each idea mapping session started off with HCWs (Step 1). The participants brainstormed for two minutes to one HCW, after which the HCW are passed on to the neighbour for the next round of brainstorming. This was done until each participant brainstormed to each HCW.

Part 2: Future of logistics process in 10 years

The second part of the idea mapping session with students and stakeholders consisted of creating the future of the logistics process in 10 years. The participants were able to use trends and technology cards for creating one future scenario each. These materials can be found in appendix 5.4. Trends and technology cards have been used to get stakeholders out of their current conceivable environment to give them permission to think in new ways about the logistics process (Conway, 2014). Out of each future scenario, three take-outs are created, that are most important for that specific future scenario. The most important take-outs are:

- Autonomous processes
- Prioritization system in delivery
- Central storage point for goods
- Stores organised in a different way

All the take-outs out of this session are combined with the clustering of the first part (Step 1).

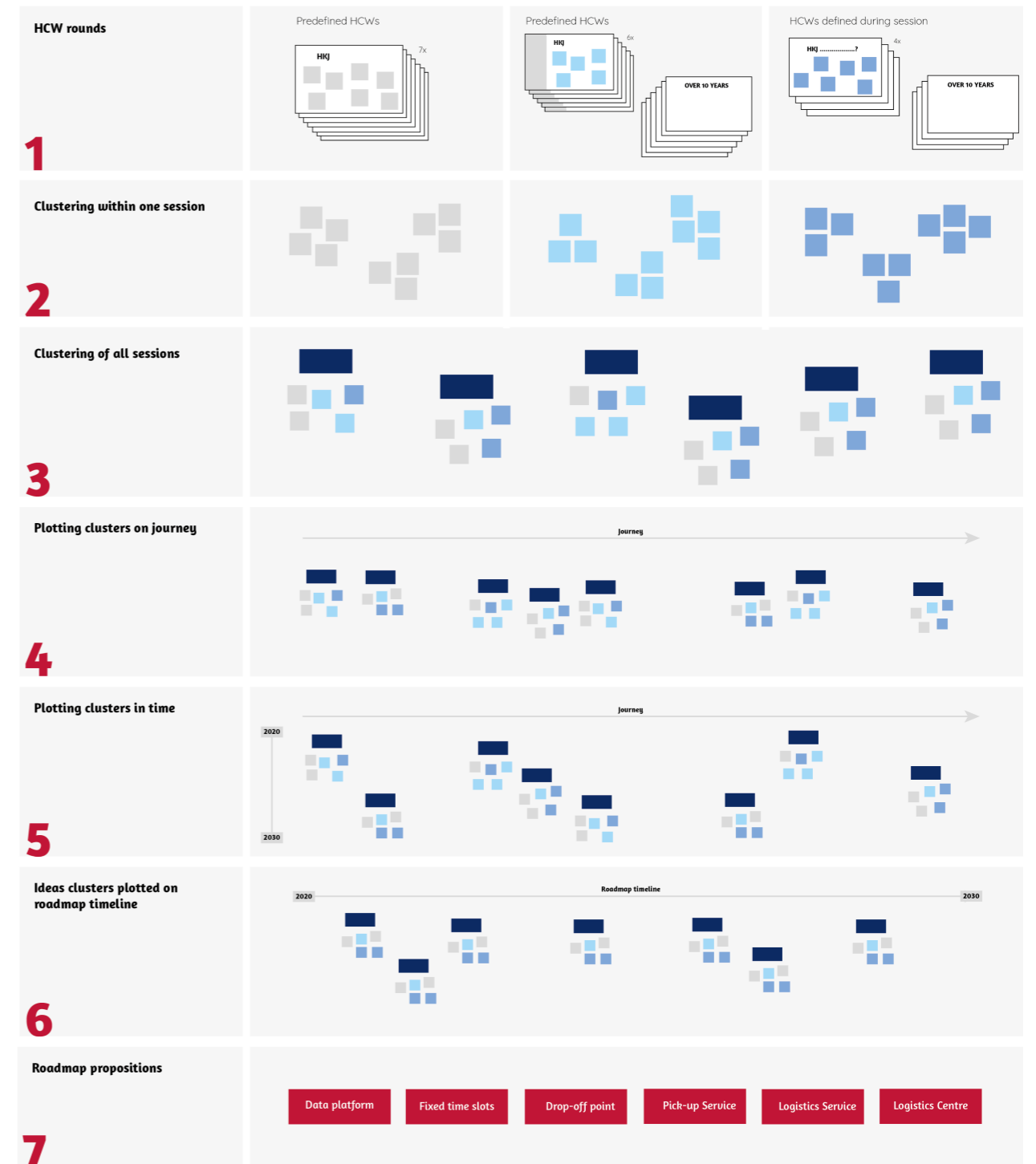


Figure 5.1: Brainstorm ideas plotted on journey and horizons

5.2 IDEA MAPPING

The ideas of both the first and second part of each idea mapping session is clustered (Step 2), after which all the three different sessions are combined, and joint clusters are created (Step 3). The joint clusters are:

Contact with suppliers

The contact with suppliers lies mainly in the communication to the suppliers and the contracts with the suppliers. Communication and contracts with suppliers are of great importance when Schiphol wants to change the logistics process.

Logistics Policy

Regulations will have to be put in place in the logistics streets, so that they can be enforced. For example, there must be control over the number of vehicles in the logistics streets and how long they have been there.

Data gathering

Schiphol can already collect data from both people and all other processes that take place at Schiphol.

Smart environment collecting data

In addition to the data already collected, new data can also be collected through the use of sensors and checkpoints at Schiphol Airport. Sensors could recognize obstacles, create heatmaps and be built into cameras.

Smart carts collecting data

In addition to the smart environments, carts can also start collecting data using RFID, Bluetooth, QR codes and GPS trackers.

Spreading of flows

To spread the crowds in the logistics street, timeslots, fluctuating prices and predictive software can be used to control the crowds.

Reduce flows

In order to reduce the number of flows, orders from different suppliers can be combined, stock can be arranged differently, and orders should be regulated centrally.

Delivery of goods

The way of delivering goods can also be changed by using a back of the house delivery, delivering goods only if they can enter the store immediately and a van that delivers all goods through the terminal.

Alternatives for carts

The carts can be replaced with other solutions such as pallets, foldable crates and covers over the carts. The layout of the cart can be adapted to be able to transport goods from multiple suppliers more efficiently, and carts can be labelled to prevent them from roaming everywhere.

Processes outside of SPL

Due to the crowds at Schiphol, it is wise to have place processes outside Schiphol such as the security check and the environmental streets. In addition, a central distribution centre from where all goods are delivered to Schiphol can also be looked at.

One responsible party

In order to gain more control, it is wise to have one party responsible for the logistics process and thus take processes out of the hands of the suppliers.

Refurbishment of logistic streets

The logistics streets could be equipped with a completely different system such as a hanging system, tunnels that run the shops and elevators that arrive in the shops immediately. In addition, the infrastructure in the logistics streets can be changed by adding multiple lifts and passageways to offer more different routes so that the logistics process does not depend on only one or two routes.

Autonomous processes

Much more can be automated throughout the logistics process. This can start with an autonomous process that is still controlled by a person/system such as tracking lines or rails and could end with a fully automated process in which no more people are involved at all. Automation can include automated assets, automated set-up areas, automated routes widely used by self-loading carts, self-driving carts and self-driving trucks.

These future idea clusters are plotted onto the logistics journey to get an idea where the solution directions are situated in the journey (Step 4) and after that, they are plotted onto a timeline indicating when these possible solutions directions could take place (Step 5). See appendix 5.5 for the journey and timeline plotting. These idea clusters plotted on the timeline are a starting point for the creation of the end deliverable, the roadmap. The idea clusters plotted in the timeline are translated into a roadmap timeline layout (Step 6) to create the service propositions (Step 7).

5.2.1 TIMELINE

The timeline is leading towards the future vision of 2030. By then Schiphol should have control over the logistics process by making use of a connected chain and autonomous processes. In order to be able to gain full control, the three pillars have been taken into account:

- How Schiphol can take control of the delivery to Schiphol?
- How could Schiphol take control in the logistics streets?
- How could Schiphol take control over the deliveries to the terminal?

These questions are solved with the use of the idea clusters. But when could these idea clusters occur at the timeline? An impact-effort matrix is created to determine which ideas have a high impact and low effort to implement. To plot the ideas on the matrix, there is looked at where these processes take place in the logistics journey and how easy they are to change/implement. It is easier to change something in the logistics streets rather than in the terminal since passengers will be involved. In addition, it is easier to make small changes first, after which larger changes can be implemented in phases. The matrix can be found in figure 5.2.

Based on the matrix, the cluster ideas have been plotted on the timeline, see appendix 5.5. At this moment, contact with suppliers and the first steps in the implementation of the logistics policy have been made. The next step will be to collect data so that Schiphol actually has data and is able base decisions on it (data gathering, smart environment, smart carts) to work towards the connected chain. After that, it is useful to see how the crowds in both the logistics streets and the terminal can be reduced. The first step in this is to spread and reduce flows and the way in which goods are delivered. The second step that can be taken is to make one party responsible and to start placing processes outside of Schiphol, so only a few parties will enter Schiphol. The final step will be to change the infrastructure of the logistics streets and the lounges.

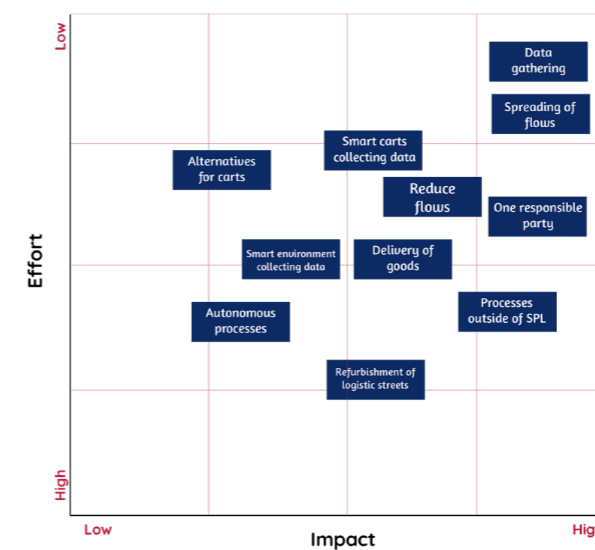


Figure 5.2: Impact- effort matrix

5.2.2 SERVICE PROPOSITIONS

After plotting the ideas on both the timeline and the logistics journey, there is looked at how these ideas can be shaped into value propositions for the roadmap by complying with the three control pillars: delivery to Schiphol, in the logistics streets and deliveries to the terminal. Figure 5.3 shows which ideas have led to the following service propositions:

Data platform

A data platform is collecting all the data and presents an overview of all the data to which the logistics process can be adjusted and based on. The data platform serves as a starting point for creating a connected chain and thus to be able to exert more control over all flows within the logistics process. The data platform is created out of the 'data gathering', 'smart carts collecting data' and 'smart environment collecting data' clusters.

Fixed time slots

With the data platform in place, fixed time slots can be set up to gain control over when the suppliers are able to deliver their goods to Schiphol. Suppliers can only deliver their goods in a scheduled fixed time slot. The fixed time slots are created out of the 'spreading of flows', 'reduce flows' and 'delivery of goods' clusters.

Drop-off Point and Schiphol Logistics Service

These propositions contribute to taking more control over the logistics processes by taking over processes of suppliers and moving processes outside Schiphol. Smaller suppliers need to deliver their goods to the Drop-off Point where a Schiphol Logistics Service takes over the rest of the logistics process. Besides that, Schiphol could offer a Schiphol Pick-up Service for picking up goods with the Schiphol Logistics Service at the warehouses of the suppliers. These propositions are created out of the 'processes outside of Schiphol', 'one party responsible' and 'alternative for carts' clusters.

Logistics Centre

A Logistics Centre is taking full control over the logistics process by letting all the suppliers deliver their goods to the Logistics Centre. Schiphol takes over the full logistics process from here. These value propositions are created out of the 'processes outside of Schiphol', 'one responsible party', 'autonomous processes' and 'refurbishment of logistic streets' clusters.

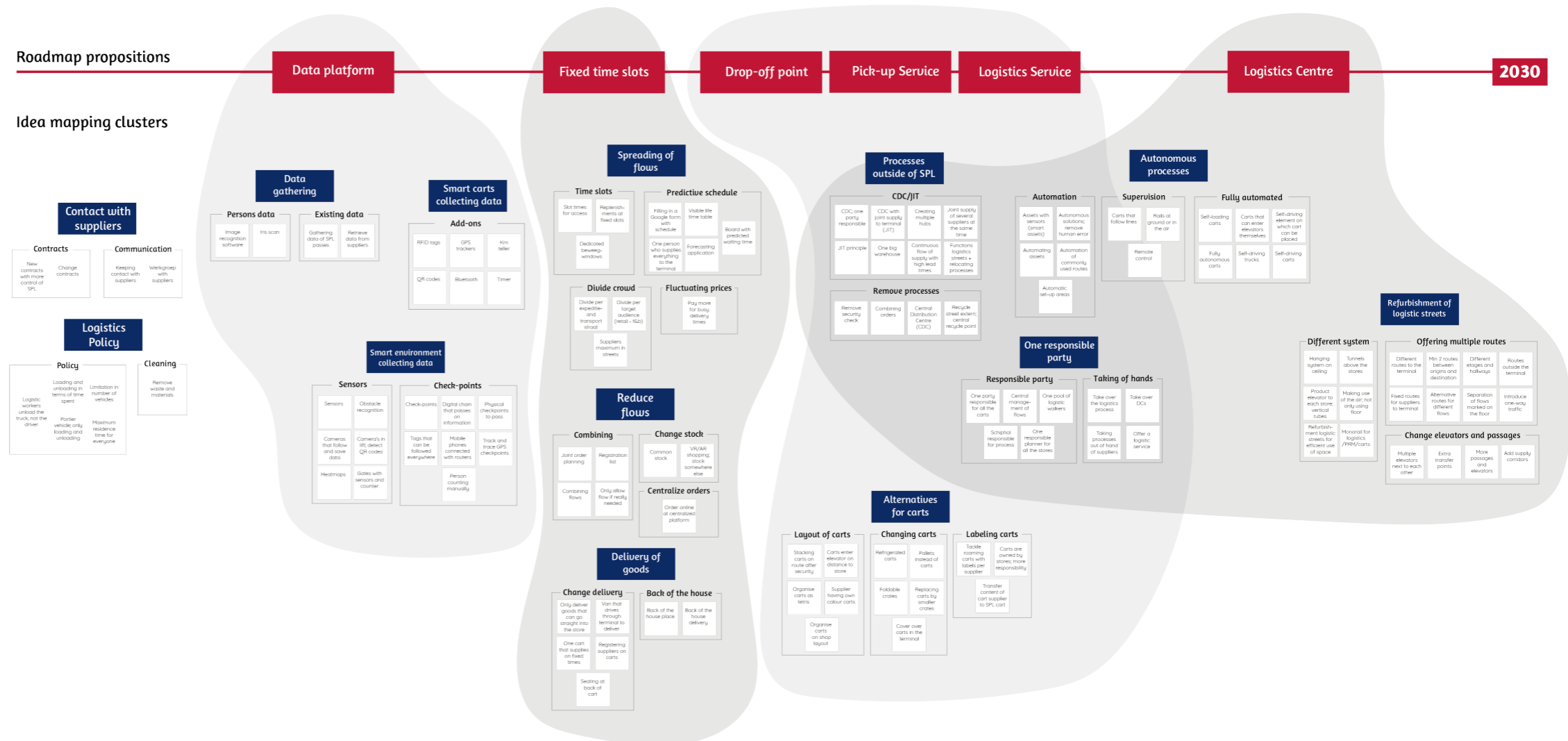


Figure 5.3: Idea clusters linked to service propositions on a timeline

5.3 TECHNOLOGY SCOUTING

The service propositions that have come out of the idea mapping phase will have to be supported with technologies. Research has been done on the possible technologies that could be used. The technologies will help to get the logistics service connected and autonomous.

5.3.1 DATA PLATFORM

In order for the logistics data platform to work, Internet of Things, Big Data and Artificial Intelligence (AI) are of importance. Each of these technologies are briefly discussed below.

