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Specialization:	Transport Engineering and Logistics
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Title:	**Direct export deliveries: an impact analysis of bypassing the Heineken distribution center in Germany.**
Author:	F.J. Reijnders

Title (in Dutch)	Directe exportleveringen: een impactanalyse van het omzeilen van het Heineken distributiecentrum in Duitsland.

Assignment:	MSc Thesis	
Confidential:	Yes (Until September 26, 2022)	
Initiator (university):	Dr. R.R. Negenborn	(Delft University of Technology)
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Supervisor:	Dr.ir. H.P.M. Veeke	
Date:	September 26, 2017	

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Student:	F.J. Reijnders	Assignment type:	MSc Thesis
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Supervisor (Heineken):	Ir. G. Versantvoort	Confidential:	Yes Until: September 26, 2022

Subject: **Direct export deliveries: an impact analysis of bypassing the Heineken distribution center in Germany.**

The Heineken Company is operating a global production and supply network with different company units, all responsible for their own tasks. The Heineken Operating Companies take care of the production and global distribution. They sell their products, internally, to the Market Sales Organizations, the Heineken representatives in a certain market. The Market Sales Organizations have a local office and one or more distribution centers from where they sell and distribute the Heineken products to the 'first customers': the wholesale and retail businesses who then further distribute the products to supermarkets at bars.

Heineken Netherlands Supply is one of the Operating Companies. They produce for the Dutch market, but they also export to more than 140 countries. Several Market Sales Organizations from neighboring export markets have asked Heineken Netherlands Supply for the possibilities to deliver directly to some of the customers, thus skipping their distribution center(s). Heineken Germany, one of these Market Sales Organizations, has so far shown the most progress in exploring the opportunities. Their main motivation for direct deliveries is to save on storage-, handling- and transportation costs.

Heineken Netherlands Supply is open towards improvements of their supply chain, but at this moment they cannot oversee the consequences of direct export deliveries. Therefore they want to know what the potential savings will be, what the effects of direct export deliveries will be on their export departments, and what else they need to take into account before they agree to implement direct export deliveries.

The goal of the assignment is to provide Heineken Netherlands Supply with the required insights into the impact of direct export deliveries on their organization, so they can make a well-grounded decision on the implementation.

The report should comply with the guidelines of the section. Details can be found on the website.

Dr. R.R. Negenborn
Section Transport Engineering and Logistics
Department Maritime and Transport Technology
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Preface

This report is the result of a graduation project that took me almost 12 months to complete. It has not been easy, I would like to say that up front. But when is something like this ever easy?

I started my internship at Heineken while I still had to finish another project. Unfortunately dividing my focus among both project made me lose track of both, until at one point I got completely stuck and totally lost the overview of what I was doing. In the end the only solution was to put this project on hold and first complete the other.

By the time I was back on track, the internship at Heineken was over, which made it difficult to get more information that maybe would be useful for this project. Another obstruction in information gathering was Heineken Germany. Despite multiple requests from my side, detailed information about their orders was never shared. A lot of assumptions had to be made to have some numbers to work with, and I have my doubts about the academic level of the result.

Fortunately, I find my comfort in the fact that Heineken was very content with the presentation I gave for them where I presented a complete overview of all the thing they need to consider before continuing with direct deliveries, which was exactly what they asked for.

Acknowledgments

First of all, I have to thank my family for being there for me along the way, and even taking me in their home again to give me all the support that I so clearly needed in finishing this project.

From TU Delft I would like to thank Hans Veeke. He has been my daily supervisor at TU Delft, and he was always prepared to listen to not only my project related problems, but sometimes also my personal struggles. Whenever I lost track of what I was doing, a quick mental boost from Hans was often enough to get me going again.

Also I have to thank Rudy Negenborn for taking the time to chair my graduation committee. During the meetings where he was present he provided me with very useful feedback, although it took me until the end of the project to understand the true value of it...

Finally, I would like to say my special thanks to Guus Versantvoort, my daily supervisor at Heineken. Not only has he been a great sparring partner in exploring new ideas and solving the problem for Heineken, but he has also been a friend. From day 1 he helped me to find my way around the large and complex organization that Heineken is. I was able to have a great time at Heineken. It was both fun and instructive, and I mainly have to thank Guus for that.

F.J. Reijnders
Delft, September 2017

Summary

The Heineken Company is more than just the Heineken beer brand. The total portfolio consists of more than 250 different brands worldwide. The Heineken Company is operating a global production and supply network with different company units, all responsible for their own tasks. The production and global distribution is done by 37 Operating Companies (OpCo) spread around the world. The OpCos deliver pallets with beer, wrapped in plastic, also called Stock Keeping Units (SKU).

The OpCos sell their products, internally, to the Market Sales Organizations (MSO), who are the Heineken representatives in a specific country or region. The MSOs sell the products commercially and take care of local distribution to the first customers. These customers are the wholesalers and retailers who then further distribute the products to supermarkets and bars.

Heineken Netherlands Supply (HNS) is one of the OpCos. HNS is operating three breweries: one in Zoeterwoude, one in Den Bosch and one in Wijlre. With an annual production of 17,5 million hectoliters, HNS is Heineken's largest OpCo worldwide. 30% of the production is for domestic distribution; the remaining 70% is destined for export to more than 140 countries.

Several MSOs from neighboring export markets have asked HNS for the possibilities of direct deliveries to the customers. They believe that occasionally delivering shipments directly to the customer, bypassing the MSOs' distribution center(s), has the potential to save on handling-, storage- and transportation costs, can solve distribution center storage capacity issues, and can satisfy some customers' requests to let them pick up their products at the HNS warehouses themselves. This makes it seem like direct export deliveries can have some supply chain benefits. However, at this point HNS does not have a clear overview of the consequences of direct deliveries on their own organization. HNS wants to know what the potential savings are, what impact direct deliveries will have on their export departments, and what else has to be taken into account, before they can decide whether or not to implement direct deliveries for export customers. HNS does not want to give in on their *quality*.

To find answers to these questions this research will focus on direct export deliveries to Germany, and will evaluate the impact of these direct deliveries on the order handling process and the HNS export operations. Two separate analyses will help to understand the current situation and clearly define the problem: a *supply chain analysis* and a *system analysis*.

The supply chain analysis focuses on the general role of the MSO in the supply chain between the OpCos and the customers' distribution centers, also called Demand Points (DP), in Germany. The supply chain analysis distinguishes five main functions of the MSO: combine, collect, create, connect and carry. Being the central contact point for the customers in a certain market, the MSO *combines* the total market demand and places orders for all required products at the right OpCos. The MSO then *collects* all the products from the different OpCos in their local distribution center(s). The OpCos supply the MSO with mono loads: trucks or containers filled with a single product. The MSO *creates* mixed loads, because generally the customers are not interested in full truckloads of a single product. The OpCos deliver with a make-to-order model: the MSOs can order once a week and then have to wait a few weeks for production until they receive the products. The customers want to order on a daily basis and receive their products the next day. This resembles a make-to-stock model. The MSO *connects* these different supply models by keeping a buffer stock in between. And finally, the MSO *carries* the market risk. This

means keeping extra safety stock to prevent going out-of-stock and providing all required customer support.

The system analysis takes a closer look at the supply chain between HNS and the customers in Germany. A PROPER-model from the Delft Systems Approach creates a clear overview of the processes in both the order- and material flow, and the related stakeholders. Removing the MSO distribution center from the material flow defines a Direct Delivery. The Direct Delivery model shows that four components in the system are affected: the contacting party (MSO or customer), the supply model (make-to-order or make-to-stock), the degree of pallet handling (only mono or also mixed loads), and the means of transport (drop-off or pick-up). For each of these components a choice has to be made between two options, resulting in 16 different Direct Delivery scenarios. The relevant Key Performance Indicators (KPI) are the transport- and warehousing costs, the Case Fill Rate, the First Time Right Order Management, the Customer Satisfaction and the Carrier Performance. The analyses lead to the following research question:

> ***Which Direct Delivery scenarios for Germany have the highest potential cost savings without reducing the Heineken Quality?***

First, the four components and their related choices are separately evaluated against the relevant KPIs, resulting in a comprehensive overview of all consequences of the variances, and other things that have to be taken into account. Second, a hypothetical Direct Delivery case study for Germany is performed to calculate the potential savings and the impact of the different scenarios.

It can be concluded that the MSO is not going to be completely removed from the supply chain. The five main functions that were identified in the supply chain analysis show that the MSO plays an important role as a central hub between the OpCos and the customers. Direct Deliveries, as defined by the system analysis, are thus only interesting for certain SKUs and certain DPs (*SKU-DP combinations*).

Even in the case of Direct Deliveries, the MSO should remain between HNS and the customers as a contacting party. Adopting the *combine* and *carry* functions from the MSO would have unacceptable effects for the Customer Satisfaction. Customer pick-ups are not preferred since they go against the HNS policy trend. HNS wants to work with a select group of trusted carriers to maximize the delivery quality. This eliminates all pick-up scenarios. Make-to-stock scenarios require moving the buffer stock to HNS, and that means outsourcing the storage and handling to Hartog & Bikker. As became clear in the case study, this is more expensive than leaving the stock in Germany. The *collect* and *connect* functions should therefore also remain with the MSO.

As an answer to the research question, it can be concluded that only 2 of the 16 scenarios do not have direct negative impact on the HNS *quality*, and do therefore still qualify for Direct Deliveries. The only choice left is whether to create mixed loads or not. Sticking with mono loads is the safe option because it guarantees that nothing will change in the current way of working. However, this greatly decreases the number of possible SKU-DP combinations that are suitable for Direct Deliveries. Creating mixed loads on the other hand, increases the potential for Direct Deliveries, but requires extra storage space.

HNS is recommended to first let their Market Business Partners, together with the MSOs, search for suitable SKU-DP combinations that show a large enough demand to qualify for mono truck Direct Deliveries. Maybe in a later stage mixed loads can be created to increase the number of Direct Deliveries, and thus increase the cost savings.

Samenvatting (summary in Dutch)

Het bedrijf Heineken is meer dan alleen Heineken bier. Het totale portfolio bestaat uit meer dan 250 merken wereldwijd. Heineken heeft een globaal productie- en leveringsnetwerk met verschillende bedrijfsonderdelen, allemaal verantwoordelijk voor hun eigen taken. De productie en wereldwijde distributie wordt gedaan door 37 *Operating Companies* (OpCo), verspreid over de wereld. De OpCo's leveren pallets met bier, in plastic gewikkeld, die *Stock Keeping Units* (SKU) worden genoemd.

De OpCo's verkopen hun producten, intern, aan de Market Sales Organizations (MSO), die Heineken vertegenwoordigen in een bepaald land of regio. De MSO's verkopen de producten commercieel en zorgen voor lokale distributie naar de eerste klanten. Deze klanten zijn de groot- en kleinhandelaren die de producten vervolgens verder verspreiden naar de supermarkten en cafés.

Heineken Nederland Supply (HNS) is een van de OpCo's. HNS heeft drie brouwerijen: een in Zoeterwoude, een in Den Bosch, en een in Wijlre. Met een jaarlijkse productie van 17,5 miljoen hectoliter is HNS de grootste OpCo. 30% van de productie is voor binnenlandse distributie; de andere 70% is bedoeld om te exporteren naar meer dan 140 landen.

Een aantal MSO's uit omringende markten hebben HNS gevraagd naar de mogelijkheden om direct te leveren aan de klanten. Zij geloven dat het af en toe direct leveren aan klanten, waarbij het distributiecentrum van de MSO wordt overgeslagen, de potentie heeft om te besparen op afhandelings-, opslag- en transportkosten, problemen kan oplossen met de opslagcapaciteit in distributiecentra, en tegemoet kan komen aan het verzoek van klanten om hun producten zelf op te komen halen bij de HNS magazijnen. Het lijkt er daardoor op dat directe exportleveringen voordelen kunnen hebben voor de bevoorradingsketen. HNS heeft op dit moment echter geen duidelijk overzicht van de consequenties van directe leveringen op de eigen organisatie. HNS wil weten wat de potentiële besparingen zijn, welke impact directe leveringen hebben op hun exportafdelingen, en waar nog meer rekening mee gehouden moet worden, voordat besloten kan worden om directe exportleveringen wel of niet te implementeren. HNS wil niet toegeven op hun *kwaliteit*.

Om een antwoord te vinden op deze vragen zal dit onderzoek zich richten op directe exportleveringen naar Duitsland, en zal de impact bepaald worden op het bestelling-afhandelingsproces en de exportwerkzaamheden van HNS. Twee afzonderlijke analyses zullen helpen om de huidige situatie te begrijpen en het probleem duidelijk te definiëren: een bevoorradingsketen-analyse en een systeemanalyse.

De bevoorradingsketen-analyse richt zich op de algemene rol van de MSO in de bevoorradingsketen tussen de OpCo's en de distributiecentra van de klanten, ook wel *Demand Points* (DP) genoemd. Er worden vijf hoofdfuncties van de MSO onderscheiden: combineren, verzamelen, maken, verbinden en dragen. Als centraal aanspreekpunt voor de klanten in een bepaalde markt, *combineert* de MSO de totale marktvraag en plaatst de bestellingen voor alle benodigde producten bij de juiste OpCo's. Vervolgens *verzamelt* de MSO alle producten van de verschillende OpCo's in hun lokale distributiecentrum. De OpCo's bevoorraden de MSO met mono-ladingen: vrachtwagens of containers gevuld met één type SKU. The MSO *maakt* mixed-ladingen, omdat de klanten over het algemeen niet geïnteresseerd zijn in volle vrachtwagen-ladingen met een enkel product. De OpCo's leveren via een *make-to-order* model: de MSO's kunnen eens per week bestellen en moeten vervolgens een aantal weken op de productie wachten voordat de producten geleverd worden. De klanten willen op dagelijkse basis bestellen en de

volgende dag geleverd krijgen. Dit lijkt meer op een *make-to-stock* model. De MSO *verbindt* deze verschillende modellen door ertussenin een buffervoorraad aan te houden. Tenslotte *draagt* de MSO het marktrisico. Dit houdt in dat een extra veiligheidsvoorraad wordt aangehouden om te voorkomen dat er uit voorraad gelopen wordt, en dat wordt voorzien in alle benodigde klantondersteuning.

De systeemanalyse bekijkt de bevoorradingsketen tussen HNS en de klanten in Duitsland. Een Process-Performance-model van de Delft Systems Approach geeft een duidelijk overzicht van de processen in de bestelling- en materiaalstroom, en de gerelateerde belanghebbenden. Het verwijderen van het distributiecentrum van de MSO uit de materiaalstroom definieert een Directe Levering. Het Directe Levering-model laat zien dat vier componenten worden geraakt: de contactpartij (MSO of klant), het leveringsmodel (make-to-order of make-to-stock), de mate van palletafhandeling (alleen mono of ook mixed-ladingen), en het soort transport (afleveren of ophalen). Elke component heeft twee opties, wat resulteert in 16 verschillende Directe Levering-scenario's. De relevante Key Performance Indicators (KPI) zijn de transport- en magazijnkosten, de Case Fill Rate, de First Time Right Order Management, de Klanttevredenheid en de Vervoerdersprestaties. Uit de analyses komt de volgende onderzoeksvraag:

> ***Welke Directe Levering-scenario's voor Duitsland hebben de hoogste potentiële kostenbesparingen zonder de Heineken Kwaliteit te verminderen?***

Eerst worden de vier componenten en hun gerelateerde keuzes apart geëvalueerd tegen de relevante KPI's, wat resulteert in een uitgebreid overzicht van alle consequenties, en andere zaken waar rekeningen mee gehouden moet worden. Daarna wordt een hypothetische casestudie voor Duitsland uitgewerkt om de potentiële besparingen en de impact van de verschillende scenario's te berekenen.

Er kan geconcludeerd worden dat de MSO niet geheel verwijderd wordt uit de bevoorradingsketen. De vijf hoofdfuncties die zijn gevonden in de analyse laten zien dat de MSO een belangrijke rol speelt als centrale hub tussen de OpCo's en de klanten. Directe Leveringen, zoals gedefinieerd in de systeemanalyse, zijn dus alleen interessant voor bepaalde SKU's en bepaalde DP's (SKU-DP combinaties).

Zelfs in het geval van Directe Leveringen moet de MSO als contactpartij tussen HNS en de klanten blijven. De functies *combineren* en *dragen* overnemen van de MSO zou onacceptabele gevolgen hebben voor de klanttevredenheid. Het afhalen door de klant is niet gewenst omdat dat tegen het beleid van HNS ingaat. HNS wil gebruik maken van een kleine groep vertrouwde vervoerders om hun leveringskwaliteit te maximaliseren. Dit elimineert alle afhaalscenario's. Make-to-stock scenario's vereisen dat de bufferstock naar HNS verplaatst wordt, wat betekent dat de opslag en afhandeling van pallets moet worden uitbesteed aan Hartog & Bikker. In de casestudie bleek dat dit duurder is dan de voorraad in Duitsland houden. De functies *verzamelen* en *verbinden* moeten daarom ook bij de MSO blijven.

Als antwoord op de onderzoeksvraag kan geconcludeerd worden dat slechts 2 van de 16 scenario's geen direct negatieve impact hebben op de kwaliteit, en dus nog steeds in aanmerking komen voor Directe Leveringen. De enige keuze die overblijft is tussen het wel of niet maken van mixed-ladingen. Vasthouden aan mono-ladingen is de veiligste optie aangezien er in dat geval niets verandert aan de huidige manier van werken. Dit vermindert echter aanzienlijk het aantal mogelijke SKU-DP combinaties dat in aanmerking komt voor Directe Levering. Het maken van mixed-ladingen daarentegen, verhoogt de potentie voor Directe Leveringen, maar vereist extra opslagruimte.

Het wordt HNS aanbevolen om eerst de Market Business Partners samen met de MSO's te laten zoeken naar SKU-DP combinaties waarvoor de vraag groot genoeg is om in aanmerking te komen voor monovrachtwagen Directe Leveringen. In een later stadium kunnen misschien toch mixed-ladingen gemaakt worden om het aantal Directe Leveringen te verhogen, en daarmee dus ook meer kosten te besparen.

List of abbreviations

CODP	Customer Order Decoupling Point; Point in the material flow where the product is linked to a specific customer.
DP	Demand Point; distribution center where a delivery is being shipped to.
DSA	Delft Systems Approach; Theory about systems analysis.
FTL	Full Truck Load; enough products to fill a truck.
hl	Hectoliter; 100 liters, common for beer volume indication.
HNS	Heineken Netherlands Supply; One of the Heineken Operating Companies (see OpCo), located in the Netherlands.
KPI	Key Performance Indicator; Performance metric.
MSO	Market Sales Organization; Heineken sales unit in a market.
MTO	Make-to-Order ; Supply chain strategy where the CODP is before production.
MTS	Make-to-stock ; Supply chain strategy where the CODP is after production.
OpCo	Operating Company; Heineken production unit.
PROPER-model	Process-Performance-model; Model from DSA to analyze industrial systems.
SKU	Stock Keeping Unit; Specific product, usually the smallest unit size a company is handling, in our case pallets.
TP	Transfer Price; Internal price for Heineken products between OpCos and MSOs.

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Introduction

1.1. The Heineken Company: a global network

Heineken beer is one of the most well-known beer brands in the world. That is not surprising, because Heineken beer is being sold in more than 170 countries[1]. It is difficult to find a place on earth where you cannot see the typical signboard with the famous red star on it hanging in the streets. But, like the slogan of one the company's 2016 campaigns, *there is more behind the star*.

That may be true for the beer, but it is mostly certainly also true for the company itself, because the Heineken Company is much larger than just Heineken beer. In 2016, 31,7 million hectoliter (mhl) of Heineken beer was produced, on a total consolidated beer volume of 200,1 mhl [13], so that is slightly over 15%.

The Heineken portfolio consists of more than 250 brands, including beers and ciders from all over the world. Next to their global flagship brand Heineken beer, the company produces international brands, like Amstel, Desperados and Tiger beer, ciders as Strongbow Gold and Apple Bandit, as well as regional and local brands. A selection of the most well-known brands can be seen in Figure 1.1.

Figure 1.1: A selection of Heineken brands.[2]

These brands are produced by a total of 156 breweries in 71 countries. The breweries are divided over 37 Heineken Operating Companies (OpCo), the production and supply units within the Heineken Company. Each OpCo has its own production portfolio, which is a selection of products from the Heineken

[1] Source: `http://www.theheinekencompany.com/brands/heineken`
[2] Source: `http://drinks.akay.ie/wp-content/uploads/2016/02/Heineken_Brands-cut-1024x545.png`

portfolio. The OpCos are not only responsible for the production, but also for the global logistics of their products.

