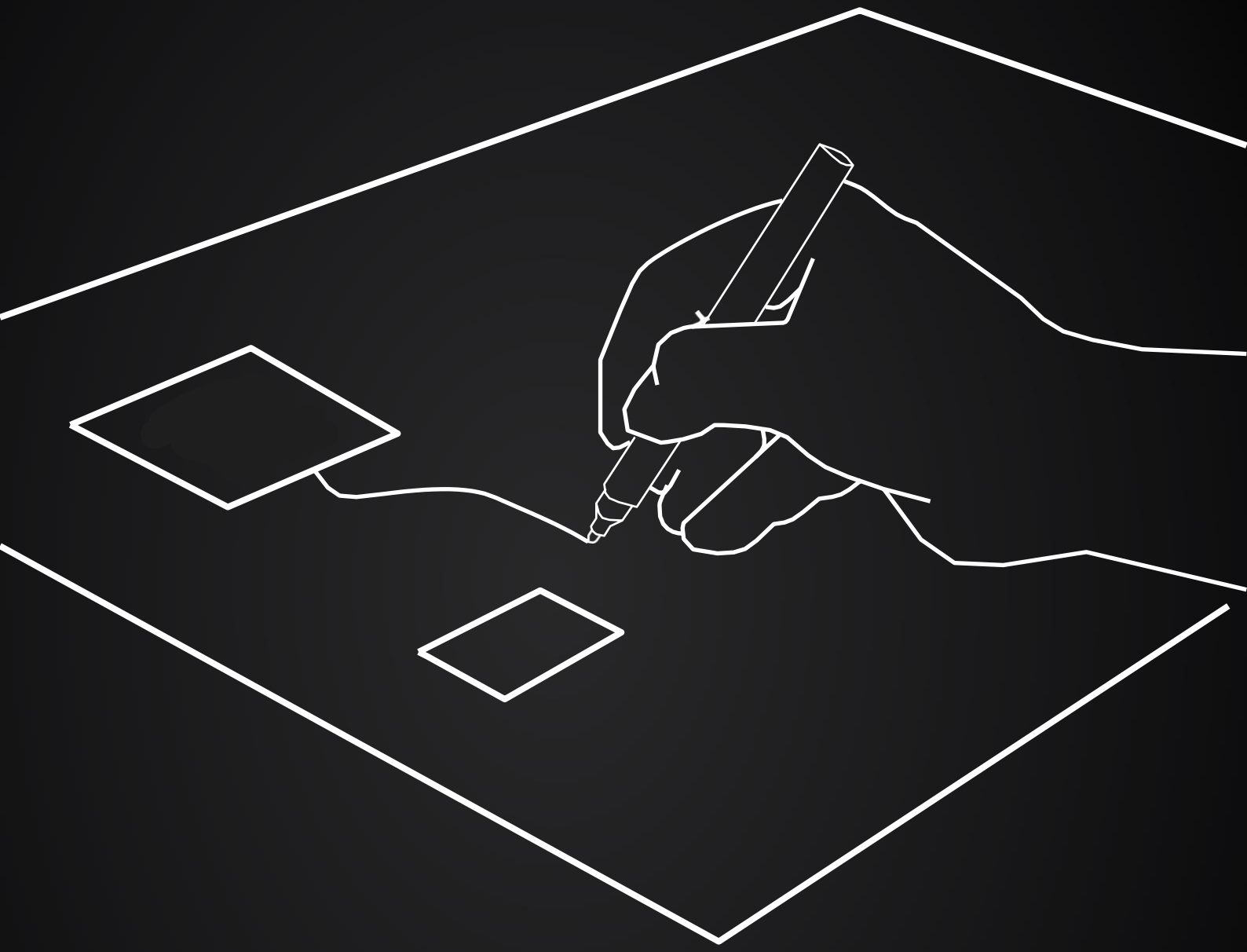
THE FUTURE COOL CHAIN

Business model design for the smart cool lane of the Air floriculture supply chain.



Master thesis

by Bart Verhees

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COLOPHON

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The future cool chain -
Business model design for the smart cool lane of the Air floriculture supply chain.

Master Strategic Product Design
21 November 2018
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EXECUTIVE SUMMARY

The Netherlands is currently still seen as the flower HUB of the world. The biggest market place for flowers, Royal FloraHolland, is located in the Schiphol area and therefore the airport is an important floriculture supply chain junction for the world flower trade. This position is of great value for all participating actors in the supply chain and the Holland Flower Alliance is established to protect this position from upcoming threats. Direct sales of flowers, fed by the rise of the digital marketplace, threaten the physical cargo stream towards the Netherlands, in addition competition increases. The HFA's focal floriculture supply chain is from Nairobi, Kenya to Amsterdam, this is therefore the scope of the project.

The objective of the project is to "Design a vision for the floriculture supply chain and create a 'Time for Quality' concept for the cool chain". This must result in strengthening the supply chain from Nairobi, Kenya to Amsterdam.

Previous research by Flowerwatch (Flowerwatch, 2015) showed that temperature is directly correlated to flower quality and that the current "cool chain" is not good enough. The logistics of the supply chain must focus on creating the optimal cool chain for flowers by quantifying quality performance to temperature.

The approach to the project is vision based. The ViP framework (Hekkert & Van Dijk, 2011) is used as guideline throughout the project to facilitate the transition from the status quo towards the desired future state. The status quo product and the interaction status quo are analyzed by the qualitative research method, modeling business models. Modeling is used to simplify the complex system and to structure all actors involved. The business model consists of an activity system, actors and its activities and the transactions that connect the system together. The modeling is performed throughout the whole chain, from grower to retail. Secondary research completes the analysis of the status quo by creating insides on the current context of the floriculture supply chain. The main findings from the analysis are to create an quality indicator based on temperature. Stimulate transparency in information, create reliable data to enable the chain to use efficient planning.

Synthesising the insights from the analysis create starting points for the future state. The starting points for the future state are:
Trust – Responsibility – Collaboration – Reliability – Quality indicator – Transparency – Pro-active – Temperature – Information.

The design of the future state exist on a vision for the supply chain, *"We believe in a smart cool lane that provides 100% temperature control of the cargo from farm to consignee by creating transparency and centralization in information using a trusted network and thereby quantify the cool chain to decrease the exposure time. "* – HFA
Boundary objects of three quality indicators: 1. Degree hours, 2. Exposure time and 3 Vase-life flowers are used to stimulate the discussion surrounding quality and the objective of the chain. Exposure time, ambient temperature vs. time spend in the temperature, fits the logistics context best. The logistics can take full responsibility for the exposure time of the cargo.

The concept, the smart cool lane is created,
A floriculture supply lane with a centralized, blockchain protected, dashboard of information.
This creates transparency in the cool chain
The smart cool lane is a logistical product of trusted partners that has a blockchain ledger with all the valuable cargo information ready to be used by the actors in the lane to deliver the best quality flowers to the consignee.

The business model design of the smart cool lane presents the future state activity system, its actors and the new transaction network connecting them. Information is centralized to create transparency of the logistics and visibility of the shipment.

ACKNOWLEDGEMENTS

My graduation project was not possible without all the lovely people that were willing to support, stimulate and challenge me during my project. I want to thank all of you that helped me to have a nice graduation experience. Thank you for all the time and effort you invested in helping me gain knowledge which could help me during my project. I have learned a lot during the project. Thank you all for allowing me to make mistakes, learn from them and the possibility to create something valuable.

I want to thank FlyCo for giving me the opportunity to work together during my graduation internship. All my colleagues from the department, thank you for the hospitality and all the fun days we had together. But I want to especially thank my company mentor for always triggering me to improve and for all the advice you gave me during the project. I really appreciate the time you took to explain and teach me about the air freight industry. I as intern always felt that you stood behind my decisions, stimulating me to create my own project path knowing that I could always ask you advice to steer me in the right direction.

I also really appreciated all the support I got from the Holland Flower Alliance and Royal FloraHolland. I was warmly welcomed in the information workgroup of the HFA and had the opportunity to present my work at the annual planning of the HFA. This was a great experience.

Another great experience was the opportunity to present my results at FlyCo. Many thanks to the people who gave up their lunchtime to come to FlyCo and listen to my story. I really appreciated the feedback and the questions afterwards as well.

Lastly, I want to thank my graduation committee. My mentor Sander Mulder for pushing me to think about methodologies, stimulating me to think outside the box and always enlighten me with a philosophical view towards the situation. You challenged me because we are two completely different persons and I liked that. My chair Lianne Simonse for your view on the academic side of the project. Pushing me to create the strategic artefacts it so badly needed. I always appreciated your honesty and I would love to work with you again.

CONTENT

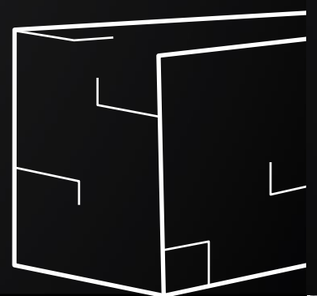
01

PROJECT INTRODUCTION

This section is the introduction towards the thesis. The section introduces the scope of the thesis. It presents the context, the boundaries and the relevance of the project.

After the project introduction of the thesis the project approach is described. The project approach consist of two part, the research approach and the design approach. The methods used during the research and the design are illustrated and directly form a guideline for the content of the rest of the thesis.

The actual research starts with analyzing the status quo. The product, the interaction and the context are separately analyzed to establish the insights for the future state. The synthesis of the research create starting points for the design of the future state. This design is established by creating a vision for the future state, design a concept that makes a step towards the vision and create business model design for the future state.



"The role of the designer is that of a good, thoughtful host anticipating the needs of his guests"

—

Charles Eames

1.1 PROJECT CONTEXT

Over the years the Netherlands and in particular the Airport area has established itself as the 'flower hub' of the world due to the fact that sixty percent of all flowers traded in the world are past true the Netherlands (Group, 2018). The Netherlands is the 4th biggest importer of cut flowers and the biggest exporter of cut flowers in the world (Rijswick, 2016). This means that the Netherlands is a trade country when it comes to flowers, we import, sell and distribute the flowers towards the world. The position as flower hub of the world is valuable to the Netherlands, its economy and the companies active in the floricultural supply chain. The marketplace of flowers in the world is stationed in the Schiphol area, Royal FloraHolland, and is the facilitator of the floriculture trade market(figure 1).

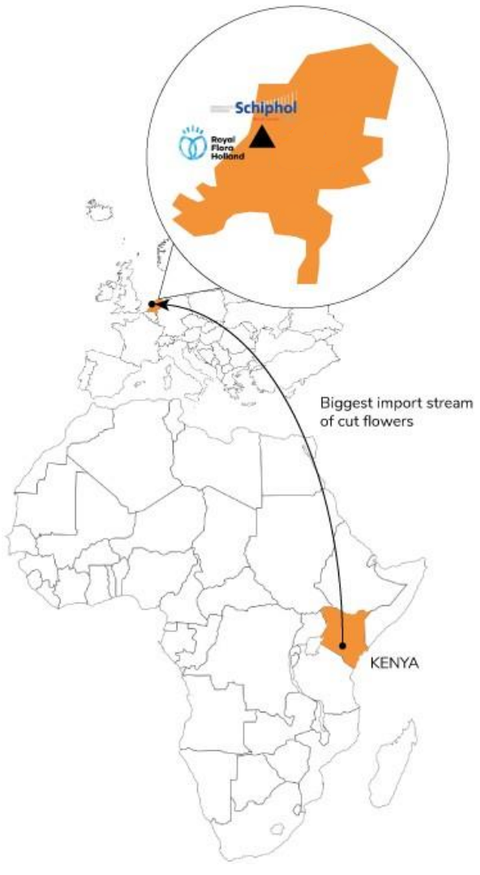


Figure 1. Project context

Royal FloraHolland is a cooperative with growers as members. The motto of Royal FloraHolland is 'Flowering the World Together, Planting Seeds of Opportunity for our Members' (FloraHolland, n.d.). It names itself the connector between the supply and the trade. It facilitates and supports the growth of their members (growers) and customers. Royal FloraHolland is optimizing logistics and control horticultural standards to cut costs and innovate processes and services. Its core business is brokering flowers and plants from suppliers to the trade. This done is by auction 'de klok' or direct sales.

In addition to Royal FloraHolland one other key player in creating and maintaining the position of flower hub of the world is Amsterdam airport Schiphol. Schiphol is the HUB that connects the Netherlands with the rest of the world regarding the floriculture supply chain. It is the import and export place of the Dutch floriculture supply chain regarding air freight. Roughly 25% of the total cargo import at Schiphol consists of flowers (Group, 2018). Next to the air freight, Schiphol is also a distributing hub for trucking destinations within Europe and has therefore a large trucking network. This is essential for a logistical junction like Schiphol because most of the freight is transfer freight destined for a different market as the Dutch market(Group, 2018). Contributing to the strong position of Schiphol are the number of destinations, 160 for air freight, and the frequency of flights due to the number 1 position of Europe in amount of flight movements at Schiphol.

FlyCo is one of the four main flower transporters to Schiphol airport. Flowers are therefore important cargo to FLYCO. The product that is connected to the shipments of flowers is called Fresh. The product Fresh is made for the segment perishable items that have a temperature requirement during shipment (figure 2).

The flowers that are shipped towards the Netherlands are mainly coming from countries that are situated around the equator. This has all to do with the optimal climate for growing flowers. The biggest import streams to the Netherlands come from Africa: Kenya and Ethiopia. These countries have a 66% share in the total import stream of cut flowers to the Netherlands. Two third of this share originates from Kenya making Kenya the number 1 import country for cut flowers (FloraHolland, 2017; P. R. Team, 2018). This makes the supply chain from Kenya to Amsterdam from utmost importance for the actors in the chain.

The product that has the largest import revenue and entails the biggest import and export stream of flowers from and to the Netherlands is the rose. The rose is the number 1 flower imported from Kenya (FloraHolland, 2017). In addition, the rose is responsible for one third of the global cut flower export. This shows that the rose is the floral product that is important to the business of the actors in the chain as well as for my project.

As said before, the actors, the import and export countries and the product are all part of the floriculture supply chain towards the Netherlands.

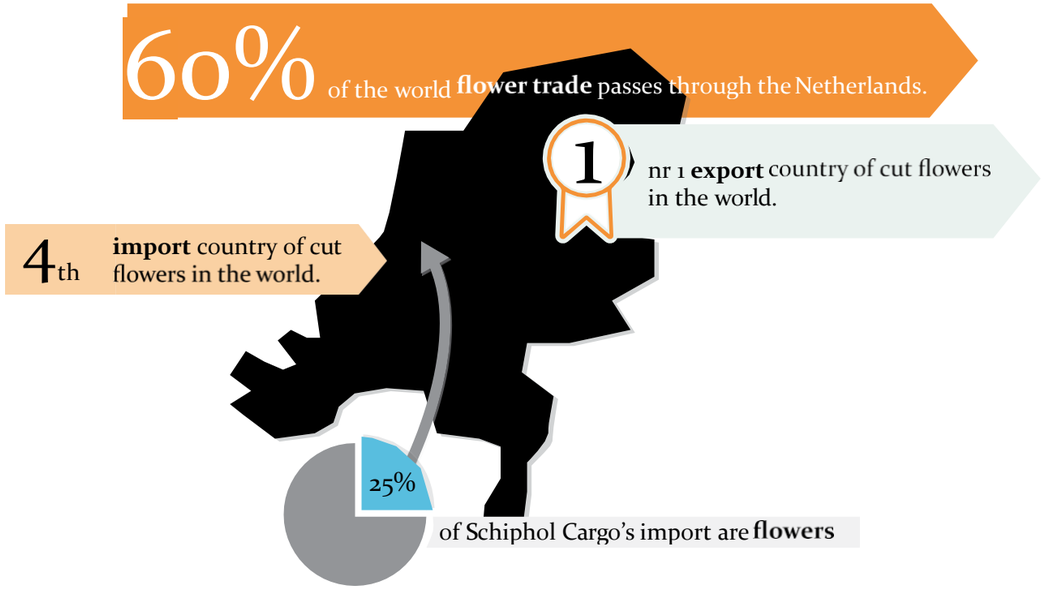


Figure 2. Facts on context

But what is seen in this industry as the complete floriculture supply chain? To illustrate the context of the floriculture supply chain figure 3 provides an overview of the supply chain and the different actors involved. Within this example of an overview Kenya is used as export country and the Netherlands as import country. This overview shows a distinction made between the whole supply chain and the logistics. The logistics is responsible for the delivering of the flowers from shipper (seller) to receiver (buyer).

The generic floricultural supply chain from Kenya to the Netherlands can be divided into five subsections. It starts with the grower in Kenya as the shipper. The freight forwarder, the logistic partner that receives and ship flowers on behalf of the growers is next. The freight forwarder is responsible for delivering the cargo at the assigned condition with the right documentation. The airline (ground handler) receives the flowers and handles them at the airport to make them ready for flight. Then ships the flowers to Amsterdam and delivers them to the freight forwarder at Schiphol. The freight forwarder will then deliver the flowers to the consignee, the designated receiver of the flowers. These five steps of the physical movement of the airfreight in the chain are consistent throughout the different floricultural supply chains around the world.

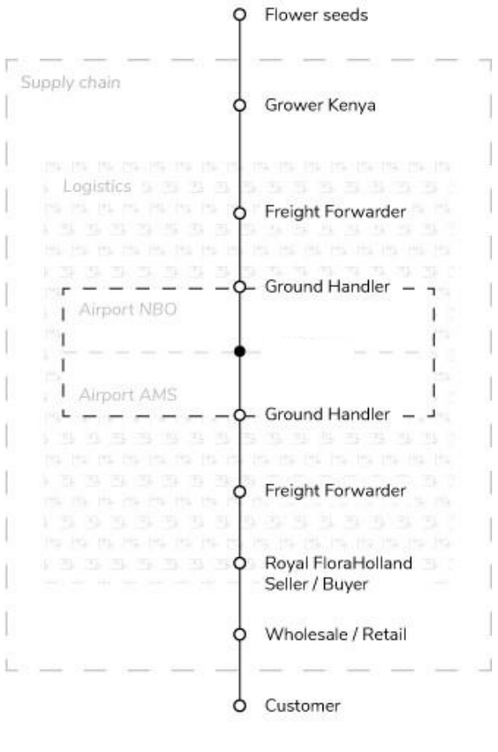


Figure 3. Supply chain and its actors

1.1.1 Conclusion

The context of this project is the floriculture supply chain. Scoping this context creates a focus on the supply chain from Kenya to the Netherlands. This chain is used as the chain on which the research and the design can focus. The chain acts as representation for the rest of the chains around the world. The rose will act as the example flower of the supply chain due to its importance in the total flower trade market. Due to the temperature requirement of the product the supply chain for fresh flowers is called the coolchain.