Big Data

All collected and retrieved data from the data platform can be seen as Big Data. Big Data is basically a large set of data volumes. It is not about the amount of data, but what an organization does with the data. “Big data can be analysed for insights that lead to better decisions and strategic business moves” (SAS, n.d.).

Internet of Things

In order to set up a data platform, new data will also have to be collected. Internet of Things can play a role in this. Internet of Things (IoT) means that all devices around us collect and exchange data through sensors (Kaplan, Haenlein, 2019). IoT is basically an input for Big Data. Various assets and devices at Schiphol could collect new data with the help of IoT. IoT can also be taken a step further towards Internet of Everything (IoE). IoE is an extension of Internet of Things. IoE consists out of four pillars (people, process, data and things), while IoT only consists out of one pillar (things). IoE “brings together people, process, data and things to make networked connections more relevant and valuable than ever before—turning information into actions that create new capabilities, richer experiences, and unprecedented economic opportunity for businesses, individuals, and countries.” (Cisco, 2013). The first pillar people is all about connecting people in relevant and valuable ways. The second pillar is about collecting data and converting that data into intelligence to make better decisions. The third pillar process is about delivering the right information to the right person or machine at the right time. The last pillar things is about physical devices being connected to the internet (IoT).

Artificial Intelligence

Big Data is needed to use Artificial Intelligence (AI). AI is “concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning, and self-correction” (Kok, Boers, Kusters and van der Putten, 2009). AI is with the use of technology able to independently reason, respond and adapt itself. AI ensures that more and more tasks will be done by machines, which previously were done by humans.

There are three stages of AI depending on the level of intelligence embedded into the machine: Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI) and Artificial Super Intelligence (ASI) (Kaplan and Haenlein, 2019). Artificial Narrow Intelligence (ANI) is also known as Narrow AI or Weak AI and focuses on one single specific task. ANI is the type of AI we are dealing with these days and many of us interact with this type of AI on a daily basis. ANI is used for image and voice recognition, making recommendations and predictions. Facebook is able to recognize faces and gives you the opportunity to tag people in images. Siri is able to understand your voice and give a response. And chatbots to understand text and speech and have a personalized and natural interaction with the human being. AGI and ASI are forms of AI that are still a far dot on the horizon.

In addition to three stages of AI, there are Machine Learning (ML) and Deep Learning (DL) as subfields within AI. ML is a subfield of AI that is about machines that are deriving rules from data themselves (Kaplan and Haenlein, 2019). The ML rules are improving when they are exposed to more data and are able to extract patterns, build models of data and give predictions without being programmed (School of Disruption, FIXME). ML is applied in many day to day applications like classifying email as spam or non-spam and recommendation systems when watching movies or shopping. DL is a type of ML. DL goes one step further than ML by making use of neural networks that are able to learn from big amounts of data. DL is able to “mimic the behaviour of a human brain and enables machines to train themselves to perform tasks” (School of Disruption, FIXME). The ultimate goal of the data platform will be to make use of DL.

5.3.2 CONNECTED CARTS

In order to obtain more data from the existing carts in the logistics process, RFID tags can be used.

RFID tag

RFID is a technology that allows any object to be wirelessly identified by using data transmitted via radio waves. An antenna sends out a signal. When an RFID tag passes the signal of the antenna, a signal is sent to the database in which the data of the RFID tag is stored. All in all, The RFID tag is a tracking system in which the tag transmits radio waves via an antenna to a reader in a computer program that stores the obtained data (Pontius, 2020). RFID stands for Radio Frequency Identification. See figure 5.4 for an RFID tag.

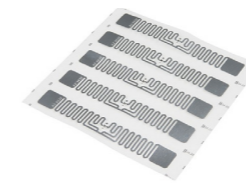


Figure 5.4: RFID tag

5.3.3 AUTONOMOUS PROCESS

In order to work towards a more automated process, the Logistic Centres could make use of Automated Guided Vehicles (AGVs) that will take over human tasks.

Automated Guided Vehicle (AGV)

An AGV can be described as a “material handling systems or load carriers that travel autonomously throughout a warehouse, distribution centre, or manufacturing facility, without an onboard operator or driver” (Taglic, 2020). AGVs are already widely used in warehouses and department stores. A visit to the Logistica Beurs has brought many insights into the use of AGVs in a logistics environment, which are incorporated in the text below. These insights can be found in appendix 5.6.

There are already many different AGVs on the market for different purposes, see figure 5.5:

- **Automated Guided Carts (AGCs)**
AGCs are the most basic AGVs where the carts follow a magnetic line that is taped to the floor or follows a pre-programmed path. The carts can be used for many different purposes but are usually used in sorting, storage, and cross-docking applications.
- **Forklift Automated Vehicles (FAVs)**
FAVs perform the same function as human-operating forklifts, but without a human operator.
- **Tugger Automated Guided Vehicles (TAGVs)**
TAGVs or Towing vehicles, pull loaded carrying vehicles in a train formation forward. These could also be called driverless trains and are often used for transporting heavy loads over longer distances.
- **Autonomous Mobile Robots (AMRs)**
AMRs are the most advanced form of AGVs. An AMR does not use pre-programmed navigation systems but uses intelligent navigation functions. Sensors and camera systems are built into an AMR to recognize and navigate around objects. In addition, they can compose their own path to move through a space as efficiently as possible.



Figure 5.5: AGVs

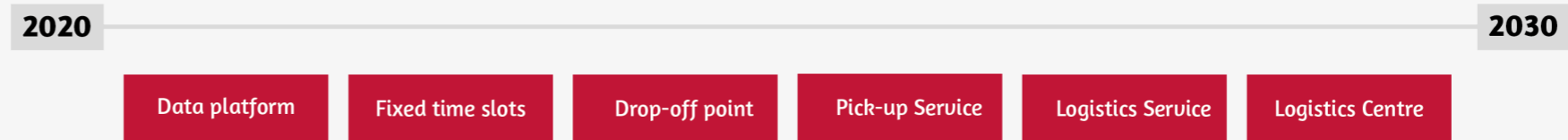
The use of AGVs can increase efficiency and productivity because they operate autonomously, perform repetitive tasks and are therefore predictable and reliable (Taglic, 2020). AGVs ensure that there is no unnecessary walking process, while also setting the work rate for possible employees. AGVs provide better safety because they are equipped with sensors that will prevent collisions. In addition, AGVs usually take up less space than traditional warehouse solutions. An AGV does have high initial investment costs and will probably have maintenance costs for routine maintenance or incidental repair but an AGV will replace a human worker involving monthly healthcare coverage, payroll taxes, salary increases and vacation time (Benevides, 2019).

5.3.4 TECHNOLOGY CARDS

With the use of the technology scouting, the technology cards for the idea mapping sessions have been created. The technology cards are used to show the participants from the idea mapping session what kind of technologies could possibly be used in the logistics process. Examples of which technologies occur in which applications have also been given per technology. The technology cards can be found in appendix 5.4.

CONCLUSION

In the idea mapping phase, three different idea mapping sessions are held with myself, students of TU Delft and stakeholders within Schiphol. These idea mapping sessions have led to many ideas that can change and improve the logistics process in the future. All ideas from the mapping sessions are clustered, from which joint idea clusters originated. The joint idea clusters are plotted on the journey to see where the ideas in the journey can be of value and on a timeline to see when the ideas might develop in the future. The ideas plotted on the timeline are converted into service propositions that ensure that Schiphol takes control of the entire logistics process. The service propositions consists of a data platform, fixed time slots, Delivery Point, Logistics Service and Logistics Centre. See figure 5.6. These propositions serve as the basis for the end deliverable, the roadmap.





06

ROADMAPPING

This chapter presents the end deliverables of the thesis, two design roadmaps. These roadmaps offer Schiphol a tactical plan to work towards the future vision. The two design roadmaps are discussed in detail per horizon, after which these are tested with various Schiphol processes and validated with the stakeholders.

6.1 DESIGN ROADMAPMING

After creating the future vision, the design roadmapping method has been used to offer Schiphol a tactical plan to turn the future vision into reality (Simonse, 2017). According to Simonse and Hultink (2015) a roadmap is a visual portrayal of design innovations elements plotted on a timeline. Elements on this timeline are entirely dependent per roadmap because every roadmap has its own format. (Phaal and Simonse, 2008). Usually, these elements include user values, market trends, technologies, and new products or services.

There are two different types of design roadmaps namely a tactical and a strategic roadmap. The tactical roadmap is meant for internal communication towards the management. A tactical roadmap is a very detailed representation of all steps in the tactical plan and is linked to all the elements that contribute to these steps. A strategic roadmap is meant for external communication towards stakeholders, suppliers and other involved parties. The strategic roadmap communicates mainly the vision and strategy that leads to this vision in an informal way without going into that much detail. Both of these roadmaps have been created and will be further discussed in paragraph 6.5 and 6.6.

6.2 TIME PACING STRATEGY

The two roadmaps are working towards the defined future vision of 2030. The service propositions created in the previous chapter have already been plotted on a timeline to get a schematic idea of when they might take place. The timeline towards 2030 in the roadmap focuses on the future chronologically and pacing of opportunities of innovation (Simonse, 2018). The timeline towards 2030 is divided into three different horizons. The three horizons are based on the three horizon model of Curry and Hodgson (2008) in which the three horizons overlap each other to create continuous innovation, see figure 6.1. The first horizon starts in the current context of Schiphol, which will lose a strategic fit over time because of a changing external environment. It is aimed at extending and defending the core business while adding a value enhancement. The second horizon is a space of transition from the first horizon to the third horizon, which focuses on building an emerging business. The third horizon is focused on the creation of new viable options for Schiphol based on the predicted changes in the external environment.

The time pacing strategy of these three horizons has been set according to the responsibilities of the involved departments of the logistics process. The future vision is already set to 2030 since CD is responsible for the logistics process from five up to ten years. PPM is responsible for the processes from one up to three years and sets up their visions to five years to have a link towards CD. Therefore, the first horizon is set to two years, the second horizon to 5 years and the last one to 10 years from now. There is looked at when the service propositions could be implemented in these horizons. The service propositions are plotted on the horizons in figure 6.1.1.

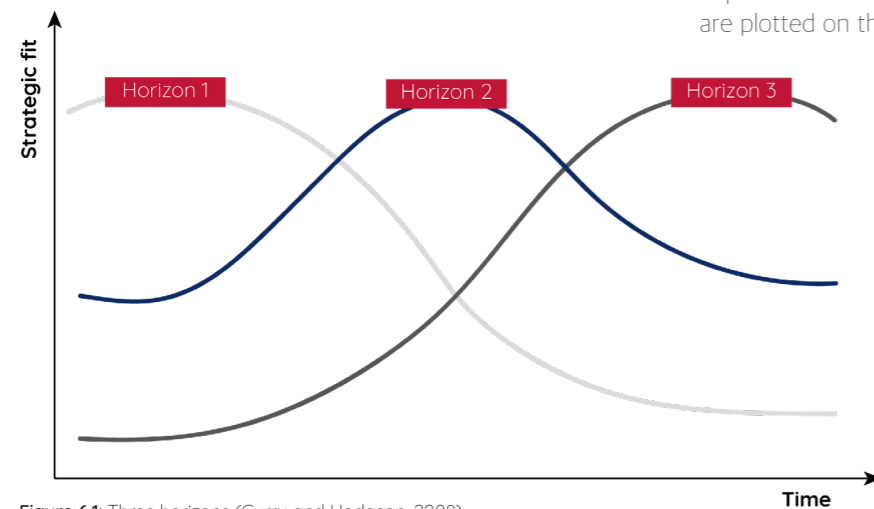


Figure 6.1: Three horizons (Curry and Hodgson, 2008)

6.3 FIRST IMPLEMENTATIONS

Before the three horizons are discussed in detail, it is important to know that a logistics policy and a logistics workgroup are being implemented at the moment.

Logistic policy

The logistics policy has been set up by PPM in 2019 and will be implemented from May 2020 onwards. The logistics policy is mainly focussed on the usage of the logistics streets by all the suppliers. The first enforcement will be in the wrong parking and the twenty minutes loading and unloading time, which will solve the first problem of the busy logistic streets. Trucks will be leaving the logistic streets immediately and there will not be a shortage of parking which earlier caused suppliers having to wait for a spot.

This implementation is a first step for Schiphol to gain more control over the logistic process.

Logistics workgroup

In addition to the logistics policy, Schiphol has set up a logistics workgroup for external suppliers, that takes place once a month. In the recent years, there was hardly any contact with the suppliers while a logistics workgroup had been in place in the past but came to an end for an unknown reason. It is important that Schiphol maintains contact with the suppliers in order to be able to build a bond of trust before working together towards a more efficient logistics process. More about the logistics workgroup is discussed in chapter 7.3.3.

6.4 ROADMAP HORIZONS

As already explained, the roadmap consist of three horizons. In this chapter, the service propositions plotted in the three horizons will be discussed in detail, after which the tactical and strategic roadmap will be explained.

Each horizon first discusses what the horizon is about with the use of the value propositions in figure 6.2, after which the different service propositions are elaborated explained. Each horizon closes off with a conclusion and a visual.

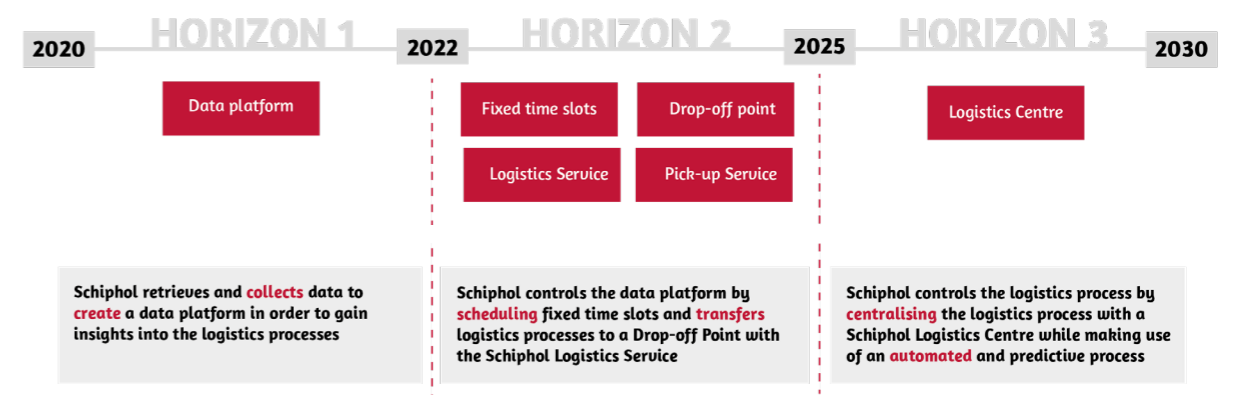


Figure 6.1.1: Service propositions plotted over horizons

Figure 6.2: Value propositions per horizon

6.4.1 HORIZON 1: COLLECT AND CREATE

The first horizon is mainly about solving the current problem in the logistics process. The goal of the first horizon is to collect data in the logistics process and create a data platform. Therefore the value proposition for this horizon is: **Schiphol retrieves and collects data to create a data platform in order to gain insights into the logistics processes.**

Lack of data-driven process

The problem that occurs throughout the entire logistics process is that data is not actively collected and, therefore, processes are currently not data-driven. Data collection enables Schiphol to produce actionable insights, optimize current operational processes, predict future trends and create new opportunities for the future logistics process (Durcevic, 2019). At this moment, it is hard for Schiphol to make any changes because data cannot prove that changes are actually necessary.

Data analytics team and data control team

In this horizon, it is important that Schiphol appoints two teams that become responsible for the data-driven processes. Schiphol will have to appoint a data analytics and a data control team. These teams could be combined into one team, as long as a distinction is made between the functions of these two teams.