The OpCos sell their products, for an internal price, to the Heineken Market Sales Organizations (MSO), the sales and distribution units within the Heineken Company. The MSOs are the Heineken representatives in a region or country. Each MSO has its own market portfolio: again, a selection of Heineken products. A market portfolio usually consists of Heineken products that are being produced by different OpCos. The MSOs sell, for the commercial price, and distribute the Heineken products to the customers in the local markets. These customers are the wholesalers and retailers that further distribute the products to the supermarkets and hospitality businesses, until they end up at the consumers. A simple representation of the Heineken supply chain is shown in Figure 1.2.

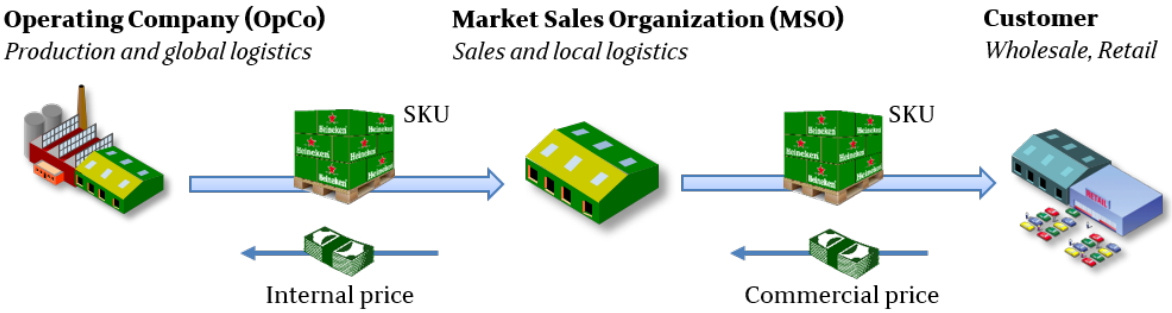


Figure 1.2: The Heineken supply chain.

1.1.1. Heineken Netherlands Supply

Heineken Netherlands Supply (HNS) is one of the 37 OpCos, and with an annual production of 17,5 mhl in 2016, it is Heineken's largest. HNS is operating three breweries in the Netherlands: one in Zoeterwoude (Zuid-Holland), one in Den Bosch (Noord-Brabant) and one in Wijlre (Limburg). The Zoeterwoude brewery is Heineken's largest brewery worldwide, and is overall the largest brewery in Europe, with a total annual production of more than 10,5 mhl.

As explained earlier, OpCos are also responsible for the global logistics. HNS is distributing its products to more than 140 countries. 30% of the total HNS production is for the Dutch market. The other 70% is destined for export, of which 30%-pt is going to the United States, making them HNS's largest customer.

HNS production can roughly be divided into Heineken beer (77%), Amstel beer (18%), Brand beer (2%), and other beer and cider types (3%), like Desperados, Sol, Affligem and Strongbow Gold. The HNS production portfolio consists of 17 beer brands, all with their own flavor varieties, resulting in more than 50 different beer types. All these types come in a range of different packages customized for regions, countries, or even special events, resulting in a total of over 900 unique products.

1.2. Project motivation

The project motivation is as follows: several MSOs from neighboring export markets (Germany, Belgium and the United Kingdom) have asked HNS for the possibilities to deliver directly to some of their customers, by skipping their distribution centers. The reasons why these MSOs want this can be different, but some known rationales are:

- Opportunities to save on handling-, storage-, and transportation costs. Heineken Germany has already been exploring the possibilities for this since 2014, and now they are interested in HNS's view on this.

- A shorter supply chain in both distance and lead time between HNS and the customer. This can potentially have positive effects on customer satisfaction and product freshness.
- Lack of storage capacity in MSOs' distribution centers. Heineken France has been experiencing storage capacity issues during the summer months, and skipping their distribution centers all together in some cases could solve this problem.
- Customer pick-up at HNS warehouses. Heineken UK has some customers who are interested in coming to the Netherlands themselves to pick-up their products.

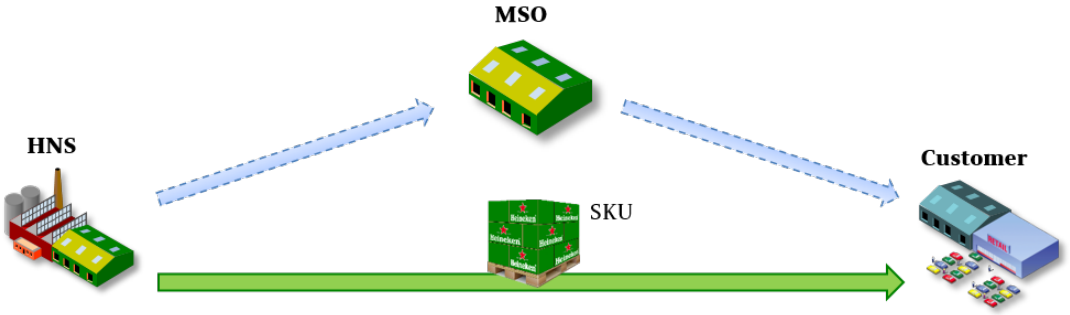


Figure 1.3: The basic idea of a direct delivery to the customer.

The basic idea of a direct delivery from HNS to the customer can be seen in Figure 1.3. Skipping the MSO distribution center can certainly be beneficial in certain ways. However, it is unknown who will benefit the most, and whether there are any downsides of export direct deliveries.

1.3. Problem definition

From a technical point of view, the concept of a direct delivery is hardly a problem. A truck or container can get to any location. However, from a logistical point of view, it is more complex. The concept of export direct deliveries introduces a number of challenges for HNS, of which HNS cannot oversee the consequences. At the moment, HNS is not able to decide whether or not to implement direct deliveries for export customers because:

- The concept of a *Direct Delivery* is not clearly defined. HNS does not know if there are more ways to fulfill a direct export delivery. Maybe different ways exist with different consequences. Because of this, HNS does not know exactly what a *Direct Delivery* is, and what all the opportunities and risks are.
- HNS does not know the potential costs and savings of direct deliveries for export markets, and where in the supply chain these costs and savings will be realized. The three main stakeholders here are HNS, the MSO and the customer. It makes a difference if some stakeholders are making profits while others need to make more expenses. Everyone wants the supply chain to be overall more efficient so that on the whole expenses are saved, but HNS wants to know how the costs and savings will be divided among the different stakeholders. It should be kept in mind that although both the MSO and HNS are a part of Heineken, they have a customer-supplier relationship with their own budgets and their own interests. Therefore they should not be seen as one and the same stakeholder.
- HNS does not know the impact of direct deliveries on its own organization. HNS is expecting direct deliveries to be unfavorable, because HNS is afraid that it will be too much of a hassle to implement (the impact will be too high) and the yield will not be significant (savings will be too

low). However, no prove in favor or against direct deliveries is yet available.

- HNS does not know who are going to receive Direct Deliveries. Will it be for all customers in an export market or only for the very large? Will it be for all products or only for the larger volume brands?
- HNS does not have an overview of all the things that need to be taken into account before implementing Direct Deliveries.
- HNS does *not* want to give in on quality and the 'Heineken Standard'.

1.4. Goal and scope

Based on the problem definition, the goal and scope of this project can now be determined.

1.4.1. Goal

The goal of this project will be to enable HNS to make a well-grounded decision whether or not to implement direct export deliveries. This decision making should be supported by creating insight in the definition, the potential costs and savings, and the impact on HNS of direct deliveries.

1.4.2. Scope

Based on what is known so far, the project can be scoped. In the project motivation it became clear that Heineken Germany has already been working on the direct delivery concept since 2014. Of the group of MSOs that have showed interest in direct deliveries, Heineken Germany has showed the most progression with this idea. For that reason, this project will focus on direct deliveries to Germany.

To be clear: this project thus only focuses on *export*. HNS makes a clear distinction between the export and the domestic distribution of their products, both having separate responsible departments, separate production lines and separate warehouses. The reasons for that distinction will be further explained in the next chapter. The domestic distribution falls outside of the scope of this research, but it will be used for reference and comparison in some cases.

100% of all transport to Germany is currently being done by trucks. A multimodal network study for the use of trucks, trains and barges to Germany has already been performed by Heineken quite recently. The results of this study showed that trucks are the most preferred way of transport to Germany. There is no reason for this project to deviate from that study. Therefore this project will only consider truck transport.

As was explained earlier, HNS is responsible for both production and distribution. However, the production process is not relevant for direct export deliveries. This project will focus on the transportation of the *finished products* from the HNS warehouses, through (or past) the Heineken Germany distribution center, to the customers' distribution centers in Germany. From there the products are further distributed to supermarkets and hospitality businesses, but that is outside of the scope.

Direct export deliveries are going to alter this product stream in some cases, and HNS wants to know what the impact is on its own organization. Therefore the order streams from the customer to Heineken Germany, and from Heineken Germany to HNS, as well as the order handling process within HNS, performed by the customer service department, are also within the scope of this project.

So, there are three 'parties' involved in this project: HNS, Heineken Germany, and the customers in Germany. All parties are operating one or more warehouses or distribution centers. HNS has two export warehouses, one in Zoeterwoude and one in Den Bosch. Heineken Germany has one distribution

center in Wesel, near the Dutch border. The customers of course have distribution centers all over Germany. A schematic overview of the project scope can be seen in Figure 1.4.

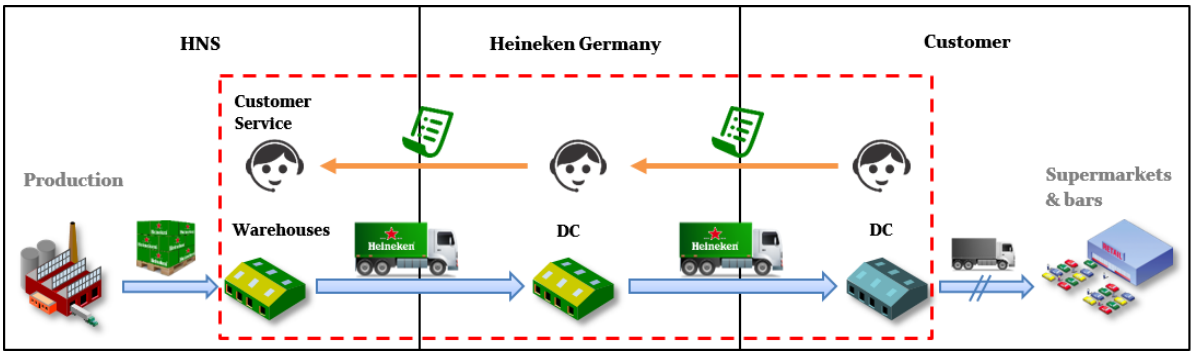


Figure 1.4: Project scope.

Returnable packaging materials need special mentioning in the case of Germany, because Germany is, just like the Netherlands, a *returnable market*. All crates and bottles need to be returned to HNS, and this requires multiple sorting steps to separate the HNS crates and bottles from those of other companies. The sorting process is an internal process in Germany and is currently taken care of by Heineken Germany. It is quite complex and goes beyond the scope of this project, however, for the final implementation of direct deliveries it is an important thing to take into account. Some remarks about returnable packaging will be made later on in this report.

1.5. Report structure

After the introduction, the report will continue with some more general observations about Heineken Netherlands Supply and the supply chain between HNS and the export customers. These observations will be presented in chapter 2.

The observations will be analyzed in chapter 3, which contains a comprehensive problem analysis. The problem analysis is split in two: a supply chain analysis and a system analysis.

Based on the problem analyses the research questions and approach will be presented in chapter 4.

First a brief literature review will be presented in chapter 5 to explore some of the basic concepts that are involved in this project.

In chapter 6 the impact parameters will be described and it will be elaborated how they impact of Direct Deliveries can be calculated.

The different Direct Delivery scenarios will be evaluated against the impact parameters. A comprehensive overview of all the consequences of Direct Deliveries, and all other things that nee to be taken into account when considering Direct Deliveries will be presented in chapter 7.

A case study on direct export deliveries to Germany will be performed in chapter 8 to calculate the potential cost savings and the impact of the different scenarios.

Finally, in chapter 9 the conclusions to this research will be presented, and some recommendations for the best next steps of HNS and future research will be given.

2

Heineken Netherlands Supply and the beer supply chain

This chapter will start with an explanation of the HNS company structure, were the most relevant departments for this project will be introduced. After that some more detailed information about the companies operations will be discussed to better understand the way of working of HNS. Finally, some facts and figures about HNS in general, and more specific about transport to Germany, will be presented to get a grasp of the scale of numbers that is being dealt with.

2.1. Company structure

As an OpCo, HNS is responsible for both production and global distribution. The production takes place in their three breweries in Zoeterwoude, Den Bosch and Wijlre. The production process consists of two stages: brewing and packaging. The production process delivers *finished products*, or Stock Keeping Units (SKUs) to the HNS warehouses. In our case, SKUs are pallets with beer, wrapped in plastic, ready for shipment, as can be seen in Figure 2.1.

Figure 2.1: Different SKUs in the export warehouse in Zoeterwoude.[1]

As mentioned in section 1.4, the production part is outside the scope of this research, because it is assumed that the production will stay unaltered in the case of direct export deliveries. A more de-

[1] https://www.omroepwest.nl/nieuws/2867409/Omwonenden-krijgen-kijkje-in-de-keuken-bij-Heineken-in-Zoeterwoude

tailed explanation of the production process, and in particular the packaging stages, can be found in Appendix B.

The logistics and all relating matters around the production process are taken care of by the department of Customer Service & Logistics (CS&L). CS&L is responsible for the complete end-to-end supply chain. This means that they take care of the supply management, the production planning, and the route-to-market. In other words: CS&L gets all HNS products from the breweries to the Market Sales Organizations.

The HNS organizational structure can be seen in Figure 2.2. The departments within CS&L that are most relevant to this project will be briefly introduced.

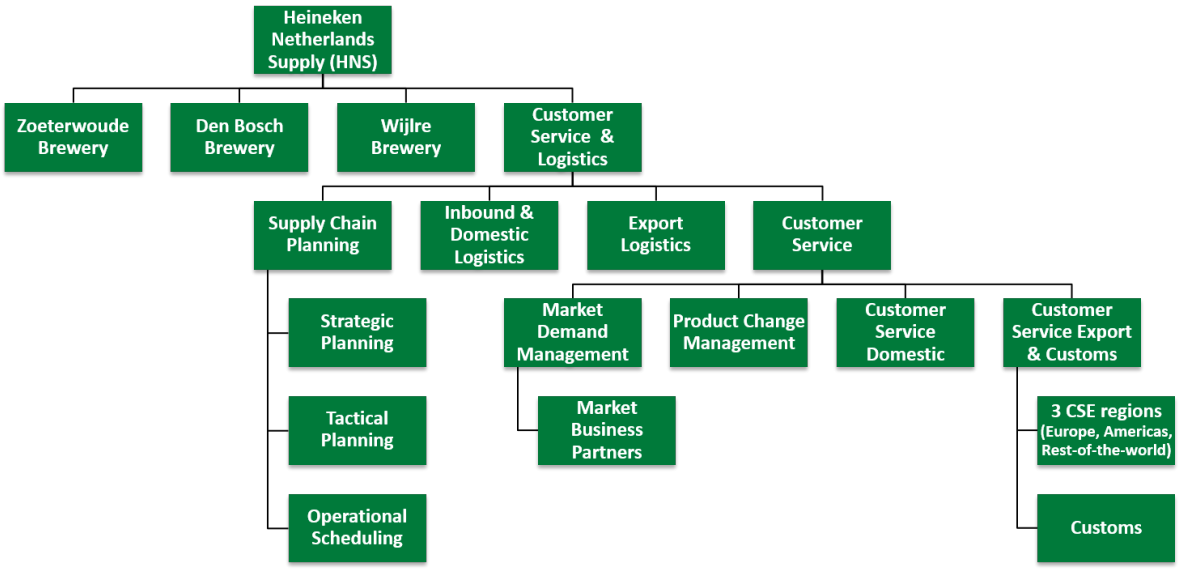


Figure 2.2: The Heineken Netherlands Supply company structure.

2.1.1. Supply Chain Planning

The planning department of HNS is subdivided in the departments of Strategic Planning, Tactical Planning, and two Operational Scheduling departments for the Zoeterwoude and Den Bosch breweries. Strategic Planning is the highest echelon in the planning chain, and is responsible for the long-term HNS planning, up to 24 months. Strategic Planning is more committed to the general supply chain policy, the carrier contracts and the long-term sales forecasts, but not directly involved in actual operations. Therefore Strategic Planning will be further left out of the scope.

Tactical Planning

Tactical Planningis the spindle when it comes down to HNS planning. They are the link between the long-term planning and the operations of all three breweries. Tactical Planning is responsible for the 13-weeks planning of all operations. This involves the material-, beer-, packaging, and resource planning. The material planning is to make sure enough raw materials are in stock for the brewing of the beers. The beer planning is for the brewing process itself, and is to make sure that enough beer is stored in the beer tanks to meet the expected production demands. Packaging planning is to make sure enough packaging materials are in stock for the packaging process. The Resource planning is important for production line maintenance and to make sure that the production lines are available when production is scheduled. Tactical Planning also provides Operational Scheduling with the 2-weeks production planning.

Operational Scheduling

Operational Scheduling is the closest involved with actual production process. Operational Scheduling is responsible for the 2-weeks scheduling of all operations. This includes the detailed scheduling of brewing, filtration, materials and loading , but their main tasks are the production schedule and the operations of the production lines. Because the operations are split over the three breweries, both breweries in Zoeterwoude and Den Bosch have their own Operational Scheduling departments, and is the one in Den Bosch also responsible for the operations in the Wijlre brewery. Operational Scheduling receives the 2-weeks production planning from Tactical Planning and translates this into a detailed operational schedule for the production lines. This plan shows exactly which production line is going to produce how much of what product on what time and date. Every day the shortages and/or surpluses are registered, and the upcoming productions are being tuned to correct for these deviations, like unplanned downtime of production lines.

The main focus of Operational Scheduling is maximum output of the production lines. Maximum output is realized by minimizing the number of so-called *changeovers*. A changeover is the conversion of a production line for production of another product. Different products for example need different labels and crown corks, but different bottles or cans also need different sizes of holders and filling heads along the line. Some large changeovers can take up to 90 minutes.

The second most important thing that is taken into account when making the production schedule is the packaging material availability. The initial production plan is shared with the packaging material suppliers, so they know when certain materials are required at the brewery. If a supplier is for some reason unable to deliver the requested materials on a certain time, the initial production plan, optimized for minimal changeovers, is updated with these material restrictions. Finding the balance between maximum output and material restrictions, while also staying flexible to respond adequately to unexpected disturbances like production line downtime, has all the priorities of the planning departments.

2.1.2. Operational Logistics

The operational logistics of HNS are carried out by the two departments Inbound & Domestic Logistics and Export Logistics.

Inbound & Domestic Logistics

Inbound Logistics is responsible for all material streams that go into the breweries. These streams consist of raw materials to brew beer like malt, yeast and hop, packaging materials like bottles, cans, cardboard and pallets, and the returnable packaging streams like recycling bottles, crates and kegs.

The Domestic Logistics department manages the outbound streams destined for domestic customers. They are in charge of the domestic warehouse. Domestic and export markets both have separated warehouses, because different logistical models are being used for these different market types. This will be explained later. The domestic warehouse is a mostly automated, by AGVs operated warehouse. A minimum of two weeks stock for all domestic products is being stored here, to avoid customers going out of stock.

Since the production process, and thus the incoming material streams, and the domestic distribution are scoped out of this project, the department of Inbound & Domestic Logistics will not be discussed any further.

Export Logistics

Export Logistics is in charge of the HNS export warehouses. They receive SKUs from the packaging lines and either guide them directly on the cross-docks to be loaded in containers, or temporarily store them. They operate the cross-docks, an automated SKU sorting system to position the correct SKUs

in front of the correct containers, and the forklifts to drive around SKUs in their warehouses and load them into containers and trucks.

2.1.3. Customer Service

The customer service department manages everything that has to do with customer contact. The three departments that are important for the HNS supply chain are Market Demand Management, Customer Service Domestic, and Customer Service Export & Customs.

Market Demand Management

Market Demand Management (MDM) is the main link between HNS and the markets. They are the contacting persons with the customers on management level. MDM is responsible for getting insight into the market developments about volumes, new products and supply chain setup. Together with the customers they compose the long-term demand forecast for all markets (up to 18 months).