1.2 PROJECT OBJECTIVE

This thesis is the result of a graduation project for FlyCo and the master Strategic Product Design at Delft University of Technology. The aim of the project was to develop a 'Time for Quality' concept for the floriculture supply chain of FlyCo. The objective of the concept is to innovate the supply chain and to improve the quality of the logistics and the end product by introducing a temperature control indicator. This is reached by designing a business model for the concept on both the network level of the chain as the organizational level of FlyCo.

Due to the amount of different actors involved in the floriculture supply chain and missing a decision making unit in the chain, overall innovation and improvement of the chain is difficult and complex (Santbulte, 2018). 'One thing that stands out from this study is that in the flower supply chain, neglect by one player typically leads to costs for somebody else. Bringing all these parties together may well prove to be the greatest challenge of all in realizing the changes this chain so badly needs' says Milko Rikken, Managing Director Hortiwise (Hortiwise, 2012). Currently, the individual actors in the chain are only looking to optimize their own part of their supply chain. However, the actors depend on each other to deliver a high quality product at the end of the supply chain. The problem is that the current floral supply chain is actually not a chain but consists of separate links that work next and not with each other (Aloserij, 2018).

The main challenge before creating a concept is to design a vision for the supply chain that leads to a clear objective in the chain. The creation of a third horizon vision (see figure 4) that strategically fits the needs of the chain (Simonse, 2018). In addition to the vision the objective of the project is to create a concept for FlyCo that fits the vision of the chain and act as a step towards reaching the objective of the chain.

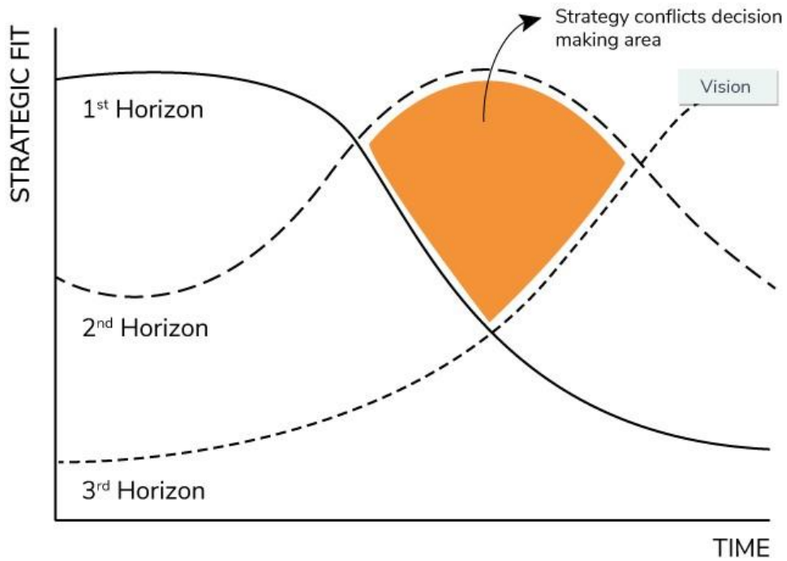


Figure 4. Horizon model (Simonse, 2018)

1.3 PROJECT RELEVANCE

This project contributes to the field of floriculture supply chain innovation. The research focuses on the establishment of building blocks that will be used to create the future state for the cool chain. The work is highly relevant due to the changing trade market, expansion of the competitive environment and the growing demand of increase in product quality.

The Netherlands is slowly losing its leading position in the floriculture market due to the increase in direct sales and online marketplaces (FloraHolland, 2017; Visser, 2013). The floral market is making a shift in type of sales, from auction clock to direct sales. This leads to a relocation of the import and export streams around the world. The necessity to ship the flowers towards the Netherlands is not there anymore. Another threat towards the flower hub is the increase in sea freight in the floriculture supply chain. More and more flowers from South America are transported by sea towards Europe due to lower costs. Both these market trends hurt the position of the Netherlands, flower hub of the world and thereby all the actors involved.

The Holland Flower Alliance (HFA) is established to protect and strengthen the position of the Netherlands as the flower hub of the world and thereby strengthen the position of the individual partners. The goal of the HFA is to "realise a seamless chain that will ensure the highest product quality and fastest transport times in the most cost-efficient way" (HFA, 2018).

The HFA focuses on 5 different levels:
1. Process innovation
2. Information sharing
3. Packaging
4. Branding
5. Governance.

All levels are used to optimise the logistics of the floricultural supply chain to deliver the flowers in the best possible quality to people's homes (HFA, 2018). Due to the objective of this project the focus will be on two levels of innovation, process innovation and information sharing.

This project is to innovate the cool chain by focussing on the temperature control of the flowers to improve the quality of the chain. This temperature control is relevant due to the temperature sensitivity of a flower. Flowers are perishable air freight that need to be treated with care. Flowers need to be preserved at a low temperature to maintain their quality during transport. Flowers need attention due to the Thermogenesis ''self heating'' process of flowers. Self heating means, generating heat through the continuous process of respiration of flowers. Cooling reduces several qualitydeterioration activities like respiration rates, water loss and microbial development (Reid & Seaton, 2015). Within the supply chain of flowers, it has been observed that a reduction in the exposure to temperatures (difference to 0° Celsius) in the supply chain – measured as the average temperature of the product during transport times the number of hoursexposed, expressed in so-called "degree hours" – has a direct effect on the vase-life of flowers (Flowerwatch, 2015). This increase in knowledge into the quality of flowers regarding temperature control and the relation to vase-life, in combination with growing usages of temperature loggers directly lead to a higher quality demand from the customer. Quality is and will remain a decision maker indicator for the customer and therefore vision and a concept focussed on temperature control innovation is highly relevant to themarket.

1.3.1 Gap

As Read & Seaton (2015) and Flowerwatch (2015) state, temperature control of the flowers is very important for the end quality of the product. At the moment there is no seamless chain that can communicate the quality of the logistic chain or the quality of the delivered product. The cool chain is missing a quality indicator that is used and known by the whole chain.

Collaboration on innovating processes and improving quality is started due to the introduction of the HFA. This collaboration has not yet let to operational or strategic decisions regarding the cool chain. The business model driven by the activity system stated as the cool chain is not yet there. The activities performed in the chain do not lead to one stated objective.

Due to the ongoing digitization of FlyCo opportunities regarding digitization of the cool chain arise as well. What is lacking in the current cool chain is digitized data. Due to the missing data that can be transferred into valuable information that can be shared, the cool chain is lacking in transferable key performance indicators. The indicators can be used throughout the chain to measure the quality of the delivered product but also the quality of the chain itself. This project will be a step towards the introduction of a quality indicator, stimulates collaboration and improvements of the chain and is future proof.

Thus, seeking options to unify the chain and to innovate the processes is of utmost importance to stay competitive and leading in this changing market. Create a unique selling point as a chain to strengthen the position of the Netherlands as the flower hub and protect the individual actors in the chain (Santbulte, 2018).

02

PROJECT APPROACH

The section product approach describes the methods used to tackle the problems stated in 01 Project Introduction. The total project approach with its methods for research and design is illustrated. After this section the reader is familiar with the project context, the challenge and the methodology used to approach the project.

“Look at usual things with unusual eyes.”

—

Vico Magistretti
(Kelsey, 2018)

2.1 PROJECT APPROACH

The project approach (see figure 5) adopted to guide the process is the Vision in Product design (ViP) approach. The ViP approach is a systematic approach that uses a coherent framework in the design process centered on the user-product interaction and driven by the context (Hekkert, Mostert, & Stompff, 2003; van Boeijen, Daalhuizen, Zijlstra, & van der Schoor, 2014). The framework presented in figure 6, presents the systematic approach by first analysing the current product, interaction and context to create starting points for the designing phase of the future state.

The limiting factor of the ViP approach is the lack of ideation and conceptualization during the process towards the future state product. Therefore it can be difficult for actors in the project to envision the end result beforehand.

Everything can be a starting point for innovation and design. That is why analysis into the status quo is essential to come up with the insights that will form the starting points of innovating the future state. These starting points are the pivoting insights that will lead the status quo to the future state (Hekkert & Van Dijk, 2011).

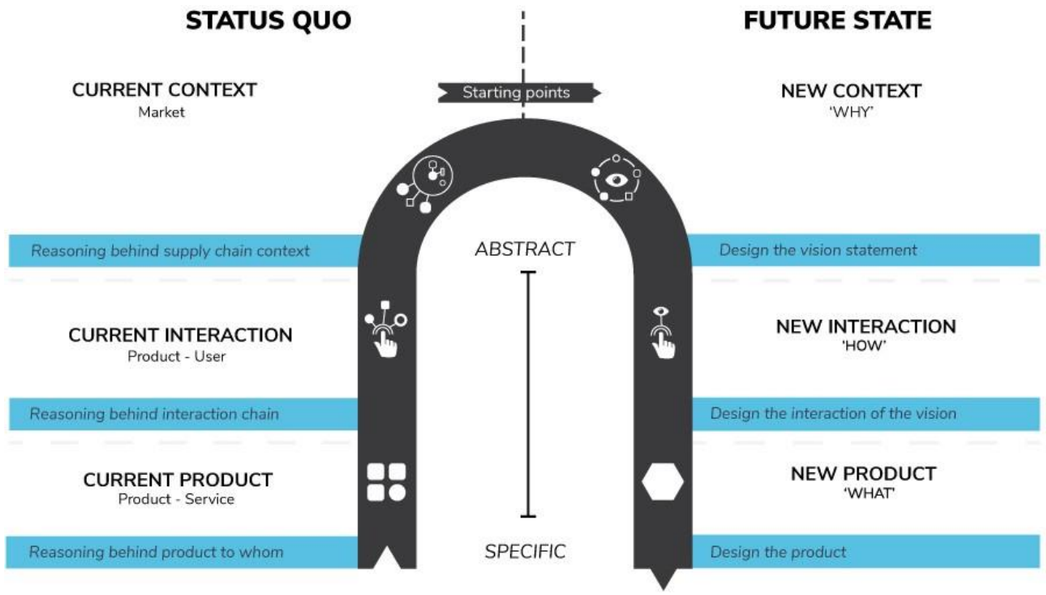


Figure 6. ViP Framework (Hekkert & van Dijk, 2011)

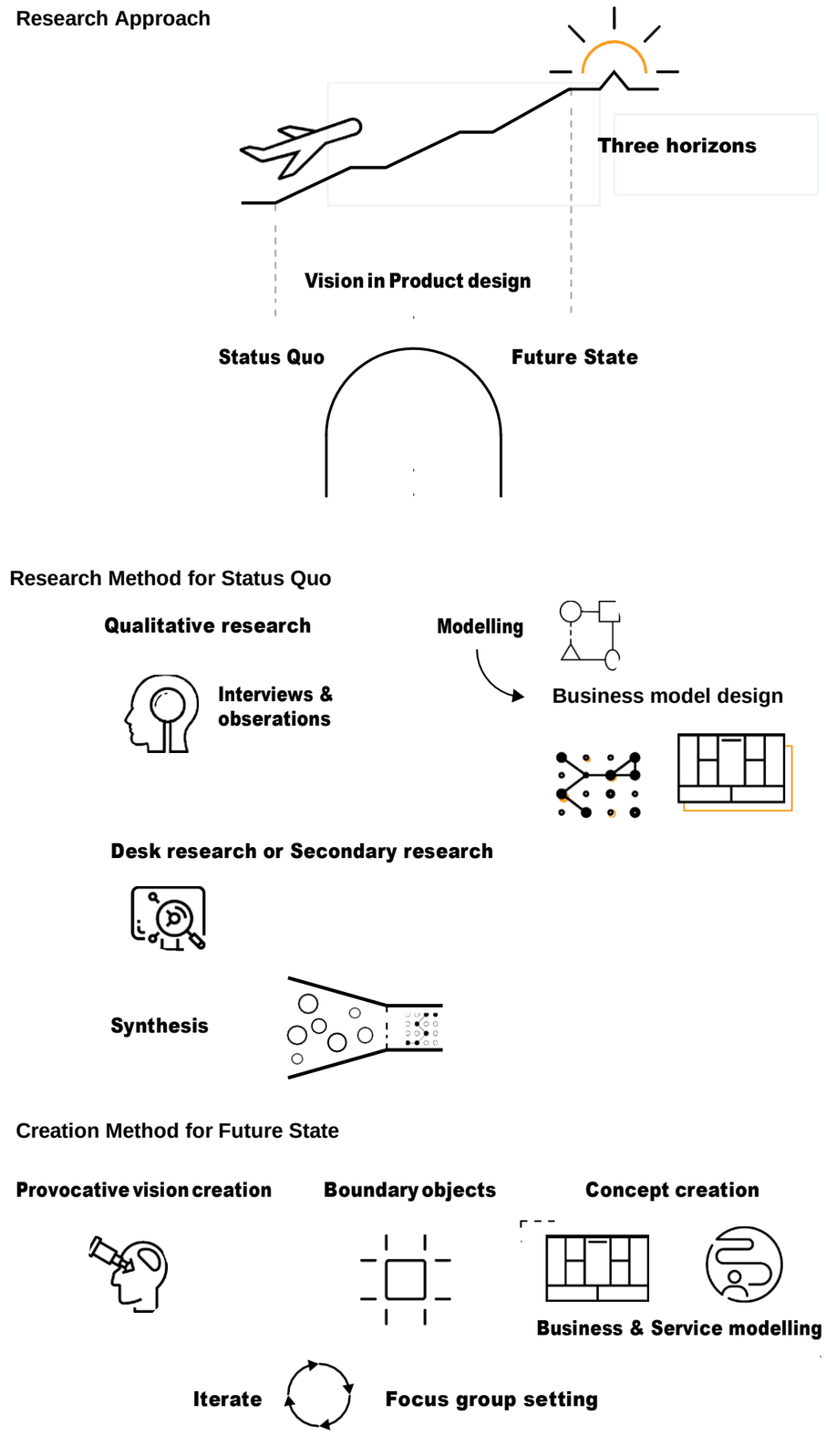


Figure 5. Project approach

2.2 RESEARCH METHOD STATUS QUO

The analysis of the status quo is based on two types of research, qualitative research and desk research. The research aim is to identify opportunities for starting points for the vision of the chain and the future concept.

2.2.1 Analysis – Desk + Qualitative research

Qualitative research is used to getter in depth insights on the status quo. The qualitative research that is performed consists of semi-structured interviewing accompanied with observations. Due to the complex system of the floriculture supply chain with all the actors and activities linking them a tool is needed to present the system clearly to establish valuable insights during research. This method is modeling.

Modeling is used as a tool to create models that present the complex system of the floriculture supply chain in a structured way. For modeling I follow Simon (1990) who stated that "modelling is a principal tool for studying the behaviour of complex systems" and "to manage this complexity we must separate what is essential from what is dispensable in order to capture in our models a simplified picture of reality which, nevertheless, will allow us to make the inferences that are important to our goals." (Simon, 1990; Simonse, 2014).

The tool modeling is used to design business models of the different actors. "the purposeful weaving together of interdependent activities performed by the firm itself or by its suppliers, partners and/ or customers - is the essence of the business model design." (Zott & Amit, 2010). Business model design as Zott & Amit (2010) state creating interdependencies between actors and its activities is of essence toward the total value creation for all actors involved (Simonse, 2014).

The activity in a business model can be seen as a commitment of resources (e.g. human, capital, operational) to establish the objective of value creation. The activity system is therefore a collection of those interdependent activities of involved actors. However it is necessary to not only look at the total system accompanied with the total value creation but also appropriate a piece of the value as a firm itself, autonomy remains. The links that weave the activities into a activity system are transactions. The business model definition I adapt is from Amit and Zott (2001): "A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities" (Amit & Zott, 2001; Verhees, van Kuijk, & Simonse, 2017). The content of transactions refers to the exchange of the 'what', what kind of recourses are shared. The transaction structure refers to 'how' and 'who', how are activities linked and by who. And the governance of transaction is the way the transactions and the activities are controlled. Thus, business models presents the product activities as well as the interaction transactions between product and user in a structured and visualized way. Therefore it suits the ViP approach in this project.

The use of business modeling with the activity systems perspective provide me as a designer with a visualized tool that engage actors and to start an insightful dialogue. This tool is used during interviews to document, stimulate and iterate on the information shared by the interviewee. The generated models together with the interview input form the basis for the data (insights) collection.

Next to the qualitative research to analyse the status quo desk research or secondary research was performed to analyse the floriculture supply chain and its context. Both internal (organization) as external (online) desk research was performed. This research technique is suitable to review previous research findings on the subject collected by others (Stewart & Kamins, 1993). This research is particularly applicable to the context research of the status quo.

2.3 DESIGN METHOD FUTURE STATE

The creative design activities used to create the future state are the design visioning, boundary objects and business model design. My skills as designer are used to create the designs and iterate on them during the process of creating the future state.

Design visioning is used to establish a future state context direction for the chain that derives from the status quo analysis.

Boundary objects, "refers to artefacts doing the crossing by fulfilling a bridging function" (Akkerman & Bakker, 2011). This can be any type of object both physical or pragmatic unless people can act toward and with the object (Leigh Star, 2010). It must be stressed that boundary objects are not independent objects in no need of explanation. It does not displace communication or collaboration but empowers it. Therefore a focus group like setting is used to present the boundary objects with me as a moderator guiding the discussion while also stating the boundary objects. "The focus group interview is a qualitative research technique used to obtain data about feelings and opinions of small groups of participants about a given problem, experience, service or other phenomenon" (Basch, 1987). The objective of the Feedback generation of concept theory and concept idea by stakeholders of the cool chain.