Analytics team

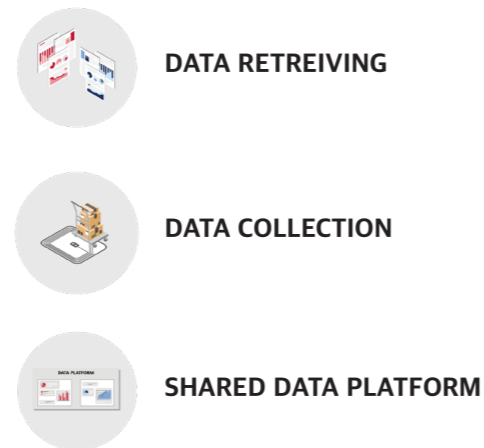
In order to make changes in the logistics process, it is important that both Schiphol and the suppliers collect their current data. The data analytics team will collect this data so that all existing data can be stored in one central place. The data platform will become a shared platform with the suppliers. After that, the analytics team will determine which data is still missing and would like to obtain. A data project can be set up by them to obtain this data.

Control team

The data control team will take control of the shared data platform, where all the data is stored. They will be in the lead to analyse, manage and anticipate the data on the data platform.

SERVICE PROPOSITIONS

After the implementation of the logistics policy and the logistics workgroup, Schiphol will in this horizon start with **data retrieving**. Existing data will be retrieved of the suppliers and Schiphol, after which **data collection** will be started to obtain new data in the logistics process. All this data will be combined in a **shared data platform**. All of these service propositions will be explained in detail:



Data retrieving

Unconsciously, both Schiphol and the suppliers do already individually collect data in their current processes. The gathered data can be distinguished into different types of data such as checkpoint, passenger, goods and transport data, see figure 6.3 for the data overview.

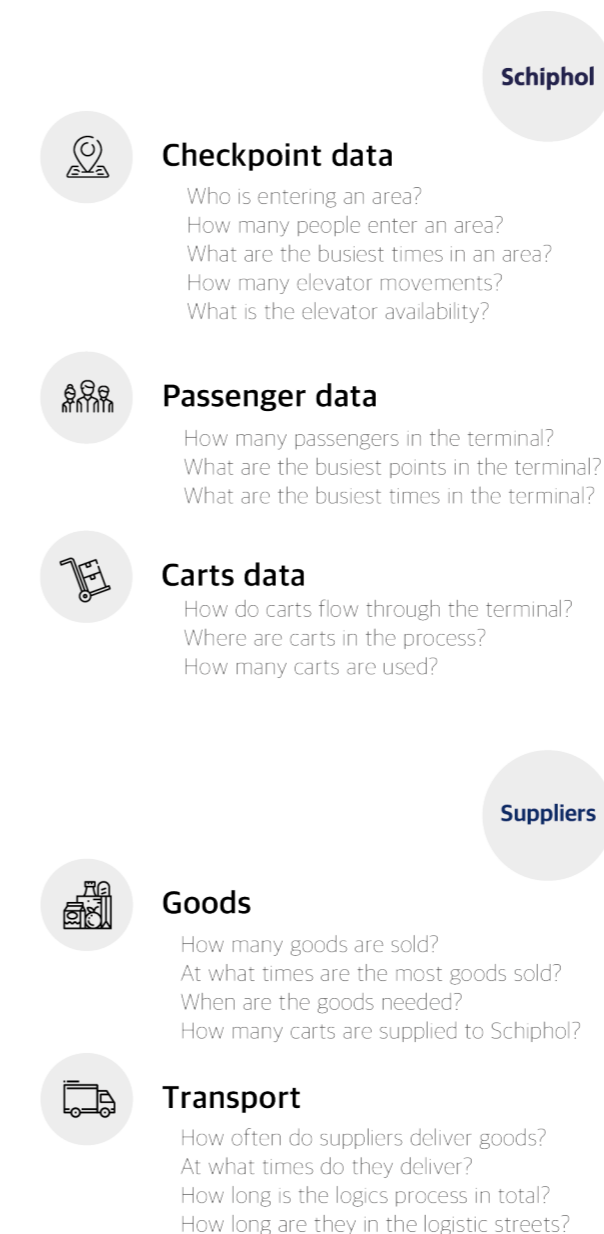


Figure 6.3: Data overview

Schiphol data

Schiphol mainly collects checkpoint and passenger data. In the Schiphol building, there are several checkpoints where staff has to scan his or her Schiphol pass in order to enter a certain area. For example, the Schiphol pass is needed to be able to get into the logistics streets, use the elevators and pass the security check. These checkpoints are used every day and collect data about who enters an area and how many people pass an area at certain times a day. The only disadvantage here is that at some of these checkpoints it is necessary to scan one Schiphol pass, but several people can come in through the same entrance. The checkpoint data can be used to track the movements in the logistics streets, the elevators and exchange between lounges. The use of the elevators also requires the scanning of the Schiphol pass. The elevators can provide data for measuring the number of elevator movements, elevator intensity and availability.

In addition to the checkpoint data, Schiphol also collects a lot of data about the passengers. Schiphol knows how many passengers are in the terminal at some point, how they move through the terminal and can create heatmaps of busy points. Based on this data, the logistics flows can be adjusted and predicted in order to avoid crowds at certain busy points.

Suppliers data

The suppliers have completely different data available. They have data from their goods and transport. The suppliers work with (digital or analogue) systems in which they can see how many goods are sold (i.e. Point of Sale data) and when goods need to be delivered again. This data can give Schiphol insights into how many goods are delivered per day by which supplier, when they actually need to deliver their goods, and with how many carts they enter the terminal. In addition, the suppliers also have data about their transport to Schiphol: how often do they deliver to Schiphol, at what times do they use the logistics streets, how long does an average delivery take and how long are they in the logistics streets and the terminal?

The only problem that could occur is that suppliers are not willing to share their data with Schiphol, while “sharing data among supply chain members is required to implement a Supply Chain Management (SCM) philosophy, especially for planning and monitoring processes” (Cooper et. al., 1997). During this process, it is important to highlight

what would be the benefit for the suppliers sharing their data with Schiphol. The advantage in sharing their data lies in the shared data platform which will be discussed in chapter 7.1.1. The logistics workgroup can be used to discuss what data they gather, what data they would like to collect in the future process, discuss what their benefits are for sharing data and in the end actually share data with Schiphol.

Data collection

When all the above data has been collected, the data analytics team will take stock of what kind of data they still want to have at their disposal in the logistics process.

For Schiphol, it can be very interesting to gain more insights into the logistics flows of the carts. In order to collect this kind of data, new technologies will have to be used. In order to be able to collect this data quite quickly, RFID tags can be used. These could be attached to carts so that carts can be tracked throughout the logistics process. The only problem here is that each supplier uses different carts and the carts are not specifically intended for Schiphol but are also used for other logistical purposes. Upon entering the logistics streets, a RFID tag will have to be offered, attached to the cart so that the cart can be traced in both the logistics streets and the terminal and collected again upon departure. Besides that, RFID could also be used to see where goods are in the supply chain. The next step in the data collection process would be to look into sensors and smart assets that gather and store data themselves. In Schiphol, there are many cameras that store a lot of data. Unfortunately, it is not possible to use this data because of the privacy regulations.

Shared data platform

Once all the data is retrieved and collected, the data platform can be created. Creating a data platform will be outsourced to a third party that has much more expertise in creating data platforms and how to process data from logistics processes into such a platform. This is further discussed in the recommendations of chapter 7.3.5.

The external party will provide a logistics data platform with all the data, of which Schiphol will become the owner. The data control team will be appointed to analyse, manage and anticipate the data on the data platform. The data control team can be compared to the air traffic control at Schiphol, who are regulating the arriving and departing aircrafts. After the platform creation, conclusions can be drawn from the data, which will have an impact in optimizing the logistics process.

The data platform gives both suppliers and Schiphol full insights into the logistics processes, which is why it is called a shared data platform. The data platform creates two different overviews: one for the suppliers and one for Schiphol. The overview for the suppliers contains all the information about their own logistics process and an overview of logistics data within Schiphol. On the basis of this information, they can set up or change their own logistics process more efficiently. The overview for Schiphol shows the logistics processes per supplier, a total overview with all suppliers and all data from checkpoints, passengers and carts. Schiphol can use this overview to gain more control over all logistics processes.



CONCLUSION

The first horizon is mainly about collecting and centrally storing data in a data platform. Schiphol will appoint a data analytics team and a data control team to support this data process. The data analytics team will collect data from the suppliers and Schiphol and start obtaining new data by setting up new data-gathering projects. Schiphol has checkpoint and passenger data available and suppliers have goods and transport data available. In addition to this data, cart data can still be collected by using RFID tags. All this data will be collected and stored centrally in a shared data platform, where the data control team will analyse, manage and anticipate the logistic processes. In this way, both the suppliers and Schiphol gain insight into the current logistics processes, which can be further built on in the next horizons. Figure 6.5 is giving a visual representation of the first horizon.

The goal of the shared data platform is to create a connected supply chain, which is important for the following horizons. A supply chain can be defined as “a network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Christopher, 1992). An overview of the data platform in this horizon can be found in figure 6.4.

Business model

In the current process, the suppliers are renting the commercial places from Schiphol and beside the rent, they pay a concession over their turnover. The suppliers do not pay an extra fee for using the logistics streets. However, they do pay their own logistic processes like sorting orders, transport and logistics workers. In this horizon, this situation remains the same.

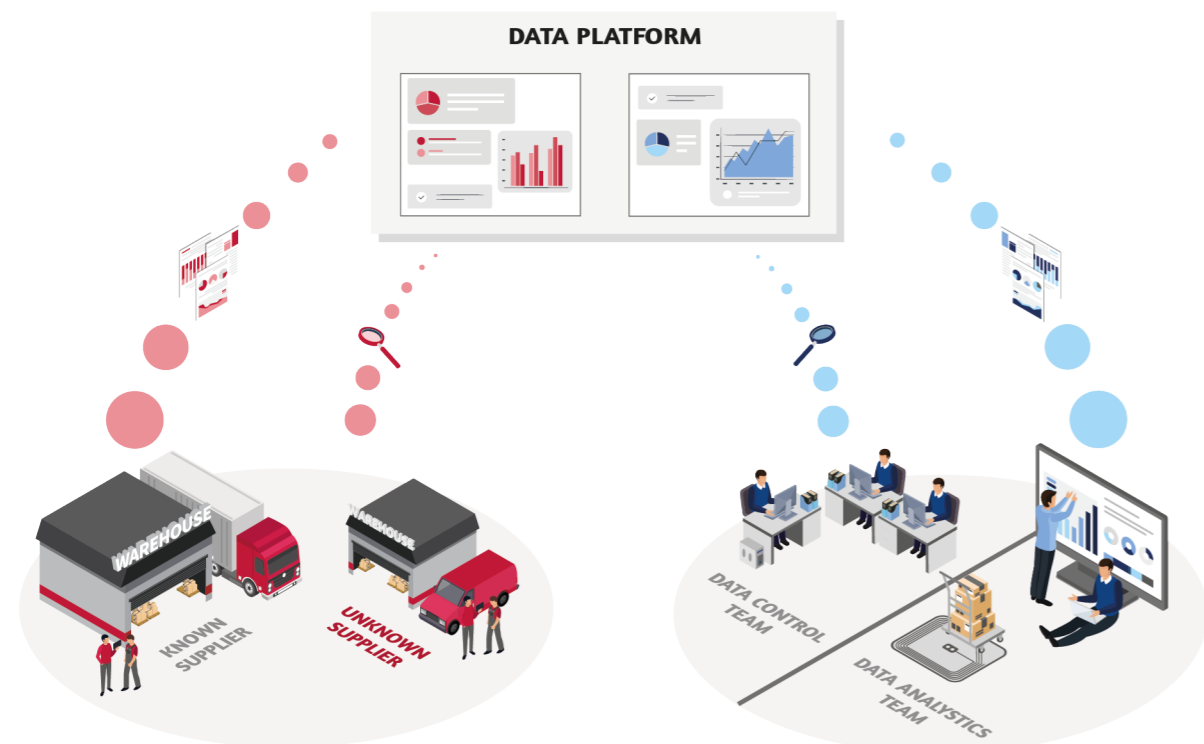


Figure 6.4: Data platform horizon 1

HORIZON 1

COLLECT AND CREATE

Schiphol retrieves and **collects** data to **create** a data platform in order to gain insights into the logistics processes



VALUES SUPPLIERS

- Overview of own logistics process
- Overview of processes at Schiphol

VALUES SCHIPHOL

- All data in one central place
- Insights into cart flows
- Insight into all logistics processes

TRENDS

- Collaboration between parties
- Data sharing in chain

BUSINESS MODEL

$$\text{Costs} = \text{[Cart Icon]} + \text{[Truck Icon]} + \text{[Person Icon]}$$

6.4.2 HORIZON 2: SCHEDULE AND TRANSFER

The second horizon is creating a bridge between the first and the third horizon, in which a new logistics service concept is presented. The goal of the second horizon is to use the data platform for scheduling fixed time slots and transferring the logistics processes outside of Schiphol by offering a Drop-off Point. Therefore the value proposition for this horizon is: **Schiphol controls the data platform by scheduling fixed time slots and transferring logistics process to a Drop-off Point with a Schiphol Logistics Service.**

Data-driven process

The data platform and the data control team from the previous horizon will be able to implement data-driven processes in this horizon. The collected and newly obtained data has been analysed by the data control team, which allows conclusions to be drawn from this data. Based on these conclusions, the logistics process can be managed in order to achieve a more efficient and safer logistic process. For now, assumptions have been made, which have not yet been officially substantiated by data. For example, it is assumed that there are many different unknown suppliers who often make smaller deliveries at busy times when the goods are not always necessarily needed at that time. For the larger well-known suppliers is assumed that they always deliver their goods with full trucks.

Known and unknown suppliers

In this horizon, Schiphol makes a distinction between the known and unknown suppliers by offering alternative logistic concepts for each of these suppliers. Schiphol already knows when the known supplier delivers their goods and how they set up their logistics processes at Schiphol. However, not much is known about the unknown supplier. All Schiphol knows is that they come to make very irregular deliveries in relatively small quantities, usually controlled by the shops in the terminal. Getting these irregular deliveries under control is the first step for Schiphol to get more control in the logistics process. The next step is to eliminate unknown suppliers in the logistics process by transferring logistics processes outside of Schiphol. In addition to more control, it is also a safety issue. The logistics streets will be less crowded and there will be no more unsecured goods in the logistics streets.

SERVICE PROPOSITIONS

In this horizon first **fixed time slots** will be implemented for all the suppliers, after which a **Drop-off Point** is created for unknown and smaller suppliers with making use of a **Schiphol Logistics Service**. Besides that, Schiphol will offer a **Pick-up Service** where Schiphol collects the goods from the supplier's warehouse. All of these service propositions will be explained in detail.

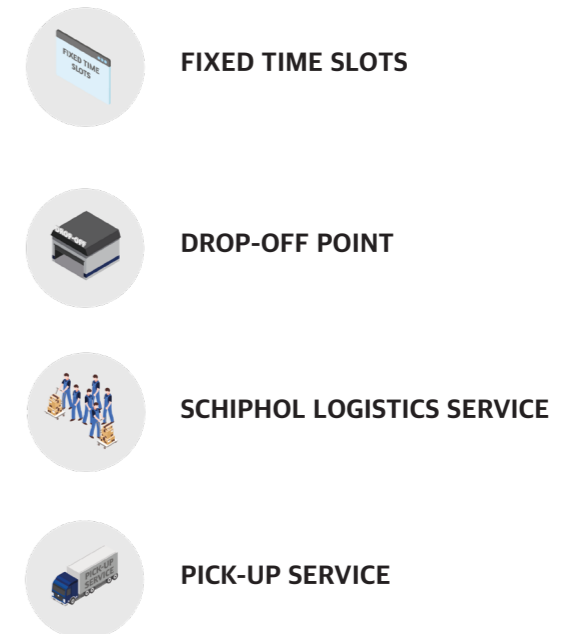


Figure 6.5: Visual first horizon

Fixed time slots

The first step in the second horizon is to set fixed time slots in order to achieve a safer and more efficient process. Based on data of the shared data platform, fixed time slots will be set up for any supplier who wants to enter the logistics streets. Fixed time slots will ensure that it is not too crowded in the logistics streets (safety), so suppliers do not have to wait at the security and the elevators (efficient). Therefore, the delivery process will save time and operational costs.