Customer Service Domestic

Domestic orders are being processed by Customer Service Domestic (CSD). They are the contacting persons for Dutch customers on order level. The CSD customers consist of retail (54%), wholesale (37%), and catering (9%) in the Netherlands. For all orders received before 11:00 in the morning, CSD makes sure the loading and transport is scheduled for the next day. CSD also keeps track of the available stock.

Customer Service Export & Customs

International orders are being processed by Customer Service Export (CSE). They are the contacting persons for international customers on order level. Their job is to organize and manage all global transport of beer by ship, truck, train or airplane, including all documentation needed for transport and customs. This includes order acceptance, order confirmation, order processing, active order management, creating replenishment plans for certain customers, transport booking, and creating and sending of all required documentation. The main goals of CSE are making sure that orders are delivered complete and on time (On Time, In Full), and that the transportation costs are kept as low as possible.

What differs from the domestic department is that the customers of CSE are not retail or wholesale customers abroad, but foreign Heineken sales offices, called Market Sales Organizations (MSOs). The MSOs in turn sell the products to their local wholesale, retail and catering customers. This means that there is an essential difference in type of customers for the domestic and the export departments. It also implies that different logistical models are being used by both department. The different models will be explained in the following section.

2.2. Supply models

As mentioned before, HNS is using different logistical models for their domestic and international distribution. Three different supply models can be distinguished: make-to-stock (MTS), make-to-order (MTO), and replenishment. The models are graphically explained in Figure 2.3. The main characteristic that differs for these models is the position of the Customer Order Decoupling Point (CODP) in the supply chain, The CODP is traditionally defined as the point in the value chain of a product where the product is linked to a specific customer order. In the figure this point is depicted by the *order entry* step in the process.

2.2.1. Domestic: make-to-stock (30%)

For the Dutch market, CSD is using the make-to-stock (MTS) model. The customers of CSD in the Netherlands vary from wholesale and retail, to catering and the hospitality industry. These customers are resupplied on a daily basis from the stocks at the breweries according to their sales forecast. The

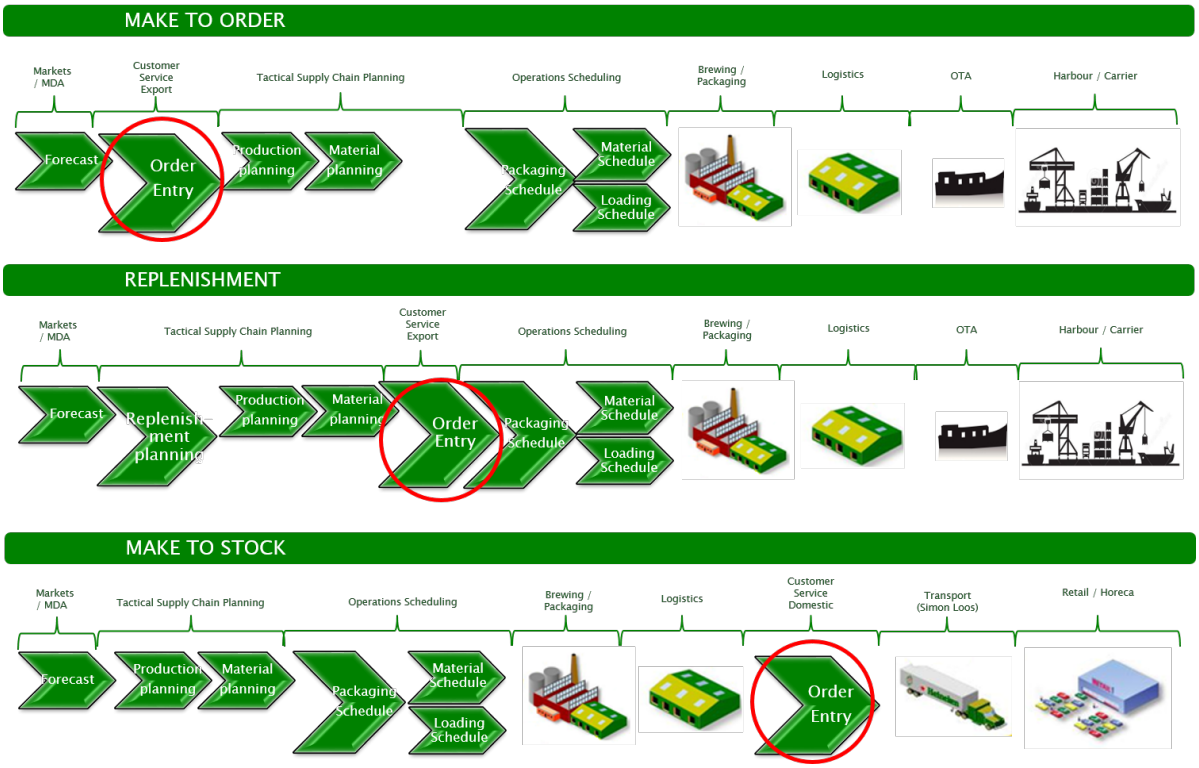


Figure 2.3: The Heineken Netherlands Supply logistical models[11].

stocks are refilled weekly to a certain amount. The size of the stocks depends on the combined sales forecast for all domestic customers. Without deviating from the forecast too much, for the customers this model basically comes down to ordered today is delivered tomorrow.

2.2.2. Export: make-to-order (17%) and replenishment (53%)

For the export markets, CSE is using two different models, i.e. the make-to-order (MTO) and the replenishment model. In the MTO model, an MSO places a new order once a week. This order is based on the forecasts for their local customers. The order is then scheduled for production, the finished products are temporarily stored until the order is complete, and finally the complete order is shipped abroad. All products are then stored again in the MSO warehouse, from where the individual orders are prepared and transported to the local customers. This process takes four weeks plus the transport time, which is the time it takes for the products to get from the HNS brewery to the MSO warehouse. MSOs will have to order multiple weeks ahead, depending on the transport time.

The replenishment model is similar to the make-to-order model, with the difference that HNS manages the MSO's stock levels. Because this provides extra production flexibility, processing time is 'only' 3 weeks plus the transport time.

2.2.3. Drumbeats

HNS is working with certain *drumbeats*: fixed schedules of when certain steps in the process have to be fulfilled. The different supply models have different drumbeats. The Customer Service Export department is working with weekly drumbeats for the make-to-order and replenishment models.

Make-to-order markets can place their orders once a week, in *Week 0* of the order handling process. The orders have to be placed every Friday before 12 p.m. *Week 1* is the planning week. CSE creates the deliveries and shipments for the placed orders on Tuesday. If everything goes without problems,

the orders will be confirmed on Wednesday. Next, the Tactical Planning and Operational Scheduling departments can create the production and loading planning for the following weeks. *Week 2* and *3* are the production weeks, in which the filling and packing of the products takes place. The brewing process has already been finished in accordance to the forecasts. In *Week 4* the shipment starts.

The replenishment drumbeat is slightly different. In *Week 0* the the export markets have to send HNS an update on their stock levels. The stock level update has to be received on Tuesday. On Thursday CSE will make the replenishment plans, based on the stock levels and the forecasts. The replenishment plans will be send to the MSOs directly after for confirmation. In Week 1 the Tactical Planning department also confirms the replenishment plan, and based on those plans the orders are entered into the order management system, and the deliveries and shipments are created on Tuesday, just as the make-to-order drumbeat. Production is in *Week 2*, and takes only one week because of the extra flexibility the replenishment model gives HNS. In *Week 3* the shipment starts. An overview of the export drumbeats can be seen in Table 2.1.

Table 2.1: The Heineken Netherlands Supply drumbeats.[2]

	Week 0	**Week 1** *Planning*	**Week 2** *Production*	**Week 3** *Production/ Shipping*	**Week 4** *Shipping*
MTO	Place orders before Friday at 12.00 p.m.	Create deliveries and shipments on Tuesday. Make production planning.	Production	Production	Shipping
Repl.	Send stock level update on Tuesday. Make replenishment plan on Thursday.	Create orders, deliveries and shipments on Tuesday. Make production planning.	Production	Shipping	

2.3. HNS operations

Some statistics from 2016 can be seen in Table 2.2. In 2016, the Customer Service Export department of HNS handled a total of 25.990 orders. These orders were loaded into 74.614 deliveries, i.e. trucks and containers, so the average order size was three deliveries. These deliveries were shipped in 29.072 shipments. Containers can be grouped on the same ship, therefore this number is lower than the number of deliveries, as explained in Appendix C. For Europe the numbers are less deviating. This is due to the fact that within Europe most deliveries are being done by trucks transport. This is of course also the reason that for Germany the number of deliveries and shipments is exactly the same. Every delivery is equal to one truckload, which is its own shipment. Apparently for Germany one order is entered per individual delivery, so the number of orders is also the same. The reason for this is unknown, but it possibly has something to do with the fact that Germany is a replenishment market, so the orders are entered into the system by the Customer Service Export department based on the forecasts.

Table 2.2: Number of orders, deliveries and shipments in 2016 for different categories.

	Total Export	**Europe**	**Germany**
Orders	25.990	13.825	2.610
Deliveries	74.614	16.359	2.610
Shipments	29.072	15.153	2.610

In 2016, HNS transported 74.614 deliveries to 141 countries. A modal split for these deliveries can be

[2] Adapted from Customer Service & Logistics (HNS) [5]

seen in Table 2.3. It is clear that almost all deliveries are being transported by boat or truck, i.e. 82% and 17% respectively. Train transport takes place to a few European countries and does not even cover 1% of all transport. Most of the time truck transport is preferred for shorter distances because it is much faster. Transport by airplane only happens on very rare occasions, for example when a certain delivery must arrive on time and there is absolutely no other possibility to make it before the deadline. For example a load of special Formula 1 Grand Prix bottles that must arrive before the day the Grand Prix takes place. Arriving one day late means that the load is worthless. However, most of the time air transport is too expensive.

Table 2.3: Number of deliveries per transport mode in 2016.

Transport Mode	**Deliveries**	
	#	**%**
Ship	61.614	82,58%
Truck	12.449	16,68%
Train	547	0,73%
Airplane	4	0,01%
Total	**74.614**	**100%**

Below is an overview of the deliveries shipped by the Customer Service Export Europe team in 2016, split by modality. Please note that, since this overview shows only export deliveries, the deliveries to the Netherlands are not domestic deliveries to Dutch customers. The Customer Service Export department also sells beer to global traders, who often have warehouses all over the world, including in the Netherlands. The products are thus sold internationally, but delivered to a warehouse nearby. From the MSOs it is clear that Germany, France, the United Kingdom and Belgium make up the top-4 of largest European customers.

2.3.1. Transfer price

OpCos sell their products to the MSOs for an internal price: the so-called Transfer Price (TP). The TP is the cost price of the products, and consists of the material- and production costs. It does not include profit margins, transport-, or insurance costs. The TP is different for each product, and can also vary per OpCo, because different OpCos have different procurement and production costs, and thus different operational expenses per product. This enables the MSOs to *source* their products at different OpCos, based on TP, quality, reliability and service. As a consequence, although being part of the same company, OpCos are competing with each other for the highest internal sales.

Table 2.4: Number of deliveries in the Europe region per transport mode in 2016.

Country	Modality			Total
	Truck	Ship	Train	
Austria	10		17	27
Azerbaijan	2	4		6
Belgium	1.174			1.174
Bulgaria	10			10
Croatia	7		2	9
Czech Republic	104			104
France	1.744			1,744
Germany	2.610			2,610
Greece	20	14		34
Hungary	12		11	23
Ireland		1.479		1.479
Italy	87		424	511
Netherlands	2.634			2.634
Poland	30			30
Portugal	1	50		51
Romania	1		51	52
Russian Fed.	38			38
Serbia	101	69		170
Slovakia	35			35
Spain	49	201		250
Switzerland	112			112
Tajikistan		65		65
United Kingdom	1.533	3.583		5.116
Uzbekistan		75		75
Total Deliveries	**10.314**	**5.540**	**505**	**16.359**

3

Problem analysis

The goal of the problem analysis is to help clearly understand the problem. Based on the problem analysis the research questions will be formulated in chapter 4.

Heineken wants to know what the *impact* is of direct deliveries on Heineken Netherlands Supply. This question can be answered in a lot of different ways, depending on how it is interpreted and what kind of approach is chosen to find an answer. At this point the question is not specific enough for a result oriented research.

In the supply chain between Operating Companies and customers, the Market Sales Organization is currently fulfilling certain functions. Skipping the Market Sales Organization's distribution center with a direct delivery may leave some of these functions unfulfilled. A good understanding of the role that the Market Sales Organization is playing in the supply chain is therefore essential in order to be able to identify the impact of direct deliveries in a later stage of this project.

As mentioned before, the concept of a direct delivery is still undefined. Different export markets have asked for different forms of direct deliveries and it is unclear what all the different options for direct deliveries are. Therefore the concept of a direct delivery needs to be defined.

It is also still unclear what is meant by the *impact* on Heineken Netherlands Supply. As was shown in section 2.1, Heineken Netherlands Supply is a large organization consisting of breweries and warehouses, as well as logistical-, planning-, customer service- and other supporting departments for sustaining their global supply network. It is probably unnecessary to investigate the impact on the whole Heineken Netherlands Supply organization. Therefore the relevant components of Heineken Netherlands Supply that are truly affected by direct deliveries need to be identified.

Next, the related stakeholders that operate in these components can be pointed out. This is important because all stakeholders have their own tasks within the supply chain. They all have their own concerns and interests, and their individual tasks have unique opportunities and challenges.

After identifying the relevant stakeholders and their specific tasks in the supply chain, we want to know which Key Performance Indicators (KPIs) are currently in use to measure the performance of the processes and what the current performance is. That way it is possible to relate the future performance to the current performance later on in this research, and find the impact.

To summarize, this chapter seeks to find answers to the following preliminary questions:

1. What is the role of the Market Sales Organization in the supply chain?
2. What is the definition of a direct delivery?
3. Which components of the supply chain are affected by direct deliveries?

4. Who are the stakeholders related to these components?
5. Which Key Performance Indicators are currently in use and what is their current performance?

In order to find the answers to these preliminary questions, two different analyses will be performed in this chapter:

- Supply chain analysis
- System analysis

The supply chain analysis will take a look at the bigger picture of how the current supply chain between Operating Companies and customers is designed in general. It will focus on the most important functions of the Market Sales Organization, and will try to clarify the role the Market Sales Organization is playing in the supply chain.

The system analysis will go into more detail of the different processes taking place within the supply chain between Heineken Netherlands Supply and a certain customer. It considers the process of a single delivery and aims to identify the changes to this process if that delivery would go directly to the customer.

3.1. Supply chain analysis

In chapter 2 some first observations where being made of the supply chain between Heineken Netherlands Supply and the customers. In this section the beer supply chain will be analyzed on a more general scale, i.e. the general supply chain between the Heineken Operating Companies and the customers in an export market. This will be done by trying to find the most important functions of the Market Sales Organization.

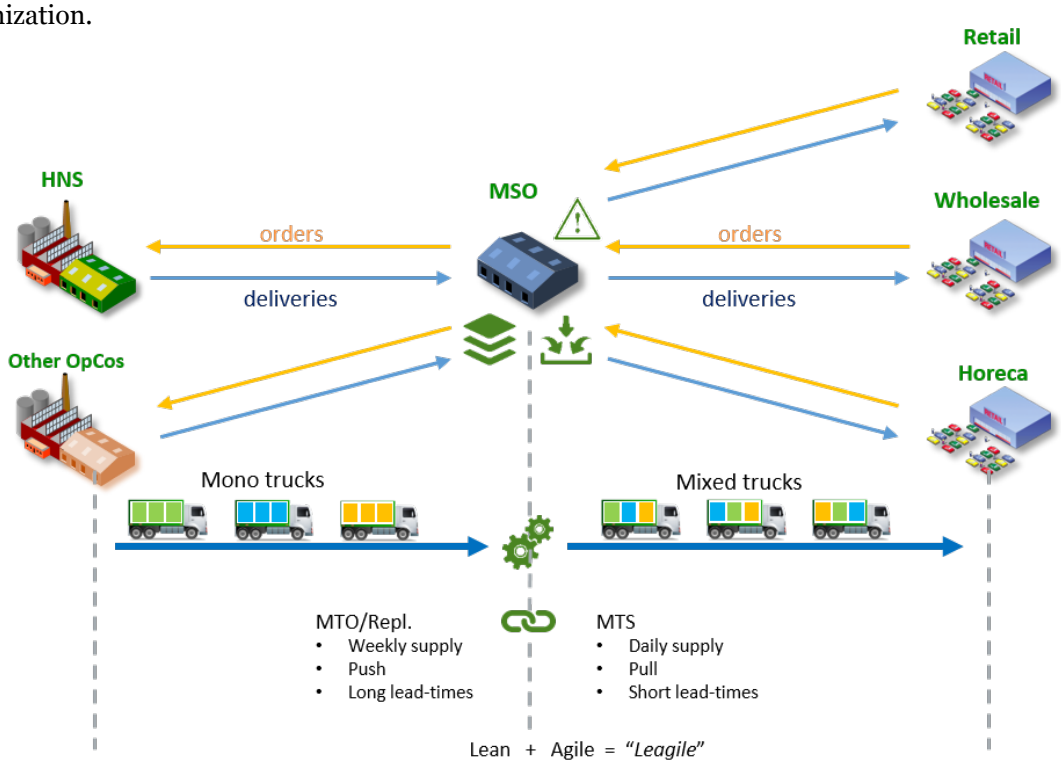


Figure 3.1: Graphical representation of the supply chain and the MSO functions.

The Market Sales Organization represents Heineken in an export market. It is the contacting party for customers in that market. The customer group in a market can be divided into three sub-types: wholesale, retail and horeca. They can order products from the Heineken

portfolio available in their market at their local Market Sales Organization. The Market Sales Organization in its turn **combines** the total market demand and places single orders of the right products at the right Operating Companies. As an OpCo, HNS thus receives one large order per export market.

The Operating Companies produce the products that were ordered by the Market Sales Organization, and deliver them at the Market Sales Organization's distribution center(s). The Market Sales Organization **collects** all the products from the combined orders from the different Operating Companies and then redistributes the products among its customers.

While redistributing the products to its customers, the Market Sales Organization also **creates** mixed loads. Generally, the trucks arriving from the Operating Companies are mono trucks, but customers are often not interested in a full truckload of a single product. Especially the smaller customers want to order one, or sometimes even half or less than half a truckload containing all the different products they need.

The supply models on the supplier side (upstream) and on the customer side (downstream) of the Market Sales Organization are different. Between the Operating Companies and the Market Sales Organization, a make-to-order (or replenishment) model is being used. As was explained in section 2.2, these supply models work on a weekly basis. The Market Sales Organization can order once a week, on a specific day. However, these orders are mostly just a confirmation, maybe with a slight adjustment, of the forecasts that have been shared with the Operating Companies weeks, or even months, in advance. These forecasts are based on the expected sales of the Market Sales Organization. It can therefore be said that this model is mostly forecast-driven. Shipping of the products will take place three weeks (or two weeks in the case of replenishment) from the moment of ordering. Shipping will start as soon as the production is finished, but the exact day of shipping will not be known until the the production schedule for that week is finalized. The shipping time depends of course on the country of destination. The lead times are therefore relatively long. The model is based on a push-principle: once production is finished, the products will be shipped to the Market Sales Organization. This supply model is all about efficiency. It handles relatively larger volumes and focuses on cost leadership and cost performance. Considering these characteristics it can be labeled as a 'lean' supply model.

Between the Market Sales Organization and the customers the supply model resembles a make-to-stock model. Although the Market Sales Organization is not actually 'making' the products itself, but only buying them from the Operating Companies, the model can be compared to the one being used between Heineken Netherlands Supply and the customers (wholesale, retail, horeca) in the Netherlands. Because all products are in stock in the MSO's distribution center, the supply can take place on a daily basis. The customers can order once a day. Ordered today is delivered tomorrow. The lead times are therefore relatively short. The model is based on a pull-principle: the products will be shipped to the customers once they have actually placed an order. It can therefore be said that this model is mostly order-driven. This supply model is all about effectiveness. It handles relatively smaller volumes and focuses on flexibility, speed and responsiveness. Considering these characteristics it can be labeled as an 'agile' supply model.

The Market Sales Organization **connects** both supply models by keeping a buffer stock in between. Simply expressed: the Market Sales Organization receives all products from the Operating Companies on one day, and redistributes them to its customers spread over the following seven days. By doing so, the Market Sales Organization is the link between a lean and an agile part of the beer supply chain, thus creating a so-called 'leagile' supply chain: economically-focused upstream, customer-focused downstream.