The boundary objects form the topic of discussion regarding the strategic decisions that need to be made to go from horizon 1 (status quo) to horizon 3 (future state) towards the vision (Simonse, 2018) (see figure 7). The boundary objects act as ideation and conceptualization tools to bridge the gap towards the future product.

Business model design is used to present the future state product, the interaction between activities and the overall context in an comprehensive model. This model presents the new activity system, activities and transactions between actors of the future state.

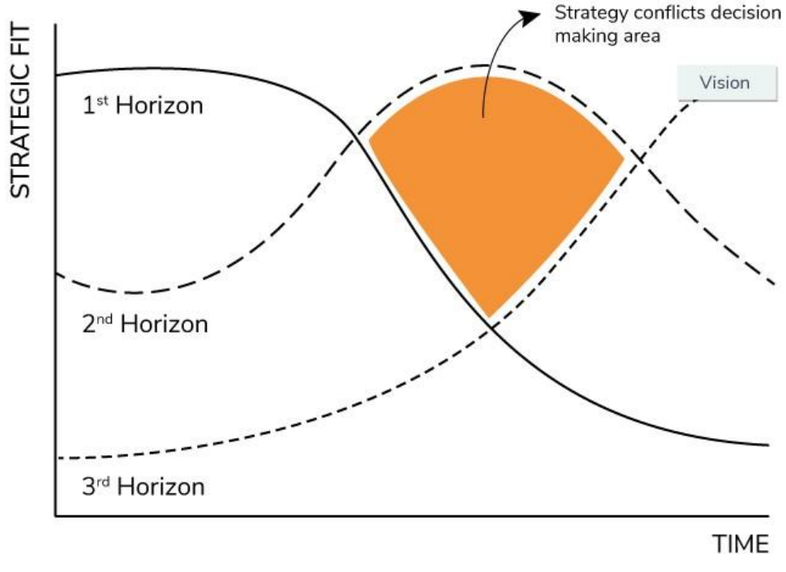


Figure 7. Horizon model (Simonse, 2018)

03

ANALYSE THE STATUS QUO

This chapter presents the research performed on the product, the interaction and the context of the status quo. As stated in the design and research approach the analysis of the status quo has as objective to generate starting points that form a base for the future state of the floriculture supply chain and the logistical process of FlyCo. The chapter is divided into four sections starting with the product, then the interaction, to the context and closing with the synthesis of the chapter.

"A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty."

—

Sir Winston Churchill
(Kelsey, 2018)

3.1 STATUS QUO - THE PRODUCT

This section present the product analysis. The context for the analysis of the product is scoped to the floriculture supply chain from Kenya to the Netherlands. However, the supply chain fits within the generic process of air freight and therefore the product analysis starts with the description of the air freight process in general. The presentation of the floriculture supply chain shows the current activity system and its value delivery.

3.1.1 The product – Generic air freight process

The logistical air freight process presented in figure 8 shows the generic process of air freight throughout the world. The process consist of four generic activities, handling, storing and transporting cargo plus information sharing (on paper and as EDI Electroninc Data Interchange). These activities are independent of the type of cargo transported. The air freight process is a standardized operational process with milestones that are applicable for every freight forwarder and carrier. The master

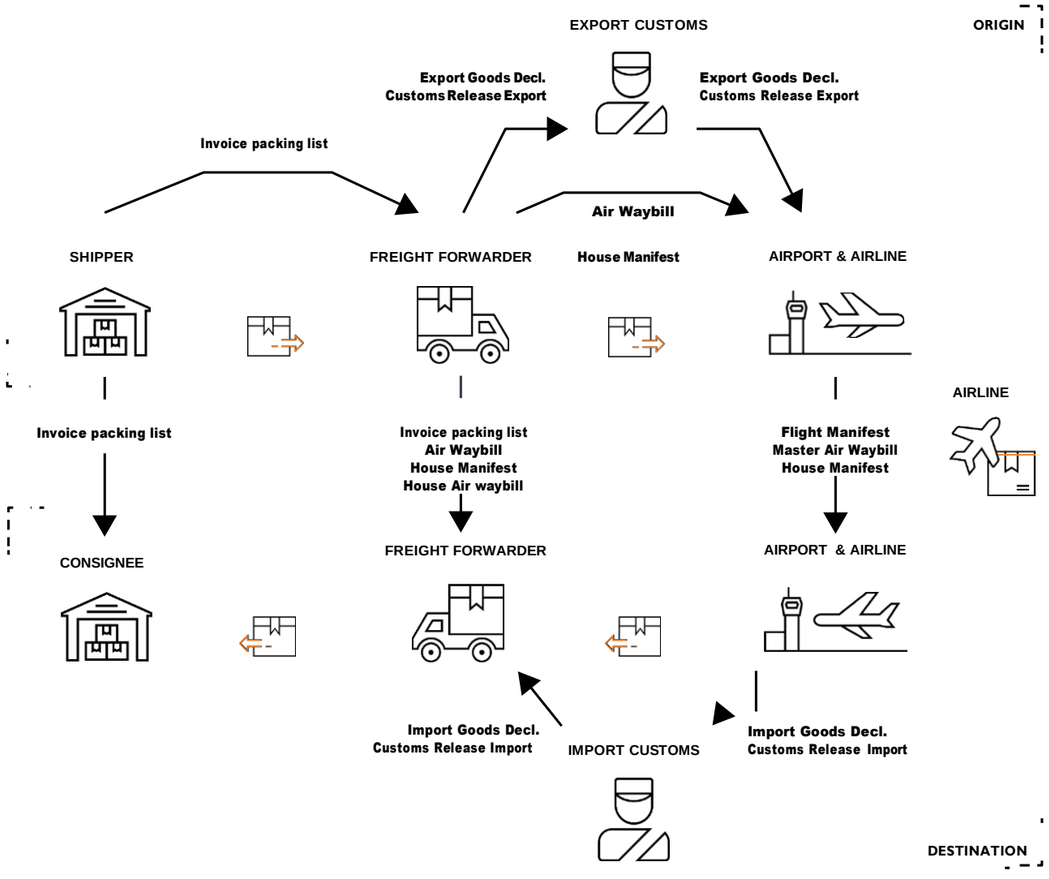


Figure 8. Air freight process

operating plan (MOP) is a description of this operational process. The MOP is created by the International Air Transport Association (IATA), the leading organisation in creating industry policies on aviation issues (IATA, 2018). IATA created MOP to

standardize the operating process worldwide. The MOP consists of two parts, a carrier- and a freight forwarder part. It maps the processes and sub-processes from shipper to final consignee. Included in the MOP are the milestones of the air freight process. These milestones are electronically send messages presenting end and starting points of the process.

Figure 9. Actors air freight

The general air freight process consist of four actors that are consistent in the process (figure 9) . The shipper is the actor that sends a piece of cargo to a receiver, the consignee. The logistics between the shipper and the consignee are performed by a freight forwarder and an airline. The freight forwarder is generally responsible for the logistics from the shipper to the airport of origin and from the airport of destination to the consignee. The airline is responsible for the shipment between airports.

These steps are generic processes and not specifically dedicated to the type of cargo. The objective of the air freight process is to transport cargo from the destination of origin to the destination of delivery in a safe way.

3.1.2 The floriculture supply chain

The floriculture supply chain regarding roses from

Kenya to Amsterdam is presented in figure 10. This picture illustrates the total supply chain from not only the grower towards the consignee but also to the end consumer of the rose itself. This shows already the amount of actors involved and the journey flowers have to make. The objective of the chain is to transport the flowers from the grower to the buyer as fast and with the best remaining flower quality possible in a cost efficient way. The product of the supply chain is to handle, store and transport the cargo to the next actor while providing them with the necessary information about the cargo.

To better understand the activity system of the supply chain the individual actors in the system are interviewed. The business models toolbox is used during the interview to map the activities of the actor and the transactions linking them. Additional desk research is performed to complement the analysis. Four types of transactions are used to link the actors and the activities.

1. Data transactions: information sharing only

2. Operational transactions: people and or means in action
3. Revenue transactions: money transfers
4. Value transactions: delivering business / process value

These transactions are chosen based on my own experience of modeling business models (Verhees et al., 2017). These transactions show the value delivery throughout the activity system, the revenue streams, operational activities and the information shared between actors.

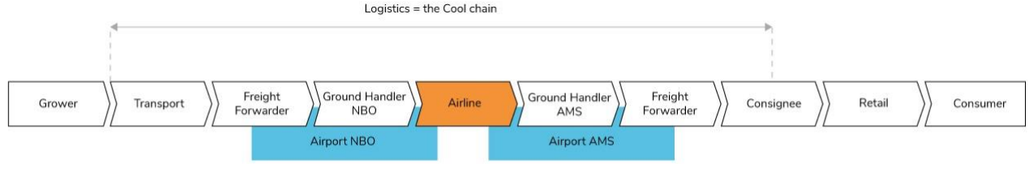


Figure 10. Supply chain Kenya - Amsterdam

3. Analyse the status quo

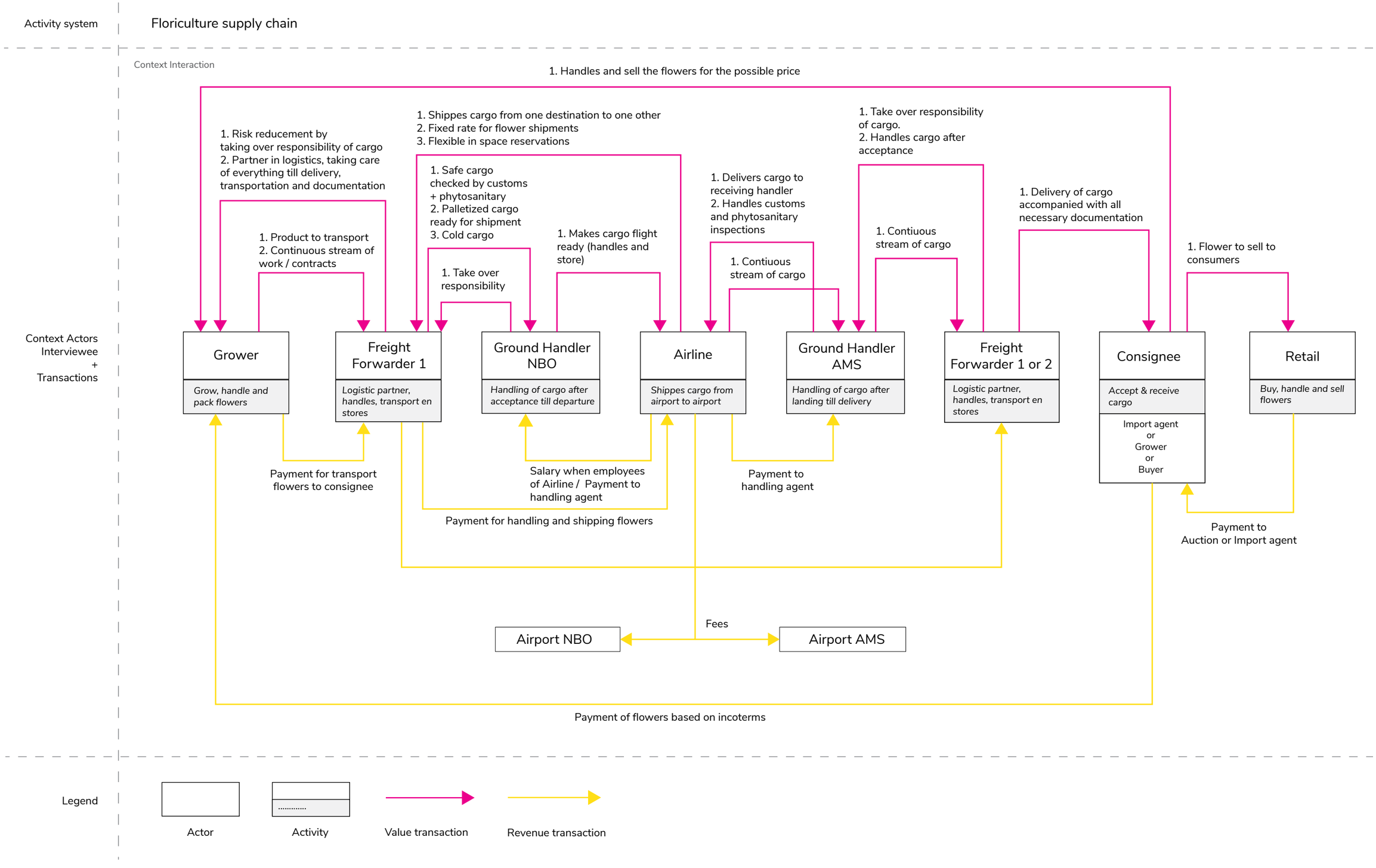


Figure 11. Business model design floriculture supply chain

The business model of the total floriculture supply chain (see figure 11) illustrates the 'product' that growers use to transport and sell their flowers to their customers. It presents the supply chain as the activity system, the actors linked by value and revenue transactions. This overview of the business model is designed only with the value and revenue transactions to identify the business value creation towards the total objective of the chain. The reason why this is the current supply chain.

The insights are based on the interviews using modelling to model the business models, the personal communication with actors and the secondary research performed.

Insights

Value transactions
The floriculture supply chain transfers the value created by the grower towards the consignee. The supply chain adds value to the product because of the connecting function between seller and buyer.
The value delivery of the logistics is an essential element to the revenue model of the consignee and the grower. The performance of the logistics determines the total end value delivered at the end of the chain, the buyer. Therefore all the actors between the seller and the buyer are a liability in creating the most value.

Revenue transactions
The revenue generated by the flowers at the marketplace is not divided throughout the chain. This means, a higher price at the marketplace benefits only the seller. As consequence, there is no direct revenue incentive for actors to invest and innovate, no direct revenue streams lead from a better flower quality back to the actor. The whole chain benefits with investments made by one. The revenue streams between the actors are based on the amount and what kind of work is performed but not on how the work is performed.

Thus, the actors in the supply chain relay on each other to deliver the best value within the chain. However performance of individual actors in the logistics is not presented to the grower or the consignee. This lack of transparency results in a supply chain based on trust and contracts.

3.1.3 Cool chain – Logistical product

The cool chain is defined as the transportation of temperature sensitive products along a supply chain using temperature regulation and logistical planning to protect the integrity of the shipment (Rodrigue, Comtois, & Slack, 2016). The cool chain is the 'product' that the logistics offer towards the growers to distribute their flowers. The cool chain as

Figure 12. Vacuum cooler

Figure 13. Cool storage

defined before is used for specific types of air freight, namely products with a temperature requirement. The cool chain offers these products special handling activities such as, vacuum cooling (see figure 12), cool storage (see figure 13) and priority boarding. To either shorten the lead time or to control the temperature of the product at best. The objective of the cool chain is to provide a product as logistics that protects and preserves temperature sensitive cargo.

3.1.4 What is product quality for the cool chain?

Product quality must be divided into the quality of the logistics, the cool chain, and the quality of the shipped goods, the flowers.

Cool chain quality
The current logistical standpoint of product quality for the cool chain of FlyCo is based on lead time. Lead time is the time it takes from accepting at origin to delivering the cargo at destination. The two quality indicators of the shipment process are Flown as Planned (FAP) and Delivered as Promised (DAP). The quality indicators indicate if the shipment is delivered (flown) to the consignee conform the booking and or planning. The route maps (see figure 14) created by the freight forwarder provide a deeper level of performance insight of planned vs. actual timing of the milestones. These indicators are based on lead time only, no other quality indicators like temperature exposure of the product are measured when the product Fresh 2 is booked. They do perform a physical damage check of the goods, boxes only, during acceptation. The quality indicator that measures the performance of the special handling activities however is missing.

Flower quality
For the actors that are dependable on the proceeds of the flowers, the grower, FloraHolland and the wholesale/retail, the quality of the flowers is imperative. However, the better FlyCo and the logistic partners understand the product that is shipped the better measurements can be taken to ship the product in the best way.

The quality of the flower towards the buyer is currently measured in exterior characteristics such as stem and flower bud size. Furthermore a maturity stage indicator is included to provide the buyer with information on the maturity level of the flower. Figure 15 presents the product information that is visible during the auction of flowers at FloraHolland. Buyers depend on this information and therefore as the quality manager of Royal FloraHolland Maarten Banki states "The reliability of information you provide to the buyer determines the satisfaction of the quality of the product at the

Consignment details

Consignment number:	000-14212284	Carrier:	Airline	Planned RCS to planned NFD:	17:20
Total pieces:	5	Forwarder:	ABC Air and Ocean	Planned RCS to last event:	25:54
Total weight:	72.0Kg	Routing:	AMS - PEK		
Product code:	R21	Baseline routing:	AMS - PEK		

Pieces	Origin milestones			Origin	Flight	Dest.	Destination milestones		
5	FWB 27 Mar 1600 (-95)	RCS 27 Mar 1605 (-90)	DEP 27 Mar 1835 (+60)	AMS	XX0897 dep: 27 Mar 1735S arr: 28 MAR 0855S	PEK	RCF 28 Mar 1455 (+360)	NFD 27 Mar 1525 (+390)	DLV 31 Mar 0855 (+4320)

Station	Code	Event time (Local)	Received time (Local)	Type	Pieces	Weight	OSI	Other detail
	BKD		19 Mar 2124	FSU	0	150.0Kg		Rte: AMS PEK, Seg:AMS PEK, KL0897, Dep:27 Mar 1735S, Arr:28 Mar 0855S, Summ:K150.0, Dtl:K150.0
	BKD		19 Mar 2124	FSU	0	150.0Kg		Rte: AMS PEK, Seg:AMS PEK, KL0897, Dep:27 Mar 1735S, Arr:28 Mar 0855S, Summ:K150.0, Dtl:K150.0
AMS	RCS	27 Mar 1301A	27 Mar 1301	FSU	5	72.0Kg		AMS, Summ:T5K72.0, Dtl:T5
! AMS	FWB	27 Mar 1600	Reason: Missed milestone. No message received					
! ~~AMS~~	~~DEP~~	~~27 Mar 1935~~	~~Reason: Missed milestone. No message received~~					
AMS	DEP	27 Mar 1925A	27 Mar 1953	FSU	5	72.0Kg		AMS, PEK, KL0897, Dep:27 Mar 1925A, Arr:28 Mar 0855S, Summ:T5K72.0, Dtl:T5K72.0
! AMS	DEP	27 Mar 1953	Reason: Milestone missed planned time					
AMS	FWB	28 Mar 0003	Code: CMFNR					Description: Not received Other Information: FWB04 Delete
PEK	RCF	28 Mar 1305A	28 Mar 1305	FSU	5	72.0Kg		PEK, KL0897, Arr:28 Mar 1022A, Summ:T5K72.0, Dtl:T5K72.0
PEK	NFD	28 Mar 1309A	28 Mar 1309	FSU	5	72.0Kg		PEK, Summ:T5K72.0, Dtl:T5K72.0
PEK	DLV	28 Mar 2359A	29 Mar 0002	FSU	5	72.0Kg		PEK, Summ:T5K72.0, Dtl:T5K72.0

Figure 14. Example route map (Borst, 2018)

end." (Banki, 2018). The reputation of the growers is mainly based on the reliability of the information. FloraHolland provides each grower/seller with a quality index rating based on the reliability of the product information (FloraHolland, 2018). Adding to the reputation of growers are the environmental and societal certificates growers have about the growing and handling process of the flowers (Buis, 2018; FrescoFlowers, 2018).