In addition to the overview of their own logistics processes, the data platform offers suppliers in this horizon an overview to arrange the fixed time slots. The larger suppliers will receive assigned fixed time slots as they make regular deliveries every day/week. In addition, it is possible for the other suppliers to subscribe for fixed time slots on the data platform. This can also be used by the larger suppliers when they want to make an extra delivery. An interactive form allows suppliers to see when they can deliver their goods, and against what price. The fixed time slots during the peak hours will be more expensive. The data control team will use this data and the data in the data platform to create a schedule for the fixed time slots. When scheduling the time slots, passenger peaks are also taken into account in order to avoid the crowds in the terminal and to ensure that all goods are delivered on time. By using fixed time slots, it is immediately clear who enters the logistics streets at what times. It is no longer possible for suppliers to come and do a delivery without signing up.

Drop-off Point

The second step in this horizon is to set up a Drop-off Point in the Schiphol area. The Drop-off Point will first be used by unknown suppliers, after which smaller known retail suppliers will follow. By introducing the Drop-off Point, the unknown supplier is completely eliminated from the logistics process. The smaller flows are removed in both the logistics streets and the terminal. This ensures that it is less busy at security for the known suppliers and there are only people in the logistic streets that actually need to be there.



The Drop-off point also uses fixed time slots, which suppliers can select on the data platform. Suppliers can indicate when they want their goods to be delivered to Schiphol and get an overview of when they need to deliver their goods to the Drop-off Point. The data platform not only offers fixed time slots, but will also provide real-time information to the suppliers about their goods:

- When should the goods be delivered?
- Where are the goods in the process?
- And most importantly, are the goods delivered on time?

Schiphol ensures that different deliveries from different suppliers are combined with each other and all goods are immediately passed through the security check at the Drop-off Point, so that from that moment on all goods can be seen as goods from a well-known supplier who can skip the security process at Schiphol itself. Cross-docking is used for this process in the Drop-off Point. Ideally, from the Drop-off Point only full trucks would drive to Schiphol to make deliveries in order to create a more efficient supply chain. A Logistics Centre Manager will be appointed to maintain contact with the suppliers and maintain control at the Drop-off Point.

Cross-docking

Cross-docking will be used in the Drop-off Point to create an efficient process as possible. Cross-docking means that when the goods arrive at the Drop-off Point, they are unloaded immediately and loaded back into the right truck so that no storage needs to be used (Hinz, 2011). Cross-docking uses a separate arrival dock and a departing dock. Cross-docking will reduce inventories and reduces the need for storage space for goods. The cross-docking process is visualized in figure 6.6.

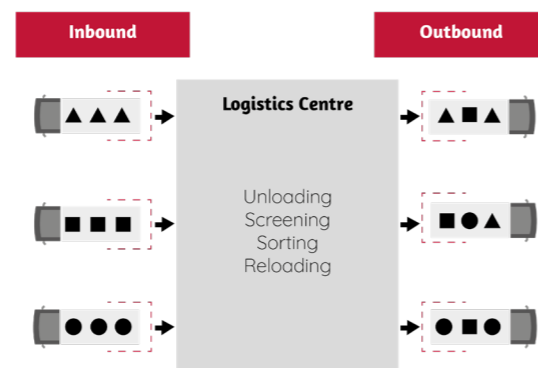


Figure 6.6: Cross docking

Unknown suppliers

Unknown suppliers are required to deliver their goods to the Drop-off Point in order to keep the small flows and not security checked goods out of the logistics streets and terminal. For the unknown suppliers, the Drop-off Point certainly has its advantages. They no longer have to come to Schiphol themselves, enter the busy logistics streets, go through all the security checks for often very small deliveries while they still have to make many other deliveries in a day. The Schiphol logistics process is very time consuming, of which the unknown suppliers will be unburdened with the Drop-off Point.

Known suppliers

Schiphol has nine known suppliers who have set up their own processes reasonably well in order to deal with the current logistical situation at Schiphol. These suppliers supply larger numbers of carts per delivery and do this several times a day. For Schiphol it is important to monitor whether these suppliers only come to deliver Schiphol with full trucks, or whether they are half full deliveries. In order to avoid crowds in the logistics streets, it is important that only full trucks come to deliver their goods. If this is not the case, a rule must be set by Schiphol that if a supplier cannot deliver a full truck, it must divert to the Drop-off Point. WOD and HMS Host have arranged their logistics process so well that they always deliver with full trucks and their logistics party takes over the logistic process at Schiphol. In addition to the unknown suppliers, small known retail suppliers will eventually deliver to the Drop-off Point. The f&b processes are difficult to transfer as it involves fresh products. Fresh refrigerated products may not be outside the refrigerator for more than fifteen minutes, otherwise they may no longer be delivered to the stores. This makes the f&b logistics process quite complicated and is chosen not to transfer the f&b flows to the Drop-off Point.

Automated processes

In order to work towards a more automated process, a trial to AGVs in the logistics environment of Schiphol can be started at the Drop-off Point. The Drop-off Point is an ideal place to do this trial so that it is not within the Schiphol environment where it is always very busy, and many other factors play a role. All current processes are currently done by hand, while the process can become more efficient by automating certain processes. First, however, it will have to be proven that an AGV is a proven technology before it can be implemented at Schiphol

Airport. As already described in chapter 5.3, there are different kinds of AGVs. In the Drop-off Point, an AGCs trial will be started that follows magnetic lines or follows a pre-programmed path to support the human workers in their work. An automation team will be set up in order to set benchmarks for automatization in the Schiphol logistics processes. After that, trials can be done and a deep dive should be done into how the logistics process can be further automated to facilitate the most efficient process possible, where human mistakes are no longer made.

In addition to AGVs, the logistics process allows even more processes to be automated in warehouses/the Schiphol logistics process. Currently, all carts are manually checked by the logistics worker whether the serial number of a cart matches the serial number on the paper invoice. For example, this process could be replaced with RFID tags, so that the process will be quicker, fewer mistakes are made and the RFID tag will automatically be identified by the antenna and linked to the data platform in order to provide a connected chain.

Schiphol Logistics Service

In order to make the Drop-off Point work, a Schiphol Logistics Service will be used. An external party will be appointed to provide this logistics service. Schiphol, which is further discussed in the recommendations of chapter 7.3.5.



A Schiphol Logistics Service ensures that all goods that have arrived at the Drop-off Point are combined, go through the security check and are transported from there by truck to Schiphol and delivered by the Schiphol Logistics Service workers to the terminal. The carts will be arranged in such a way that all goods are order picked in the order of the stores in the terminal. This makes it easier for the logistics workers by not having to criss-cross through the entire terminal. In the Drop-off Point, a special cover is used that covers the carts. These covers look more attractive and ensure that clutter in the cart is not visible to the passengers in the terminal.

Schiphol can use RFID tagged carts that are only intended and used for the logistics process at Schiphol, which ensures that there will not be any roaming carts in the logistics streets and terminal anymore. The Schiphol logistics workers immediately take back waste from the stores and take this to the environmental street in the

Drop-off Point. This ensures that the environmental streets in logistic streets will be used less and could be made smaller, so that more space is freed up in the logistic streets. Besides that, SUEZ does not have to come to the logistics streets that often, which saves transport movements at landside and in the logistic streets.

Schiphol Pick-up Service

Besides the Drop-off Point, Schiphol should start a trial with a Schiphol Pick-up Service. Suppliers can choose to have their products picked up from their warehouse. The warehouses of most known suppliers are located in the Schiphol area, two in Lijnden and two in Hoofddorp both right next to each other. After the pick-up, Schiphol has the choice to transport the goods immediately to the terminal or deliver to the Drop-off Point first. The use of this service will be especially useful for known suppliers who cannot get their entire truck full of carts with every delivery. This would allow them to save on their transport costs by sharing transport with other suppliers from the Drop-off Point.



Zero emission

An important consideration for the Schiphol Pick-up Service may also be the zero emissions policy that Schiphol has promised to meet in 2025. It is important for Schiphol to pass this on to all suppliers and perhaps before then even take steps towards that policy by banning deliveries with non-zero-emission vehicles. According to CRS, nothing has yet been communicated to all suppliers about this new policy, while suppliers do have to take this into account because of the consideration of purchasing zero-emission trucks. In order to manage all this and take a look into the future of how Schiphol could cope with a zero-emission future, a zero-emission team should be set up.

Data platform

The data platform will be used in this horizon to facilitate a data-driven process. It is used in this horizon to regulate the fixed time slots for the logistics streets, the Drop-off Point and the Pick-up Service. With all the data on the data platform, the data control team will create certain fixed time slots, which take into account the number of goods, where the shop is located in the terminal and the passenger volume at that time. All this in order to minimise the inconvenience of the logistics flows and to facilitate the logistics process for suppliers to be more efficient by minimising the waiting times for security and the elevators. Most of the known suppliers have already planned their logistics processes and know when they would like to deliver their goods. They will receive designated standard fixed time slots for the logistics streets in consultation with the control team. For each supplier, the number of standard fixed time slots varies due to the number of deliveries required. In addition to the standard fixed time slots that are included for the known suppliers, all suppliers can also sign up via the fixed time slots registration form on the data platform. When a supplier wants to sign up for a fixed time slot, he/she gets an overview of different options indicating how busy it will be at that time at Schiphol.

The Drop-off Point uses the fixed time slots in a different way. Suppliers can indicate on the data platform when they want their goods delivered to the stores, on which the control team then offers fixed time slots for the Drop-off Point to the suppliers. Schiphol guarantees that all goods are delivered on time when registering for these fixed time slots. The control team takes cross-docking into account when offering fixed time slots: combining goods from different suppliers in order to be able to deliver Schiphol with the most full possible trucks. These deliveries will also be included in the fixed time slots scheme of the logistics streets. The suppliers, who use the Drop-off Point, receive an overview of where their goods are on the data platform and a confirmation when they are delivered.

Furthermore, the data platform serves as a sign-up form that suppliers can sign up to, to make use of the Pick-up Service. Again, this data will be connected to the fixed time slots of both the logistics streets and the Drop-off Point.

The data platform uses Big Data and IoT, as explained in chapter 5.3. Thanks to the data platform, all logistics flows are in contact with each other, enabling the logistics process to be as efficient as possible. An overview of the data platform in this horizon can be found in figure 6.7.

Business model

The business model in the second horizon does change with the current situation. In the second horizon, suppliers will have to pay a fee for all the logistics services. The business model of this horizon encourages suppliers to transfer logistic processes to an area outside of Schiphol. The use of the logistics streets by the known suppliers will therefore become more expensive than using the Drop-off Point, the Schiphol Logistics Service and the Pick-up Service. The use of the logistics streets can be compared with renting spaces at Schiphol. Renting a space at the Schiphol terminal is more expensive than renting a space in an area outside of Schiphol. Besides that, the fixed time slots during peak hours will be more expensive. Besides the lower price for using the logistic services, the suppliers will save a lot of time, costs and effort for not having to deliver to the Schiphol terminal. The costs of using the logistics streets and the Schiphol service will be incorporated into the percentage of concessions that the suppliers have to pay over their turnover. The percentage over concessions will be determined by the number of goods to be delivered plus the fee depending on which service is used.

CONCLUSION

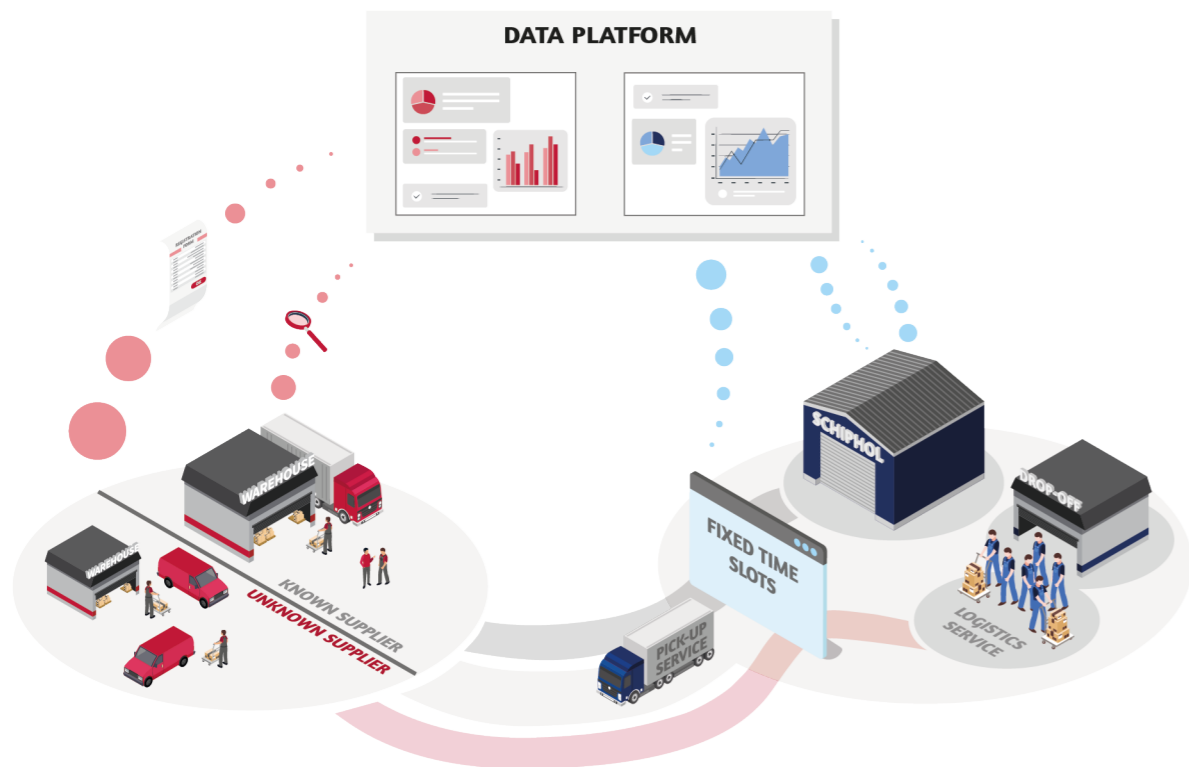
The second horizon is about scheduling fixed time slots for all the suppliers and transferring logistic processes to an area outside of Schiphol. With the introduction of the data platform, fixed time slots are set up, giving Schiphol control over which suppliers will deliver their goods at what times. The fixed time slots will make it less crowded in the logistics streets. In addition to the fixed time slots, the unknown suppliers will be removed out of the logistics process at Schiphol by setting up a Drop-off Point. Unknown suppliers have to deliver their goods to the Drop-off point, where all the goods of different unknown suppliers are combined and go through the security check in order to be delivered in one truck delivery to Schiphol. This delivery is done by a party responsible for the logistics deliveries: Schiphol Logistics Service. The Drop-off Point ensures that there are no more small deliveries and that a security check of goods is not needed anymore at Schiphol. In addition to the unknown supplier, smaller known retail suppliers will eventually deliver to the Drop-off Point when they cannot make deliveries with full trucks. Finally, a Schiphol Pick-up Service can be used, in which the Schiphol Logistics Service collects goods from suppliers in the Schiphol area and transports them to either the Drop-off Point or Schiphol. In this horizon, the suppliers are unburdened of delivering their goods to the Schiphol terminal, saving them money, time and effort. The Drop-off point is the first step towards centralizing the logistics processes in the next horizon. Figure 6.8 is giving a visual representation of the second horizon.