Finally, by acting as the Heineken representative in a market, the Market Sales Organization is also **carrying** the market risk that comes with it. With market risk we mean all the risks that can be associated with being a high-service company dealing with highly critical and demanding customers. Throughout the order process, customers want to be kept up-to-date and have the feeling that they are the most valued customer. This requires active customer management, and building and maintaining a good supplier-customer relationship. Customers want to receive their products as fast as possible. They want to order today and receive tomorrow. This often requires keeping a buffer stock of products. Going out-of-stock on a particular product is never received well with customers. Avoiding out-of-stock situations usually means keeping an additional safety stock in your warehouse, next to the already mentioned buffer stock, as can be seen in Figure 3.2. Besides wanting their products as soon as possible, customers can be very specific about the time they want to receive their shipments. Especially the larger wholesale and retail customers receive so many trucks during a day, that they work with very strict time slots in which a delivery can be unloaded. Arriving too early can leave your carrier waiting at the customer's gate, while arriving too late can lead to a decrease in performance rating, or sometimes even fines, depending on the arrangements made in the so-called Service Level Agreement. Monthly, or sometimes even weekly, evaluation meetings between customer and supplier to discuss the supplier performance are not uncommon. The performance on carrying this market risk is often expressed in customer satisfaction.

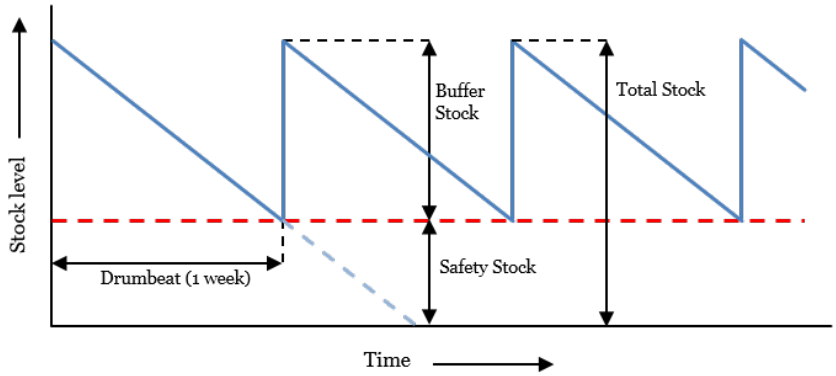


Figure 3.2: Theoretical stock levels at the Market Sales Organization.

While describing the supply chain between Operating Companies and customers, five important functions of the Market Sales Organization have been identified. These functions are:

1. **Combine** market demand
2. **Collect** products from different OpCos.
3. **Create** mixed loads
4. **Connect** supply models
5. **Carry** market risk

A graphical representation of the supply chain between the OpCos and customers, including the identified MSO functions, can be seen in Figure 3.1. These functions will be referred to later when trying to define the impact of Direct Deliveries.

3.2. System analysis

The second part of the problem analysis consists of a system analysis. The system analysis will be based on the theory from the Delft Systems Approach by Veeke et al. [27].

The Delft Systems Approach shows that every system can be represented by a 'function model': a black

box that performs a certain function in its environment. The black box receives input that is transformed into output. This transformation takes place due to a process inside the black box. The black box also receives requirements that are set to this process, and it returns the measured performance of the process. The system that is analyzed in this research for example has the function to transport beer from HNS to the customers. A simple function model of this system can be seen in Figure 3.3.

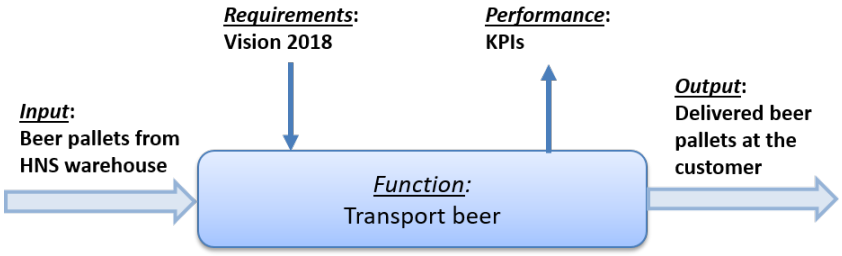


Figure 3.3: A basic function model.

The black box can be opened to study the process taking place inside in more detail. Opening up a black box and 'zooming in' reveals the process inside, that in its turn consists of a series of functions that can all be represented as their own function models.

3.2.1. Process-Performance model

The system that will be analyzed in this research can be seen as an industrial system. The Delft Systems Approach uses a Process-Performance model, or PROPER-model, for the analysis of industrial systems. The PROPER-model is an expanded function model that distinguishes three different aspects that are present in every industrial system, and their interrelations: the order flow, the material flow and the resource flow. Each aspect has its own function, and each aspect has its own in- and output(s). Just like the standard function model described earlier, an industrial system also has requirements and a performance measurement. There is also a control function that manages the whole system. The industrial system that will be analyzed here has the function to transport beer from HNS to the customers. This system can be called the 'beer transportation system', and can be seen in Figure 3.4. The control function and the three different aspects of our beer transportation system will now be discussed.

System control

The beer transportation system is managed by the system control function. The control function receives the requirements for the system from the top level management. These requirements are translated into standards, more specific goals for the functions inside the system. The control function also receives the results from the system. The results are then compared with the standards, and in that way the performance can be calculated. The control function of our system also receive the sales forecasts from the MSOs. These forecasts are both shared with the system, and used to set the standards.

In the beer transportation system the role of function control is being executed by the Strategic Planning and the Market Demand Management departments. All the separate streams will now be discussed individually.

Requirements

The requirements describe the goal(s) of the system. For HNS, the goals of the organization are described in their Vision, a document that sets out the goals for a period of three years. Every department within HNS has its own vision document, which is derived of the general HNS vision, but translated to the specific department's activities.

Since this project is not focusing on the production of beer, we are not interested in the vision for the

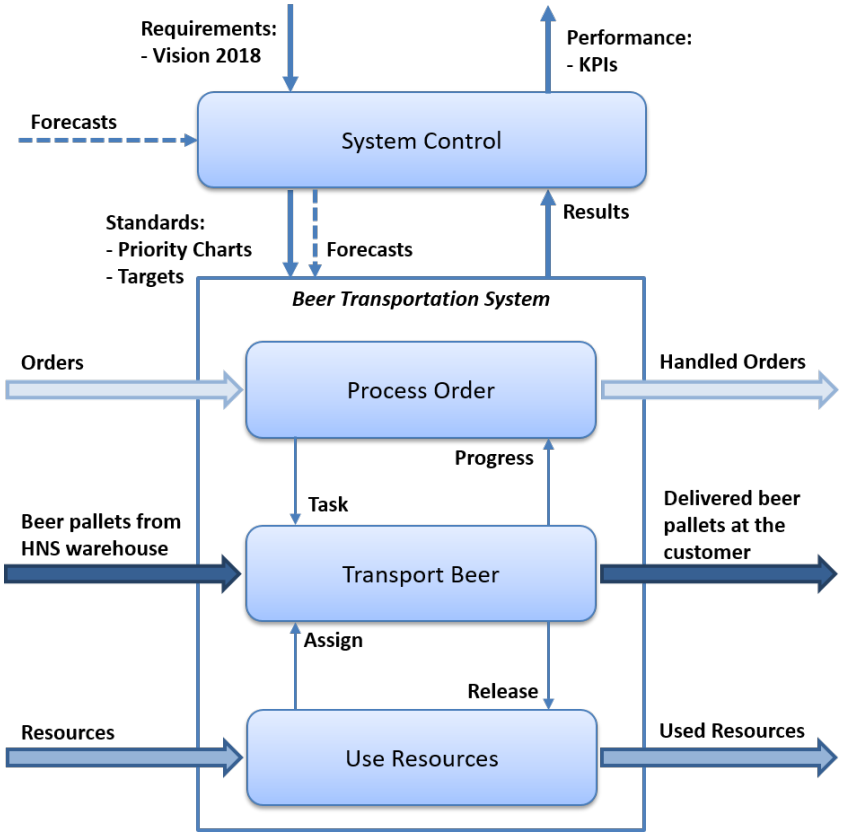


Figure 3.4: The PROPER-model of our beer transportation system.

breweries. The requirements for our beer transportation system will therefore come from the Customer Service and Logistics Vision 2018 [12]. The requirements to our system that can be deduced from the Vision 2018 are:

1. Deliver the best *service*;
2. against the lowest possible *costs*;
3. while working with the highest possible *efficiency*;
4. and reducing the global footprint to reach the *sustainability* goals;
5. but always keeping *safety* first.

These five categories will be used later to group the performance indicators.

Forecasts

All customers have to send HNS their sales forecast. The forecast represents the customer's expected sales for the next 1.5 years. This forecast needs to be updated weekly. The long-term forecast, up until 1.5 years ahead, is important for the strategic planning department. This forecast is of course impossible to get very accurate, but it is needed to see certain trends so HNS can respond to those trends in time. The mid-term forecast, up until 3 months ahead, is important for the tactical planning department. It will determine the 'beer planning', the purchasing of raw materials and the actual brewing of the beers. The short-term forecast, up until 1 month ahead, is the most important. It must be very accurate, and deviating from this forecast is undesirable. The forecast information is shared with the beer production process, which fall out of the scope of this research, and the Customer Service departments.

Standards
The control function translates the system requirements and the forecasts into standards for the system. In the beer transportation system, the standards consist of the priority charts and targets.

The priority charts are custom made for each department. They tell the department where the focus should lie in the coming period. For example, the focus of the export department should be to reduce the transport costs, and increase the percentage of on-time deliveries.

The targets are hard numbers that tell each department what goals to reach or what the limits are.

Results
The results are all the hard numbers that return from the system. The number of orders handled, the number of deliveries made, if the deliveries arrived on time, if all the products were readily available, etc. The results are used by the control function to determine the system's performance.

Performance
To find out whether the system meets the requirements, the performance of the system is measured. This is done by comparing the results with the standards, or by just using the results to calculate some values that indicate the performance of the system. The performance is an expression of how well the requirements are being fulfilled by the system. Usually performance is measured with certain Key Performance Indicators (KPIs) that correspond with the requirements.

As mentioned earlier, HNS wants to deliver the best service at high and constant quality. The quality of the service is measured in Customer Satisfaction, which is a grade between 1 and 10 that is given to HNS by their customers through periodical surveys.

For their service, HNS is also for a large part relying on the performance of their carriers. The carriers are in 'physical' contact with the customers when they deliver the products, while HNS mostly has contact with their customers from a distance. HNS can only deliver the best service to their customers, when the carriers are also functioning optimally. Another important KPI to measure the service level therefore is the Carrier Performance. The Carrier Performance is a grade periodically given to the carriers by HNS. For the Carrier Performance, the carriers will be evaluated on the number of 'no-shows', the number of changes they make in the Transwide planning, the number of invalid bookings, the number of failed bookings, and the number of failed safety tests.

To remain competitive against other OpCos, HNS wants to deliver this service against the lowest possible costs. The most obvious costs are of course the transport costs, measured in euros (€), and the warehousing costs, measured in euros per hectoliter (€/HL). Also the costs of dumping obsolete products are being measured.

The efficiency within HNS is measured in many different KPIs for each department. The HNS overall efficiency is measured with the Productivity. The Productivity is the amount of hectoliters produced per full time equivalent employee (HL/FTE).

The efficiency of the supply chain is measured with the Case Fill Rate (CFR). The CFR is measured as a percentage, and is a combined value of the percentages for the Product Availability (PA), the On-Time (OT), and the In Full (IF). The Product Availability is measured in the HNS warehouses, and tells if products have successfully been produced and are ready for shipping by the time they are planned to start the transport. The On Time measures if the products arrive at the MSO before the deadline, and the In Full measures if the desired quantity of the products is delivered. If anything goes wrong with these three things, extra rework is required and the efficiency drops.

Inside the warehouse the efficiency is measured with the Stock Levels. If the stock levels are too low

Table 3.1: Case Fill Rate in 2016 for different categories.

it means that precious storage space is being wasted. If the stock levels are too high there is a risk of blocking the entire warehouse operations because their is a lack of movement freedom, which in turn also blocks the production process because the production lines cannot be emptied.

Outside the warehouse the efficiency is measured with the Residence Time. This is the time that trucks or containers have to stay on the brewery terrain before they are successfully loaded. Keeping the Residence Time low enables a day to be divided into more time slots, which means that more truck and containers can be filled.

The efficiency of the order handling is measured with the First Time Right (FTR) Order Management. This KPI is of course specifically for the customer service department. It measures if the order handling is performed on time and without errors. The FTROM is the product of several sub-categories, i.e. the SAP Pollution, the Order Entry On Time, the Minimum Order Quantity (MOQ), and the Cyclicity. SAP is the order management system being used by HNS. The SAP pollution is a measurement if all the information available in SAP is without errors. The Order Entry On Time measures if every order handling by the Customer Service departments is according to the drumbeat, so on time. The Minimum Order Quantity is to check if the customers comply with the ordering rules. The Customer Service department is responsible for making sure that the customers do. The Cyclicity checks if all the orders are in accordance with the cyclic production of certain products. Some 'slow-movers' are only produced once every two, four, or sometimes even eight weeks, so they can not always be ordered.

HNS wants to provide sustainable door-to-door solutions. The main KPI for measuring sustainability is the amount of CO_2 emitted per hectoliter (kg CO_2-e/HL).

Last but not least, the safety is the most important KPI. Presentations by managers or team leaders almost always start with the latest update on safety. Safety is measured in the number of accidents, with and without non-attendance. With direct deliveries, the on-site operations are not going to change, so although the *safety* is one of the most important requirements for Heineken, it will therefore be assumed that the safety is not going to change. The safety will not be taken into account in the rest of this research.

Order flow

The order flow consists of the order handling process. The inputs for the order flow are both forecasts and orders. The forecasts are received from the control function. The orders are received from make-to-order MSOs. For make-to-order MSOs the orders are compared to their forecasts. Like mentioned before, deviating from the short-term forecast is undesirable, but can happen after negotiating with the Customer Service department. Replenishment MSOs don't have to order products themselves. The orders for replenishment MSOs are created by the Customer Service department based on the forecasts received from the control function, the current stock levels at the MSO, and the available production capacity. The outputs of the order flow consists of handled orders. The order handling process is being executed by the Customer Service Export department.

Material flow

The input of the material flow consists of pallets with beer that have been produced by the production processes as explained in Appendix B. Each pallet contains a single type of product; Heineken Netherlands Supply does not produce mixed pallets. These pallets, also called ”finished product”, are wrapped in plastic and ready for shipment. Right after production the pallets arrive in the HNS warehouse in either Zoeterwoude or Den Bosch. As soon as they arrive on the warehouse floor, they have entered our system. Inside our system the material is being transported to the customer, where it comes out as output. The output of the material flow consists of the same pallets as the input, but now they are delivered at the customer's distribution center. As soon as the pallets arrive at the customer, they have exited our system.

Resource flow

The resource flow consists of the resources that are required to fulfill the function of the systems. The resources are assigned to certain tasks in the material flow, and they are released when the task is completed. In an industrial system this flow often consists of the employees and equipment. Usually the flow rate of the resources is much slower than the flow rates of the orders and products. People can be employed long-term, and means and equipment will usually be used for their economical lifetimes. Therefore we are not interested in the resource aspect in our PROPER-model. The resource flow will further be left out of the scope of this research.

3.2.2. Steady-state models

For each of the aspects that can be distinguished in the PROPER-model, a steady-state model can be made. For this research we will focus on the order flow and the material flow. As mentioned earlier the resources flow will be left out of the scope.

Steady-state: order flow

As explained in section 2.2, for export markets there are two different logistical models in use: make-to-order and replenishment. Both models have a slightly different order handling, as will be explained next.

Make-to-order

Make-to-order customers are managing their own stock levels, and are thus free to order what they want. However, all Heineken customers are expected to hand in a sales forecast at the Market Demand Management (MDM) department. The brewing process of beer takes almost a month, so HNS needs to have a global idea about how much beer is needed in the next few weeks, months, and even years. MDM is responsible for making sure these forecasts are up-to-date, which they share with the Tactical Planning (TSCP) department.

Make-to-order customers can place an order at the Customer Service Export (CSE) department of HNS. This order has to be more or less conform their forecast, that they have agreed upon with Market Demand Management. CSE enters the order in the order management system. This information is then shared with the Tactical Planning department, and tells Tactical Planning how many pallets of each product are needed in shipping week. Tactical Planning can then make the production planning for all breweries. They send the planning to the Operational Scheduling (OS) departments of both Zoeterwoude and Den Bosch, who can then make a detailed production schedule for their packaging lines.

Next, CSE cuts the order into separate deliveries, and then places those deliveries in one or more shipments. This information is shared with both OS departments, so they know which pallets need to be loaded into which truck or container, and they can make a loading schedule for the loading logistics departments.

As soon as OS confirms that the delivery is ready and will be picked up by the carrier, CSE sends a status update to the customer. When the truck has left, CSE prepares an invoice and sends it to the customer. The order is now handled, and the customer is waiting for its shipment.

Replenishment

The replenishment model is very similar to the make-to-order model, but replenishment customers don't manage their own stock levels. The minimum and maximum stock levels per product are fixed in agreement with MDM. The customer sends a weekly sales, stock and forecast update to MDM. MDM shares these forecasts with TSCP and CSE. Then all three departments create replenishment plans based on the customer's stock levels, the forecasts and the available production capacity. MDM looks at what would be best for the market as a whole, TSCP looks at how much of each product is available in shipping week, and CSE keeps the stock level between the minimum and maximum levels for each product.

Next, CSE compares and combines all three replenishment plans, and then enters the replenishment order in the order management system. CSE then creates deliveries and shipments, and the replenishment order continues the same way as the make-to-order order.

Steady-state: material flow

The finished goods, produced by the different breweries and co-fillers, enter the system boundary when they arrive on pallets in the HNS export warehouses. The export warehouses in Zoeterwoude and Den Bosch are managed by the Export Logistics departments. They are responsible for the warehouse management, and the loading of the products into containers and trucks.

Pallets that will be shipped in a container, are moved directly to the cross-docks (also called X-docks). Cross-docks are automatic sorting lanes to group all pallets belonging to the same shipment in front of the correct docking station. A container is ordered from the barge terminal close to the brewery, and arrives shortly after at the docking station. The container is loaded and then transported back to the barge terminal, waiting for transport to the sea terminal. This is the preferred way of handling the beer pallets. When pallets enter the cross docks they can be loaded and transported to the barge terminal very fast. Technically the pallets skip the warehouse, and thus don't require any storage space. The cross dock-percentage is an important KPI for the HNS warehouses. When the container is somehow delayed, the delivery isn't complete, or the products are in blockade (see subsection 3.2.2), the pallets are stored in the export warehouse instead of moving onto the cross dock.

Pallets that will be transported by truck, are always first stored in one of the HNS warehouses. When a shipment successfully arrives in the warehouse, Operational Scheduling receives a confirmation the next morning. OS will then order a truck from one of the carriers to come pick up the shipment the next day. The carrier can then make a time slot reservation himself in an online slot reservation system called *Transwide*. The carrier can select time slots that are still available and that suit the carrier. This way, products for truck transport are stored for approximately 48 hours before they are being shipped. This has two advantages. First, it ensures that the shipment is complete before the truck arrives. The time slots of 45 minutes are tight, and the fines for missing the time slot are high. Both the carrier and HNS want to make sure that no errors are being made so the loading can go smoothly. Second, it is a safety measure in case a product gets into a blockade, because the products will still be in the warehouse to check for errors.

OS then sends the loading schedule to the loading department. When the truck arrives, the pallets are loaded manually in the truck with a forklift. The truck then drives to the MSO distribution center, also called a Demand Point (DP). Some export markets only have one DP, others have multiple DPs. As soon as the truck has delivered the products, the shipment is completed. When all shipments of the

same order are delivered, the order is fulfilled.

It is important to understand that the customer's order is not delivered as a whole, unless the order consists of only one delivery, thus one truck. Trucks leave the warehouse as soon as a specific delivery is ready to be transported. For example: an order from a certain export market consists of 50 deliveries, so that are 50 truckloads. The departures of these trucks are spread over the week. The customer only knows that 50 trucks will arrive at their distribution center in a certain week, but they don't know when exactly these trucks will arrive. Only when Operational Scheduling can confirm that the delivery will be picked up by the carrier, they can share that information with the Customer Service Export department, who can then inform the customer about when to expect the shipment.