New quality indicator concept
"The predicted vase life should be the result of the effects of air temperature and humidity in the various links of a supply chain on rate of senescence, germination of Botrytis conidia and the water balance of the cut flowers. Whether cut flowers are placed in water in some of the links or not, as well as re-cutting

by the consumer should be taken into account".
(Buck-Sorlin et al., 2009)

Flowerwatch stated that the loss in vase life can be measured. They describe an amount of degree hours towards the loss in days of vase life (Flowerwatch, 2015).

Bottlenecks for flowers
There are four main degradation variables of the flower quality, temperature, time, bacteria/deceases and ethylene gas.

The increase in temperature of the flower increases the transpiration of the flower as well, this result in an exponential increase in flower temperature (Reid & Seaton, 2015). This harms the flower quality due to the loss of water inside the flower. A negative water balance is created when the uptake of water is less than the transpiration rate (Van Meeteren, 2008), the drying process sets in. Transpiration also increases the humidity which increases the chance on fungus and deceases.

The clock is always ticking in the disadvantage of the quality of the flower. From the moment the flower is cut off from its roots degradation sets in. Therefore speed in transport from the grower towards the consumer is of essence.

Ethylene gas is a hormone produced mainly by fruits that causes senescence or aging of flowers.

3.1.5 Conclusion product quality

The product quality of the chain or the flower is currently not measured. The logistics is responsible for the temperature and time exposure of the flower boxes. This responsibility is not quantified and is therefore based on trust that the logistics care about the product. Contracts made are not based on product quality delivery but only on lead-time. No quality indicator about the logistical process of the flower exists and therefore buyers depend on the reputation of the grower. Measuring the temperature of the cargo is sometimes done with a passive logger by the growers. After the shipment is delivered and accepted a reading can be done of the logger. No alternating actions towards the process can be taken to increase the quality or reduce the temperature. Therefore growers can suffer from mistakes made by the logistics.

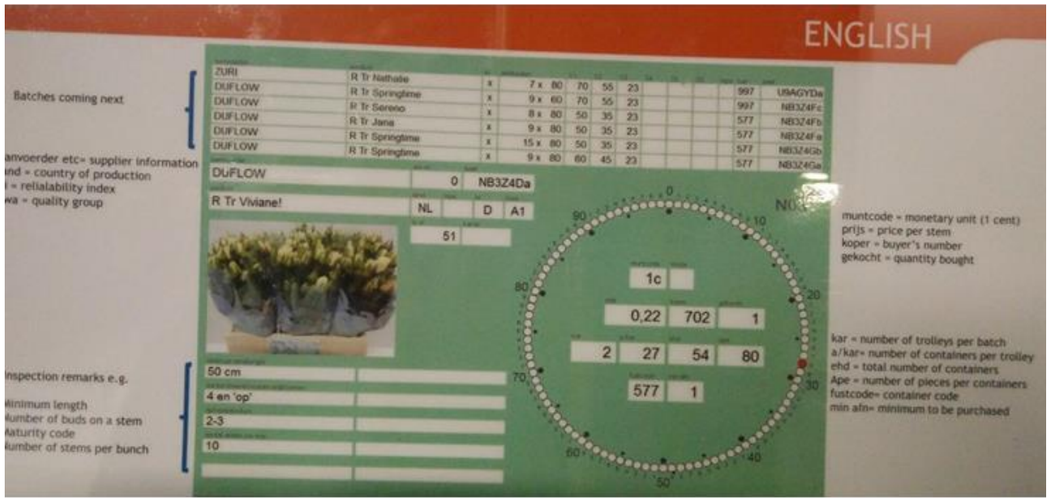


Figure 15. Auction information

3.1.6 Product insights

Product
The airline offers a worldwide network of connections. These connections enable shipment of cargo between destinations. FlyCo is thereby the connecting element. FlyCo handles, stores

and ship's cargo. These activities are generic activities that occur every time a piece of cargo is transported.

Fresh flowers are perishable items that are in need of special handling (extra) activities. FlyCo's product for items that are in need of special handling is variation. Variation is the product category that entails specific solutions for shipments that need special handling. FlyCo's Variation Fresh is the product created for perishable items such as flowers. The main objective of the Fresh product is to control the temperature and lead time to maintain the optimal quality of the product. Within Fresh currently three types of products can be booked.

1. Fresh 1 is a closed cool chain using refrigerated containers that keep the product on temperaturesvariating from -20 to +20°C. Mainly booked for freshly frozen food.
2. Fresh 2 tries to control the temperature between 2 till 8°C using cool storages during parts of the process or thermal blankets. This product is mainly used for fresh flowers like roses.
3. Fresh 3 protects the cargo from extreme temperatures by maintaining a temperature between 2 and 25°C. Suitable for different types of fruits or vegetables.

However, the products Fresh 2 & 3 cannot guarantee the temperature windows provided as benchmark for the product to the customer. No feedback towards the customer about the actual temperature of the product and or process is provided. Fresh perishable flowers like the roses from Kenya are normally booked and shipped using product Fresh 2.

Product activity system

FlyCo's business model learns us that the activity system consists of three steps. Analysis based on this model, interviews, the individual business models of revenue management, planning and the ground handler and the

secondary research lead to the insights regarding the three steps.

Step 1: Booking
The booking (BKD) process marks the start of the shipment process. This process is mostly a data-driven internal process. A commercial and operational (e.g. checks on load capacity, placement of cargo in cargo hold plane) check is performed. Revenue management decides what is shipped on a certain flight, commercial check is leading in this decision making process.

Step 2: Handling Origin
The handling process at origin consist of a three core steps, 1. Check of documentation, 2. The preservation of the cargo and 3. Making the freight flight ready.

Before the physical handling of the cargo a check on the documentation is required. The documentation must be complete and match the actual freight delivered. Mismatch or missing documentation is the number 1 delay creator inside the chain. It prohibits the cargo from exporting or importing a country.

The handling of the cargo is bounded to a procedure with guidelines based on departure time of flight. The time until departure determines the placement in the warehouse, cool storage or platform. To preserve the cargo, platform (tarmac) time must reduced due to the uncontrolled conditions of the outside weather. The handling process is also specified based on the delivery conditions of the

forwarder. In Kenya forwarders like Keuhne Nagel and Panalpina deliver the flowers already palletized(see figure 17). Less cargo handling is needed to make the freight flight ready compared to the delivery of loose cargo. Build up of pallets and breakdown of pallets are the most time consuming warehouse handling processes. Therefore pre-defined delivery conditions determine the operational handling process at Nairobi airport. A value proposition of the handling is the pre-cooling of aircraft. The cargo hold is cooled before loading begins.

Step 3: Handling Destination
The handling process at destination consist also of three core steps, 1. Check of documentation, 2. Customs import clearance and 3. Delivery of freight ready for pick-up.

The check of documentation is also performed at the airport of destination. In addition, import clearance is provided when customs control and phytosanitary inspection is performed. This step is the delaying factor of the handling at the airport of destination. The cargo must be cleared first for EU-admission before handing it over to the consignee. Due to the open warehouse handling (see figure 18) at Schiphol the handler itself is responsible for the cargo when this is placed inside the warehouse.

3.1.7 Conclusion product

The activity system is not a real cool chain. FlyCo cannot cool the product when the flowers are palletized during the transport. The thermogenesis of the flowers wins over the cooling power of the cool storage and the cargo hold in the plane.

The handling procedure is a fixed system based on time till departure. Planning and regulation of the procedure steer the handling process.

Miss match in documentation can lead to delay along the cool chain. However, it can also lead to inefficiency during the handling process. Repairs must be made to fix the problem in a certain time frame because the flight needs to leave a certain time.

Figure 17. Aircraft pallet (Smulder, 2018)

Figure 18. Freight belt directly connects airside with landside

3.1.8 Product insights Supply chain actors

This section presents the analysis and insights on the product activities performed by the supply chain actors. The insights are based on the interviews (see sample list, the generated business models and secondary research. I decided as researcher which insights are of interest and can influence the future state of the cool
chain. The main activity of the actor is described accompanied with bottlenecks and opportunities of the cool chain backed with secondary research and quotes.

The grower
(Knepper, 2018; Koot, 2018; Zuurbier, 2018)
The activity of the grower is to grow, handle and transport roses from farm to freight forwarder (see figure 19). The grower is the first step in the supply chain and therefore responsible for the input quality of the flower in the cool chain and the proper documentation (e.g. origin certificate, packing list, labelling). For the interviewed actor Knepper Roses a second activity must be performed as well because Knepper is situated in both Kenya as the Netherlands. This means Knepper is its own import agent. Therefore Knepper must transport, unpack, handle and distribute the roses from the airport to their warehouse to the marketplace.

The product quality
The cool chain is important to the grower because it effects the quality of his product and therefore the revenue. To check the logistic partners in the supply chain, Knepper Roses places a temperature logger in flower shipments in a flower box.

"My own temperature loggers help me to understand the historical temperature course of the product but does not help me to increase the value of my flowers" states Richard Knepper (Knepper, 2018).

No buying information is connected to the temperature data. Temperature control do can strengthen the reputation of the grower. But what can be down about bad temperature readings?

Richard Knepper – ***"Who is responsible for the temperature increase of the shipment and what are the consequences?"*** (Knepper, 2018)

To check the quality of the flowers growth test of flowers are performed before and after the usages of the cool chain. This provides the grower with a test method to determine the end-quality, remaining vase life of the flower. "The predicted vase life should be the result of the effects of air temperature and humidity in the various links of a supply chain on rate of senescence, germination of Botrytis conidia and the water balance of the cut flowers. Whether cut flowers are placed in water in some of the links or not, as well as re-cutting by the consumer should be taken into account". (Buck-Sorlin et al., 2009)
In addition, a prediction cannot be given about the treatment of flowers by the consumers. So many variables that influence the remaining vase life, no reliable prediction can be given.

Conclusion
There is no transparency about the logistical process for the owners of the flowers. Continuous feedback about the product performance would be opportunity. Measurements relating to time and temperature inside the chain are good to have. However, the data about the performance must be quantified in terms of value delivery but also in revenue allocation. Growers need the have pro-active tool to plan the quality outcome of their product. Uncertainty is a reliability to the owner of the product. Benchmarking is of essence looking only at the product quality of the flower, quality loss must be measured in percentages of the benchmark due to

Figure 19. Process on farm (Alliance, 2017)

difference on the product quality of the flowers when entering the supply chain.

Product insights Forwarder (Borst, 2018)
The Freight Forwarder is the logistic partner that provides the grower (shipper) with everything they need, it is the connector in the chain. I interviewed Keuhne Nagel (K+N), one of the biggest players

in the market, and created their activity system business model with them (see figure 20).

The freight forwarder handles the transport of the flowers from farm till consignee. They create so called route maps of the shipment to plan the logistics. This route map is milestone driven and therefore data driven (see figure 14). During the supply chain the freight forwarder is the only actor that has the capacity to cool down the product using vacuum cooling. This way of cooling is the standard nowadays for the beginning of the cool chain.

The route map example of figure 14 on page 33 shows that missed milestones at the beginning of the chain will not directly lead to a later delivery at the end. But along the chain repairs has to be made to make the milestone of delivery.

"All actors have to work together to do 1 job, bringing the flowers in the best condition to the consignee." – Jeroen Borst Keuhne Nagel

Because they are the exporting and importing agent of most of the shipments delays in these processes are bad for their performance and the product quality. The freight forwarder works with the documentation and labelling of the cargo provided by the grower. This labelling must be correct to match the right cargo to the right HAWB and to send reliable information towards customs. This operation is not paperless and is therefore sensitive to errors. Errors and miss matched in documentation vs. the cargo creates import problems in the country of destination. This the biggest bottleneck for the freight forwarder in their process, customs clearance.

Conclusion
The freight forwarder is dependable on reliable documentation of the grower to perform at its best. As they create a route map for the logistics, the freight forwarder is the controlling agent of the logistics. Improving the collaboration and the reliability within chain the leads to a direct process improvement of the freight forwarder by decreasing the delays and repairs necessary.

Product insights Ground Handler AMS (Groen, 2018)
There are two type of handlers, ground handler and cargo handler. Ground handlers handle the cargo to and from the airplane and cargo handlers handle the cargo inside the warehouse. These activities however are most of the time combined and therefore if we speak about ground handling we include both.

The handling process starts when the cargo is accepted at the airport. This process is described in 3.1.5. FlyCo has a partner that handles the handling of the full freighters at Amsterdam Schiphol airport. This company off loads the cargo, handles the customs clearance and deliver the T-ULD's (through ULD's, 1 consignee on the pallet) towards the forwarder. Process of offloading

Figure 20. Freight Forwarder process Nairobi (Alliance, 2017)

and delivering it to the forwarders is fast due to the direct connection (open warehouse), no interference of other actors if there is no customs check. The whole handling process is not cooled so any delay directly leads to an increase in temperature of the product.

Product insights Customs (Blasse, 2018)

The customs at AMS have 3 main controlling functions. 1. Customs check (documentation) if the cargo can be imported into the European Union. 2. Perform border control. 3. Import transactions control.

The customs check is almost completely a documentation check and therefore data-driven. This mean reliability and completeness of the documentation is essential to avoid delays or even import rejection. Continuity is the most important aspect of the control.

"What comes in must come out" stated by Maarten Blasse (2018).

As example, there cannot be differences between the manifesting, the AWB, the export declaration and the import declaration. This would mean cargo is lost or added to the shipment during the transport according to the documentation and will lead to checks of the actual cargo with delays as consequence. To avoid the problems with the documentation the documentation at the beginning of the chain must be reliable.

Product insights import agent (Buis, 2018)
The import agent Frescoflowers is responsible for the importing and distribution process of flowers from their clients, the growers. They unpack, check and supply.

There operational planning is completely dependable on the arrival time of the flowers at dock services (arrival of trucks) of FloraHolland. They have no prior knowledge about the temperature of the product or are able to influence the incoming product quality of the flowers. When the flowers are

delivered to dock services, Frescoflowers take over the responsibility of the flowers (see figure 21).

This supply manipulation can only take place when the quality of the flowers is good. As import agent and distributer of the flowers, a quality improvement along the supply chain can lead to business opportunities at the end of the chain. Frescoflowers benefits directly from a higher selling price due to the percentage of revenue of the flowers they get as earnings.

Product insights Retail (Pels, 2018)
The retail, florist, buys the flowers from a local Dutch grower, the auction or the wholesale. It prepares and presents the flowers for the customers to buy.
The customer is very critical on the quality of the flowers, they expect a certain vase life and want a prediction or even a guarantee on it. The retail itself do not really want to sell flowers that last for 14 days, they want the customers to return every week. However, improving the quality of the flower do lead to more flexibility for the retailers in terms of the selling window of the flowers.

The quality control of the flowers consist of a visual check when the flowers are delivered to the retailer after the auction. The retailer checks the maturity stage of the flower and compares it to the description based on experience. The retailer has no knowledge

Figure 21. Process Frescoflowers

about the temperature exposure or the lead time of the supply chain.

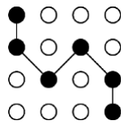
3.1.9 Conclusion Product insights

The cool chain is the logistical product offer to the buyer or seller of the flowers. This cool chain is driven by trust. Trust in each of the actors to do their job, trust in reliable information and trust in each other create value towards the objective.

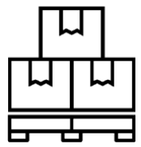
The current cool chain has problems in keeping that trust. The cool chain is hardly monitored on performance, lead times between milestones can be retrieved but are not transparent. Temperatures are occasionally measured but not used as quality indicator.

The biggest improvements on the current cool chain are to establish measurable reliability, create commitment towards a standard of quality and to unify as chain to really collaborate and support each other towards the common objective.

Close the chain



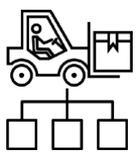
Consistency **in information (quality) is essential**



Cold air has no access to the boxes when placen on ULD

Cooling is much harder then preserving **temperature**

Revenue **decides, quality suffers**



No boss **or controlling party in the chain.**

However, chain depends on FF

A cool flower at the beginning **of the chain**

is essential

The chain is not the owener **of the flower.**

Who pays for innovation?

3.2 STATUS QUO - INTERACTION

The interaction between product and the user is presented in this chapter. The interaction is divided into to two subjects. The actor-process interaction and the flower-user interaction. This distinction is made because they are two different aspects of interaction, one focussing on the higher level process interaction and the other on the cargo handling.

3.2.1 Actor-process interaction

How do the actors interact within the cool chain?
The actors in the supply chain work together on a one-to-one relationship without having the complete system and objective of the chain in mind. The reason is the lack of an orchestrating party that controls the supply chain and oversees the performance of the chain.

The interaction in the chain is for one part data-driven and for another part user-driven. The actors interact by sharing documentation and information about the cargo. This exchange of information can be both digitally as physically (paper). The exchange of information is based on a messaging structure between two actors. This happens most of the time parallel on the movement of the physical cargo.