Figure 6.7: Data platform horizon 2

SCHEDULE AND TRANSFER

Schiphol controls the data platform by **scheduling** fixed time slots and **transfers** logistics processes to a Drop-off Point with the Schiphol Logistics Service



VALUES SUPPLIERS

- Self-determination time slots
- Control in logistic streets
- Unburdened of processes at Schiphol
- Overview of goods status

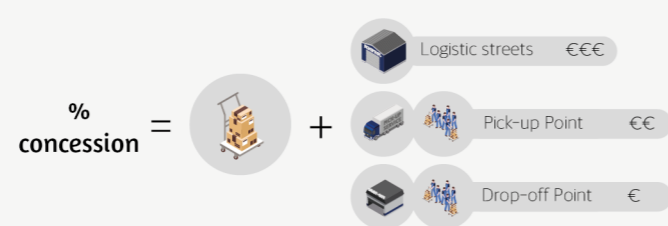
VALUES SCHIPHOL

- Control over who enters logistic streets
- Data-driven process
- Control over small flows
- Unknown suppliers removed from logistics process
- Carts sorted with multiple store orders

TRENDS

- Conscious facility usage
- Data driven decision making
- Connected chain
- Robots replace humans

BUSINESS MODEL



6.4.3 HORIZON 3: CENTRALISE AND AUTOMATE

The third horizon is offering a new viable concept for the logistics of Schiphol. The goal of this horizon is to centralise and automate the logistics process of Schiphol. The value proposition for the horizon is: **Schiphol controls the logistics process by centralising the logistics process with a Schiphol Logistics Centre while making use of an automated and predictive process.**

Data-driven process with Schiphol in control

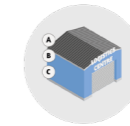
Schiphol will in this horizon gain full control over the logistics process by making use of data on the data platform. All the data will make sure that Schiphol is able to use of the Just in Time (JIT) principle. The fixed time slots for the suppliers, to deliver their goods to the Logistics Centre, are set according to the data on the data platform that facilitates the JIT principle. Besides controlling the fixed time slots for the Logistics Centre, Schiphol is controlling the logistics processes in the Logistics Centre, and all the way to the terminal by making use of the Schiphol Logistics Service.

Green Deal Zero Emission Stadslogistiek

Schiphol has signed the Green Deal Zero Emission Stadslogistiek, which will be in place from 2025, meaning that no emission is allowed at Schiphol landside. For the logistics process, this means that all trucks and cars need to be emission-free to deliver goods to Schiphol. The service propositions in this horizon are an ideal solution for suppliers, who are not able to make use of zero emission trucks.

SERVICE PROPOSITION

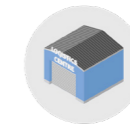
In this horizon the Drop-off Point from the previous horizon will be further centralized with the use of first a **Shared Logistics Centre**, after which a **Schiphol Logistics Centre** will be created. The Schiphol Logistics Centre will give Schiphol full control over the logistics process since all the suppliers have to deliver their goods this centre before they will be delivered to Schiphol by the **Schiphol Logistics Service**.



SHARED LOGISTICS CENTRE



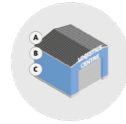
SCHIPHOL LOGISTICS SERVICE



SCHIPHOL LOGISTICS CENTRE

Figure 6.8: Visual second horizon

Shared Logistics Centre



After the use of the Drop-off Point for only the unknown suppliers and suppliers who cannot deliver Schiphol with full trucks, all the suppliers will need to move to a Shared Logistics Centre. This ensures that there are no more suppliers in the logistics streets, but only the Schiphol Logistics Service that comes to supply the goods. The Shared Logistics Centre will still use fixed time slots, combining flows from different suppliers and cross-docking as in the Drop-off Point. With the use of the further developed data platform, a Just in Time (JIT) principle will be used in the Logistics Centre. According to Europlatforms (2004), a logistics centre can be defined as “the hub of a specific area where all the activities relating to transport, logistics and goods distribution are carried out, on a commercial basis, by various operators”. The logistics centre will not only be intended for Schiphol’s logistics processes but will be shared with other logistics parties out of the Schiphol or Amsterdam area. The costs of the logistics centre and services can be shared in this way. These costs include the building, the logistics staff and AGVs. The only difficult thing is the safety check of Schiphol but a separate section could be set up for this. Ideally, parties who supply the same goods as Schiphol would join the logistics centre.

Schiphol Logistics Service



Schiphol will offer the same Logistics Service as with the Drop-off Point when using a Shared Logistics Centre. This means that the Schiphol service starts when the goods are delivered at the Shared Logistics Centre and ends when the goods are delivered in the store. Because all logistics flows at Schiphol have to go through the Share Logistics Centre, RFID carts and refrigerated carts can be used. The refrigerated carts will ensure that the fresh products from f&b will stay cooled all the time, not having to worry about the fifteen minutes regulation as explained earlier. These carts are then only used for the logistics processes of Schiphol.

Furthermore, the logistics process will continue to look the same with covers over the carts in the terminal, an environmental street in the logistics centre and a logistics centre manager. By taking all the waste from all the shops in the terminal back to the logistics centre, the environmental streets in the logistics streets can be reduced creating more space in the logistic streets.

JIT principle

All the parties in the supply chain will need to collaborate in order to create a connected and effective supply chain (Ellram and Cooper, 1990). But how could we make the supply chain as effective as possible while making use of a Logistic Centre? The logistics process of Schiphol will make use of a JIT principle.

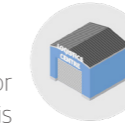
It starts with the Point of Sale (PoS) system of the suppliers. A quick response (QR) strategy could be used to offer shipping parties the latest sales information from PoS data (Tanaka et. al., 2018). These PoS data should be integrated into the data platform so that the logistics centre can anticipate on this data. Besides the PoS data, a new way of shopping could be implemented in the terminal. The development of new ways of shopping falls under the department CRS instead of OPS and is not incorporated further in this thesis. This principle is called Electronic Commerce (EC). According to Lai et al. (2003) “EC describes the process of buying and selling or exchanging of products, service, and information via computer networks such as the Internet”. With the use of this PoS and EC data, a Just In Time (JIT) principle could be applied. The JIT principle consists of a system designed to provide only the necessary products, at the necessary time and in the necessary quantity (Lai et. al., 2003). The JIT principle makes use of minimal inventories and therefore is making use of a pull system, also called kanban (Turban, Lee, King and Chung, 1999). A kanban system is “a multistage production scheduling and inventory control system that is used to control production flow and inventory” (Kumar and Panneerselvam, 2007). In a pull system, the process starts with the customer (EC) or the sold goods (PoS system). The philosophy behind JIT is to continuously search for ways to make the processes more efficient, without incurring any waste (Lai and Cheng, 2009). Queues of trucks loading and unloading at the dock and not maximizing the capacity of trucks for transport can be seen as waste as well. Therefore, fixed time slots for delivering goods to the Logistics Centre are set and transport routes are planned to optimize the capacity of the trucks. All of this is incorporated in the data platform.

Automated processes

The processes in the Share Logistics Centre can be further automated with the help of the extensive data platform. For example, AGCs can be replaced by AMRs, which can adapt and program itself to drive more efficient routes. No operator is required at all in this process. The logistics centre must strive for an environment where manual work is no longer used. Eventually, there will be a fully connected supply chain, where the AMR is in contact with the data platform and can make choices using the data on the platform itself to make the process more efficient.

In addition to the AMR, self-driving zero-emission trucks could also be used. The trucks travel the same route from the logistics centre to Schiphol every time. The trucks could be pre-programmed with which the stigma around self-driving trucks can be reduced.

Schiphol Logistics Centre



The Shared Logistics Centre is a trial for creating a Schiphol Logistics Centre that is only intended for Schiphol processes. If it is proven that the Shared Logistics Centre solves the problems within the logistics streets and the terminal, other flows should be directed to the Logistics Centre as well in order to combine flows. All of this aims to have as little flows as possible and only the necessary flows into the terminal and logistics streets. In the Schiphol Logistics Centre, the same processes as described in the Share Logistics Centre will then be used. A Central Logistics Centre is already in place at London Heathrow, as explained in chapter 3.2.1.

Data platform

The data platform in this horizon will be taken one step further by the commissioning of the Logistics Centre. The fixed time slots principle of the Drop-off Point will work the same for the Logistics Centre in this horizon. The advantages of this horizon are that there is no need to take into account different fixed time slots from different locations and there is only one logistics party that transports the goods from the Logistics Centre to Schiphol. In this horizon, the JIT principle is used, in which the data platform plays a major role. The suppliers each indicate when they want to have their goods delivered and are assigned with fixed time slots to deliver their goods to the Logistics Centre. The Schiphol control team controls the data platform in order to use the JIT principle by getting the right products in the right shop at the right time with the Schiphol Logistics Service. At a later stage of this horizon, Artificial Intelligence (AI) will be used to make the data platform work independently. AI will be able to use all the data on the data platform to create algorithms, propose fixed time slots and composing the flows to the terminal in order to achieve the most efficient logistics process. AI makes it possible to work predictably. The suppliers will receive a full overview of the current processes and are able to look into the future to see what is planned for the coming weeks. This information gives the suppliers the opportunity to adjust their processes.

The data platform ensures that the logistics process is fully connected and all players are involved and have insight into the logistics process. An overview of the data platform in this horizon can be found in figure 6.9.

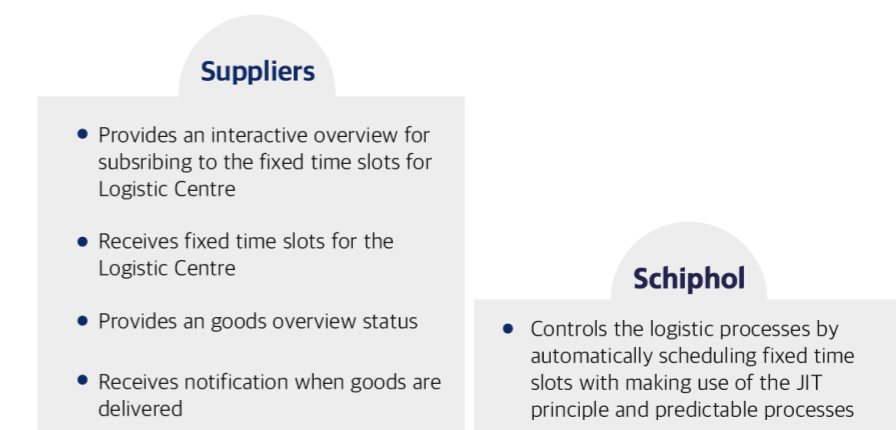


Figure 6.9: Data platform horizon 3

Business model

The business model for the third horizon will remain about the same as in horizon two. The logistics streets will no longer be used by the suppliers in this horizon, but only by the Schiphol Logistics Service. In this horizon, the suppliers pay a fee on the number of goods delivered to Schiphol airport and a fee for the Schiphol Logistics Service. These costs will be incorporated into the percentage of concessions that the suppliers have to pay over their turnover.

CONCLUSION

The third horizon is about centralizing the logistics processes of Schiphol to a Logistics Centre. Schiphol will with the use of the Shared Logistics Centre and eventually the Schiphol Logistics Centre gain full control over all logistics processes at Schiphol. All suppliers deliver their goods with fixed time slots at the Logistic Centre, after which the Schiphol Logistics Service takes over. The Schiphol Logistics Service ensures that all goods in the Logistics Centre are ordered, transported to Schiphol and delivered to the right store in the terminal on time. In the Logistics Centre, AMRs will be used alongside the logistics workers. In this new logistics concept, the Just In Time (JIT) principle will be introduced, which will require only the necessary products, at the necessary time and in the necessary quantity and use as little inventories as possible. The data platform will support the JIT principle, which allows the logistics process to become predictive. Figure 6.10 is giving a visual representation of the third horizon.

HORIZON 3

CENTRALISE AND AUTOMATE

Schiphol controls the logistics process by **centralising** the logistics process with a Schiphol Logistics Centre while making use of an **automated** and **predictive** process

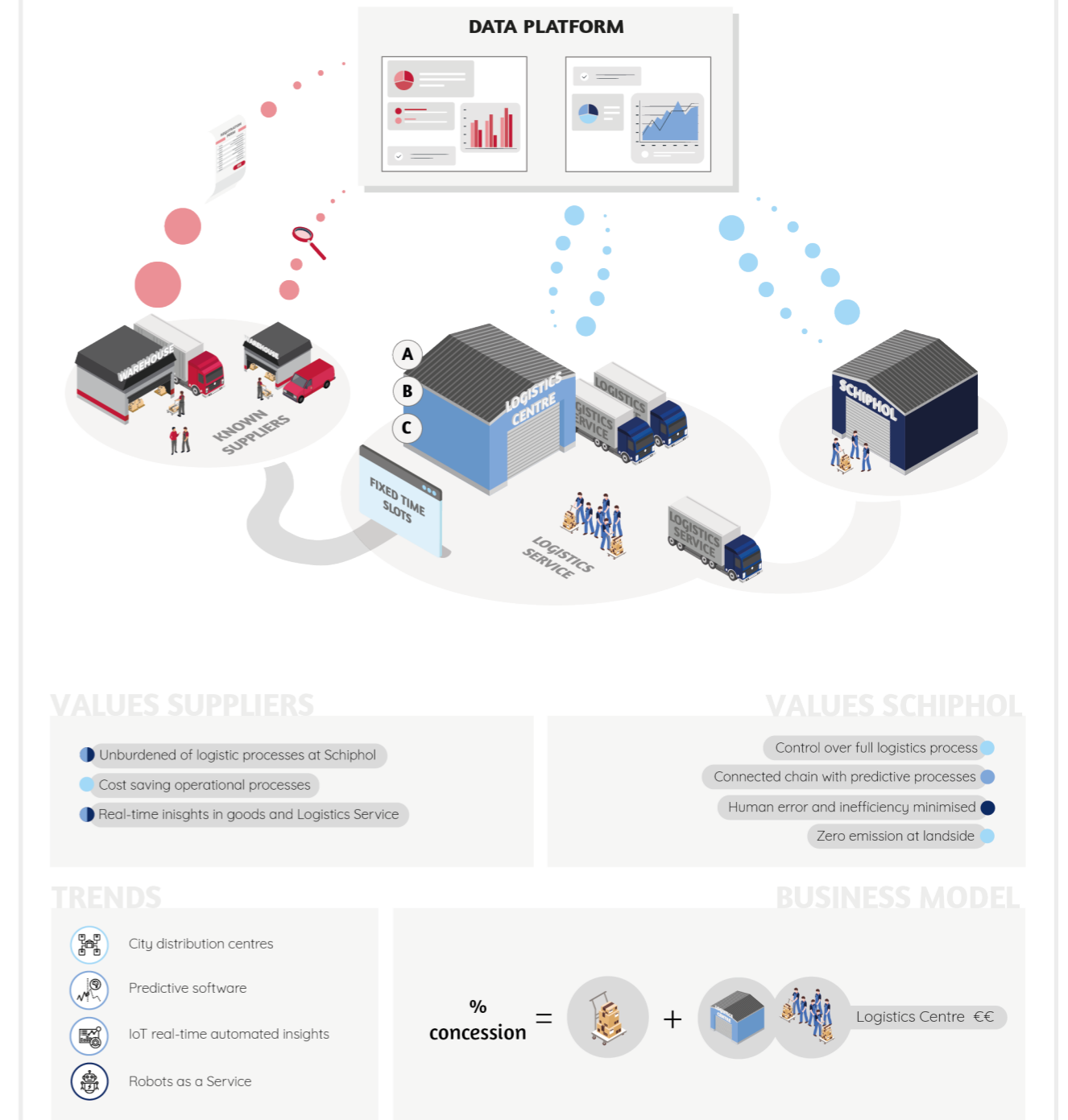


Figure 6.10: Visual third horizon

6.5 TACTICAL ROADMAP

The tactical roadmap is meant for internal communication towards the management. It is a detailed representation of all steps in the tactical plan. The horizons as described in the previous paragraph are visualised in the tactical roadmap in figure 6.11.

The tactical roadmap is linking all the performed research for this thesis with the service propositions. The roadmap is divided into various elements:

Value proposition

The value proposition reflects the purpose of the horizon.

Vision themes

Per value proposition is also visualized to what extent the vision pillars control, connected and autonomous come back in the horizons. These pillars all have a different blue colour that comes back throughout the roadmap.

Values

The values section is divided into values for the suppliers and values for Schiphol. It describes what values the service propositions provide for both parties. The values have coloured blue dots indicating to which vision pillar the value is linked.

Trends

The trends obtained during trend foresights research support the logistics service elements. The trends are visualised with use of an icon. The trends within one vision pillar are linked to each other, seeing when the pillars will be of value in time. The roadmap starts off with connected trends and closes off with automation trends.

Logistics service

What are the service propositions? And how are these linked to all the elements in the roadmap? The service propositions are visualised in the circles and all the elements belonging to that proposition are described below. The elements between the horizons are linked to each other, showing the evolutionary steps within that element. Furthermore, all components from other sections are attached to the service propositions to see where the service propositions are built up with.

The logistics service in the tactical roadmap is divided into two different flows. It has been chosen to work with two different flows because a distinction is made between the unknown and known suppliers in the second horizon.