It is also important to understand that the MSOs are customers of HNS. They buy products from the Operating Company HNS. It does not mean however, that HNS is their only source. They are also be buying from other OpCos like Heineken France, Heineken Mexico, and Heineken Singapore. Other Heineken OpCos have a different production portfolio, so they could be selling their own unique products, products that are only produced and sold in a particular region, and products that are branded as *global*, but all at their own prices, depending on their operational costs. Heineken OpCos are competing with each other!

Although MSOs are the OpCos' customers, they are not the final customers. Export markets sell the products to the final customers, which can be wholesale, retail, or hospitality customers. These final customers are served the same way by the foreign Heineken office, as the Dutch wholesale, retail, and hospitality customers are being served by HNS. Ordered today, is delivered tomorrow. Also these final customers can order mixed trucks, because most of them aren't big enough to order full truckloads of a single product. Making mixed loads is therefore an important function of the foreign Heineken DC, just like making mixed loads is a function of the HNS domestic warehouses.

Blockade

When an error is discovered in a product, the whole batch is put in a blockade. This means that all pallets from this production batch are not allowed to be shipped, and that all pallets that have already left, have to be returned to the brewery for inspection. Loaded containers are usually waiting in the barge terminal near the brewery, so returning a container is inconvenient, but relatively easy. Loaded trucks are more difficult to return. They either have already unloaded the products at the customers, or they are already hundreds of kilometers away.

3.2.3. Current state: the steady-states combined

The steady-state models from subsection 3.2.2 can be combined into one overview, as seen in Figure 3.5. This is the current state of the beer transportation system. With this system model, the future states can be defined. Also, a definition of a Direct Delivery can be determined.

3.2.4. A Direct Delivery

With the help of the current state model as shown in Figure 3.5, we can finally try to see what a Direct Delivery is. A Direct Delivery is a delivery from HNS directly to the customer, skipping the MSO distribution center. This can be graphically shown when the MSO distribution center is removed from the model, as shown in Figure 3.6.

3.2.5. Affected components in the supply chain

Two processes in the order handling are directly affected by the implementation of a Direct Delivery, i.e. *Create Deliveries and Shipments* and *Create Shipment Update*. This is for the simple reason that the destination of the transport is going to change. In case the new destination is already known when

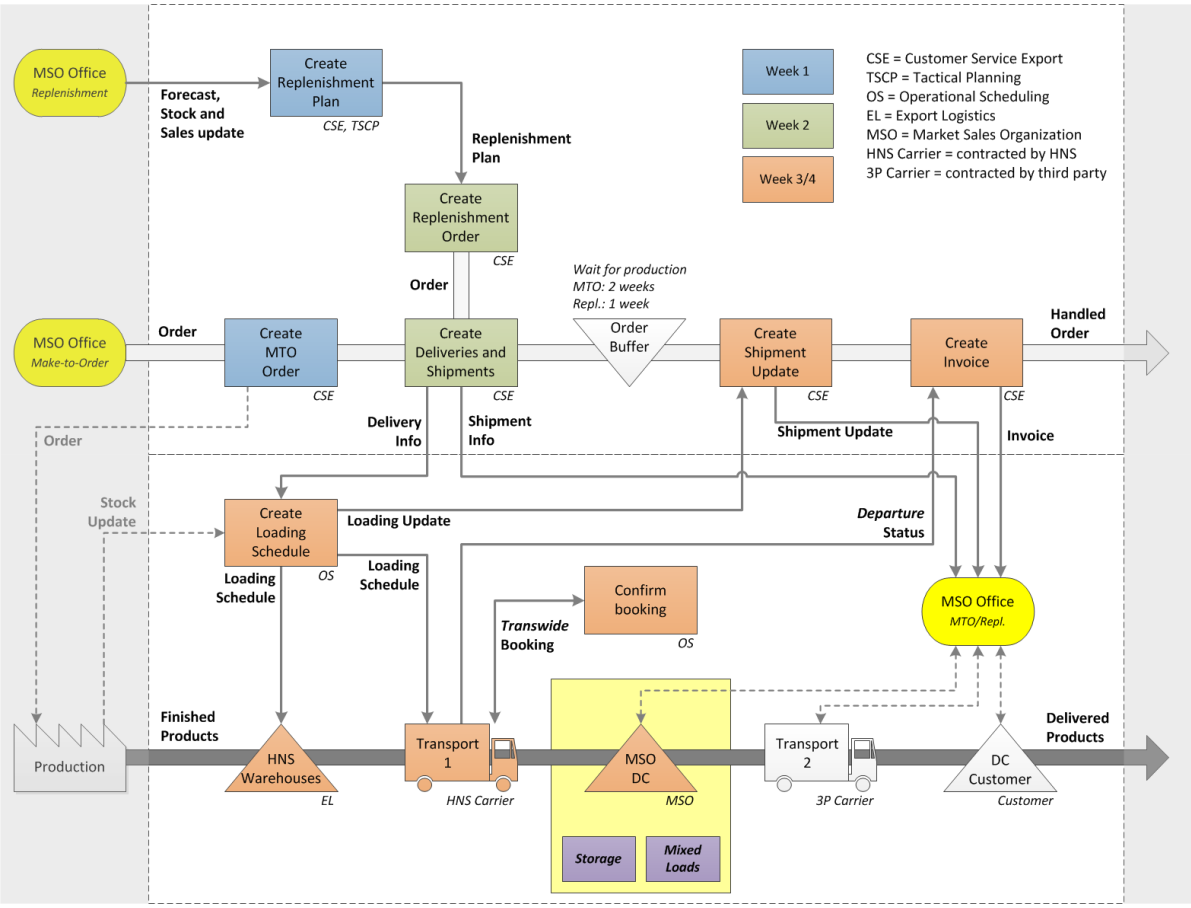


Figure 3.5: The steady-states combined: a detailed model of the current state.

the order arrives at HNS, the address can be added to the shipment information during the Create Deliveries and Shipments process. It can also happen that the final destination is not known yet during order entry, but that HNS receives that information during the production of the goods. In that case the new address can be updated in the shipment information in the Create Shipment Update process. The latter is the currently taking place with orders from Heineken Ireland. During the production process, when the order is waiting in the Order Buffer, Heineken Ireland tells HNS which containers need a different shipment address than the original Heineken Ireland warehouse address, so they will be delivered directly to Tesco, one of Heineken Ireland's largest customers.

When looking at the Direct Delivery model in Figure 3.6, a series of options appears between which a choice has to be made for the future states.

First of all, only one transport is required to transport the products from HNS to the customer. Either Transport 1 or Transport 2 has to be removed from the model as well. This creates a choice between a Drop-off and a Pick-up model for the future states. Transport 1 is being performed by a carrier that is contracted by HNS. Using Transport 1 in a future state represents a Drop-off scenario, where HNS takes responsibility for the delivery of the goods at the Customer DC. Transport 2 is being performed by a carrier that is contracted by a third-party. In the current state this is being done by the MSO. Using Transport 2 in a future state represents a Pick-up scenario, where the customer is going to be responsible for picking up the goods at the HNS warehouse.

It also becomes clear that two important functions that were previously being performed by the MSO DC, are now unfulfilled.

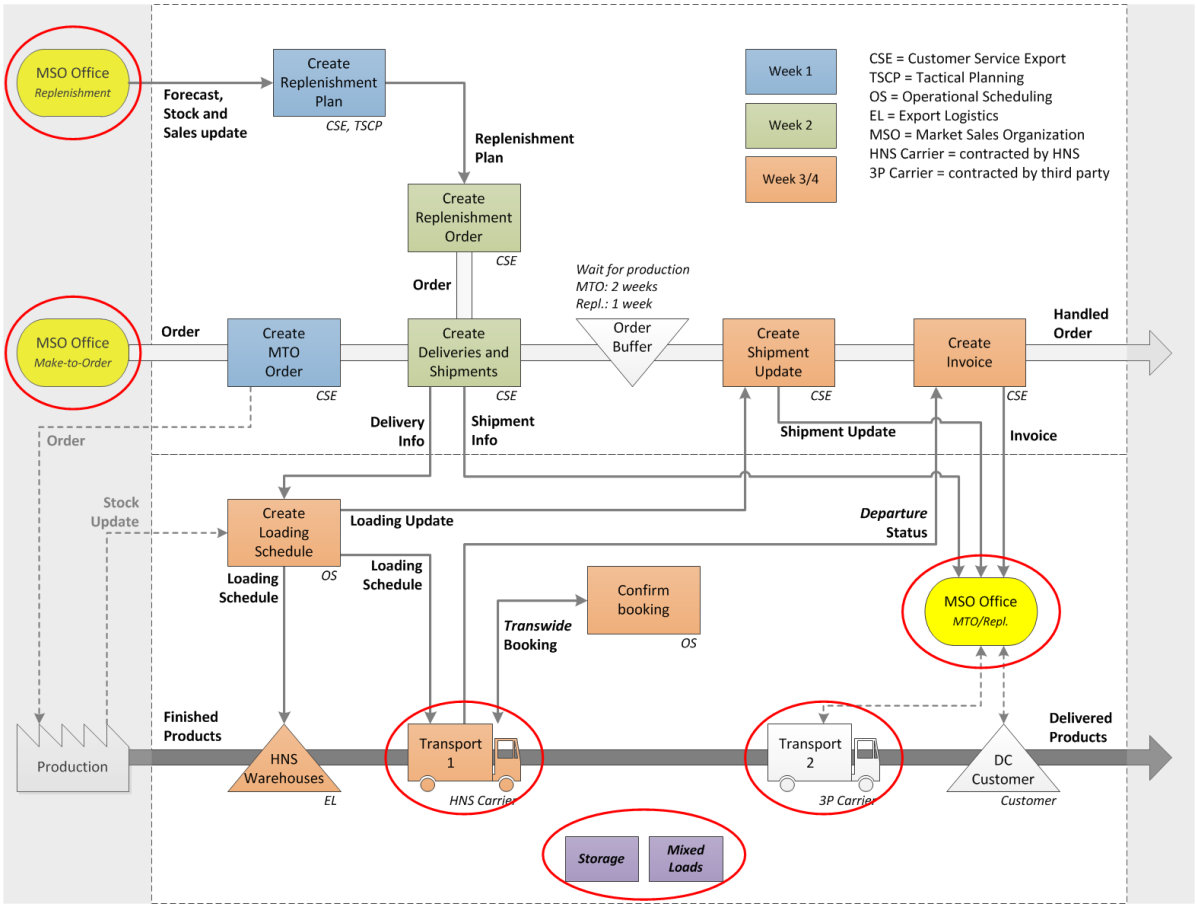


Figure 3.6: Graphical representation of a Direct Delivery, based on the detailed steady-state model, including the affected processes and stakeholders.

First of all, the MSO DC is being used to store the products until the customer needs them. The customer can order on a daily basis at the MSO Office, and is being resupplied on a daily basis from the MSO DC. This can be viewed as a make-to-stock supply model, the same model being used for wholesale and retail customers in the Netherlands. The MSO DC, on the other hand, is resupplied by HNS on a weekly basis, according to the make-to-order or replenishment supply models. The transition between the different models requires storage space. When the MSO DC is removed, this storage space is required somewhere else, either in the HNS Warehouse, or in the Customer DC. This basically means a choice of supply model for the Direct Delivery: MTO/Replenishment or MTS.

Second, the MSO DC is making mixed truckloads for their customers. As mentioned before, HNS preferably delivers products per full truckload, to avoid creating mixed trucks. However, the customer is generally not interested in full truckloads of a single product. In most cases the sales numbers are not large enough to sell a full truckload within the expiration time of the product, and there is not enough storage space to stock a truckload of every different Heineken product.

When removing the MSO distribution center, one further step is to completely remove all presence of the MSO in the model. This means that the MSO office is left out of the order and supply processes. This creates another choice for the future states: with or without the MSO.

Four different affected components can be identified from the definition of a Direct Delivery as described above.

1. Contacting party: MSO or customer?

2. Supply model: MTO or MTS?
3. Handling: Mono or mixed?
4. Transport: Drop-off or pick-up?

The combination of these four choices for the future states creates sixteen different future state models, as shown in

Table 3.2: Sixteen different future scenarios.

FS 1.	MSO, MTO/Rep, Mono, Drop-off	FS 2.	MSO, MTO/Rep, Mono, Pick-up
FS 3.	MSO, MTO/Rep, Mixed, Drop-off	FS 4.	MSO, MTO/Rep, Mixed, Pick-up
FS 5.	MSO, MTS, Mono, Drop-off	FS 6.	MSO, MTS, Mono, Pick-up
FS 7.	MSO, MTS, Mixed, Drop-off	FS 8.	MSO, MTS, Mixed, Pick-up
FS 9.	Customer, MTO/Rep, Mono, Drop-off	FS 10.	Customer, MTO/Rep, Mono, Pick-up
FS 11.	Customer, MTO/Rep, Mixed, Drop-off	FS 12.	Customer, MTO/Rep, Mixed, Pick-up
FS 13.	Customer, MTS, Mono, Drop-off	FS 14.	Customer, MTS, Mono, Pick-up
FS 15.	Customer, MTS, Mixed, Drop-off	FS 16.	Customer, MTS, Mixed, Pick-up

3.2.6. Affected stakeholders

The analysis of the PROPER-model and the subsequent Direct Delivery model have identified the components of the supply chain that will be affected by Direct Deliveries. All of these affected components have stakeholders tied to them that normally perform the related functions within the process. The identified stakeholders and their interactions are the departments of Customer Service Export, Operational Scheduling and Export Logistics, the MSO, the Carriers and the Customers.

3.2.7. Key Performance Indicators

The most important key performance indicators have been identified when describing the performance of the PROPER-model in subsection 3.2.1.

An overview of the KPIs, how they are measured in their target values are listed in Table 3.3.

3.3. Conclusions on the problem analysis

In the beginning of this chapter, five preliminary questions where asked:

1. What is the role of the Market Sales Organization in the supply chain?
2. What is the definition of a direct delivery?
3. Which components of the supply chain are affected by direct deliveries?
4. Who are the stakeholders related to these components?
5. Which Key Performance Indicators are currently in use and what is their current performance?

The first question can be answered with the findings from the supply chain analysis. From the supply chain analysis it can be concluded that the MSO is playing a central role in the beer supply chain between OpCos and customers. Five main function of the MSO have been identified. The MSO is *combining* the market demand, *collecting* the products from all the different OpCos, *creating* mixed loads for their customers, *connecting* the 'lean' to the 'agile' part of the supply chain by keeping buffer stock, and *carrying* the market risk by dealing with all their customers' issues and keeping additional safety stock.

From a supply chain point of view, the MSO is adding value right where it should be doing that: as far downstream as possible, with on the upstream side a long and lean part of the supply chain, and on the downstream side a short and agile part of the supply chain.

It is therefore unrealistic to completely remove the MSO from the supply chain. The MSO will stay in its place and will continue to do most of its work. Because of that, Direct Deliveries are only interesting

Table 3.3: Overview of the KPIs and how they are expressed.

Category	KPI	Unit
Service	Customer Satisfaction	[1-10]
	Carrier Performance	[1-10]
	No-shows	#
	Transwide changes	#
	Invalid bookings	#
	No bookings	#
	Failed safety tests	#
Costs	Transport Costs	€
	Warehousing Costs	€/HL
	Dumping Costs	€
Efficiency	Productivity	HL/FTE
	Case Fill Rate (CFR)	%
	Product Availability (PA)	%
	On Time (OT)	%
	In Full (IF)	%
	Stock Levels	# Pallets
	Residence Time	min
	First Time Right Order Management	%
	SAP Pollution	%
	Order Entry On Time	%
	Minimum Order Quantity	%
	Cyclicity	%
Sustainability	CO_2 emission	kg CO_2-e/HL

for certain products (fast-movers?) and for certain customers (wholesale?). Which products and which customers is something that has to be researched.

The other questions can be answered with the findings from the system analysis.

With the help of the PROPER-model and the subsequent steady-state models, we were able to graphically represent and define a Direct Delivery.

The parts of the supply chain that will be affected by Direct Deliveries have been identified: the contacting party, the supply model, the handling and the transport parts. Four choices have to be made, one for each part, resulting in a total of sixteen future Direct Delivery scenarios.

Also, the stakeholders that are related to these parts have been found. The stakeholders can be used later to find the impact of Direct Deliveries on their operations.

Finally, the relevant Key Performance Indicators were listed that are currently being used by Heineken to measure their performance. The changes of these KPIs can later be used to measure the impact.

Based on the findings in this chapter, the research questions and the corresponding approach for the rest of this report can be formulated in chapter 4.

4

Research questions

Based on the problem definition, the project scope and the analysis, the research questions will be formulated in this chapter.

From the problem definition and the project scope we know that HNS would like to know what the impact is of Direct Deliveries on their own organization. The MSO Heineken Germany has progressed the furthest with researching the possibilities of Direct Deliveries from HNS to their customers. The focus will therefore be on Direct Deliveries to Germany.

In the analysis we have seen that sixteen Direct Delivery scenarios can be constructed, based on choices that have to be made for four supply chain components that are affected by Direct Deliveries.

Based on these findings, the main research question can be formulated as:

> ***Which Direct Delivery scenarios for Germany have the highest potential cost savings without reducing the Heineken Quality?***

To find this impact, a definition of impact is needed. Therefore impact parameters are required, so the impact can be expressed. It would be obvious to use the KPIs that are already in use by HNS as our impact parameters. However, some may be more useful than others for our perceived goal.

The main research question can therefore be split into several sub-questions:

1. What are the impact parameters that define *Quality*?
2. What is the qualitative impact of Direct Deliveries?
3. What is the quantitative impact of Direct Deliveries?

Answering these sub-questions will hopefully give us an answer to the main research question.

4.1. Approach

The approach that will be used for the rest of this research follows the sub-questions that have been mentioned above, to ultimately answer the main research question.

In subsection 3.2.6, the stakeholders were identified that will be affected by Direct Deliveries. Within HNS, the departments of Customer Service Domestic, Operational Scheduling and Export Logistics are the most directly affected, as was shown graphically in Figure 3.6. To find out how their daily operations will be affected, a series of interviews will be conducted with people from these departments, both from the operational level as from the managerial level. As extra reference, the departments of Customer Service Domestic and Global Duty Free will also be included. The results from the interviews will be used to identify the impact parameters.

With the impact parameters known based on the interviews, the four affected components, as identified in subsection 3.2.5, will be evaluated against all these impact parameters. This will hopefully give an impression of the qualitative impact of Direct Deliveries.

As discussed before, the quantitative impact is more case-specific. With a case study for Direct Deliveries to Germany, the quantitative impact of Direct Deliveries can be researched. With the quantitative impact for Germany known, an impact model can be completed to give an overview of the impact to HNS by Direct Deliveries.

With the impact parameters, the qualitative impact and the quantitative impact, the main research question can be answered.

5 Literature review

5.1. Direct deliveries

The direct delivery model that is going to be researched is sometimes also called a *distribution center bypass*. Although it is difficult to find any scientific work for this term that is not medical related, several supply chain websites use it. Most of these web pages come with the same list of obvious benefits.

According to one these pages [23], a distribution center bypass has a number of significant benefits. It eliminates a shipment leg, thus decreasing the transport costs and transport time. It also eliminates a touch of the product, reducing distribution processing costs and product damage. Finally, a distribution center bypass can significantly reduce the total cycle time, which allows for inventory to be taken out of the system.

Askari and Nader [2] researched the impact of a distribution center bypass in the luxury fashion industry with a cost model, in which the transportation costs, facility holding costs, facility processing costs, ordering costs and pipeline costs were separately incorporated. It was found that the biggest impact on total costs are transportation and holding costs. They found that the benefits of centralization are a decrease in overall product touches, a decrease in total amount of inventory, and lead-time efficiency increase. As risks they mainly mentioned an increase in supply chain complexity.

In our situation, the MSO distribution center receives product streams from multiple OpCos, and distributes those product streams to multiple customers. The distribution center is a central hub in this system, which is called a hub-and-spoke system. A direct delivery system is seen as the counterpart of the hub-and-spoke system.

Liu et al. [17] studied a mixed truck delivery system that allowed both hub-and-spoke and direct shipment delivery modes. It was stated that the hub-and-spoke system is generally preferred, due to the higher delivery frequency, which is associated with a higher service quality, but that in cases where the delivery quantity is large enough to justify the shipping of goods with full truckloads, the direct delivery system is better. Therefore it is argued that a mixed delivery system can be better than either of the two pure delivery systems. The results showed that the mixed system can on average save around 10% of the total traveling distance compared to both pure systems. Since the transport costs are directly related to the travel distance, this would imply a reduction in transport costs as well.