The movement of the physical cargo, the boxes, is the user-driven interaction. The cargo only moves if it is moved by someone or something. Cargo cannot move on its own. Users of the cool chain, the personnel of the actors, handle the cargo accordingly to the required operations. The interaction with the users of the other actors takes place at the cargo transit moments from one actor another.

The value delivery between the actors and within the total chain is based on trust. Trust is necessary because responsibility of the flowers shift from one actor to another but ownership remains with the grower. The grower dependents on the logistics and the marketplace to transform the flowers into a revenue stream. Each actor and activity in the chain adds to the risk off revenue reduction at the end of the chain.

The supply chain depends on its actors but the actors also depend on the supply chain. The actors need to work together to reach the objective and thus are dependable on each other. The individual business thrives by a good working chain. But currently responsibility to reach the objective is not shared. There is no overarching actor of the supply chain that controls the process.

To conclude, the interaction between actors, the cool chain and the cargo is mostly reactive. No transparency in information throughout the chain and no transparency about the status of the cargo itself.

3.2.2 Product-user interaction

How is the interaction with the flowers, the product?
The interaction with the flowers in the floriculture supply chain exists only in the beginning and the end of the chain. During the logistics the interaction takes place with boxes that have a temperature requirement due to the content of the boxes. The boxes of flowers are seen as cargo that needs handling, storage and transportation. The interaction with the product is from box level to ULD level. This means the handling of the cargo take place by hand, by fork lift or dolly. However, the users, the handlers, care about the boxes of flowers. They know that the cargo they are handling is delicate and require a temperature requirement and try to act accordingly. But, regulated operational instructions and strict process handling agreements are leading in the interaction with the cargo.

Business model design is used as tool to present the “user-product” interaction of the chain!!!! To map the activities performed of the actors and to illustrate the transactions between them and the activities.

3.3 STATUS QUO - CONTEXT

The analysis of the context presents the context of the current floriculture supply chain market. This context analysis include an identification of trends and competitive environment. Trends are predicted developments that will have a long lasting effect and change on the future. The most impactful market trends are explained that threaten the current position of the supply chain and its actors. Technology trends that are and will change the context and the interaction and product of the future. Closing the context analysis is presenting the competitive environment of FlyCo and the threats they include.

3.3.1 Market trends

There are three main trends (see figure 23) that threaten the position of the Netherlands as the flower hub of the world and therefore also the individual actors involved. The trade market is shifting from auction clock towards online direct sales. The import streams towards Europe are decentralizing. And the transportation sector is changing.

The trade market is shifting from auction clock towards direct sales. The direct sales between grower and customer increased and resulted in a shift in 2017 of 3.7 percent point and in 2016 1.9 percent point to a total of 56.3% of the turnover (FloraHolland, 2017). This decrease in sales at the auction clock has an negative effect on the floral supply chain in the Netherlands. It means, less flowers are imported and exported through the Schiphol area (Lijster, 2017). This affects all the actors in the floral supply chain and threatens the position of the Netherlands as the flower hub of the world (Berg, 2018). New online marketplaces are established such as FloraHolland's Floramonde which become the largest digital marketplace for flowers and plants in the world (Floramondo, 2018).

Figure 23. Context trends

In addition to this trade shift an allocation of the import towards other airports in the area is hurting the logistics partners of cool chain in the Schiphol area and Schiphol airport itself.
The costs are debit to this decrease. The landing fees, fuel prizes and labour costs are different at the airports and due to the lower costs at Liège airport, Liège airport is growing regarding the flower import streams towards Europe (Visser, 2013) (FloraHolland, 2017).

Another change in the market that is threatening FlyCo and other logistic actors in the chain is the increase in the sea freight floriculture supply chain. The lower costs and the optimal temperature control are the two biggest advantages towards sea freight. Especially the sea freight supply chain from South-America is growing (see figure 24). This trend is threat towards the current supply chain system.

The last market trend is not directly related to the floriculture supply chain. The forecast of the Asian consumption value is predicted to increase by 80% in the next ten years (Lijster, 2017). But can we as the Netherland benefit from this increase? Direct lines from Kenya and Ethiopia are more likely to supply this market in combination with India. The main export market for the Netherlands is and remains Europe. The consumption value of Europe regarding flowers and plants will rise to around €33 billion in 2027. This consumption is then equally distributed between supermarkets, online shops and the florist with the biggest grower being the online shops(Lijster, 2017).

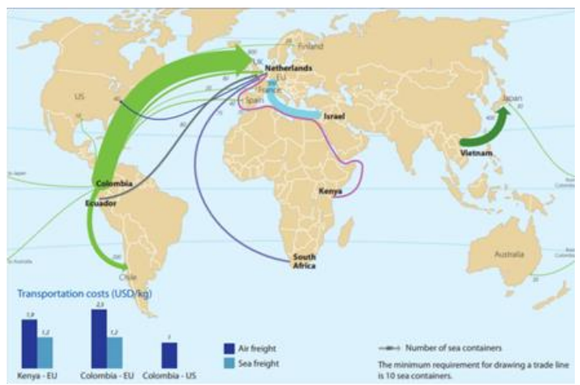


Figure 24. Cut flower trade via sea container (Rijswick, 2016)

3.3.2 Technology trends supply chain market

The future state of the air supply chain market will be changed due to upcoming technology trends. FlyCo is aware of the upcoming change and therefore already established a trend map. In this trend map, trends are mapped that are profitable and likely to be integrated in the cargo process within 7 years.

The core trends of the trend map focus on three areas: 1. Digitization, 2. Automation, 3. Data (BPI, 2018). Within the scope of the floriculture supply chain I identified several promising trends that can revolutionize the chain and effect the operations of the individual actors (see figure 25).

Blockchain
"Blockchain is essentially a public ledger with potential as a worldwide, decentralized record for the registration, inventory, and transfer of all assets—not just finances" (Swan, 2015)

Blockchain technology can be extremely suitable for the airfreight industry due to all the safety and security requirements necessary. In addition, the context of the floriculture supply chain, with all its actors and parties involved can benefit from the transparent character of the ledger. MIT's chief executive Jody Cleworth agrees and states: "It is unhackable and safe, it allows many intermediaries in the air chain, from handlers to Customs, from shippers to carriers to communicate safely, cheaply and affectively" (Cleworth, 2017).

The main disadvantage of using Blockchain technologies in the supply chain is the accessibility off all parties involved. For it to work as a cost saving and value driving technology, every actor in the chain must comply and collaborate with the blockchain for it to work.

Artificial intelligence
"Artificial intelligence (AI) is a computer science

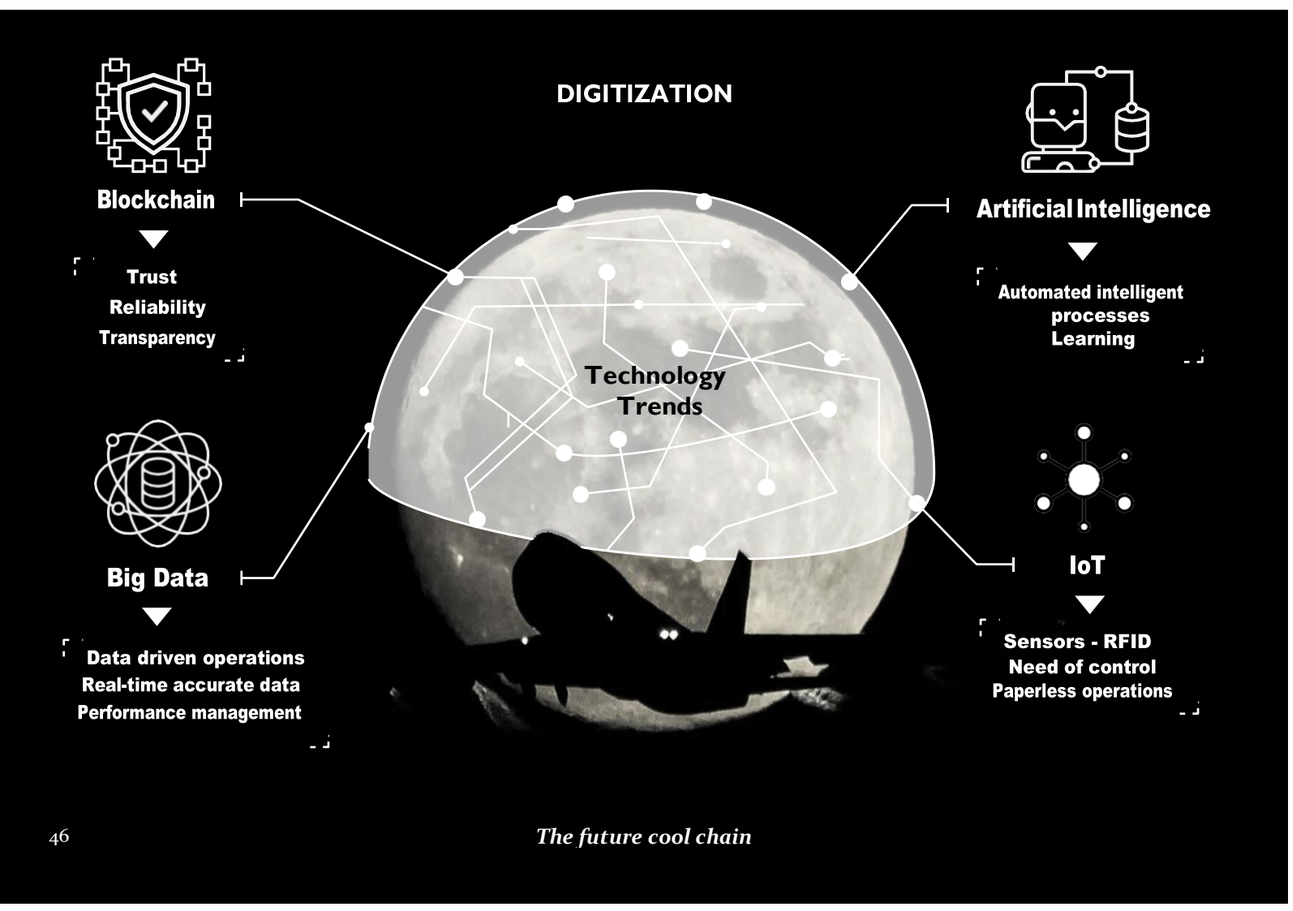
that makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks." (SAS-2, 2018). The two main methods used as artificial intelligence are machine learning and deep learning. Machine learning is a method of artificial intelligence that focuses on data analysis to create models and identify patterns and decide without interference of a human based on self learning algorithms. Deep learning is a subset of machine learning. Deep learning is more advantaged and learns features and classifies data automatically. Therefore deep learning does not need experts (prior knowledge) to pin point features. However, far larger data sets and computing power are necessary to create results. The main disadvantage of machine and deep learning is the reliability of the data, this will directly affect the reliability of the results. (SAS-1, 2018)

First applications of machine learning are already introduced at FlyCo. The tool FIT OA is used to predict the capacity occupation of the customers. Due to unavoidable last minute changes in capacity requests a pro-active tool predicts the net occupation per flight. This saves FLYCO a lot of "empty" flights. (Radier, 2018)

Big Data and IoT
Big data is a trend that is created by all the digitization in de industry. IoT developments create together with digitized information a growing bundle of data. The usages of this big data bundles can be valuable for the parties involved. FLYCO indentified data driven operations as a valuable opportunity. The increase usages of IoT in the operations (e.g. RFID, sensors) will stimulate the data driven and paperless operation. The floriculture supply chain is also creating more data about the shipments (e.g. temperature loggers) because the need of control of the shipment is growing.

Conclusion trends
The technological trends of blockchain, artificial intelligence, big data and IoT can be very valuable in innovating the floriculture supply chain and adding value towards the future. However, the correct application and implementation is necessary to utilize the full benefits of the new capabilities.

Figure 25. Technology trends



3.3.3 Competitive environment

The identification of the competitive environment leads to insights on the market involving the competitors of FlyCo and their strengths.
The competitive environment is divided into four levels. Each level presents competitiveness on a different levels and therefore creates its own insights for the future state.

Product level
On product level FLYCO has a competitive environment that exist of Airlines that both have a passenger division as a cargo division. They offer the same kind of product as FLYCO, offering full freighter cooled airfreight space to their customers.

The main differences between the product level competitors are based on time slots, airport of destination and direct or indirect flights. These factors influence the competitiveness of the airlines. For the floriculture supply chain the duration of the flight and the airport of destination are very important. The airport is the preferred destination due to the close distance towards the marketplace of FloraHolland (Buis, 2018). In-direct (transit) flights via the middle east (e.g. Emirates, Qatar, Ethiad) or other European airports as destination (e.g. Liége, Franktfurt, Brussel) increase the total delivery time towards the marketplace.
Therefore delivery time is currently a competitive advantage in the industry.

New innovations to extend the cool chain do emerge. Emirates introduced the SkyFresh Ventilated Cool Dolly which creates cool transport from warehouse till aircraft. A big competitive advantage is established for the cool chain. However, costs are high, distribution of the dollies is required and availability is only at Dubai airport (Gil, 2017).

Product category level
On the product category level, freighter operators like DHL and AirBridgeCargo (ABC) are competitors. They are specialized airfreight carriers. ABC and Cargolux are the biggest competitors regarding flowers. They have a larger fleet of freighters and can therefore offer more main deck temperature controlled space.

HUB Level
Airlines all have a main airport off which they operate from, this is called the HUB of an airline. Different airports act as different HUB's for the airline (e.g. Dubai for Emirates). The recourses avaible on a HUB can create competitive advantage for airlines. Qatar airways and Lufthansa both build a new perishable center at their HUB's (Doha, Frankfurt)(LufthansaCargo, 2018; QatarCargo, 2018) with the latest cool technology. This can be a threat to Schiphol because better control of the cool chain leads to competitive advantage. Additional advantages of other HUB's also include lower costs like landing fees as to Schiphol (e.g. Liege and Maastricht).

Need level
Next to the air freight competitors the need of cargo transportation can be fulfilled by other means of transportations as well. Especially the industry of sea freight is growing (Rijswick, 2016). Perfectly temperature controlled transport from export to import country. The competitive advantage is based on lower costs and a lower carbon footprint. However, the additional transportation time (two weeks instead of 2 days) can cause quality issues.

3.3.3.1 Conclusion competitive environment
Competitive advantage in the airfreight of the floriculture supply chain is established by several factors. First of all, a short lead time from shipper to receiver by having a direct connection between Nairobi and Amsterdam. Capacity availability due to amount of time slots and freighters at your disposal in addition to your network density. The HUB of an airline and its perishable facilities can provide tremendous value as well. There are no difference in aircraft hold conditioning but cool chain differences are made in the handling process before and after the flight.

3.4 STATUS QUO - SYNTHESIS

The synthesis describes the insights from the status quo analysis and combines them towards starting point for the future state (see figure 28).

"The goal of a designer is to listen, observe, understand, sympathize, empathize, synthesize, and glean insights that enable him or her to 'make the invisible visible." – Hillman Curtis (Kelsey, 2018)

The objective of the project was to create a vision for the floriculture supply chain and to create a concept for this, using business model design, which will be the first step towards achieving this vision.

The objective of the synthesis is to create starting points or building blocks for the desired vision and the future state. I as a designer take the responsibility to choose the insights that I believe can innovate and strengthen the cool chain towards a future state. I will translate these insights into future state transactions and activities.

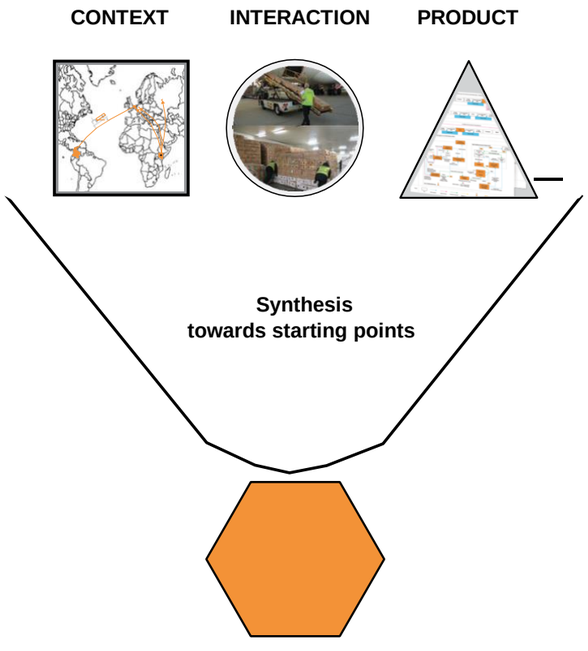


Figure 28. Synthesis towards unified starting points

The cool chain is the logistical product offer to the buyer or seller of the flowers. Shipping the cargo from shipper to consignee remains a physical process which therefore requires operational process improvement to establish process in the logistical chain. Next to the operations, the cool chain is driven by trust. Trust in each of the actors to do their job, trust in reliable information and trust in each other to create value towards the objective of the chain. This means responsibility must be taken by the actors over their processes but also to the total cool chain. Actors can no longer be only focussed on their own process but must see a strategic bigger picture.

As said before, the cool chain is a product of many actors. The quality of the cool chain depends on how the actors are linked to each other. Direct cool chain products linked to each other can 'close' the gaps between the links and thereby offer a real cool chain. Collaboration is necessary to bridge the gaps and together create the optimal product, 1 lane 1 job. Especially because the transfer of the cargo from one actor to another can cause delays. The main reason for this delay is the documentation process. All the correct documentation with the correct cargo is necessary to create a reliable and save process.

The quality delivery of the lane and thereby the flower quality is not measured or quantified regarding temperature. This quantification using a quality indicator creates quality/performance insights towards the customers within the chain (e.g. grower, forwarder, buyer of flowers). Measuring data to transform it into information. Then the shift can be made from guessing to knowing. When you know the information not only after the process but beforehand a shift from passive handling towards pro-active handling can be made. Transparency between actors is therefore essential to be able to transfer the acquired information about the process. Pro-actively act on all information recourses can lead towards optimizing the processes and thereby establish a efficiency advantage.

The biggest improvements on the current cool chain are to establish measurable reliability, create commitment towards a standard of quality and to unify as chain to really collaborate and support each other towards the common objective.