By using the Drop-off Point, there will be no unknown suppliers in the logistics process of Schiphol anymore. Therefore, the red line (unknown supplier) stops after the Drop-off Point and continues into a grey line (known supplier). Besides that, the roadmap makes a distinction between retail and f&b suppliers. The smaller retail suppliers are more likely to move to the Drop-off Point because they cannot deliver to Schiphol with full trucks, after which the f&b suppliers will join the Shared Logistics Centre in horizon three because of the more complicated process of cooled products.

Operational resources

The operational resources show what operational people are needed to make the new logistics concept work. A distinction is made between internal and external resources.

Technology

The technology section indicates which technologies can be used in the various service propositions. The technologies are linked to the vision pillars, indicated with the three different blue colours.

Business model

What does the business model in the horizons look like? The business model shows how Schiphol could finance the service propositions.

6.6 STRATEGIC ROADMAP

The strategic roadmap is meant for external communication towards stakeholders, suppliers, business partners and other involved parties. The strategic roadmap communicates mainly the vision and strategy that leads to this vision in an informal way without going into detail.

The strategic roadmap is visualized in figure 6.12. The strategic roadmap visualizes the different horizons and indicates what service propositions belong to that horizon. The value proposition, values of both Schiphol and suppliers, trends and business model are supporting the service propositions in that horizon.

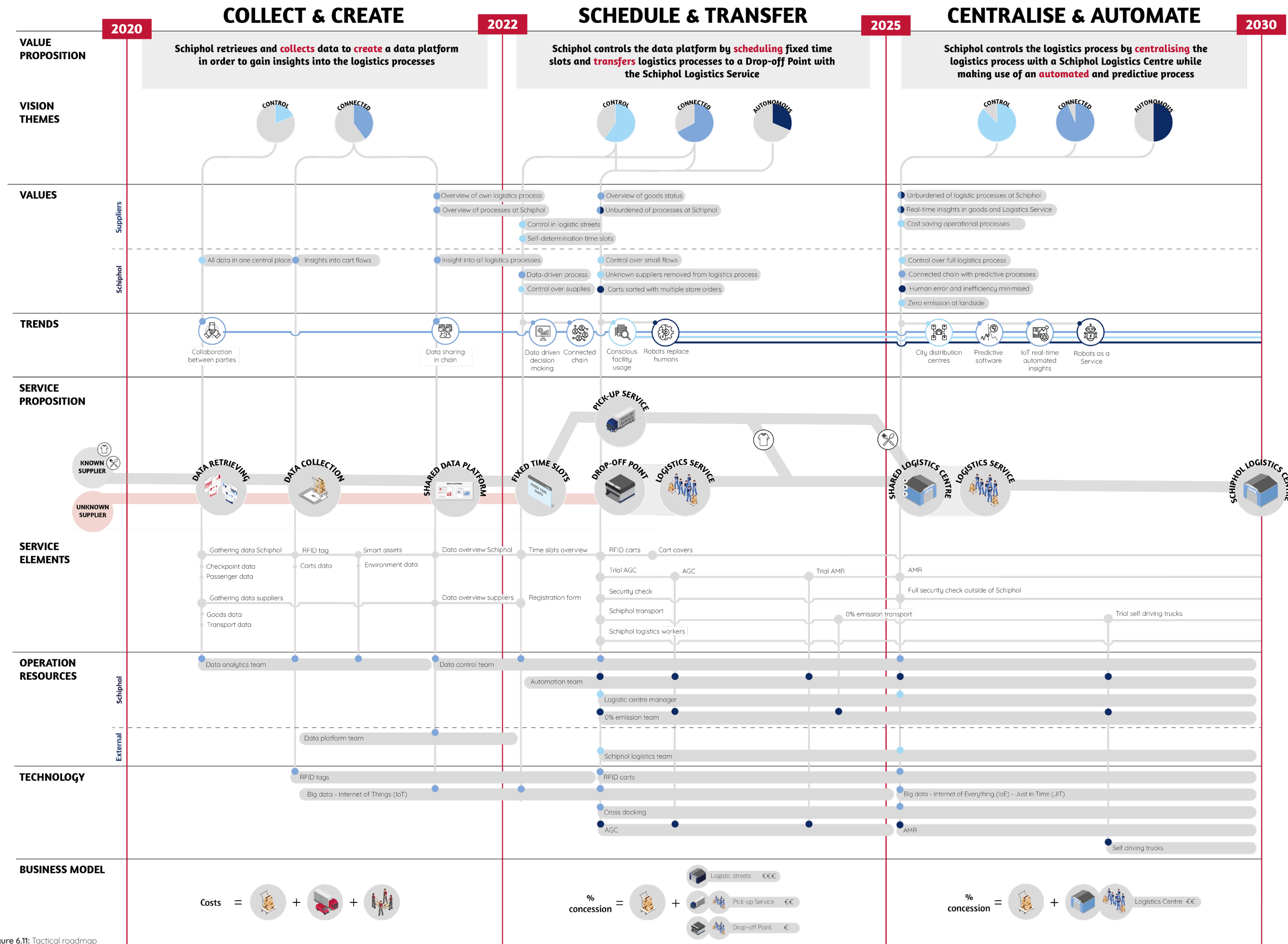


Figure 6.11: Tactical roadmap

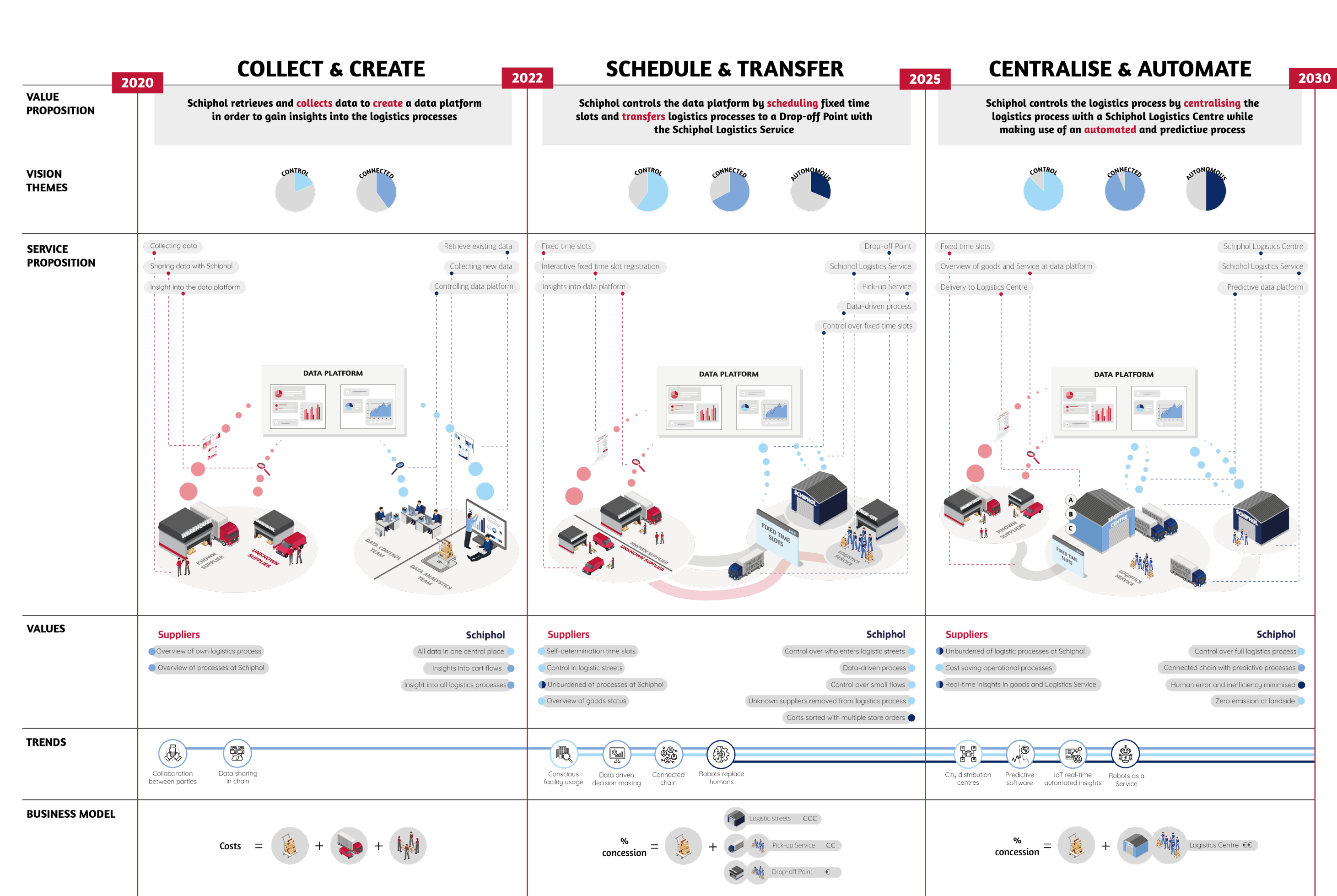


Figure 6.12: Strategic roadmap

6.7 ROADMAP EVALUATION

The roadmap and service propositions have been evaluated and validated in different ways: what value do the service propositions deliver for both Schiphol and the suppliers, how do the new service propositions fit the Schiphol vision of 2050, the TPIs and CONOPS of the OPS department and what the internal stakeholders find of the service propositions in the roadmap.

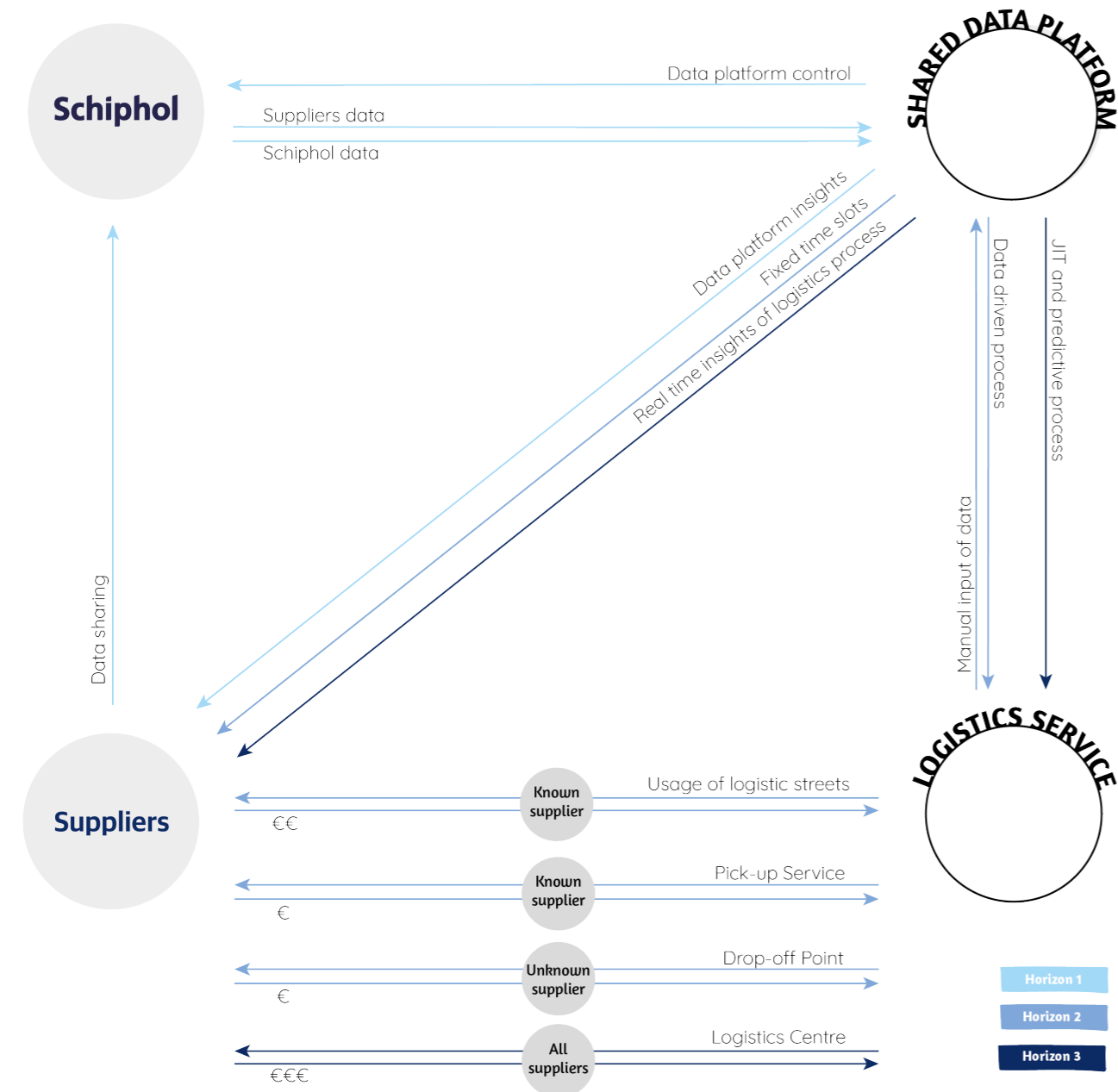


Figure 6.12: Value streams

6.7.1 VALUE OF SERVICE PROPOSITIONS

The service propositions out of the design roadmap are going to change the current logistics process. Important in this change is that all parties are involved in the process and understand the value of the new service propositions.

Value streams

Schiphol and the suppliers are the two main parties involved in the new logistics process. The data platform and the new Schiphol Logistics Service mainly deliver the value in the new logistics concept. In figure 6.13 all value streams are visualized. The value streams are divided per horizon, displayed in the three different colors.

Horizon 1

In the first horizon, the supplier shares his data with Schiphol, after which Schiphol uses this data and their own data to set up the data platform. Schiphol takes control of the logistics process by setting up the data platform. It is of the utmost importance that the suppliers do share their data and see what they get in return. By sharing their data, the supplier gets access to a data overview in which their own logistics processes and logistics data from Schiphol are displayed. On the basis of this data, the suppliers can choose to change their logistics process or set up their logistics more efficiently. Schiphol can modify/compose the content of the data in this overview to the wishes of the suppliers.

Horizon 2

In the second horizon, the data control team will define fixed time slots for the data platform, after which the suppliers can register for the fixed time slots via the data platform. The suppliers are appointed with fixed time slots, which ensure quieter logistics streets and suppliers no longer having to wait at both the security and the elevators. In addition, various logistics services are offered in the second horizon all having a different business model. The logistics service will collect data on the use of the logistics streets, the Pick-up Service and the Drop-off Point out of which a data-driven logistics process can be created by using the data platform.

Horizon 3

In the third horizon, the central logistics point is introduced, where the suppliers pay a fee on the number of goods and the Logistics Service. The data collected in the entire logistics process will ensure that a JIT principle is in place and processes can be predicted. The data platform gives feedback to the suppliers with real-time insights into the logistics processes in which they can follow their goods and have a glint of what is planned for future processes.

All the data platform flows, have already been discussed in this paragraph and the horizons of chapter 6. Figure 6.14 gives an full overview of all the flows to and from the data platform towards the suppliers and Schiphol.

Value Schiphol

For Schiphol, the value of the new logistics concept lies mainly in the transfer of logistics process outside the Schiphol area, where Schiphol facilitates and controls the logistics process. The transfer, facilitation and control of the logistics process ensure that the safety and passenger experience norms can be met. By setting up the new logistics concept, all orders of the various suppliers are combined in the Logistics Centre and delivered with the JIT principle to Schiphol. Facilitating the logistics process with the Schiphol Logistics service ensures that there are no unnecessary flows in the logistics streets and the streets will therefore become quieter which will improve the safety in the logistic streets. The Logistics Service will also make it less crowded in terms of logistics flows and reduce the negative impact on the passenger experience. All of this ensures that Schiphol has full control over the logistics process.

Value suppliers

For the suppliers, the value of the new logistics concept lies in taking care of the complex and time-consuming logistics process at Schiphol. The suppliers do get a full real-time overview of all logistics processes and still have the opportunity to indicate when they want their goods delivered. The suppliers pay a fee for the use of the Logistics Service and the Logistics Centre. Ultimately, it will be cheaper for suppliers in operational costs by being unburdened of in the logistics process. For example, they no longer have to pay for their logistics staff and truck rides that often took a lot of time due to the hustle and fuss in the logistics streets and the many suppliers who use the security and elevators.