5.2. Supply chain metrics

To evaluate the impact on the supply chain, metrics are needed to measure the performance. Many metrics have been proposed over the years in literature about supply chain management. A comprehensive overview of these metrics was presented by Gunasekaran et al. [8] who performed a literature

review on supply chain performance metrics and made a classification framework in the strategical, tactical and operational level.

However, more generally supply chain performance metrics are aggregated into four main categories, quality, service, cost and lead-time, as was presented first by Johansson et al. [15] in the total value metric, a means to calculate a supply chain's total value as can be seen in Figure 5.1.

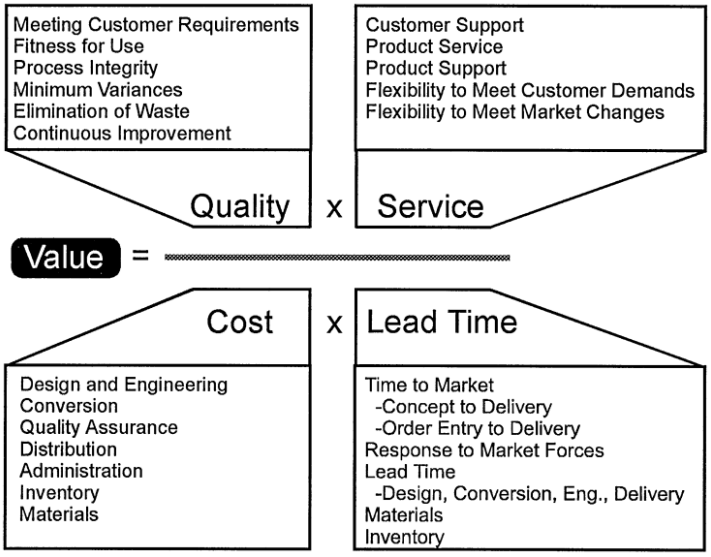


Figure 5.1: The supply chain total value metric. *Source*: Johansson et al. [15].

They also argued that the four metrics have relative importance, and that this relative importance changes over time and that it needs to be evaluated continually. Agarwal et al. [1] used the Analytic Network Process (ANP) to determine this relative importance, and presented a pairwise comparison matrix, shown in Table 5.1, based on experts' opinions from supply chain management.

Table 5.1: Pairwise comparison matrix for the relative importance of the determinants (consistency ratio: 0.016). *Source*: Agarwal et al. [1].

	Lead-time	Cost	Quality	Service level	
Lead-time	1	2.000	3.000	0.111	0.162
Cost	0.500	1	2.000	0.250	0.123
Quality	0.333	0.500	1	0.125	0.063
Service level	9.000	4.000	8.000	1	0.652

Furthermore, the equation in Figure 5.1 is particularly helpful as it emphasizes the futility of improving one performance measure at the expense of worsening another [4].

These same four metrics were also used by Mason-Jones et al. [19] in the market winner-market qualifiers matrix when discussing the differences between lean and agile supply chains. They found that cost is a market-winner for the lean supply chain, while quality, lead-time and service level are market-qualifiers, but that service level is a market-winner for the agile supply chain, while quality, cost and lead-time are the market-qualifiers, shown in Figure 5.2. Lean thus focuses on costs, and agile focuses on service level.

Beamon [3] performed a literature review on supply chain design and analysis. A distinction was made between qualitative performance measures, and quantitative performance measures. Some of the most relevant qualitative performance measures are customer satisfaction, flexibility, information and ma-

	Market Qualifiers	Market Winners
Agile Supply	1. Quality 2. Cost 3. Lead Time	1. Service Level
Lean Supply	1. Quality 2. Lead Time 3. Service Level	1. Cost

Figure 5.2: Market winners-market qualifiers matrix for agile versus lean supply. *Source*: Mason-Jones et al. [19].

terial flow integration and supplier performance. The quantitative performance measures are all measures based on cost, and measures based on customer responsiveness, such as the fill rate and the lead-time.

5.3. Customer order decoupling point

The customer order decoupling point (CODP) is the point in the material flow where the product is tied to a specific customer order [21]. The position of the CODP is related to the supply model chosen, i.e. make-to-stock, assemble-to-order, make-to-order, and engineer-to-order [14], as can be seen in Figure 5.3.

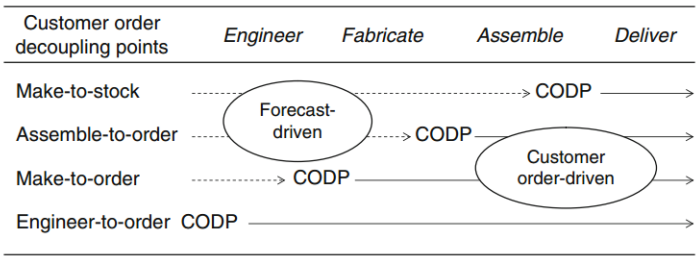


Figure 5.3: Different customer order decoupling points. *Source*: Olhager [21].

The CODP is an interesting point in the supply chain for a number of reasons. The CODP divides the material flow in two: upstream (forecast-driven) and downstream (order-driven). It also coincides with the main stock point, from where the customer order process starts and the amount of stock should be sufficient to satisfy demand in a certain period [26].

In our case there are two ways to look at the supply chain between HNS and the customer. The first way to look at it is how the supply chain is currently working. HNS and the MSO have a supplier-customer relationship, and the MSO and the customer have supplier-customer relationship as well. Both relationships have their own supply model, and thus their own CODP somewhere in the chain. According to Olhager [21] this is the company perspective, where the CODP can be positioned inside the manufacturing operations.

However, HNS and the MSO are both Heineken units. Although they are running their own businesses, with their own budgets, overall they have the same interests, which is to make Heineken a successful company. The second way to look at the supply chain is therefore from a more integral approach, as the supply chain between Heineken and the customer. Now Heineken and the customer have a supplier-customer relationship, with one supply model and one CODP. According to Olhager [21] this is the supply chain perspective, where there is typically one dominant CODP along the entire supply

chain flow. From the supply chain perspective, the MSO distribution center clearly is the CODP, which makes the entire supply chain a make-to-stock model.

5.4. Lean, agile, leagile

Naylor et al. [20] states that the CODP also has another function, namely as a divider between lean and agile operations in supply chains. Supply chain management knows two main approaches: lean and agile, described by Naylor et al. [20] as follows:

> *"Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place. Leanness means developing a value stream to eliminate all waste, including time, and to ensure a level schedule."*

The lean concept tends to work well when the demand is relatively constant and the product variety is low. The focus in lean is with cost effectiveness and level scheduling. Agile concepts on the other hand work well when the demand is relatively volatile and product variety is high [4]. Yusuf et al. [28] suggested that the agile approach originated from the need for flexibility and speed, both of which were constrained by mass automation when cost became the dominant factor after the introduction of lean manufacturing.

Another distinction between lean and agile is made by Purvis et al. [22], stating that the fundamental difference is the fact that they have different requirements for different types and levels of flexibility. Flexibility is the promptness and degree to which a firm can adjust its speed, destinations, and volumes [18].

Although lean and agile are mostly discussed as separate supply paradigms, both Naylore et al. [20] and Towill and Christopher [24] suggest that lean and agile do not necessarily have to be seen isolated, but can also be combined in a hybrid form: the leagile supply chain.

According to literature about leagile supply chains, upstream of the CODP there should be a make-to-stock model, while downstream of the CODP there should be a make-to-order model. Oddly enough, this is exactly the opposite of how we would describe the current supply chain between HNS and the customers.

6

Impact parameters

Impact in this research will be defined as a change of performance. Before the impact of Direct Deliveries can be found, impact parameters are required that will be used to evaluate the future scenarios. We have already seen what KPIs are currently being used to measure the performance in the supply chain and order handling process, and how they are expressed. An overview was shown in Table 3.3. It would be obvious to use these KPIs as a basis for the impact parameters. However, some KPIs are more useful for our research than others. In this chapter it will be discussed which KPIs are interesting for this report. Also it will be shown how these KPIs are used to define impact parameters, and how these impact parameters will be measured.

As was mentioned earlier, the KPIs can be grouped into qualitative KPIs and quantitative KPIs. For the impact parameters, the same distinction will be made:

- Qualitative impact
- Quantitative impact

6.1. Qualitative impact

The qualitative impact parameters cannot be based on hard data and are therefore not measurable for this research. The clearly qualitative KPIs that were found are the Customer Satisfaction and the Carrier Performance. However, for this research two extra qualitative impact parameters will be introduced: the order complexity and the warehouse complexity.

6.1.1. Customer satisfaction

The Customer Satisfaction is one of the most important KPIs for Heineken. Heineken has always been a service-oriented company, and their reputation as a brewer that always delivers is something they do not want to lose. Customer Satisfaction, however, is not something that is easy to measure. It depends on how the customers value your service.

The Market Business Partners, the customers' account managers within HNS, are constantly trying to find out what the Customer Satisfaction is. With the help of surveys that are send out periodically they collect feedback from their customers. The feedback they receive from all their customers is translated into a grade between 1 and 10 that indicated the Customer Satisfaction.

For this research it unfortunately means that it is impossible to measure the change of the customer satisfaction, and therefore the impact on it. However, it can not be ignored. Every change in the way of working has its effects on how the customers perceive the service delivered by HNS. Implementing Direct Deliveries will also most certainly influence the Customer Satisfaction.

6.1.2. Carrier Performance
The Carrier Performance is going to impact the service level of HNS, especially when HNS is not only delivering to the MSOs, but also directly to the customers. As for the Customer Satisfaction and the Order Complexity, it is impossible to predict how the carriers will perform with Direct Deliveries. Carrier Performance is therefore also a qualitative impact parameter.

6.1.3. Order complexity
The qualitative impact parameter order complexity will be introduced as a measure to describe the impact on the order handling process. Part of the order complexity is for example the First Time Right Order Management, a KPI HNS is currently using. The First Time Right Order Management (FTROM) is an efficiency measurement of the order handling process. It is used by the Customer Service Export department, and measures if the order handling is performed on time and without errors. As explained before, the the FTROM is measured as a percentage, being the product of several sub-categories: the SAP Pollution, the Order Entry On Time, the Minimum Order Quantity and the Cyclicity. In this research we will be unable to quantify the impact on this KPI, therefore it will be treated a part of the quality.

6.1.4. Warehouse complexity
The qualitative impact parameter warehouse complexity will be introduced to describe all impact on the warehouse operations, for example forklift movements, loading schedules, Quantifying the impact in the warehouse goes beyond the scope of this research, therefore it will be treated as part of the quality.

6.2. Quantitative impact
The quantitative KPIs can be calculated. They are based on hard data. For this research, the quantitative impact parameters will be the costs. More specifically, the cost savings that can be realize with Direct Deliveries. They will be used to express the yield of the future scenarios. Two types of costs will be included in the quantitative impact parameters:

- Warehousing costs
- Transport costs
- Case Fill Rate

6.2.1. Warehousing costs
One of the main reasons to start with this Direct Delivery project, is the opportunity to save on warehousing costs by skipping the MSO distribution center(s). It is not always exactly clear what the warehousing costs are or how they are calculated. In this subsection it will be evaluated what the best approach is to find these costs and what the estimated costs currently are. The warehousing costs can be sub-divided into the storage- and the handling costs. Letting pallets bypass the MSO distribution center frees up storage space, but that storage space is still going to be there, unused. Therefore it is expected that the handling costs will be the most significant.

Handling costs
The Handling costs are often expressed in euros per pallet per movement (€/pallet). The handling costs that will be saved by Direct Deliveries are of course the handling costs at the MSO distribution center.

The handling cost in the HNS warehouses are unfortunately unknown and cannot be deduced from the overall operating costs in the HNS warehouses. HNS calculates the total warehousing costs in euros per hectoliter (€/HL), but this does not tell us how much it costs to move a pallet. However, the amount of handling by HNS is not going to change in a Direct Delivery scenario. The demand is not going to change, so the same amount of pallets will have to be produced, stored (for an undetermined period),

and moved into the trucks for shipping. The total amount of pallets is not going change, so it can be assumed that the handling at HNS is also not going to change. The handling costs at HNS are thus not relevant.

No detailed information about the Heineken Germany handling costs was available, but according to Heineken Germany, their handling costs are [redacted] per pallet [10]. It is unclear how this was calculated, or whether these costs are per pallet flowing through the distribution center or per forklift movement. For this case study it will be assumed that the handling costs in the Heineken Germany distribution center are [redacted] per single movement. These handling costs are similar to the handling costs at Hartog & Bikker, who charges [redacted] per pallet per movement. This means that the handling costs per pallet are [redacted] in total per pallet, for an in- and out-movement of the distribution center.

Storage costs

Next to handling costs, warehouses and distribution centers also have storage costs, although storage costs are very difficult to identify. Ideally, storage costs are expressed in euros per pallet per week (€/pallet/week). As for the handling costs, the storage costs that will be saved depend on the storage costs at the MSO.

The storage costs at Heineken Germany are estimated at [redacted] per pallet per week [10], and it will be assumed that pallets stay in the distribution center for one week on average.

The warehousing costs are thus dependent on the number of pallets that flow through the distribution center. From Table E.1 it can be seen that the total number of [redacted] pallets were shipped by HNS to Heineken Germany. Now the total warehousing costs can be estimated, as seen in Table 6.1.

Table 6.1: Estimated warehousing costs in Germany in 2016.

[redacted]

The total warehousing costs are estimated at [redacted]. The warehousing costs savings are dependent on the number of pallets and therefore case specific. The warehousing costs savings will be further evaluated in the the case study in chapter 8.

External storage

Because the HNS warehouses are lacking of storage space, a lot of products are being stored in external warehouses. HNS has been working closely together with Hartog & Bikker. Hartog & Bikker owns warehouses right next to the Zoeterwoude and Den Bosch breweries, and HNS already makes use of their storage space as to outsource the logistics. Storing products at Hartog & Bikker is of course more expensive than storing it in the HNS warehouses, but HNS simply doesn't have enough space. The following price information for external storage is available:

The warehousing costs at Hartog & Bikker can become relevant in some Direct Delivery scenarios, depending on the supply model that will be chosen. That will be discussed later.

6.2.2. Transport costs

As was shown in Figure 3.6, only one transport is required, instead of two transports in the current situation. This means that the MSO does not have to hire a carrier to transport the products from

Table 6.2: Hartog & Bikker storage and handling prices.

their distribution center to the customer. Also, when skipping the MSO distribution center and driving directly to the customer, less kilometers will be driven in total. Direct Deliveries will therefore reduce the transport costs.

Currently, the transport costs are fixed in arrangements with the carriers through yearly tenders. HNS estimates, based on the forecasts, how many deliveries per route are expected for the following year. The carriers then returns with the tariffs per trip per route. These prices will be fixed for a year. In some special cases temporary arrangements can be made in between.

These tariffs are calculated by the carriers, and depend on many different factors. Some factors that are taken into account are:

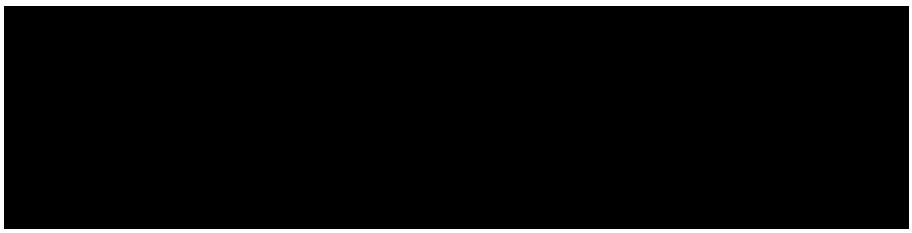
- How busy the route is;
- If it is a day trip or a night trip;
- If it is a single trip or a round trip;
- How many yearly trips are expected.

The transport costs to Germany are not exactly known, but with the tariffs and the available information about the deliveries, the The 2016 transport tariffs per route type to Germany are shown in Table 6.3.

Table 6.3: Transport tariffs per route type to Germany in 2016.

With this tariff list and the available delivery data, the total transporting costs to Germany for 2016 can be approximated. As can be seen in Table 6.4, the total transport costs to Germany are estimated at [redacted].

Table 6.4: Estimated transport costs to Germany in 2016, based on route tariffs.



However, these costs are only for the transport between HNS and Heineken Germany. The costs for the transport between Heineken Germany and the customers are unknown. Also, the above list presents

'fixed' costs, while a more generic transport cost calculation is required to predict the transport cost savings for Direct Deliveries.

An expression for the transport costs in euros per kilometer (€/km) is preferred. The Global Supply Chain department of Heineken is always trying to find relations for the transport costs around the world, so they can estimate the transport costs for budgeting purposes. For Northwestern Europe the following simple formula is often being used for calculating the transport costs in that region[7]:

$$C_T = 80 + 1 \cdot d \tag{6.1}$$

Where C_T are the transport costs in euros, and d is the travel distance in kilometers. Basically this formula says that the fixed costs for hiring a carrier are €80, and that the additional costs are €1 per kilometer. For a crosscheck this formula can be used to calculate the theoretical transport costs over 2016 based on the travel distance, and then compare those costs to the ones based on the route tariffs. The distance in kilometers between Den Bosch and Wesel is 125km, which means 250km for a roundtrip The distance between Zoeterwoude and Wesel is 173km, which means 346km for a roundtrip. The transport costs based on the travel distance can be seen in Table 6.5

Table 6.5: Estimated transport costs to Germany in 2016, based on the travel distance using (6.1).

The total transport costs based on the travel distance do not differ much from the transport costs based on the route tariffs. What is even more striking is that the total costs for the Den Bosch-Wesel roundtrip are equal, at [redacted] euros. Based on these findings, equation (6.1) is a reliable formula to calculate the transport costs. This equation will thus be used to estimate the transport cost savings.

CO2-emissions

The fact that less kilometers will be driven in the case of Direct Deliveries, also means that less CO_2 will be emitted by the trucks. As we have seen before, the CO_2 emission is one of the KPIs use by HNS to measure their sustainability. The CO_2 emission are measured in kilograms per hectoliter (kg CO_2-e/HL).

The CO_2 emissions are directly related to the amount of kilometers that are driven. According to the European Environment Agency the specific CO_2 emissions per tonne-km in Europe were 139.8 g/tkm (grams/tonne-kilometer) in 2014 [1].

Following the trend over the most recent years it can be concluded that the CO_2 emission per tonne-kilometer are decreasing by an approximate of 1 gram per year. This is probably due to the fact that older trucks are replaced by newer (Euro IV) trucks with less emissions. It can be assumed that by 2017 the estimated emissions are 137 g/tkm. This value will be used for further calculations. The CO_2 emission savings will be calculated with:

[1] https://www.eea.europa.eu/data-and-maps/indicators/energy-efficiency-and-specific-co2-emissions/energy-efficiency-and-specific-co2-9

$$E_{CO2} = 137 \cdot M \cdot D \tag{6.2}$$

Where 137 is the specific CO_2 emission value as calculated by the EEA, M is the mass in tonnes of the transported load, and D is the distance in kilometers that will be driven less because of a Direct Delivery. To estimate the total CO_2 emission the total kilometers driven en the load mass is required. The total distance driven is calculated by multiplying the route type distance by the number of deliveries on that route. In Table 6.6 it can be seen that an estimated total of 614.270 kilometers were driven to Germany in 2016.

Table 6.6: Total distance traveled to Germany in 2016.

		Distance [km]	
Route type	Deliveries	/trip	Total
Den Bosch - Oneway	333	125	41.625
Den Bosch - Roundtrip	2.211	250	552.750
Zoeterwoude - Oneway	17	173	2.941
Zoeterwoude - Roundtrip	49	346	16.954
Total	2.610		614.270

The average mass of a Full Truckload (FTL) is approximately 25.000 kilograms, or 25 tonnes. The total emitted CO_2 can now be calculated:

$$E_{CO2} = 137 \cdot 25 \cdot 614.270 = 2.104 tonne \tag{6.3}$$

6.2.3. Case Fill Rate

The Case Fill Rate (CFR) is an efficiency measurement of the supply chain performance. It measures the performance from the HNS warehouse till the customer. As explained earlier, the CFR is measured as a percentage, being the product of several sub-categories, i.e. the Product Availability, the On Time and the In Full. The Case Fill Rate can help us show the impact on the material flow from steady-state model in Figure 3.5.

6.3. Conclusions on the impact parameters

The impact parameters have been grouped and defined as follows:

Qualitative impact	Customer Satisfaction
	Carrier Performance
Quantitative impact	Warehousing Costs
	Transport Costs
	First Time Right Order Management
	Case Fill Rate

The qualitative impact is not case-specific, but more model specific. It depends on the choices that are made on the four supply chain components that make up the sixteen Direct Delivery scenarios. Based on the interviews and logic reasoning, it can only be guessed what the impact of Direct Deliveries on these impact parameters will be.