The changes in the market support these insights. The shift towards direct sales and digital marketplaces creates decentralization of the product. Therefore reliability of the product quality and the product information is of essence to buyers to establish a long during connection between growers and buyers. Responsibility of the logistics can shift as well due to the change in ownership in the beginning of the chain.

Technologies are developed to support us, to help us and to improve what we are doing at the moment. They can help in the development of an optimal cool chain but I believe that it is not the leader in this transition. It is about the kind of value you want to deliver and the technologies are a mean to get there.

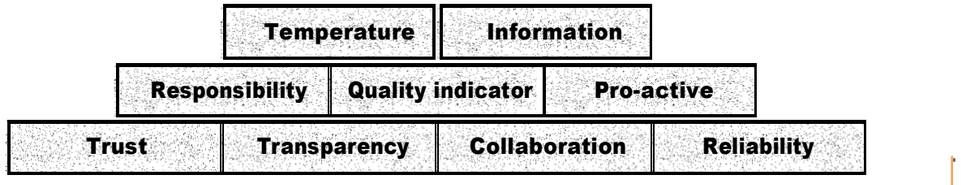


Figure 29. Building blocks future state

Handling process
Flexible, personalized and specialized handling is what some shipments need. Exceptions made in the normal handling procedure mostly lead to inefficiency and are therefore not wanted. Planning and directing people and means is difficult if procedures can change due to variables of shipments, for instance an increase in the temperature of flowers. Pro-activity within the handling procedure instead of reactivity is necessary to be able to deal with personalization.

Build up of pallets and breakdown of pallets are the most time consuming warehouse handling processes. These processes are not cooled at FlyCo and therefore speed and planning are essential to limit these times outside the cool chain.

3.4.1 Starting points

The starting points for the future state are these wording representing contextual concepts (figure 29)

04

DESIGNING THE FUTURE STATE

The section future state presents the design and creation phase of the project. It entails the vision statement for the chain and what kind of consequences such a vision has on the context, interaction and the product. Boundary objects are created and used to create feedback and iterate on future state quality indicators. Decisions are made regarding the new context, the new interaction that follows and the new product. All these decisions made come together in the design of the business models of the new cool chain. They are created to present the future state with its actors, transactions and new value delivery. The process of designing the future state is illustrated in figure 30. Throughout the section references towards the figure are made to guide the reader trough the process.

"The best way to predict the future is to create it"

—

Abraham Lincoln
(Kelsey, 2018)

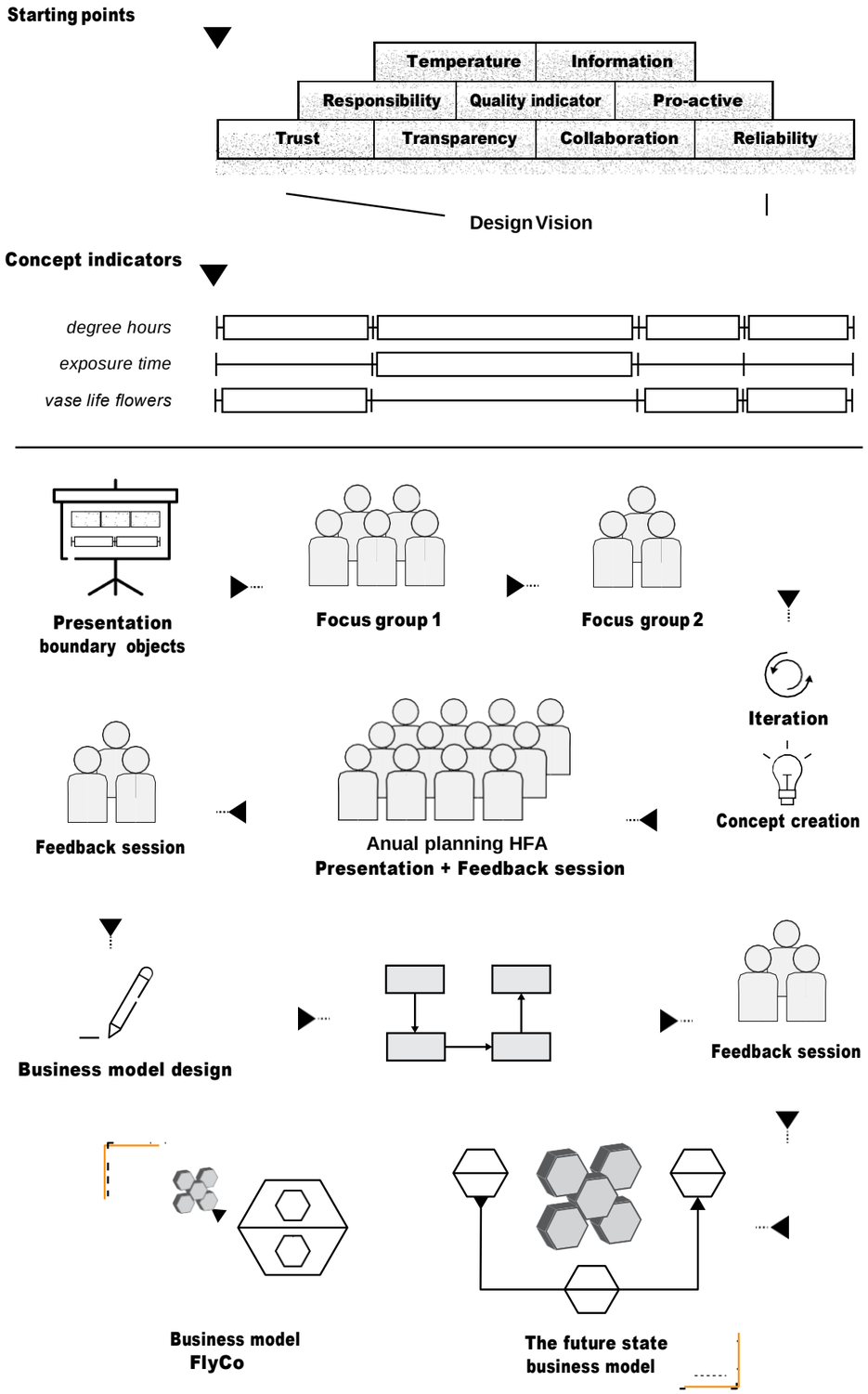


Figure 30. Process guide of designing the future state

4. Designing the future state

4.1 THE FUTURE STATECONTEXT

The context starts with the creation of my vision for the cool chain in 2025. Starting points for this vision are: Trust – Responsibility – Collaboration – Reliability – Quality indicator – Transparency – Pro-active as can be seen in figure 30.

The vision I created for the cool lane from Kenya to Amsterdam in 2025 is:

"I believe in a smart cool lane that provides 100% temperature control of flowers from farm to consignee by creating complete transparency between trusted partners and thereby quantify the cool chain to decrease the degree hours of the flowers."

–

Bart Verhees

The basis for this vision is the idea of the creation of a smart cool lane. The smart cool lane is a route specific cool chain. Within this lane optimal temperature control is created. This means knowledge of the temperature and controlling elements like alternate planning or operational activities to control the temperature. This lane stretches from the grower towards the receiver. Part of the lane is a partnership between actors of the cool chain. These actors have a collaboration agreement about the process, the quality and the objective. Therefore complete transparency between the partners can acquired because the cool lane is a trusted place. Within the cool lane agreements about the quantification of the quality can be made and thereby accepted and integrated by all actors. This quantification has as objective to establish an quality insight into the process and the end product

and eventually increasing this quality. The amount of degree hours, time vs. product temperature, must be decreased by the lane to establish a longer lasting flower. I believe this cool lane needs to be smart to reach this objective. Technologies (e.g. sensors, software) are needed to create control and trust within the chain and in addition the quality indicator is also data driven. The intelligent cool lane can innovate the supply chain sector and create unique selling points for the trade market.

What does this mean for the floriculture supply chain context?

The context changes from individual thinking towards collaborative doing. Performing one job and working together to do the best job possible.

The floriculture supply chain will make a transformation from physical to digital. This means digitizing information but also the expansion of the digital marketplace are bound to happen in the future state.

What kind of quality indicator can be used to drive the context and the quality forward?

The process of deciding about the correct quality indicator is an iterative process. The actors within the current cool chain are asked to give feedback about the indicators.

For the quality indicator of the lane three options that all incorporate a time as a temperature component to measure the quality are created (see figure 31).

These three concepts of quality indicators are mainly representing different parts of the cool chain.

The concepts are:

1. Degree hours

Degree hours consist of the average product temperature during the supply chain vs. the lead time of the supply chain. This creates an indicator that can calculate remaining vase life of flowers (Flowerwatch, 2015). Degree hours can be assigned to all actors in the chain because all the actors can have influence on them and appropriate the value it delivers to them.

+ Known concept in the supply chain
+ Applicable to all actors in the chain
¬- Product core temperature necessary which requires collaboration with growers to put in temperature loggers

2. Exposure time

Exposure time is the average ambient temperature of the logistical supply chain vs. the lead time of the supply chain. This quality indicator is particularly useful for the logistics because logistics cant directly interact with the flower itself but can control the environment it is in. This indicator can be introduced by the logistics itself without any dependency on the shipper or consignee.

+ Not dependable on others
+ Logistical quality indicator
- Less accurate flower quality indicator

3. Vase life flowers

The vase life of flowers is very difficult to measure due to all variables that affect the quality. Growth test are performed to create a benchmark vase life for the flowers. As said, degree hours can help to calculate remaining vase life and combining this with the benchmark vase life a prediction of the vase life at the end of the supply chain can be provided. However, the vase life can be predicted only until the last actor in the chain (e.g. the consignee) and not beyond.

+ Accurate flower quality indicator
- Very difficult to predict without pre-set vase conditions
- During supply chain no direct influence on flowers possible

These concepts are used as boundary object in a focus group (focus group 1) like setting to start the discussion on what actors really see as valuable and realizable. The ideal indicator is the accurate prediction of the remaining vase life of flowers, but due to several reasons explained in the product analysis, this is extremely difficult. The degree hours concept due come with a consequence as well. Temperature loggers must be shipped in every shipment (or even every box) to have an accurate product temperature. This requires a new logistical network around the loggers as well. Exposure time is the least accurate indicator for the flower quality. However, it is very suitable to indicate the the logistics in terms of cool chain performance.

After the first focus group an iteration was made on the quality indicators itself but also the strategic placement within the market. (see figure 32).

The trade context of the floriculture supply chain can be divided in two parts. First the flower value for money. The flowers are goods that have a particular value related to inherent quality (e.g. stem size, color and head size) and their vase life. This value is valuable for the grower (seller) , retail/wholesale (buyer) and the consumer. The logistics is a risk in decreasing the value of the flowers and can only do harm to the flowers.

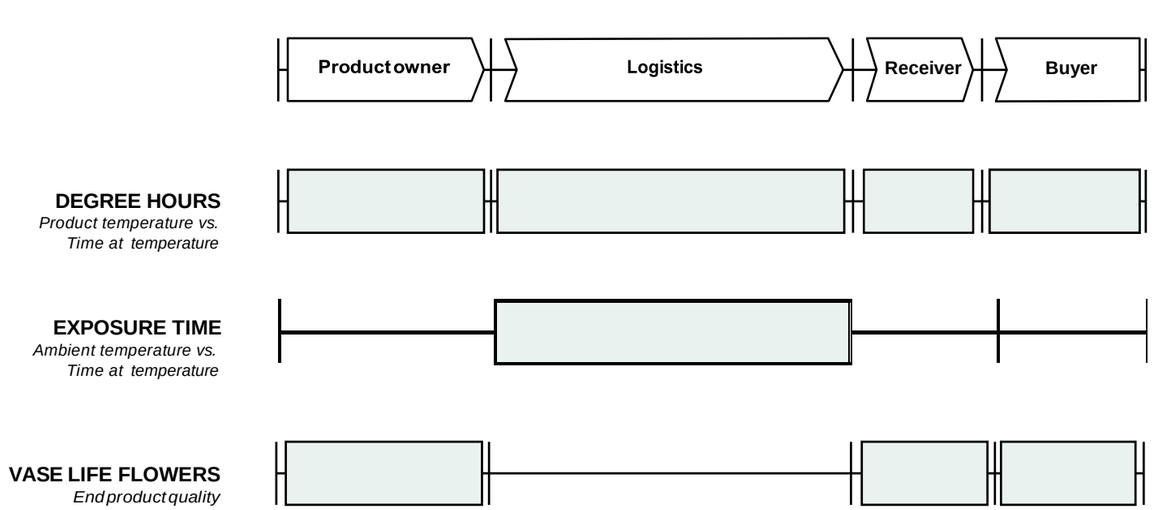


Figure 31. Boundary object - Quality indicator concepts

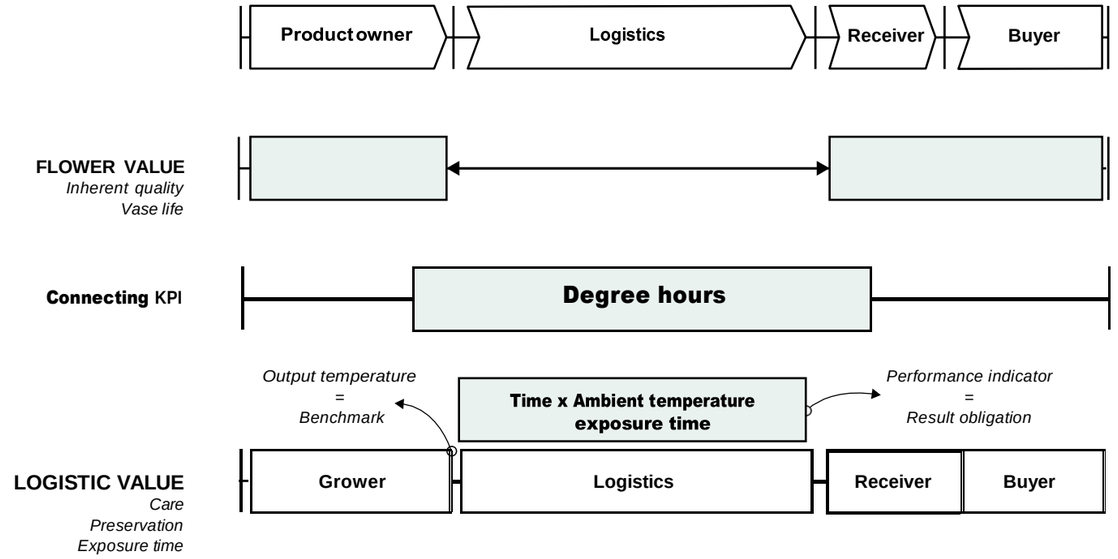


Figure 32. Boundary object - Quality indicator concepts translated to the market

The logistics context have an effort obligation to care for the product they ship. The try to preserve the quality of the flower . The grower determines the benchmark of input quality of the flowers for the logistics. If the logistics can measure the ambient temperature at all the places the cargo will be at certain times, the quality indicator exposure time can be used to measure the performance of the logistics. Agreements can be made about the total amount of exposure time that can be reached and therefore logistics can change their objective from care towards results, a result obligation.

The connecting KPI between the product quality for the traders in flowers and the logistics is degree hour. Degree hours can be translated toward loss in vase life of flowers. Degree hours is also known in the logistics context and can derive from exposure time. However, core product temperature and ambient are not the same. Test must prove the difference and if there is a correlation between them. The logistics must only make agreements based on delivered exposure time.

4.1.1 Concept Smart cool lane

In addition to the boundary objects for the quality indicator a concept was presented in feedback session 1 and the annual planning session of the Holland Flower Alliance. During these sessions I had the opportunity to present the indicator concepts
and the smart cool lane concept towards strategy decision makers. The concept was presented to stimulate the discussion on what are the consequences of introducing a quality indicator in the new context.
This concept derived from the vision and the indicator concepts.

The concept presented was the smart cool lane (figure 33). The smart cool lane is a supply chain with an AI controlled database that creates an exposure time optimized route map based on current and historical temperature and time data stamps connected to cargo information. The smart cool lane is a collaboration principle between actors on the supply chain from Kenya to the Netherlands. They work together to innovate and improve the supply chain of flowers to cut down lead time and increase product quality. A route map is a journey map of the cargo accompanied with process milestones and quality milestones. Exposure time will be the indicator that transfers these milestones towards the quality of the lane.

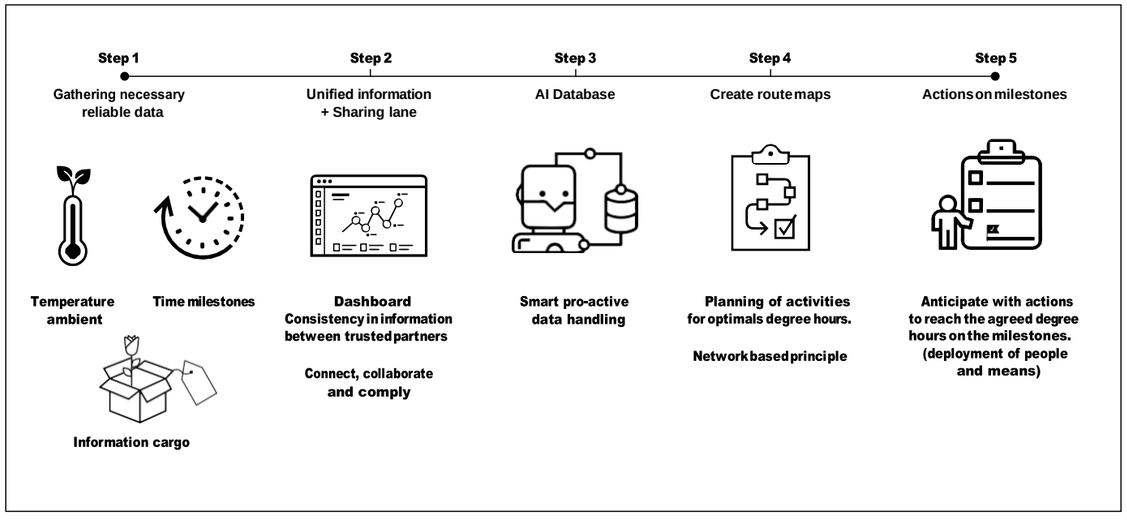


Figure 33. Concept idea of the smart cool lane

Before achieving a smart cool lane principle several steps need to be taken by the actors to transform the current cool chain. To achieve data-driven operations suggested by the introduction of a route map, the actors need to collect data first. When this data is reliable and shared with the partners operations can be adjusted towards improvement using smart technologies as tool.