	Suppliers	Schiphol
Horizon 1	<ul style="list-style-type: none"> Receive an overview of their own logistics processes Receive an global overview of the logistic processes at Schiphol 	<ul style="list-style-type: none"> Create one central point where all the suppliers data and Schiphol data is stored Receive an full overview of all the logistics processes
Horizon 2	<ul style="list-style-type: none"> Provides an interactive overview for subscribing to the fixed time slots: Logistic streets Drop-off Point Pick-up Service Receives fixed time slots for: Logistic streets Drop-off Point Pick-up Service Provides an goods overview status for suppliers who handed over their goods to the Logistics Service and receives notification when goods are delivered 	<ul style="list-style-type: none"> Controls the logistic processes by manually scheduling fixed time slots
Horizon 3	<ul style="list-style-type: none"> Provides an interactive overview for subscribing to the fixed time slots for Logistic Centre Receives fixed time slots for the Logistic Centre Provides an goods overview status Receives notification when goods are delivered 	<ul style="list-style-type: none"> Controls the logistic processes by automatically scheduling fixed time slots with making use of the JIT principle and predictable processes

Figure 6.14: Data platform flows

6.7.2 LINK TO SCHIPHOL 2050

The Schiphol 2050 vision consists of three vision pillars, as already discussed in chapter 2.1. The service propositions have been tested against each of these pillars:

Quality of network

Quality of network by facilitating an outstanding multimodal international connectivity to the benefit of national and regional development, trade and well-being. The new logistics concept contributes to the quality of network by connecting the entire supply chain with the help of the data platform and RFID tags in the carts. The supply chain starts with the suppliers who indicate when they want to have their goods delivered in the data platform, delivering the products to the Logistics Centre until the goods are delivered using the JIT principle by the Logistics Service. The data platform ensures with the use of data and artificial intelligence that processes can be predicted.

Quality of life

Quality of life by caring about your life and health, Schiphol takes its responsibility to neighbours and future generations being a frontrunner in sustainability. The new logistics concept contributes to the quality of life by limiting the number of vehicle movements to Schiphol and the use of zero-emission trucks for this delivery. The commissioning of the Drop-off Point and the Logistics Centre ensures that all orders of the suppliers are combined and from there are transported with only full trucks to Schiphol, bringing down the number of vehicle movements. In addition, from 2025, Schiphol only allows vehicles to enter landside when they meet zero-emission, which also means that all logistics vehicles must comply. The Schiphol Pick-up Service is using zero-emission truck in order to set a good example, after which in the Logistics Centre only zero-emission trucks from the Schiphol Logistics Service are used.

Quality of service

Quality of service by making sure that all travellers, airlines and business prefer our airports for the personal experience and high-quality service and products. The new concept contributes to the quality of service by offering an entirely new service to all suppliers which unburdens them of the complex, time-consuming logistics process at Schiphol. The logistics service is designed in such a way that all products are delivered on time and the suppliers gain full insight into what is happening to their goods.

6.7.3 LINK TO TPIS

The new logistics concept contributes to the two important TPIs of the OPS department:



On-Time Performance (OTP)

The new logistics concept is designed in such a way that all products can be delivered on time. At the Logistics Centre, the suppliers deliver with fixed time slots, from where the goods are delivered with the JIT principle by the Logistics Service to Schiphol. The data platform plans all these deliveries in advance and predicts when these deliveries should be delivered so that they are in the stores on time. By using the Logistics Service and the data platform, deliveries can be planned so that not too many deliveries take place at the same time in the logistics streets. This prevents queues at the security checks and elevators with as end result all products to be delivered on time.



NPS (Net Promoter Score)

In the new logistics concept, all individual suppliers will be replaced by the Schiphol Logistics Service, which will ensure that less logistical flows will be visible in the terminal. In addition, the Logistics Service uses special cart covers, so that the goods and any waste in the carts do not become visible. In addition, all carts will be owned by Schiphol to prevent carts roaming around in the terminal. All in all, this ensures that the passenger is less inconvenienced by the logistics flows and thus the NPS score will not be brought down.

6.7.4 LINK TO CONOPS

As already explained in chapter 2.1.3, OPS is working with an operating model called CONOPS. CONOPS deals with developments within 5 years, with a focus on five development paths. The new service propositions from the roadmap contribute to the following development paths:

Spatial capacity

The current logistics processes all take place in the logistics streets under the terminal. Due to the expected increase in passengers and increasing safety standards, the logistics processes in the new logistics concept are decentralised in the airport by introducing the Drop-off Point and the Logistics Centre in an area outside Schiphol.

Control

In the current logistics concept, Schiphol allows the suppliers to do their thing without monitoring any of the logistics processes. The new logistics concept ensures with the data platform, fixed time slots, Drop-off Point, Logistics Service and Logistics Centre that Schiphol is in control of the logistics process.

6.7.5 VALIDATION WITH STAKEHOLDERS

The roadmap service propositions have been validated by doing interviews with the four internal stakeholders out of table 7. Five critical subjects have emerged out of the validation, namely data, responsibilities in the logistics process, different systems, averting smaller flows and the Logistics Centre.

Data

In this validation, all stakeholders indicate that data is definitely needed before Schiphol can look further into future solutions. They admit that Schiphol has been thinking for years about the future of the logistics process, whereas in all these years data could have been collected. The only two obstacles in the data collecting proposition are that (1) the suppliers may not want to share their data and (2) the question is who is going to collect all the data inside Schiphol. For the suppliers, it will be important to indicate what would be the value of sharing their data. Before setting up and controlling the data platform, it has to be clear who will be in the lead. Ideally, the data platform would be linked to the control centre or APOC so that the rest of the operation can also be included.

Responsibilities in the logistics process

In the current logistics process, there is already uncertainty about who is responsible for what process. In the new service propositions this should be made clear. Therefore, it would be wise to create different working groups or teams for setting up the data platform, monitoring data, autonomous processes and zero-emission policies. In the autonomous field, not much research has been done within Schiphol and it is often difficult to make changes due to safety restrictions. An autonomous team should be appointed to look at how autonomous processes can play a greater role within Schiphol. For the zero-emission policy, it is also useful to appoint a team that can look at how landside can ultimately become emission-free.

Different systems

In addition, stakeholders indicated that Schiphol has been working with many different systems for years and the translation to one system has still not been laid. For the logistics system, the data will also have to be extracted from different systems and combined into one data platform, which could cause some problems.

Averting smaller flows

It is a good idea to keep smaller flows away from the logistics streets by using the Drop-off Point and the Schiphol Logistics Service. Years ago, Schiphol decided to take control of third parties. It is good that Schiphol is taking back control with a Logistics Service. However, it might be useful to outsource the service to one third party only, instead of all different third parties, such as the logistics workers of HMS Host. They have their logistics processes in control and are already familiar with all processes and floor plans within Schiphol.

Logistics Centre

A central logistics point would mainly be a solution for smaller suppliers because known suppliers often deliver their goods with full trucks. Otherwise, the goods of a known supplier are unloaded and then loaded back into a truck of the Schiphol Logistics Service again. However, it is important again to make clear what the benefits for the supplier would be by not having to enter the logistic streets anymore. Before Schiphol moves to a Logistics Centre it could be useful to set up a Logistics Centre together with different companies in the SPL environment. The stakeholders do see a Central Logistics Point in 5 years' time being realistic, but definitely not earlier than 5 years. This is due to the longer contracts with the suppliers. The contracts of the suppliers can be dealt with in phases so that every supplier has a new contract within 5 years. In addition, a suitable location must also be found, a tender has to be prepared and then outsourced to one party. There will also still have to be a legal issue with regard to contracts and the responsibility of the deliveries of the goods.

All in all, the roadmap is well thought and does not contain any illogical steps or propositions. It is certainly an option that Schiphol could go to. All the results out of the interviews can be found in appendix 6.1.

Interviewee	Department	Function
1	PPM	Service Owner Logistics
2	CRS	Commercial Coordinator
3	SRE	Manager Terminale Verhuringen
4	SQC	Sr Safety Advisor
5	CD	Jr Advisor Airport Strategy & Devopment
6	CD	Sr Advisor Airport Strategy & Devopment

Table 7: Interviewees roadmap validation



07

DISCUSSION

This chapter forms the discussion of this thesis. It summarizes all the results and answers the previously defined research questions. Besides that, the recommendations are discussed and a personal reflection is done.

7.1 CONTRIBUTION OF THIS MASTER THESIS

This master thesis aims to contribute and add value to the field of Strategic Product Design, Schiphol and the airport logistics sector. In addition, the innovation sweet spot was taken into account to ensure that the new logistics concept is a desirable solution and builds on Schiphol's qualities. According to IDEO, innovation can only be achieved if it meets the three pillars of desirability, feasibility and viability.

The future vision and the two design roadmaps serve as inspiration for **Schiphol** and the **airport logistics sector** to see what the logistics process might look like in the future and how this could be put into operation phase by phase. The logistics process at Schiphol is almost incomparable to the normal logistics sector because of its complex environment and the many safety requirements. The proposed logistics concept was specifically designed on the basis of the complex environment and safety requirements at Schiphol, which could also be applied to other airports. For all airports, it is a big step to move towards a Logistics Centre at once, where the roadmap offers an ideal tactical plan that gives substance to how to work towards that Logistics Centre.

Besides that, I hope to have inspired **Schiphol** to approach projects differently in the future by making more use of design thinking and applying design methods. I am convinced that it has been of value to have looked at the logistical problems with a 'design thinking' view. Especially for the PPM department within Schiphol I believe that the (1) trend research to dive into the future, (2) creative sessions to connect and collaboratively create ideas with stakeholders, and (3) ideation tools to generate solutions in a creative way could be used more often in their future processes.

With this thesis I contribute to the field of **Strategic Product Design** by taking into account all the different stakeholders and a focus on the vision themes in the roadmap.

Stakeholders

Schiphol is responsible for organising the logistics process, where the external stakeholders are the user of the logistics processes. The design roadmap is not designed for only one stakeholder or user, but makes a distinction between different external stakeholders: known, unknown, retail and f&b suppliers). All the interests of these stakeholders have been taken into account in the proposed logistics

concept. For each stakeholder group, an appropriate solution is offered in the roadmap to eventually work towards the new proposed logistics concept. Besides the interests of the external stakeholders, Schiphol's interests are certainly included as well which definitely touches upon the **desirability** of the proposed logistics concept that tackles the biggest pain points in the logistics journey.

Vision themes

A special attention has been put on the vision themes in the roadmap. The vision themes are emphasized in the roadmap by having each vision theme linked to a colour. All the elements in the roadmap that are connected with a vision theme have been given the colour code of that theme. Based on these colours, the roadmap shows how the vision themes develop over time through the roadmap.

For the pillar **feasibility**, it is necessary to look at whether the solution builds on the operational capabilities of Schiphol. Schiphol is a large company and its core business is to facilitate and control the flight process for airlines. Schiphol is already dealing with complex environments where many third parties are present, that use the Schiphol facilities. The proposed logistics concept builds on these core operational capabilities of Schiphol by also facilitating and controlling the logistics process, while having to deal with multiple external parties. The proposed concept strengthens Schiphol's business by taking control over these external parties to create a more efficient and safe logistics process step by step.

The **viability** pillar focusses on the long term growth of the proposed concept. In order to meet the viability pillar, there is looked at how, step by step, can be worked towards the Logistics Centre. By dividing the concept into smaller steps, after each step, through interim feedback, access can be obtained in the profitability for Schiphol and if the users are willing to continue to pay for this solution. On the basis of this inspection, it can be decided to make any adjustments to the further development process or investments can be put on hold. Business models have been proposed for the proposed concept, but Schiphol still needs to investigate the exact rates that will need to be linked to the business model. This is further discussed at the recommendations in Chapter 7.3.

7.2 CONCLUSION

The goal of my graduation project was to design a new logistic concept for Schiphol in 2030. The new goods logistic concept is elaborated in a design roadmap after having defined a future vision for the logistics at Schiphol.

Throughout this master thesis, the research question and the sub-questions, mentioned in chapter 1,2, have been answered. In this chapter, all sub-questions will be answered per phase, after which the main question will conclude the thesis.

Chapter 2: Context

What does the current logistics process at Schiphol for supplying retail and f&b goods look like?

The logistics process at Schiphol starts in the shops at Schiphol where goods have to be delivered after they have been sold to passengers. Each store has its own supplier that delivers goods to Schiphol from a warehouse. First, the suppliers enter the logistics streets of Schiphol. After which they unload their goods and go through the security check. All the goods are then transported to the terminal with the use of elevators. The goods are transported in goods carts. Arriving at the terminal, the logistics workers have to cross the passenger flows with their good carts in order to deliver the shops. After their delivery, they need to deliver another shop or take back waste to the logistics street, where a new delivery will start.

Chapter 3: Value mapping

What are the main problems in the logistics process?

For the future logistics process, it is important that (1) there are not too many people in the logistics streets by gaining control over the suppliers, (2) the shortage of assets and malfunctioning assets can be seen as an opportunity to move towards automated processes, (3) there are not too many different flows in the terminal by gain control over the flows in the terminal, (4) carts no longer stand in front of the terminal by looking at a different terminal and shop layout, and at last (5) a data collection process does since no data is collected in the logistics process.

What values are of importance for the stakeholders?

The stakeholder value themes include (1) control which mainly includes control over suppliers and EV usage, (2) data gathering indicating the need for a data-gathering process, (3) safety in which there should not be any accidents and the escape routes must be accessible at all times and (4) assets that are reliable to ensure the continuity of the process.

What trends could be of value in the logistic process?

The trends will be of most value in the external, on landside and in the terminal areas of the logistics process. In the external field, there are opportunities in the areas of connectivity, data and facilities. On landside, robots and smart environments could be used. In the terminal, there are opportunities in the personalization of processes, the passenger experience, way of ordering goods and way of shopping, sort shops, brand engagement and commercial collaborations.

Chapter 4: Future visioning

What should the logistics process look like in 2030?

The logistics process in 2030 will be facilitated and controlled by Schiphol. Schiphol will take control of the delivery to Schiphol, control in the logistics streets and control of deliveries to the terminal. In order to gain more control throughout the process, Schiphol should work towards a connected chain and autonomous processes.

Chapter 5: Idea mapping

How could Schiphol gain more control in the logistics process?

If Schiphol wants to gain more control in the logistics process, they will first have to collect data in order to be able to base changes in the logistics process. A data platform will ensure that Schiphol can work towards a data-driven logistics process. In order to gain more control over the logistics process, logistics processes will be transferred to a Schiphol Logistics Centre in the Schiphol area from where Schiphol takes over the logistics process completely with the Schiphol Logistics Service. By transferring these processes, Schiphol will gain control over deliveries to Schiphol, in the logistics streets and deliveries to the terminal.

Chapter 6: Roadmapping

How can Schiphol achieve this?

Schiphol will work towards a Schiphol Logistics Centre in smaller steps. First of all, a data platform will have to be set up. In order to set up this data platform, existing data will have to be retrieved (from the suppliers and within Schiphol), and new data will be collected. Based on the data on the data platform, fixed time slots will be scheduled for all suppliers in order to make deliveries to Schiphol. Due to the fixed time slots, Schiphol will gain more control over deliveries to Schiphol, in the logistics streets and the deliveries to the terminal. After the fixed time slots, a distinction will be made between known and unknown suppliers. The known suppliers have their logistics processes quite well organised and are delivering their goods frequently with full trucks. Of the unknown suppliers, it is not really known when they deliver their goods and how many goods they deliver. With the fixed time slots there will already be more visibility on these deliveries, but they will still make relatively small deliveries with few goods. As a second step, the smaller flows of the unknown suppliers will be transferred to a Drop-off Point. These suppliers will deliver their goods in fixed-time slots to the Drop-off Point, from where a Schiphol Logistics Service takes over. In the Drop-off Point, the supplier's goods will be combined and go through the security check so that these goods can be seen as goods from a known supplier from that moment on. Another intermediate step for Schiphol is to offer a Schiphol Pick-up Service to all suppliers, in which the goods of the suppliers will be picked up at the suppliers' warehouses. Schiphol will have the choice to transport these goods to Schiphol via the Drop-off Point, saving flows to Schiphol. Ultimately, data will have to indicate which suppliers cannot deliver Schiphol with full trucks and full carts. These suppliers will be required to deliver to the Drop-off Point. In this way, only efficient logistics flows will be located to Schiphol, in the logistics streets and the terminal. From this position, Schiphol will work towards a Shared Logistics Centre, with other parties out of the Schiphol area, where all suppliers have to deliver their goods. Finally, Schiphol will set up its own Logistics Centre, where all the logistics flows may meet in the future.