The quantitative impact, we will be able to calculate. The quantitative impact depends on numbers, and is therefore case specific. To find the quantitative impact, a case study on Direct Deliveries to Germany will be performed.

7

Direct Delivery consequences

Based on the Direct Delivery model that was shown in Figure 3.6, four main choices have to be made for different Direct Delivery scenarios. The choices that were found are:

1. Contacting party: Market Sales Organization or Customer?
2. Supply model: make-to-stock, make-to-order or replenishment?
3. Handling: only mono or also mixed?
4. Transport: drop-off or pick-up?

In this chapter these choices will be evaluated individually, and all the consequences per variant will be discussed.

7.1. Contacting party: Market Sales Organization or Customer?

The whole point of Direct Deliveries is to skip the MSO distribution center and delivering the product directly to the customer, thus influencing the material stream. The question is if Direct Deliveries are also going to influence the order stream. The first component therefore is the contacting party, where the choice is to let the orders come to HNS through the *MSO* or directly from the *Customer*.

It can be argued that also skipping the MSO in the ordering process saves time, and can thus be beneficial for the flexibility towards the customers, but there are a number of downsides to dealing directly with the customers.

Language barrier

The first problem that arises when HNS is going to deal with customers directly, is the fact that there will be a language barrier. Heineken is an international organization, and for the MSOs it is normal to communicate in English with the OpCos for international trade, but the customers are mostly local businesses. The HNS export team must be capable of communicating in either Dutch or English. Although some operators can speak a little German or French, these languages are not required and it cannot be expected from all of HNS employees. Placing orders at HNS will have to be done in English. This might be a problem for foreign customers. The customers probably prefer placing orders in their native language.

It is difficult to determine the impact of a language barrier, as is also noted by Feely and Harzing [6], because it cannot be evaluated using simple quantitative measures . Instead, the true cost has to be seen in terms of the way it distorts and damages relationships, as described in their *sociolinguistic theory*. "*In summary*", they say, "*it is worth noting that the language barrier triggers a whole range of negative consequences*". With respect to buyer/seller relationships, they even state that communication in a seller's second language makes that party appear "*less able, less credible, less likable and ultimately less*

persuasive", and that as a consequence "*companies in general have more success selling to countries that share the same language*". This also goes for the buyers, who "*are likely to demand that negotiations are conducted in the language of the customer. Companies unable to work in the language of the customer will therefore, under-perform in export markets relative to their more linguistically able competitors*".

These findings are backed by Kim and Mattila [16] in their research on the issue of language barriers during so-called *intercultural service encounters*. Their findings suggest that a "*...language barrier generates negative emotional and cognitive responses, and prevents customers from taking certain actions such as seeking necessary information or complaining about service failures*".

Because of this it can therefore be assumed that not being able to communicate in the customer's language not only has a negative influence on the Customer Satisfaction, but also distorts the reliability of customer surveys because customers, while being less satisfied, are also less likely to share their honest opinion.

Extra orders
Second, it was already determined that the MSO is not going to be removed completely. The Direct Delivery customers still have to order smaller quantities and all their non-HNS products at the MSO, and the MSO still has to order products for non-Direct Delivery customers at HNS. Letting the customers order directly at HNS thus only creates double order streams, making the order handling unnecessarily complex and possibly reducing the customer satisfaction.

Extra customers
Finally, it basically means that HNS gets extra customers, next to their normal base of customers, the MSOs. Extra customers require extra customer management. It requires regular contact with more different people. The weekly consolidated order by the MSO is now cut into multiple smaller orders, which means more order complexity. In case of disturbances, for example in out-of-stock situations or a recall, more different parties need to be contacted.

The easiest way is to stick with the current way of working: the customers order at the MSO, and the MSO orders at HNS. The only thing that is changing in this scenario is the ship-to address. The MSO has to let HNS know what the new ship-to is of a certain delivery. This system already exists for Heineken Ireland, and only adds a little order complexity because some last-minute changes need to be made to certain deliveries.

To summarize, having the customer as a direct contacting party means:

- Creates a language barrier → *Decreased customer satisfaction*
- Extra order for both customer and MSO → *Decreased customer satisfaction*
- Extra customer management for HNS → *Increased order complexity*

Keeping the MSO between the customers and HNS for the order flow means:

- MSO must update HNS with a new ship-to address → *Increased order complexity*

It is clear that having the customer as a direct contacting party makes things unnecessarily complex. The MSO should stay in the middle to **combine** the orders and deal with all other customer service issues to their customers, in other words, **carry** the market risk.

7.2. Supply model: make-to-stock or make-to-order?

The supply model between HNS and the MSOs is either make-to-order or replenishment. The supply model between the MSOs and the customers is similar to make-to-stock. When the customers are going

to order directly at HNS, a discrepancy arises between the conventional supply models. The second component of the Direct Delivery model therefore is the supply model, where a choice has to be made between *make-to-order/replenishment* or *make-to-stock*.

For HNS, the advantage of the the make-to-order model is the weekly drumbeat of the order management, and the replenishment model has the extra advantage of giving HNS more flexibility in the order sizes depending on the available production capacity. Sticking to the make-to-order or replenishment models has no impact on the current order handling and operations. The safety stock remains at the MSO.

For the customers on the other hand, the make-to-order/replenishment model has a big impact. First of all, the customers have to change their order behavior and deal with much longer lead-times. Currently the customers are used to order on a daily basis at the MSO, and receiving their products the next day. In a make-to-order or replenishment situation, the customer will have to adjust to the weekly order drumbeat of HNS, and after that they have to wait for the production of their order. This takes at least three weeks in the case of make-to-order, and 2 weeks in the case of replenishment, plus the transport time. The customers will experience Heineken as less flexible and customer friendly, and could mean a decrease in Customer Satisfaction.

Also, the buffer stock at the MSO has an extra safety function in the case of disturbances. In most of the cases when something turns out to be wrong with a certain product, the fault is detected before the products are loaded into a truck. But in some cases the fault detection takes longer. When this happens, the products are in the MSO distribution center. The MSO can be contacted and the products can be recalled. With Direct Deliveries however, the products might be already in the customers distribution center.

On the upside, customers receive a fresher product if they are resupplied with via make-to-order or replenishment. Normally the products are in stock in the MSO distribution center for two or three weeks, but now the products go straight from the production lines to the customers.

The service to the customers can be increase by offering them the replenishment model. HNS will manage the stock levels of individual customers instead of only one MSO. To do this, information about forecasts, current stock levels and actual sales is required from all these different customers. This will require active order management by the export department, and means a lot of extra work.

For the customer this is an extra service since they don't have to think about their stock levels themselves. They can agree with HNS on maximum and minimum stock levels, and HNS will make sure the actual stock will stay between those two values.

Being responsible for the customers' stock levels, means preventing them going out-of-stock.

However, an out-of-stock situation, that can always happen, and in this case it will mean that the customer will go out-of-stock. Currently this risk is with the MSO. Going out-of-stock means that the MSO will go out-of-stock. This is of course a small crisis, but it often can quickly be resolved by either shifting products from less important MSOs to the out-of-stock warehouse, or by just increasing production for the following week and hoping that orders for the specific products are less than expected. Most of the time the customers won't even notice that the MSO was ever out-of-stock. But if the customers themselves go out-of-stock, it's a different story. First of all, it is very bad for customer satisfaction and will reflect badly on all of Heineken. Second, who is to blame for the out-of-stock situation? Did HNS fail with their replenishment management? Or did the customer fail with their forecasts? This is always a point of discussion. Finally, the customer will most certainly file a claim against HNS for missed revenues and the damage of their company's image because of angry consumers. These claims can be

so high that they can completely cancel out all Direct Delivery benefits, but the damage to Heineken's image could be even worse... The importance of having a safety stock between the breweries and the customers becomes awfully clear.

If HNS wishes to provide their Direct Delivery customers with the same Heineken service that they are used to, they will have to start supplying them with a make-to-stock model. Switching to the make-to-stock model means that HNS is going to keep all the products in stock in their warehouses. Having all products for a specific export market in stock will require a lot of extra storage space. HNS does not have that storage space itself, so extra space needs to be rented at Hartog & Bikker. This very expensive. The extra storage costs potentially cancel out the initial Direct Delivery savings.

It also means that HNS has to switch to daily order input and management for export customers. Daily order management is already the way of working for the domestic department, but the question arises who is going to do these new orders for foreign customers. Either way, this will require a lot of extra work and increases the order complexity.

Finally, when keeping products in stock there always is a risk of obsoletes: products that do not get sold before the expiration date. Obsolete products are dumped, which requires dumping costs.

To summarize, sticking with make-to-order means:

- Current way of working for HNS → *No impact on order handling*
- Fresher products for customers → *Increased customer satisfaction*
- Much longer lead-times for customers → *Decreased customer satisfaction*
- Customer adjustment to weekly drumbeat → *Decreased customer satisfaction*
- Extra work in case of disturbances → *Increased order complexity*

In addition to sticking with make-to-order, the replenishment model means:

- Extra service for customers → *Increased customer satisfaction*
- Extra Demand Point management for HNS → *Increased order complexity*

Switching to make-to-stock means:

- Customer receives the same service level → *Same customer satisfaction*
- Extra storage space required → *Extra storage costs*
- Daily order management for HNS → *Increased order complexity*
- Risk of obsoletes → *Extra dumping costs*

7.3. Handling: only mono or also mixed?

In section 3.1 it was shown that the transport between the OpCos and the MSOs consists mostly of mono trucks: trucks loaded with only one product type. The transport between the MSOs and the customers on the other hand consists mostly of mixed trucks: trucks loaded with more than one product type. Creating mixed out of mono is one of the identified functions of the MSO. The handling is therefore the third component of the Direct Delivery model, where a choice has to be made if HNS is going to directly deliver *only mono* trucks or *also mixed* trucks.

HNS prefers delivering mono trucks. There are a few reasons for that. First of all, mono trucks decrease the handling complexity in the warehouses. Different products are stacked on different pallet types, each type with its own dimensions. Each type of product therefore has its own loading pattern, which is how the pallets are oriented, optimized to fit as many pallets of that product into one truck. Mixing different products thus creates some challenges for fitting differently sized pallets into the same truck. Also, when every truck is loaded with only one type of product, the forklift drivers do not need to keep

track of how many pallets of each product they need to load into a particular truck. The forklift drivers only need to know which type of product needs to go into which truck, and the associated loading pattern for that particular product. The only thing they need to do next is keep driving to and fro the same pallet stack until the truck is fully loaded. The simplicity greatly reduces the risk for errors in the loading process.

Secondly, loading mono trucks minimizes the required storage space in the HNS warehouses. This is because all products are produced in batches. When a batch is finished, the pallets enter the warehouse. The pallets need to be shipped as soon as possible, to free up warehouse space for new products. This means that the whole batch needs to be shipped as soon as possible after production, without having to wait for other products to finish, thus creating mono loads.

So, loading mono trucks is the least complicated and the least expensive. HNS can afford itself to stick with mono trucks because the number of Demand Points per MSO is limited, which means that the stream of products to the MSOs' distribution centers is consolidated. The demand per product type per Demand Point is large enough to ship full truckloads of each product.

On the outflow of the MSO distribution center however, the products are distributed to many customers, with even more distribution centers. The product streams get segmented, because most of the times the customers are not interested in full truckloads of the same product. They want to order one truck with all the products they need.

Sticking with mono trucks for Direct Deliveries therefore creates two problems. It can either mean that HNS has to make customers order a full truckload of a single product, thereby forcing the customer to order larger quantities than required, which also means that the customer requires extra storage space for that particular product. Customers will of course not be very happy about that, and maybe they will demand an extra discount for the inconvenience. It also may reflect on the Heineken flexibility, and has a risk of reducing customer satisfaction.

Or it means that Direct Deliveries have less potential, because Direct Deliveries can only take place to customers that already order mono trucks from the MSO. As mentioned before, there is currently no knowledge about the exact composition of the product streams from the MSO to the customers. It is unknown how many mono trucks currently leave the MSO distribution center, but as was already discussed earlier only the largest customers and the products with the highest volumes are eligible for Direct Deliveries.

The only way to increase the Direct Delivery potential is to start creating mixed loads at the HNS warehouses, thus enabling Direct Deliveries to many more of the MSO customers. For the customer it is all the same. They receive the same products and service as they would receive from the MSO, so no changes there. However, creating mixed loads can have a large impact on HNS.

First of all, creating mixed loads increases the handling complexity in the warehouses. Forklift drivers cannot just load thirty of the same pallets into a truck, but they will have to accurately keep track of how many pallets of each product they are loading. This increases the risk for errors and thus for wrongly delivered products, and decreases the warehouse quality.

Second, creating mixed loads require more storage space. Pallets cannot be loaded directly after production, because not all products for the delivery are available in the warehouse yet. This probably means that products will have to wait in the warehouse until all the products for a specific delivery are available, and that extra storage space is required because of the longer pallet dwell times. The increase of the pallet dwell time, and thus the increase of required storage space, can be limited if the Operational Scheduling department, when making the production planning, takes into account the composition of

the mixed loads, and makes sure that the production runs of products in the same delivery are scheduled simultaneous or consecutive. However, as was explained in chapter 2, the production planning is already completely focused on something else: maximum output. The extra required storage space requires extra storage costs. The only exception is when the make-to-stock model is chosen for a Direct Delivery model as well. Because all the products are already in stock, there is no *extra* storage space required for creating mixed loads.

Finally, there is a chance that mixed loads will contain both products that are produced in Zoeterwoude and products that are produced in Den Bosch. This means that either inter-brewery (IB) transport is required to get all products for one delivery to the same location before shipping, or the carrier needs to visit both breweries to pick-up all products for the delivery. This of course increases the logistical complexity, and requires extra transport costs.

To summarize, only delivering mono trucks to Direct Delivery customers means:

- No change in current HNS way of working → *No impact*
- Customers can only order full truckloads → *Decreased customer satisfaction*

  or
- Direct Deliveries are only interesting for a few customers → *Low Direct Delivery potential*

Also creating mixed trucks means:

- Complex forklift movements → *Increased warehouse complexity*
- More storage space required → *Extra storage costs*
- More inter-brewery transport → *Extra transport costs*
- Direct Deliveries for many customers → *High Direct Delivery potential*

7.4. Transport: drop-off or pick-up?

The fourth and final component is the transport model, where a choice has to be made between *drop-off* or *pick-up*.

7.4.1. Drop-off

HNS delivers nearly all of its products. That is, HNS takes the responsibility for all transportation of their products from the HNS warehouse to the MSO distribution center. Delivering the products like that will be referred to in this report as a 'drop-off'. Dropping off the products is the current way of working for HNS. This means that when choosing the *drop-off* option for a Direct Delivery scenario, nothing really changes for HNS, except for the fact that a new *lane* has to be created in the order management system, and that this new lane needs to be tendered with the carriers. The biggest consequence however is for the carrier. The ship-to address changes, so the carrier has to drive to a different destination than the original location of the MSO. This could also mean that both the distance and the transport time increase, and thus the lead time.

7.4.2. Pick-up

The opposite of a drop-off is a 'pick-up', which is when the customer comes to the HNS warehouse to pick up the ordered products. Some customers prefer this way of working, and in some other countries customer pick-ups are more common than in the Netherlands, for example in Germany, where around 80% of the orders is being picked-up at the Heineken Germany distribution center in Wesel. More about this will be discussed in the case study in chapter 8.

Customer pick-ups used to be quite common for HNS as well. More recently however, the policy trend has been to completely ban them, and consequently they have been phased out. Today, customer pick-

ups only occur on special occasions, or for customers who still have running contracts (Service Level Agreements) that allow pick-ups to take place, but new customers or renewed contracts do not get the pick-up option.

There are multiple reasons why HNS thinks pick-ups should not be allowed. By definition, a pick-up means that the customer is responsible for arranging the transport from the HNS warehouse to its own distribution center. They will hire their own carrier for this, and chances are that this is a (foreign) carrier unknown to HNS.

One of the main problems that HNS is having with unknown carriers is that there is less destination certainty. It may seem far-fetched, but this is a real issue. The risk that the products end up being somewhere where they are not supposed to be, is always present. But when some unknown carrier comes to pick up the products, this risk is increased. Global traders may get their hands on the products, which means that the beer can end up in so-called *grey markets*. Grey markets are not illegal, but they could include parts of the world where HNS does not want to be seen doing business. When HNS delivers the products at the customers' distribution center themselves, or with a trusted carrier, at least they know for sure where they left the products, and that the products are halfway to the intended consumer.

Also, foreign carriers bring foreign truck drivers, and this means an extra language barrier. Not only can this be very bothersome for the people working in the HNS warehouses who have to deal with the truck drivers, this also can be a problem for entering the brewery terrain at all. All truck drivers have to pass a safety test once before they are allowed to enter the brewery terrain. This test has to be made in Dutch, English or German. Currently there already is a problem with foreign drivers, driving for Dutch(!) carriers, that don't possess the required language skills to successfully pass the test. When a driver fails the safety test he is not allowed to enter the brewery terrain, and thus is unable to load his truck with the shipment. Another truck driver, who either already past the test before or is certainly able to pass it, has to come to drive the truck over the brewery terrain to the loading dock. In the meantime, the products are waiting at the loading dock, blocking one of the scarcely available warehouse outputs. When the new truck driver finally arrives, the time slot of 45 minutes has passed and a lot of rescheduling has to be done to squeeze the truck somewhere in the loading schedule. This can be avoided with very strict rules on the truck driver requirements, but it is expected that the risk for unqualified truck drivers at the brewery gates will increase with foreign carriers, resulting in more failed safety tests. This decreases the carrier performance.

HNS has to start dealing with more different carriers if customers are sending their own carriers to pick-up the products. More different carriers also means more different carrier equipment. Heineken sets high standards for the quality of the carrier equipment. The trucks are loaded with forklifts, and a full truckload of beer typically weighs around 25 tonnes, so the equipment needs to be able to handle those loads safely. The carriers that deliver the products are like HNS's business card towards the customers, and HNS want to make a good impression as part of their customer service. Therefore they do not just want high quality equipment, but it also just needs look good and trustworthy, so new and shiny trucks are preferred. Because the product is prone to external damage during transport, the drivers must be able to do their work safe and professional. When customers are sending their own carriers to come pick-up the products, HNS doesn't know what to expect and the risk for bad equipment and unqualified drivers increases.

Not only can the equipment be of bad quality, it can also be the completely wrong equipment. For example, HNS can only load trucks from the back, not from the side. At the HNS warehouses, the trucks are loaded by forklifts who drive in and out of the trailer, and this needs to be possible. At Hartog &

Bikker however, the trucks are automatically loaded with chain rails, that also need to be present in the trailer to work. Also, all SKUs have their own loading patterns and can only fit specific trailer sizes. Direct contact between HNS and the carriers makes is easier to tune the loads to the trailers.

Finally, carriers that have to come from other countries to pick up the products have a higher risk of not arriving on the agreed time. The loading time slots at HNS are set as strict as possible. The more time slots, the more trucks and containers can be loaded per day. The downside of short time slots is of course that if anyone is delayed, this has a huge impact on the loading schedule. The margins are small so it is difficult to make up for lost time. When a driver misses his time slot it requires a lot of rescheduling to get that truck loaded. In the meantime, the products cannot be loaded and take up valuable warehouse space, potentially blocking the warehouse operations. All of this needs to be avoided at all costs. The longer the truck has to travel to get to HNS, the higher the risk it will arrive to late, although it is unsure if this effect is noticeable for travel times from surrounding countries. For example, the glass suppliers from the United Kingdom are usually on time for their time slot. Good arrangements with carriers have to be made to prevent a decrease of the carrier performance.

For all the above reason HNS prefers to work with a select group of well-known carriers that are trusted to have the equipment that meets these high standards.

7.5. Other things to consider

Next to the general impact and the scenario-specific impact, there are several other subjects that need to be taken into account before implementing Direct Deliveries.

1. Demand Point specifications for truck unloading compatibility.
2. Excise duties on alcohol within the European Union.
3. Product freshness management.
4. Slow-mover build-up

7.5.1. Demand Point specifications

For the truck transport in Europe, HNS is using the services of many different carriers. Those carriers are all operating different fleets of trucks, with different specifications. But not all trucks are suitable for transporting HNS products, and not all trucks are suitable for delivering products to certain locations. For example, in Germany only lightweight trailer are allowed. This means that all trucks going to Germany must be lightweight trailers. This also imposes restrictions on the maximum loading weight. These things need to be taken into account when creating the shipments in the order management system, and when selecting the carrier.