The smart cool lane concept was enthusiastically received by the audience because of its potential value delivery of an optimized cool chain. However, concerns were also pronounced. The information shared in the dashboard must be protected against competitors. As well as the reliability of the data that needs be gathered is off concern. The issues need to be addressed in the future state interaction and the proposed product.

4.1.2 Conclusion

The future state context of the floriculture supply chain need to have a quality indicator. For the logistics exposure time is the ideal indicator. The logistics have control over the ambient temperature of the cargo and can bear responsibility for the consequences of temperature fluctuation. The grower and buyer depend on the logistic to deliver the best possible quality, therefore an result obligation in the future state context in the form of exposure time will be a big step forward towards achieving the vision.

The concept presents a new data-driven collaboration context with a centralized information dashboard. The creation of transparency in information and performance is necessary to illustrate the quality of the product on a digital marketplace.
The creation of the future context leads to a common goal and believe for the stakeholders involved in the design process. This believe is presented in a common vision.

"We believe in a smart cool lane that provides 100% temperature control of the cargo from farm to consignee by creating transparency and centralization in information using a trusted network and thereby quantify the cool chain to decrease the exposure time. " – HFA

4.2 FUTURE STATE - INTERACTION

The future state interaction is based on the created vision, the concept indicator exposure time and the concept idea of the smart coollane.

4.2.1 Pro-active interaction

The vision and the concept clearly implicate forms of future state interaction of the floriculture supply chain. The new interaction will be pro-active. The transparency and centralization of information create a shift in interaction between actors. The future state interaction is via centralized point of information where information is available for each actor in the smart cool lane at all times. The messaging structure is over. The pro-active character of the interaction also comes forward in the artificial intelligence of the database. The machine learning technology is essential in creating route maps that create efficient deployment of people and means. Pro-active reactions to changes in supply chain process are possible know. One lane is one job and to deliver a constant product quality at the end of the smart cool lane repairs, alternations or changes must be made during all operational process. If this can be achieved pro-actively less operational setback can be achieved due to the changes. The downfall of this kind of interaction is the reliability. The information delivered by all actors must be trustworthy to depend all operations on. Trusted partners are therefore very important for the success of the smart cool lane.

4.2.2 Safe and transparent interaction

To establish a centralized point of information which has complete transparency towards all actors a database could be the answer. However, a trusted network is required as well. Blockchain is extremely suitable as a technology to create a safe and secure database of information. Smart contracts can be made to protect the agreements made by the actors. Using blockchain also provides the opportunity to upscale the smart cool lane principle to other lanes throughout the world once the trusted record is in place. This network creation is supported by the future blockchain interaction. New participants must comply to all smart contracts and existing actors can see, check and approve new participants. Blockchain is future proof. All forms of digitized information can be placed on the blockchain (e.g. images, contracts, FWB). In addition, IoT devices can be easily linked to the blockchain. Active temperature sensors could send continuous updates towards the blockchain to create temperature transparency at all times. Adding new forms of information and applying IoT solutions to the blockchain will only increase the value delivery of the smart cool lane. (IBM, 2018)

4.2.3 Cargo handling interaction

Due to the centralization of the information in a blockchain ledger all trusted, approved, actors can access the cargo sensitive information. Because of the blockchain, real time data is visible to all actors and is ready for interaction. This interaction is stimulated by the creation of the route map. The route map provides a cargo handling process guideline towards the actors and thereby provides transparency in the operational interaction with the cargo. These route maps are personalized per shipment. The physical handling interaction with the cargo will not change at the introduction phase of the new concept. The cargo will move in the same way as before. However, more flexibility is required by the handlers regarding personalized operational processes per shipment. The individual route maps per shipment can result in difference in warehouse processes. Handlers need to be alert and follow the correct route map per shipment.

To conclude, the interaction between actors and the cargo of the future state will be pro-active instead of reactive. To interact in a trusted environment blockchain is used to secure the information, certify the actors and create a transparent platform of information.

4.3 FUTURE STATE - PRODUCT

4.3.1 The concept

The future state product derives directly from the new context and interaction as its a result of the decisions made there. As presented in 4.1 The future state context, the smart cool lane concept was presented towards the stakeholders. The new smart cool lane based on feedback and the new interaction results is presented in figure 34.

The future state product is the smart cool lane. The smart cool lane is an intelligent product that innovates the floriculture supply chain.
The product features of the smart cool lane are:

- **Exposure time track and trace**
Continuous insight into location and ambient temperature of the cargo due to the transparency of information.
- **Pro-active intelligent Route map creator**
Personalized route maps that are unique to the characteristics of the shipment. Pre-filled route maps based on all available data are created and only need the booking confirmation to go live on the blockchain. The route map presents handling steps of the supply chain to achieve the least amount of exposure time to the cargo. Milestones are used to control the steps.
- **Blockchain information dashboard**
The centralized information dashboard provide all the information needed to ship the cargo to the consignee.
- **Shipping of cargo**
The lane ships the physical cargo from the shipper towards the consignee by the agreed terms.
- **Quality performance indicator**
Exposure time is the quality performance indicator and provide the lane and the flowers with a quantification of quality.
- **Process feedback generator**
Continuous feedback on the operations due to an continuous route map optimization and performance indicator. The feedback is shared and used to optimize the operations of the actor.

4. Designing the future state

4.3.2 Gain creators and Pain relievers

The smart cool lane create trust between the actors and between the logistics and the shipper, the owner of the shipment, because performance of the logistics can now be quantified. The quality indicator exposure time is a gain creator because it can act as a purchasing decision maker at the market place. Objective and reliable information about the product quality is what buyers are looking for. The will lead to a higher product satisfaction for the buyers. In addition, it provides the lane and the actors with 1 performance truth throughout the lane.

The blockchain dashboard will relieve a lot of pain about the incompleteness and mismatch of cargo information. Always the correct information on hand will lead to less delays during the supply chain. Therefore operational steps can be taken by using accurate planning of people and means to improve the efficiency of the operation. Due to visibility of the cargo on the dashboard, the frustration of uncertainty about the shipment will be gone as well.

Adding new trusted partners in the cool lane will result in more data input. The smart cool lane thrives by an increase in data input because this result in more reliable route maps as output which will lead to better performance of the supply chain operation.

The smart cool lane is presented as a logistical product for the lane of Kenya to the Netherlands. The smart cool lane however is a generic product for different floriculture lanes as well. The smart cool lane can be sold as an logistical product to shippers of flowers and buyers of flowers. Ideally the product would be available on digital marketplaces as a supplement product to the flowers.

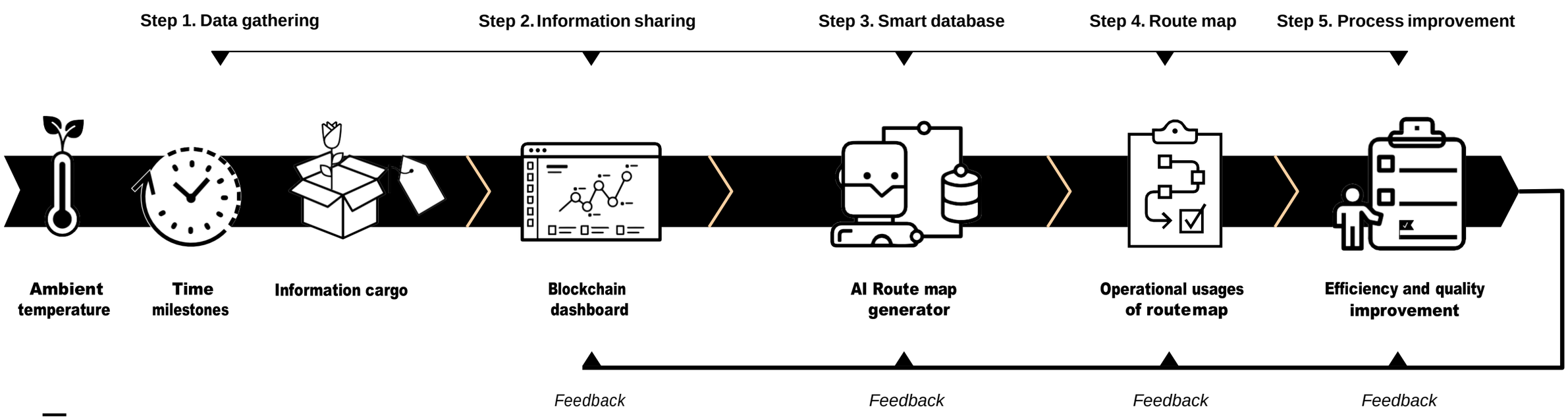


Figure 34. The smart cool lane

4.4 BUSINESS MODEL DESIGN

In the section business model design of the future state the business model (see figure 35) of the Smart cool lane concept is presented. This model is on a network actor level illustrated and presents the future state activities and transactions within the new lane. In addition a business model (see figure 36) on organisational actor level for FlyCo is presented to show the business model changes for the future state of FlyCo.

4.4.1 Business model smart cool lane

Activity system
"Smart cool lane that provides a logistical lane from Kenya towards the Netherlands with a structure that supports network collaboration and value creation"

The design of the business model of the future state of the floriculture supply chain presents the supply chain in a different structure. The smart cool lane structure is implemented and illustrates a network structure between the actors. The network structure is realised in the activity of information sharing throughout the chain. Instead of data transactions in the form of messaging (electronic data interchange or paper-based) between actors a network of information is created in a form of a blockchain ledger. The operational activities and transactions of the supply chain remain on a one-to-one actor basis within this system. This means the operational transaction of the cargo moves from one actor to another until delivery. The actors within the activity system of the network all have individual activity systems that represent their operations. This has not changed in the future state but the connection of the individual systems in the network system has due to the new network structure.

The ledger is an information database where all actors transmit their data transactions towards. The basis of the ledger lies in the agreements made between the actors that are connected to the smart cool lane. These partners decided on the one version of the truth within the chain and create therefore also single versions of the transactions made.

Activities
The activities in the future state business model can be divided into generic network activities and specific organisational activities. The generic activities that has been added by the smart cool lane are mostly based on digitization. The individual actors need to digitize the information created by their operation and transfer the data towards the ledger. This will create more visibility and transparency about the activities within the lane. As example, the continuous ambient temperature measuring and sharing towards the ledger is a new activity combined with a transaction and leads towards a temperature profile of the lane that can be used by the actors towards value creation.

The activities of the individual actors in the future state business model can be changed due to the usages of the ledger. Each actor can use the network of information sharing to optimize their operations. The activity that has been added to their operations is the a planning tool. The AI route map generator is a tool that helps actors be transparent about their own operational process, it creates an exposure time optimized planning and delivers feedback towards the other actors about the progress and quality of the shipment. This route map will be used by people and act as a tool to optimize the deployment of people and means. This route map is based on all information available of the shipment, the actors and all the historical data. A route map for the whole smart cool lane is created as well and provides insights in the potential quality of the lane before a shipment started.

Transactions
The biggest disruption in transactions within the new business model are the data transactions. The digital information generated by the actors that is contributing to the supply chain is shared using the ledger instead of one-to-one messaging. Thereby the information is "publically" available for the trusted partners in the lane. The ledger uses blockchain technology to protect the information shared by the partners, it delivers transparency due to the traceability of all information and it creates a reliable digital information connection and chain. Within the ledger, the logistical milestones are incorporated. These milestones are used as monitoring moments for the supply chain to check the compliance to the agreements and transactions and the progress of the shipment. The ledger is used by the actors to have a live dashboard on the progress in the supply chain and insights into the product quality of the cargo that is being shipped.

Data transactions created are related to timing of milestones of the logistics, milestones of the operational processes of the actors and the ambient temperature of the milestones. Sensors placed at all participating actors provide an automated temperature exposure insight throughout the lane. All other data transactions are digitized and shared as well, specific cargo information (e.g. FWB, ePhyto), performance indicators and declaration reports.

The revenue transactions between all actors are centralized as well. Due to the 1 job 1 product character of the smart cool lane, the lane and thereby the ledger receives the proceeds of the flowers. Individual revenue transactions towards the actors will divide these process based on the to be established value distribution. The revenue allocation between the actors can be based on individual performance (e.g. exposure time) but will need further research by the network itself.

The operational transactions based on the physical movement of the cargo remain in a one-to-one serial basis. Individual optimization and innovation on the operation of the actors can be established due to the smart cool lane concept and the new business model. This innovation is created for FlyCo (see figure 36).

The value transactions in the new business model originated from the ledger and are created by the information network structure created inside the smart cool lane. Each individual actor has a value transaction that is based on the information transparency and reliability created by the ledger. The value lies in the usages of the information in for instance planning of the operations and the ability to pro-actively make adoptions to the process.

4.4.2 Value delivery of the business model

The value delivered by the new business model is divided in value for the individuals and the partnership. The individual actors can optimize their operations due to all information available in the ledger and the collaboration agreements. Efficiency of operations is the first incentive for actors to join the partnership.

The multiplier effect of the smart cool lane lies in establishing a quality lane that can be offered as a logistic connection between the supplier and the buyer. Especially when the marketplaces are going to decentralize and do not have a physical process of its own the logistics becomes the connector between supply and demand. The smart cool lane is a logistical solution that can be offered as a product in the trade market of flowers.

In addition, the quality indicator created by the smart cool lane can be used on the market places to provide input on the quality of the flowers and the logistical product. This can result in higher proceeds of the flowers and into more logistical product demand.

The network structure and the knowledge about the smart cool lane can be transferred towards other destinations as well. The network structure remains but the partners can change and also the physical operations of the cargo can change due to other origin.

The digitization of the supply also creates value towards other cool chain products like Pharma. The infrastructure is mostly generic and will deliver value for both product. The digitization of the supply chain will deliver more digitized data, all this data can be shared on the ledger and thereby increase the value of the chain continuously. The ledger itself is open towards new input of technologies and can in combination with the AI route map tool continue the improvement of the lane.

Lastly, the supply chain process can be accelerated due to the early knowledge of reliable information. Especially customs and the phytosanitary inspection can use the trusted 1 single source of information to improve and accelerate the checking process. There might not even be a double check, at origin and destination, necessary.

4. Designing the future state

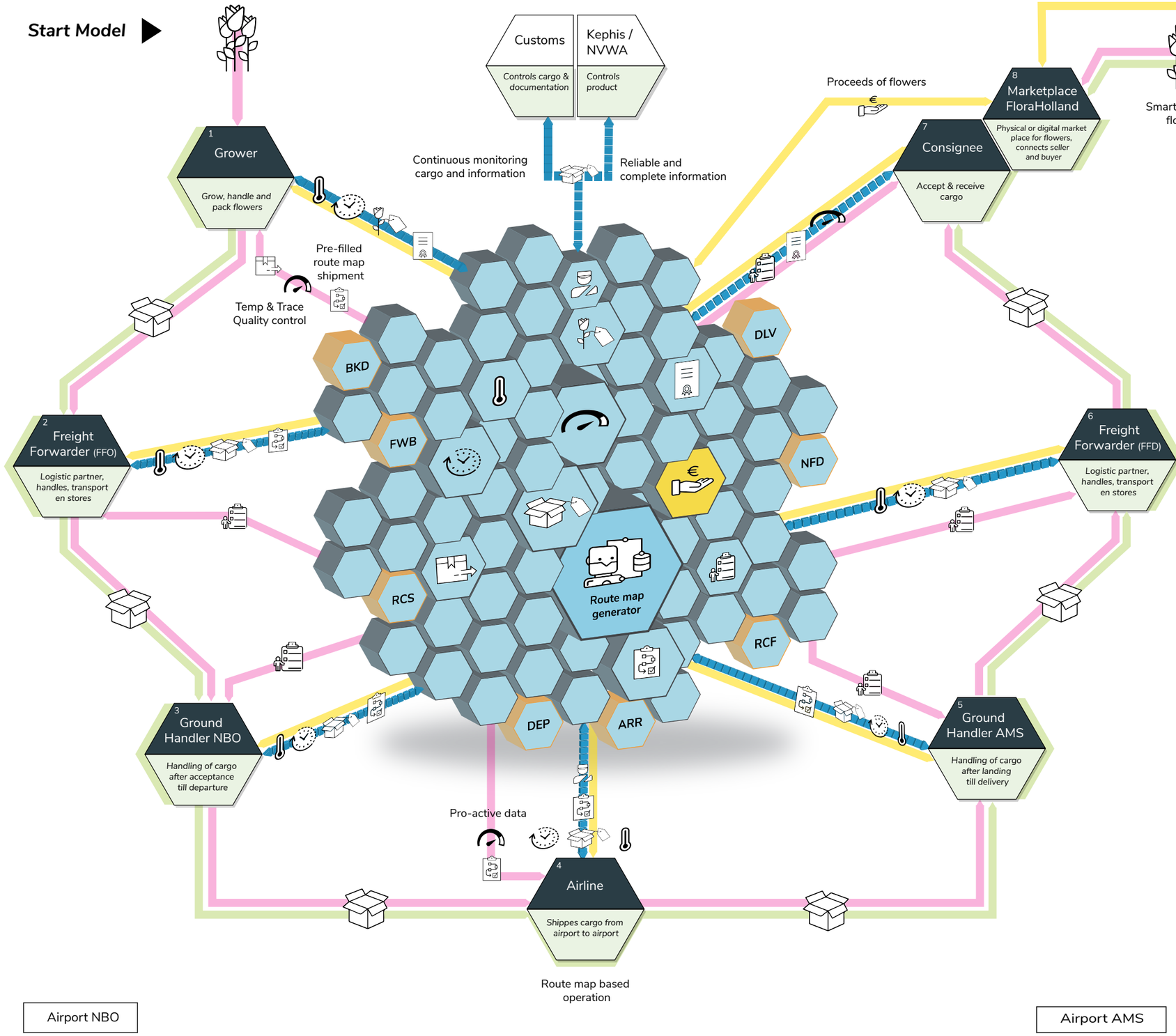
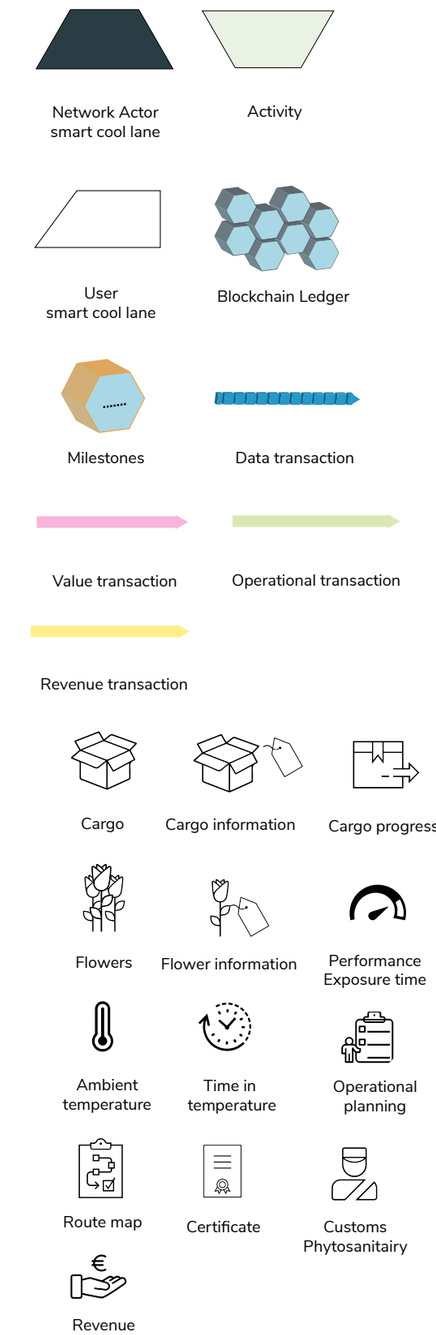


Figure 35. Network Business Model Smart Cool Lane

Legend



4.4.3 Concerns

As the value of the new business model is presented concerns regarding the model also remain.
To start, the forwarders are the orchestrating actor in the floriculture supply chain. They generally provide the logistics services from shipper to airline and airline to consignee and therefore play a vital part of the new smart cool lane. The forwarders must be willing to share all information towards its logistical partners otherwise the lane cannot be created. By extending the smart cool lane towards other lanes as well new partnerships will be created. How transparent will all logistics partners stay if competitors can observe your performance of your operations?