Main research question

“How can the logistics process be organised differently in order to meet the passenger experience and safety norms?”

The logistics process of Schiphol will look completely different in 2030. The logistics processes will be moved to a Schiphol Logistics Centre. All suppliers will have to deliver their goods to this Schiphol Logistics Centre by using fixed time slots. Schiphol will use the data platform to determine these fixed time slots in such a way that all goods of the suppliers will be combined as efficiently as possible and yet to get all goods into the shops on time using the JIT principle. The data platform will be further developed so that it can use AI to predict and manage the logistics processes itself. The Schiphol Logistics Service will take care of the entire delivery from the Logistics Centre to the terminal. In the Logistics Centre, AMRs will be used to replace human processes. In addition, RFID tagged carts that are linked to the data platform will be used to understand where these carts are located in the logistics process in order to be able to pass on information to the suppliers over their goods. Refrigerated carts will be used for refrigerated f&b products. Throughout the process, special covers for over the carts will be used, so that all goods are neatly shielded.

By centralising the logistics processes and making one logistics party responsible for the logistics process, the number of logistics flows in the logistics streets and the terminal will be reduced, thereby benefiting the passengers' experience and safety norms.

7.3 RECOMMENDATIONS

After the logistics concept has been designed and validated with stakeholders, recommendations have been formulated that should be taken into consideration for the further development of the proposed logistics concept.

7.3.1 LOGISTICS PROCESS RESPONSIBILITIES

Many different people and departments within Schiphol are involved in the current logistics process. Currently, it is not entirely clear who is responsible for which part of the logistics process. Before further work can be done on a new logistics concept, Schiphol will first have to get things right by determining who exactly is responsible for which parts within the logistics process. When this is done, the same needs to be done for the implementation of the proposed logistics concept.

Fixed time allocated to logistics process

In addition, Marijn Scholten from PPM is the only person now full-time working on logistics while there are other departments involved in the logistics process. The people responsible for the logistics process in these departments carry out the logistics work in addition to their normal function. They are experts in their own function, but do not have special expertise in the logistics sector. I would recommend Schiphol to put more personnel on the logistics process, preferably with an expertise in logistics and fixed time allocated for the logistics process.

Besides that, there has been a lot of indecision in logistics process in recent years. This was mainly because not one party was responsible for the entire logistics process. Hopefully this will be resolved when more personnel is present with allocated time for the logistics process instead of personnel partially addressing the logistics process in addition to the normal functions.

Bridging the gap

The processes within Schiphol are arranged in such a way that PPM picks up the logistics processes between 1-3 years and CD from 5-10 years from now. Fortunately, CD has been a member of the logistics process for a few months now, but it is important that a bridge is created between PPM and CD. At the moment, both parties work independently of each other, while it would be good to actively cooperate in the logistics process to work towards the future of the logistics process.

7.3.2 LOGISTICS PROCESSES IN CONOPS

In addition to making clear who will be responsible for the logistics process and having more people available for the logistics process, it will be important that the logistics process will be actively included in the operating model CONOPS. If the logistics flows cause many delays or congestion, other flows in the CONOPS will also suffer from this.

7.3.3 STAKEHOLDER MANAGEMENT

For the future of the logistics process, it will be important that both the stakeholders within Schiphol and the external stakeholders are well involved with the logistics process.

Internal stakeholders

Within Schiphol I noticed that the stakeholders are all very busy with their daily functions and could hardly make time available for the logistics process. There is a logistics workgroup, which takes place every two weeks. However, the presence is low and the workgroup has never been complete in the last six months. These meetings are often multiple-hour meetings and not knowing what exactly to expect during the meeting. I suspect that this is one of the reasons why the stakeholders did not show up or cancel these meetings. For the future process, I would recommend that these meetings will be shortened and clearly communicated in advance what will be on the agenda.

Besides that, not all the stakeholders always have to be present at these meetings. A selection could be made depending on the subject of the meeting. One person should be held accountable to keep stakeholders involved in this working group, take into account which stakeholders are responsible for what and who should therefore be invited to which meeting. Although I do think that it would be good to meet once a month with all the stakeholders to catch up about the logistics process, since all stakeholders are located at different locations within Schiphol.

Externe stakeholders

For the past two months, a working group has been set up for external stakeholders, which is intended to take place once every two months. For this working group I would recommend Schiphol to make use of the stakeholder management triangle of Vaz (2015). Stakeholder management will ensure that Schiphol and the external stakeholders can work together towards a good end result. According to APM (n.d.) stakeholder management is defined as “the systematic identification, analysis, planning and implementation of actions designed to engage with stakeholders”. Stakeholder management consists of three pillars: appreciation, communication and engagement, see figure 7.1 (Vaz, 2015). This working group will be a good start for creating stakeholder management. It will be important to schedule, plan and prepare these meetings in such a way that all these three pillars can be met.

Communication

First of all, it is important that there is good communication between Schiphol and the suppliers. This has to be both outside and during the meetings. As with the internal stakeholders, it would be wise to make someone responsible for scheduling these meetings and focus on communicating the subject of the meeting so that the suppliers know at all times what will be discussed and done in the meetings. Besides that, this person responsible will need to become the contact point for all suppliers so that an open flow of communication can arise.

During the meetings, it is important that there is a good communication so that all suppliers can feel heard and trusted. Without this, the meetings will not yield much value. In addition, it is important to take into account the fact that there may also be tension between different suppliers as they are competitors of each other in the logistics process. The person responsible will have to keep this in mind when scheduling and dealing with topics in a meeting.

Appreciation

After good communication, it is important that the stakeholders feel valued. Schiphol will have to try to understand their processes and problems, and comprehend what they all offer in the logistics process. On the basis of this information, next steps could be set towards the future of the logistics process.

Commitment

The external stakeholders play a very important role in changing the logistics process as they are the users of the logistics process. In order to change processes, stakeholders will have to be involved in future plans. This gives them the opportunity to take responsibility, get involved and develop a sense of ownership. The suppliers are the experts in the daily operation of the logistics process. Schiphol would do well to ask the suppliers for feedback on the proposed logistics concept. The suppliers need to be able to comment and have input throughout the process, in the developments of decisions that affect them (Jeffery, 2009). Only in this way Schiphol and the suppliers can work together towards a logistics concept that works out well for everyone.

Creative sessions

In the working groups I see an opportunity to make use of creative sessions. The creative sessions can be arranged to create deeper insights into the needs of the stakeholders in the two levels of knowledge: tacit and latent (Sanders and Stappers, 2013). Creative sessions ensure that stakeholders are jointly involved in the logistics process in an interactive and creative way. I advise Schiphol to hire a service designer, who will design and facilitate these sessions.

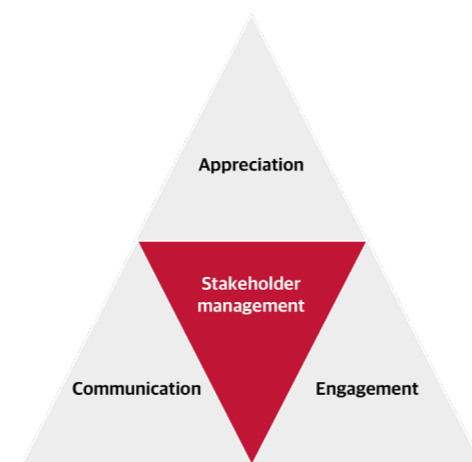


Figure 7.1: Stakeholder management

7.3.4 RESEARCH TO SUPPLIERS' PROCESSES

In this thesis, the focus of the research was on the logistics process within Schiphol. However, there is looked at how the suppliers are setting up their processes within Schiphol, but a qualitative as quantitative research should be carried out to exactly determine how both the known and unknown suppliers set up their logistics processes. For the known suppliers: What is going on in their department stores? What kind of systems do they work with? For the unknown suppliers: Who are they? Do they come to Schiphol regularly? What exactly are they coming to deliver? The answers to these questions could be obtained by doing creative sessions in the suppliers workgroup.

In addition, assumptions have been made in this thesis because no data is currently collected. Research will also have to be carried out to check whether these assumptions are actually correct before implementing the new logistics propositions.

7.3.5 EXTERNAL PARTIES IN LOGISTICS PROCESS

The proposed logistics concept proposes to appoint several external parties to support the service data platform and Logistics Service propositions.

I advise Schiphol to investigate further which external parties they would like to appoint for these teams, as this has not been the focused in this thesis. It is important to find out what external parties have expertise in these areas. Based on a business case to be delivered by the external parties, and the fact that they have to meet the requirements imposed by Schiphol, Schiphol can determine who they would like to engage with. By issuing a tender, Schiphol can benefit from this in a monetary way. Despite the outsourcing, Schiphol remains in control in terms of the logistics process.

An external party will also be used to put AGVs into service. Further research will have to be carried out by Schiphol on which parties could be eligible.

7.3.6 VIABILITY OF THE NEW LOGISTICS PROCESS

As previously discussed, innovation can only become a success if it meets the three pillars of desirability, feasibility and viability. The scope of this thesis did not allow time to research the profitability of the viability pillar since the financial system within Schiphol is quite complicated. In addition to that, CRS has contracts with the suppliers, of which it is unclear what is exactly in these contracts. The duration of these contracts also vary per supplier which causes that a straight line from being drawn.

As discussed, this thesis did look at what business model could be used per horizon, but without allocating any rates. All in all, Schiphol will still need to perform research on how to create a sustainable business model.

7.3.7 INNOVATION IN TERMINAL LAYOUT

Besides optimizing the logistics process, a lot can be changed in the terminal and shop layout. This has emerged in both logistics journey values and trend research but is not part of the PPM department for which I have done this thesis. The development of new shopping concepts falls under the CRS department. I would therefore recommend CRS to look at how airport shopping could be changed in the future.

Collaboration PPM and CRS

In addition, it is also important that PPM and CRS work closely together in order to jointly create a new terminal layout to improve the passenger experience. Both PPM and CRS have their own interest in developing a new concept. PPM considers it important that passengers can easily and safely move through the terminal, while CRS considers it important that passengers are offered enough products and are able to meet their shopping needs in which the number of square metres of the shops play a major role. These two interests will have to be combined in order to achieve a new way of shopping.

7.4 REFLECTION

For the past seven months, I have been working on my graduation project with great pleasure. During this period, I have grown both in a personal and professional way.

7.4.1 PROCESS REFLECTION

I am proud of the process I went through during my graduation project. The whole process has gone quite smoothly, and I have not encountered any major obstacles. I think this is mainly due to the fact that I am a planner, can adapt quite flexibly to unexpected situations by thinking solution-oriented. In advance, I had made a complete planning of all phases within my graduation project. However, it soon became apparent that this was not entirely realistic. I was confronted with the fact that this is not a group project, and everything takes much more time than previously thought. I think this was mainly because I had done a project with six people before starting this individual project and was used to us getting a lot more done in a shorter period of time. After this confrontation I decided to change the overall planning and work with weekly schedules, taking into account that everything will take longer than expected. Just before the two end deliverables, I found out that I should have planned a lot more time to write my report. I noticed that enjoyed diving deep into the elements of my project and working these out without immediately writing about it for my report. This has meant that I spent much more time writing my report than I had taken into account in my planning. After the mid-term report, I planned a lot more time to write my final report, which still ended up taking a lot of time, but in the end, certainly saved stress.

However, I did have some delays in my process. During my research phase, I have suffered some delays due to the not being able to contact external stakeholders, low availability of internal stakeholders, the deep dive into trends and the defining of the vision. In the second part of my graduation, I had difficulties with designing the tactical roadmap.

Contact with stakeholders

At the beginning of the process, I researched what kind of external stakeholders are involved in the logistics process and I had decided to set a scope because it was not possible to interview all stakeholders. However, after I had set the scope there was some resistance from Schiphol to approach these external parties even though I had only selected three. I was lucky that Marijn had some contacts

which ensured that I came into contact with two of the three stakeholders. There was a lot of resistance from CRS to make contact with WOD because of the already many different ongoing research projects and some tensions between the two parties. Fortunately, just after my research phase, I was finally able to join one of the ongoing research projects to find out how they organize their logistics processes. However, I am disappointed that it was not possible to validate my roadmap and service propositions with external stakeholders because of this reason, while they are actually part of the change within the logistics process.

Availability of stakeholders

During the research phase, I quickly found out that it became very difficult to get all internal stakeholders together at the same time because of their busy agendas. During my process, I wanted to organize several creative sessions to take a look at the logistics process, what they think is important and how they see the future ahead of them. After trying this twice, I had low attendance and often stakeholders cancelled just before the meeting. Therefore, I decided to schedule shorter and individual meetings. This has ensured that I have obtained all my information. However, I am very sorry that I have hardly been able to use creative facilitation, as I think this is a very effective and creative way to gather information and co-create with all the stakeholders.

Defining the future vision

Before creating the future vision, I was first convinced that this could be done by using core values. In the interviews with the stakeholders, I tried to look for what value they found important for the logistics process. I soon noticed that first of all, they found it very difficult to define what they believed was important in core values and secondly that each stakeholder ended up with having efficient and optimal as core values. The two words did have a different meaning to each stakeholder. At that moment I decided to change plans and look at how the process can be improved by making it as efficient and optimal as possible, from which the three vision themes and the future vision has emerged.

Deep dive in trends

In the research phase, I did a deep dive on trends. I personally like to dive deeper into trend research, which has caused me to lose myself a bit in this individual process. I spent a little too long looking for trends, partly because I wanted to collect trends in all the different areas and was afraid that I would not have collected enough trends that could be useful for the logistics process. I noticed that my PPM department was not at all concerned with trends and thought it would be nice to be able to show them what might occur in the future. I certainly do not regret that I have been working on this for a little too long although a learning point for next time would be to set either a time limit or a limit on the number of trends.

Tactical roadmap design

In the second phase, I mainly had difficulty in drafting the tactical roadmap. In the logistics process, there are many different variations possible in which different parties are involved. In my roadmap, I wanted to emphasize the advantages of the service propositions for both Schiphol and the suppliers while keeping it organised. In addition, I had decided to make a distinction between known, unknown, retail, and f&b suppliers in my strategy, which made it difficult to visualize this in a roadmap. Since a roadmap is usually created for one target group.

7.5.2 PERSONAL REFLECTION

Before my graduation began, I set learning goals for myself. These learning goals have come from reflections of previous projects and results of projects where I have mainly looked at what I would like to have done in this last project during my studies.

In advance, I had set goals for myself to make choices faster and not to be too perfectionist. This is mainly because these have been stumbling blocks during earlier projects in my studies. I think I have handled these two stumbling blocks reasonably well by setting deadlines for myself in the process. I felt it was important for my project to involve the internal stakeholders as much as possible in my design process. I think this worked out pretty well since I have involved them in every step I took, involved the stakeholder in interviews, kept them up to date from what I was doing and validated my results with them.

When choosing my graduation project, I wanted to be involved again in a larger company where design thinking is not implemented in order to be able to add extra value in that way. My interest was always in the airline industry, so my choice for Schiphol was not entirely unexpected. I took great pleasure from the fact that my assignment is a real problem and is currently actively being investigated. I enjoyed seeing how parts of my research and vision were used in practice immediately. In addition, I loved working above the terminal because it gave me insights into what was going on in the operation. Furthermore, it was very instructive to be in a team with non-designers who are purely busy organizing the daily operation. In addition, during my graduation I hope to have inspired my department to make more use of 'design thinking' in the future after they have been able to see how I have used my design skills while helping them besides my graduation and for this thesis.

All in all, I am proud of the fact that I have used all my design skills and knowledge to investigate an existing problem in such a large company as Schiphol and to have designed a strategy to change the logistics process at Schiphol.



08

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