Secondly, within a partnership revenue and value allocation remain a concern. Especially in the supply chain where all actors have their own operations, own costs and own profit margins. Creating a value allocation for the smart cool lane is necessary to convince other actors of the value of the partnership. The efficiency in operations and the additional revenue must justify the investments made to have a long lasting future for the smart cool lane.

Lastly, agreements must be made about quality indicator itself, the benchmark of quality and the performance objective of the smart cool lane. Without these agreements the business model of the future cool chain will not succeed.

4.4.4 Organizational business model

The organization business model of FlyCo (figure 36) is a more specific business model in comparison to the network business model of the supply chain. The operations of the actor are presented in detail.

Activity system
"Smart cool lane shipment process from milestone booked (BKD) until delivered (DLV)".

The design of the business model of the future state of FlyCo presents a lot of similarities to the network model of the floriculture supply chain. The activity system of FlyCo is transformed towards the new smart cool lane structure of the centralized blockchain ledger used for all data transactions.

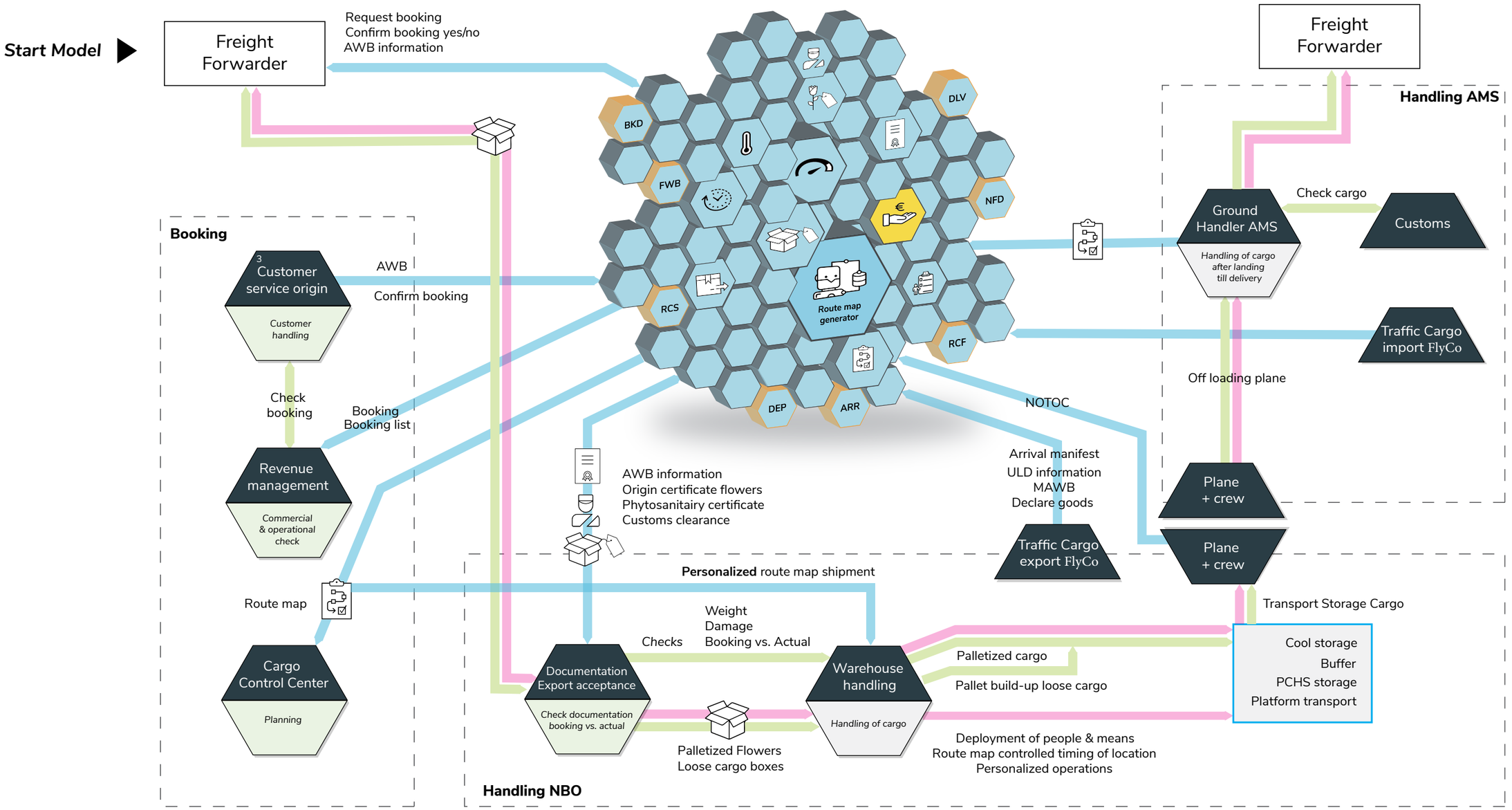
Activities
The activity system of FlyCo can be divided into three activities. The booking process is the first activity that kick-off the operations. At this point in time, at milestone BKD, the route map generator creates a route map for the shipment and thereby a planning for the operations. The blockchain ledger in combination with the route map generator could eventually automate the booking, checking and confirmation process of an airline.
The activity of warehouse handling at airport of departure is controlled by the personalized route map for each shipment. It determines the placement of the cargo at the facility, all based on the optimal exposure time realization. The physical activity of handling, storing and transporting the cargo remains the same.

The last activity is the handling at airport of arrival. The blockchain ledger has provided the authorities, customs and NVWA, with reliable information long before the arrival of the physical cargo.

Transactions
The transactions of the information, the data transactions are all transferred to the blockchain ledger. The value transactions are directly connected to the movement of the cargo. All value created by the data transactions can now be translated into improved movement of the cargo. The new operational transactions are different than the current operations due to the personalized route maps. The route map decided which operational transaction is necessary to reduce the exposure time. Revenue transactions are excluded from the organizational business model due to all the revenue allocation at network level.

It still remains a concern if personalized route maps per shipment really create an efficiency advantage in the operation or maybe only disrupt the other shipments process in the warehouse.

4. Designing the future state



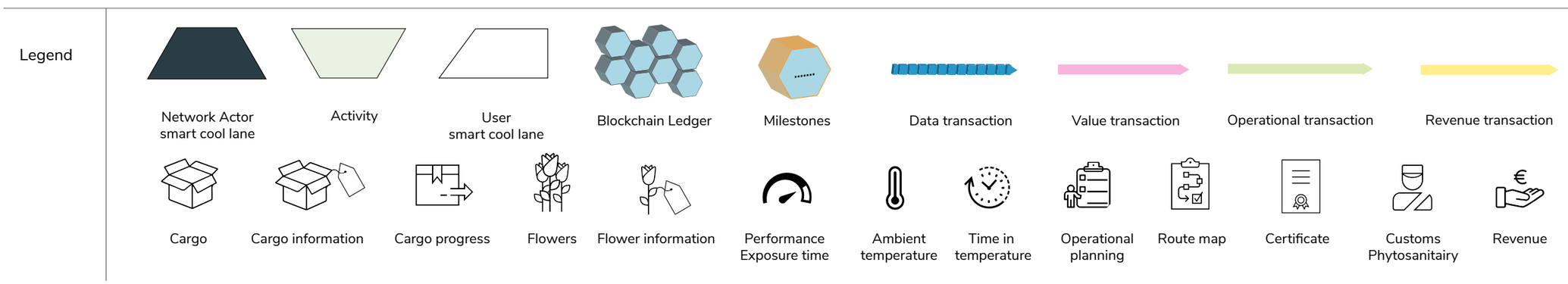


Figure 36. Organizational Business Model

05

DISCUSSION

The discussion section presents a reflection towards the project and the solution to the stated problem. It includes implementation recommendations and suggestions for further research. To conclude, a personal reflection on the process and the result will finalize the thesis.

5.1 DISCUSSION

5.1.1 Implementation

The proposed business model is a step towards reaching the vision for the floriculture supply chain in 2025. The business model is currently situated in the decision making area of the three horizon model (figure 37 (Simonse, 2018)).

The network and organizational business model provide the supply chain and its actors a look into the future. To realize these models and create the value they promise several steps need to be taken towards implementation.

Step 1: Digitization
All information surrounding the shipment of flowers need to be digitized. FlyCo itself already has the ambition to digitize the operation and have a complete paperless operation. However, companies, authorities and growers in Kenya need to digitize as well to be able to fully benefit from the value of the smart cool lane. This digitization shift is much harder to realize in Kenya because of the lack of IT infrastructure present at for instance the growers (Knepper, 2018).

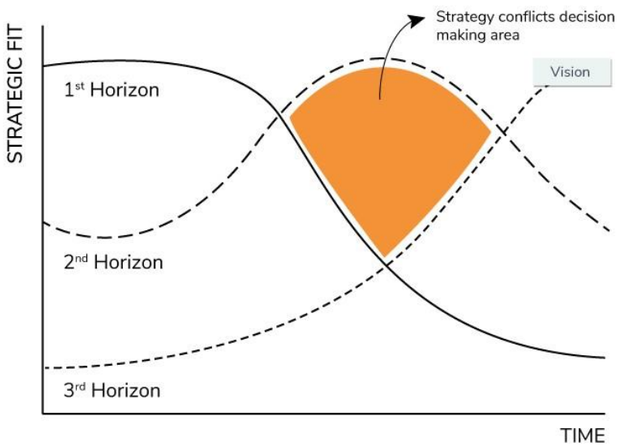


Figure 37. Horizon model (Simonse, 2018)

The shift towards a digitized supply chain also implies that all official documents published by authorities necessary for the shipment to move safe and secure, must be digitized as well. For instance the phytosanitary certificate will become electronic. The consequence is that regulations need to change to allow digital phytosanitary certificates as a legal document. Extensive collaboration with the authorities is necessary to make the also necessary shift towards digital.

As proof of concept that digitization of the supply chain will lead to value the sea freight shipping industry has successfully run a pilot using a model that represent the shipment of soybeans. No paper was needed during the shipping and resulted in a big acceleration in the transactions. (Haegens, 2018)
IoT devices like sensors, temperature and time, must be introduced to measure the exposure time of the cargo. Currently, FlyCo already has temperature sensors in their warehouse and the cool storages. Test pilots with new measurement devices like Bluetooth trackers for ULD - tracking are in place. Bluetooth tracking of the cargo inside the warehouse handling is a very good step towards complete transparency of the operation. When combined with the temperature data, the exposure time can be indicated very accurately.

Step 2: Agreements
The new blockchain structure requires new agreements made between the whole supply chain. Agreements on the desired quality delivery of exposure time, on the investments that need to be made but also contract agreements towards each individual actor need to be evaluated and adapted.

Step 3: Value allocation
1 lane = 1 job is an idealistic view on the supply chain. The business model builds on this view. To achieve the optimal collaboration between actors appropriate compensation for delivered work must be in place as well. The smart cool lane value can be capitalized at the end of the chain as higher proceeds for the flowers (Pasma, 2018). But what will be the allocation of the additional earnings be towards each individual actor? The supply chain works as one product to deliver the best quality but the grower receives the extra proceeds. This step is a vital step towards the success of any collaboration between the actors. Currently a new graduate intern is completely focussed on this subject only, the next step in realizing the smart cool lane.

5.1.1.1 Conclusion
The vision of the future state of the floriculture supply chain is created. First decisions are made regarding a quality indicator for the chain, the desirability of the smart cool lane concept is there and the business model provide the actors with a viable solution.
As a start I propose to expand the participating actors of the HFA with a grower. When successful the whole chain (grower, freight forwarder, airline, import agent, marketplace) is presented in the collaboration. Then the first step is testing the quality of the current supply chain as benchmark. Measure exposure time of all the actors own operations, share these and evaluate.

5.1.2 Reflection on project

The original aim of the project was to develop a 'Time for Quality' concept for the floriculture supply chain. The objective of the concept was to innovate the supply chain and to improve the quality of the logistics and the end product by introducing a temperature control indicator.

The vision, the proposed smart cool lane and the business model design are the deliverables of this thesis. The deliverables are strategic artefacts and provide the network, the cool chain, as the organization, with value regarding the future state of the floriculture supply chain. The deliverables definitely innovate the supply chain and deliver the quantification of temperature. However, the difference between the outcome of the project and the first assignment presented by FlyCo is definitely there.

I transformed the assignment from the design of an operational concept for FlyCo towards a strategic concept for both the whole chain as CargoCo. The research showed that the base of the Dutch Flower HUB was crumbling. Solving the bigger strategic question the Holland Flower Alliance deal with could create tremendous value for the chain. Are the vision, the proposed smart cool lane and the business model design I created desirable, viable or feasible?

Desirable
During the feedback session, my presentation at the annual planning of the HFA and my end presentation for the stakeholders at FlyCo the feedback on the value delivery of the smart cool lane was very positive. The Holland Flower Alliance is created to strengthen the position of Netherlands the flower HUB and the smart cool lane is a step towards the future of the floriculture supply chain.

The desirability of the smart cool lane is also shown in the hiring of two new interns that will elaborate on my research. In addition, the information workgroup of the HFA is already busy with pilots to share information throughout the chain.
Knowledge about the desirability of the handlers in the warehouse is missing. Because the concept is on a strategic level the operational consequences are not measured.

Viable
The smart cool lane is viable. No other alliances are in the market and are also willing to collaborate so closely together. The actors in the chain have the urge to innovate the chain because the market is changing. The decrease in flower import streams towards FloraHolland continuous. Digital marketplaces accompanied with direct shipment towards the buyer are changing the industry. The smart cool lane is product that can adapt to the change. It can be sold as a logistical product package with a quality guarantee directly after purchasing the flowers.

Feasible
The smart cool lane is technologically feasible. Sensors that can measure temperature, time and location of cargo are already on the market. Connecting the gathered data towards the blockchain is feasible as well because all digitized data can be placed on the blocks of the chain. The machine learning technology used for the creation of

the route maps due require customization. Features need to be programmed and desired outcome needs to be designed.

Digitization of all the cargo information does limit the feasibility of the concept. Data is necessary to create the smart cool lane and without data the value cannot be delivered.

To conclude, the end result of the project end the deliverables are very positively received by the stakeholders in the supply chain. The business model design innovates a multi-billion euro industry and contributes to the qualities of the Netherlands as trade country.

5.1.3 Personal reflection

My graduation of the master Strategic Product Design at the Delft University of Technology was an interesting and challenging journey. The graduation consisted of an internship at FlyCo and a thesis for both FlyCo as the TU Delft.

I was not new in the aviation industry due to two other big projects regarding aviation during my studies. FlyCo though, the air freight industry and the floriculture supply chain where new industries to explore. In the beginning I struggled with scoping my assignment. Exploring the air freight industry, exploring the floriculture supply chain and its stakeholders and exploring design methods feasible for the project was a challenge. I focussed mainly on the company instead of focussing on creating academic results. Creating value for FLYCO and the HFA was my objective in the beginning which resulted in delays regarding the writing of my thesis.

The methods I used during the project like modeling business models helped me to structure all the information I received day in day out at FlyCo. The coaching regarding the usages of methods really helped me but also confused me sometimes. Adapting a method like ViP in your graduation if you never used it before was a challenge. However, I still believe the project approach I chose was very suitable to the problem.

During my internship I also got the chance to inspire FLYCO colleagues with the methods that I used. My vision based approach towards the project was sometimes difficult to understand by some people that are more into the day to day operations. But even they saw it is very useful to have a goal, a value ambition at the end of the road. This was a new of working because, beforehand business cases and return on investments where decision makers for the project. For me it showed the potential value we as designers have in every company.

I can honestly say that I learned a lot from this graduation project. How I like to work, what my strengths and especially my weaknesses (planning) are and what kind of designer I would like to be during my professional life.

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Master thesis

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