Several truck specifications are important factors in choosing a suitable carrier. Examples of these specifications are:

- Maximum loading weight
- Weight of the trailer
- Soft- or hard cover trailers
- Back- or Side load trailers

The variances in trucks is also imposing requirements on the demand point specifications. Not all truck types are compatible with all warehouse types. What type of warehouse is it? How many unloading docks are present? What type of unloading docks? Are there back- or side loaders present? Is the warehouse also opened during the night?

Before starting Direct Deliveries, the Demand Point of the customer must be checked and it must be

made sure that the HNS trucks can successfully be unloaded there.

7.5.2. Excise duties

Under EU legislation, excise duties have to be paid on excise goods, including alcohol. These excise duties have to be paid at the final point of consumption. In order to make sure that the excise duties are properly paid, the movements of excise goods within the Union are closely monitored. This monitoring is done with the Excise Movement & Control System (EMCS).

The idea behind the EMCS is that excise goods can only be moved within the EU between special tax warehouses run by authorized warehouse keepers. 'Authorized' in this context means being authorized by the local fiscal authorities, e.g. the 'Belastingdienst' in the Netherlands. This means that excise goods can only be moved between locations within the EU that are registered and have a license to dispatch or receive excise goods.

This can be a problem for delivering excise goods directly to the customer, because if that customer is not an authorized warehouse keeper with a tax warehouse, receiving excise goods is not possible by EU legislation.

An exception to the rule exists. The 'receiving party', in our case the MSO, can apply for a Direct Delivery license at their local fiscal authorities, that will allow for the products to be shipped to a third party's warehouse, i.e. the customer.

So before considering the implementation of Direct Deliveries, it must always be verified that:

1. Either the customer is an authorized warehouse keeper himself, in possession of a tax warehouse;
2. Or the MSO is willing and capable of applying for a Direct Delivery license.

More about the EMCS system, the EU directive that covers the general arrangements, and the exception to the rule can be found in Appendix D.

7.5.3. Product freshness

Every batch of product is produced in a certain production week, and consequently that batch is labeled with the week number in which it was produced. This is called the product freshness. It is something that is easily forgotten, but it absolutely cannot be ignored in the case of Direct Deliveries.

Within HNS, a lot of attention is paid to product freshness. It is important that the warehouse works with a First In, First Out (FIFO) system. Once customers have received products from a certain batch, they will not accept to be resupplied with products from an older batch after that. This requires active product freshness management.

The MSOs of course also have this same problem with their customers. As long as they work with the FIFO system in their distribution centers, this it not a problem.

Direct Deliveries, however, can complicate things, especially since Direct Deliveries will not be for all customers. Because the MSO is keeping stock of approximately three weeks, the products that are shipped by HNS are three weeks fresher than the products coming out of the MSO distribution center.

This is of course good news for the customer who is being supplied directly from HNS. They receive very fresh products. But things will get complicated when they decide they want to order extra because the sales are higher than expected. Or when something goes wrong with production at HNS and the product is not available at all in the following week. Luckily in these cases, there is a safety stock for that. But the safety stock is in the MSO distribution center, and like mentioned before, these products have an older, or the same, production date than the products that were delivered in the first place.

The MSO has to keep track of the product freshness, because Direct Delivery customers now receive other batches of products than the conventional customers. This requires active freshness management by the MSO.

Please note that freshness management by the MSO is not required if the stock is not placed with the MSO but in the HNS warehouse, so when the *make-to-stock* option is chosen for the Direct Delivery model. In that case the products will be shipped according to the FIFO system. Consequently this means that the customer does not get a fresher product than in the current situation.

7.5.4. Slow-mover build-up

In Heineken jargon, a distinction is made between 'fast-movers' and 'slow-movers'. Fast-movers are products that always sell in large quantities. They are produced every week, most of the week, and take up the largest part of the total transport. The most popular brands, like Heineken beer, Amstel beer and Desperados are fast-movers. Slow-movers are products that are not sold very regularly. They are produced with a certain cyclicity, so not every week, and they are sold in smaller quantities, not in full truckloads. Because a truck is not going to drive with only a few pallets of a slow-mover product, the truck is filled up with a fast-mover. In this case the fast-mover is acting as a 'runner'. The runner is used to get the slow-mover to the customer.

This is problematic for Direct Deliveries. Direct Deliveries only make sense for mono trucks. Products in a mono truck are, almost by definition, all fast-movers. The slow-movers are not going to be delivered directly, unless both the *make-to-stock* and the *mixed loads* options are chosen for the Direct Delivery model. The slow-mover will thus be in stock in the MSO distribution center, while its runner will be transported directly from HNS to the customer. This can lead to a slow-mover build-up at the MSO, because there are not enough runners left to fill the trucks and get the products to the customers. This is not the responsibility of HNS, but it is something that the MSO must take into account before implementing Direct Deliveries.

8

Case study Germany

To find the quantitative impact, a case study will be performed. Multiple MSOs from neighboring countries have shown interest in Direct Deliveries by HNS in different forms. However, Heineken Germany has made the most progress in exploring the possibilities of Direct Deliveries to some of their customers. That is why the case study will be about Direct Deliveries to Germany.

8.1. Introduction Heineken Germany

Heineken Germany has been working on two separate projects on direct deliveries already. Unfortunately both projects are still unfinished and have shown little to no progress in the past months. This graduation project could serve as a kick-start for the implementation of direct deliveries to the German market.

Heineken Germany is a replenishment customer of HNS, so HNS keeps track of the stock levels and decides every week how much of each product will need to be shipped to Germany three weeks later to keep the stock between the minimum and maximum levels. Every year approximately 2,500 truckloads are delivered to the Heineken Germany warehouse in Wesel, close to Oberhausen and next to the Dutch border. Around 80% of the customers in Germany, most of whom are wholesalers, come to pick up their products at the warehouse in Wesel.

Special about the German beer market is that it, just like the Dutch beer market, is based on returnable bottles and crates. This makes exporting products to Germany more complicated because returnable packages have to return somehow. The logistics of these return streams are quite complex, and will be left out of the scope of this research. However, some remarks will have to be made later on.

The two projects that Heineken Germany is currently running are in co-operation with their two largest customers: Trinks and Lekkerland. Both Trinks and Lekkerland are large wholesale customers, responsible for further distributing all kinds of consumer products to supermarkets and the catering industry. The two different projects will be briefly introduced.

Trinks

Confidential

Lekkerland

Confidential

8.1.1. Product streams

Confidential

Figure 8.1: Product streams to and from Heineken Germany.[1]

8.1.2. Stock levels

Confidential

[1]Information adapted from Heineken Germany[9].

Figure 8.2: Stock levels in the Heineken Germany distribution center.[9]

8.1.3. Product portfolio

Confidential

8.1.4. Customers

Not much is known about the supply chain between Heineken Germany and the customers. It is unclear how many customers are being supplied by Heineken Germany, and what the total number of DPs is. The information that is known about the top-5 customers by volume is listed in Table E.2, together with the volume expressed as a percentage of the total approximated distributed volume. The volume distribution per DP is also unknown, therefore it will be assumed that the delivered volume is equally distributed among the DPs from a single customer, resulting in the average volume per DP.

8.2. Case study

For the case study a Direct Delivery destination and frequency is required, so this needs to be determined first. A logic first step is to start with mono loads only, and to find the volume per SKU per customer Demand Point that show a large enough demand to be eligible for Direct Deliveries. We are looking for suitable *SKU-DP combinations*.

8.2.1. SKU-DP combinations

The information from Table E.1 and Table E.2 can be combined. This can be seen in Table E.3. The percentage of the product streams per customer DP that were calculated can be multiplied by the number of yearly deliveries per SKU. The result is the average number of Full Truck Loads (FTL) per SKU per customer DP on a yearly basis, potentially identifying eligible SKU-PD combinations for Direct Delivery. For these calculations, two assumptions were made:

1. The product distribution between HNS and the MSO stays the same between the MSO and the customer DPs.
2. The DPs from a single customer all receive the same amount of products.

The first assumption is quite reasonable to make. Their is no reason to assume otherwise. However, the second assumption is most certainly not true. The DPs from a single customer have different sizes, and thus their demand is different. Unfortunately no detailed information about the volume distribution per DP was available, so this assumption had to be made.

Table E.3 shows how many FTLs per SKU are on average shipped to the customers DPs. The reason why this is interesting is because a FTL has the potential to be one mono truck Direct Delivery. Unfortunately the results do not look promising for the Direct Delivery potential. The table's highlights are summarized in Table 8.1, for the top-5 SKUs and the top-3 customers.

Table 8.1: Average FTL per SKU per customer DP per year.

Taking into account the fact that the products can be stored for a maximum of two month due to the sell-by-date, the FTL per customer DP needs to be at least 6 in order to deliver one mono truck Direct Delivery every two months. Only the first SKU in combination with the DPs from *Winkels* meets these requirements. *Winkels* has four DPs, so in theory this means that these four DPs can receive a Direct Delivery with SKU 120817 every two months. The second SKU comes close to 6 FTL for the *Winkels* DPs, so there is some potential there as well. Unfortunately, no more information about *Winkels* and its DPs is available, so this makes them unsuitable for the case study.

Because Heineken Germany is already working on the Trinks project, the two Trinks DPs in Berlin and Munich are of extra interest. For that reason those DPs will be chosen for the further case study. According to Table 8.1 the average FTL for the Trinks DPs is only 3,67 for the highest ranked SKU, which means that a mono truck Direct Delivery is only possible every 3,3 months. Based on these numbers the products will thus be stored longer than the sale-by-date of two months. However, for the case study it will be assumed that the two DPs in Berlin and Munich standard have a higher FTL per year than the other Trinks DPs, and that the for the case of Direct Deliveries Trinks can be persuaded to consolidate some orders into those DPs as well, thus raising the FTL per year to 12 for the Berlin and Munich DPs. This allows for two Direct Deliveries every month: one to Berlin and one to Munich.

These direct deliveries contain the highest ranking SKU, i.e. 120817, a certain crate with four 6-packs of 33cl bottles Heineken beer. The deliveries of this SKU contain 32 pallets per truck, as can be seen from Table E.1. The weight of a delivery can be estimated at approximately 25 tonnes. On average pallets will remain in the Heineken Germany distribution center for one week, because that is the size of the buffer stock since the distribution center can be seen as a static system as was discussed earlier.

8.2.2. Transport costs

As we have seen in subsection 6.2.2, the transport costs C_T are a function of the fixed costs per shipment and the transport distance, and can be calculated with Equation 6.1.

This means that the transport costs savings can be calculated by inserting the amount of kilometers that will be driven less than in the original situation. The distance from Den Bosch to Wesel is 122 km. The distance from Wesel to Berlin is 554 km. The distance from Wesel to Munich is 664 km. The direct

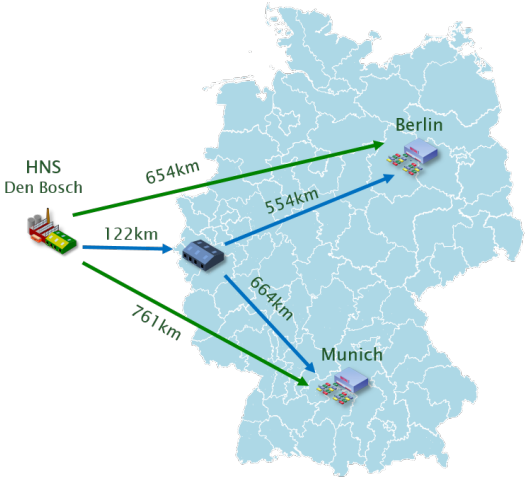


Figure 8.3: Travel distances.

Figure 8.4: Transport costs savings.

distance between Den Bosch and Berlin is 654 km, and between Den Bosch and Munich 761 km. These distances can be seen in Figure 8.3.

The amount of kilometers that will be driven less than in the current situation can be calculated:

Den Bosch - Berlin: $(122 + 554) - 654 = 22$ km
Den Bosch - Munich: $(122 + 664) - 761 = 25$ km
Total kilometer savings: $22 + 25 = 47$

These kilometer savings can be inserted in Equation 6.1:

Den Bosch - Berlin: [redacted]
Den Bosch - Munich: [redacted]
Total monthly savings: [redacted]
Total yearly savings: [redacted]

These calculations are not taking into account special transport tariffs for round-trips, night-trips, or busy transport lanes.

CO2 savings

The CO2-savings are, just like the transport costs a function of the travel distance, but also of the weight of the transport. The CO2 emissions can be calculated with Equation 6.2. The total kilometer savings of 47 kilometers can be inserted in this formula. The combined weight of the transport is $2 \cdot 25 = 50$ tonnes. Also, it was already found that the specific CO2-emissions for truck transport in Europe are 140 grams/tonne-kilometer.

Monthly CO2 savings $137 \cdot (2 \cdot 25) \cdot 47 = 322$ kg CO2
Yearly CO2 savings $12 \cdot 329 = 3.863$ kg CO2

This may seem like a lot, but it is an insignificant amount of CO2 compared to the current emissions.

CO2 impact

In Table 6.2.2 it was calculated that the total estimated CO_2 emissions are 2.104 tonnes per year. The CO_2 emission savings in the case study are 3.863 kg. The impact is thus -0,18%, as shown in Table 8.2.

Table 8.2: CO_2 impact.

	Emissions [kg]	Impact
Total emission	2.103.875	
CO_2 savings	3.863	+0,18%

8.2.3. Warehousing costs

As we have seen in subsection 6.2.1, the warehousing costs consists of the storage- and the handling costs. The storage costs at Heineken Germany were estimated at [redacted] per pallet per week, and the total handling costs were estimated at [redacted] per pallet per (double) movement.

It was determined that pallets stay in the distribution center for one week on average, so [redacted] is added to the costs to find the costs for a regular pallet movement: 2x handling + 1 week of storage. This comes down to [redacted] for a regular pallet throughput.

HGE Storage costs: [redacted]
HGE Handling costs: [redacted]
HGE Regular handling: [redacted]
Monthly warehouse savings: [redacted]
Yearly warehouse savings: [redacted]

The make-to-stock scenarios require the buffer stock to be moved to HNS, which means that the warehousing will be outsource to Hartog & Bikker. The storage costs at Hartog & Bikker are [redacted] per pallet per week. The handling costs are [redacted] per pallet per movement. In addition to the storage and handling costs, Hartog & Bikker charges shuttle costs between the HNS warehouse and their distribution center. These shuttle costs are [redacted] per pallet. A regular pallet movement thus costs 1xshuttle + 2xhandling + 1 week storage, which totals tot [redacted] per pallet:

HB Storage costs: [redacted]
HB shuttle costs: [redacted]
HB Handling costs: [redacted]
HB Regular handling: [redacted]
Monthly warehouse costs: [redacted]
Yearly warehouse costs: [redacted]

The warehousing costs at Hartog & Bikker are thus more expensive than the costs at the Heineken Germany distribution center.

8.2.4. Cost impact

With the cost savings known, the costs impact can be calculated compared to the estimated total costs. The total costs consist of the warehousing costs and the transport costs. The warehousing costs were estimated at [redacted] and the transport costs were estimated at [redacted] which brings the total estimated costs to [redacted].

The calculated savings were [redacted] on the transport costs, and [redacted] on the warehousing costs, adding up to a total savings of [redacted] for 24 Direct Deliveries per year. The impact of these savings on the total costs is 0,49%.

In the MTS scenarios, the pallets are being stored at Hartog & Bikker. It was calculated this requires extra expenses of [redacted]. This reduces the costs savings to [redacted] and subsequently the impact to only 0,13%, as can be seen in Table 8.3

Table 8.3: Cost impact.

[redacted]

8.2.5. Impact model

The Direct Delivery impact model for our case can be constructed, as shown in Table 8.4.

The qualitative impact is counted as the times impact is expected according to the scenario evaluation in chapter 7. We are not interested, for now at least, in the exact size of the impact, but merely in whether impact is expected or not. Counting the times that the parameters are mentioned will therefore suffice.

The calculated savings for transport and warehousing summed in the last column to show the project total savings for each scenario. For the cost parameters, the impact as compared to the estimated total costs is shown as percentages. So for example, the transport savings are compared with the total transport costs as calculated in chapter 6.

Two scenarios stand out: scenarios 1 and 3. They show relatively low qualitative impact, but still rank between the highest estimated savings. These models both have the MSO as a contacting party, make use of the make-to-order/replenishment supply model, and have a HNS carrier dropping off the products. The only difference is the mono versus mixed loads option.

8.3. Conclusions on the case study

Based on the case study it can be concluded that storage and handling at Hartog & Bikker is more expensive than at the MSO distribution center. Eliminates all scenarios that require storage space near HNS, thus the make-to-stock scenarios.

Overall it can be said that still the projected savings are marginal. Compared to the current expenses on transport- and warehousing costs, the savings are almost insignificant. Are these savings really worth all this trouble?

Table 8.4: Impact matrix for the Germany case study. (CS=customer satisfaction, OC=order complexity, WC=warehouse complexity, CP=carrier performance, TS=transport savings, WS=warehouse savings)

Even though some scenarios show a relatively low qualitative impact, they still show impact! HNS was very clear from the beginning: they do *not* want to give in on their quality. The exact impact is difficult to predict. Experience with a pilot program is required to determine the true impact on, for example, customer satisfaction and order complexity.

The fact that Germany is a returnable market, has been left completely out of the scope in this case study. However, that is not something that can be ignored if Direct Deliveries are really going to be implemented for the German market. More research on this topic is required.

9

Conclusions and recommendations

Based on the two analyses, the findings on qualitative and quantitative impact, and the conclusions on the Germany case, some more general conclusions on this research can be drawn. After that, this report will conclude with some recommendations for Heineken Netherlands Supply about what would be the best next steps in Direct Deliveries.

9.1. Conclusions

We have seen that it is unwise to remove the Market Sales Organization as a contacting party between Heineken Netherlands Supply and the customer. Talking in Market Sales Organization functions, this means that both the **combine** and **carry** functions should stay with the Market Sales Organization. Adopting these functions would bring too much responsibility to Heineken Netherlands Supply, and it is unlikely that Heineken Netherlands Supply is able to deliver the same level of service to the customers as the Market Sales Organization is currently doing, resulting in a lower customer satisfaction. This means that all the *customer* scenarios are eliminated.

It is also clear that the pick-up scenarios are not preferred. Pick-up deliveries have been phased out over the recent years, and company trend is too completely ban them in the future. Multiple underlying reasons can be pointed out for this, but the main reason is that HNS prefers to work with a select group of trusted carriers to assure a highest possible delivery quality. All the 'pick-up' scenarios are therefore eliminated.

Finally, the make-to-stock scenarios require moving the buffer stock from the MSO distribution center to HNS, and that means outsourcing the storage and handling to Hartog & Bikker, since the HNS warehouses are full. Any Direct Delivery-scenario that requires extra storage space at Heineken Netherlands Supply, therefore means that extra storage space needs to be rented at Hartog & Bikker. As became clear in the case study, storing products at Hartog & Bikker is more expensive than keeping the stock in Germany. It completely cancels out the potential savings on warehousing costs, and it even reduces the remaining savings on transportation.

At the same time this means giving in on supply chain agility, because compared to the current state nothing really changes except for the fact that the distance between stock and customer will increase. One could also argue if it even still counts as a direct delivery if the handling is not removed from the chain, but merely moved upstream from the Market Sales Organization distribution center to a Hartog & Bikker warehouse. Also, from the supply chain analysis in section 3.1 it already became clear that the Market Sales Organization is playing central role in the supply chain, and that this role should be played as far downstream as possible. In terms of MSO functions, **collect** and **connect** have to be fulfilled by the Market Sales Organization. The effect is that all the 'make-to-stock' scenarios are eliminated.

In chapter 4 the following research question was asked:

> ***Which Direct Delivery scenarios for Germany have the highest potential cost savings without reducing the Heineken Quality?***

As an answer to the research question, it can be concluded that only 2 of the 16 scenarios do not have direct negative impact on the HNS *quality*, and do therefore still qualify for Direct Deliveries.

As an answer to the research question, it can be concluded that none of the 16 scenarios have no expected quality reduction. However, the exact size of this reduction is unknown, an needs to be further evaluated. If it turns out that the -4 quality reduction can be overcome or is not high in reality, there are two scenarios that still show relative high cost savings, i.e. scenarios 1 and 3. These scenarios still qualify for Direct Deliveries.

In these scenarios the Market Sales Organization stays as a contacting party between Heineken Netherlands Supply and the customers, the supply model remains either make-to-order or replenishment, and Heineken Netherlands Supply makes use of their own carriers to drop-off the products. This is the most simple variant of the Direct Delivery scenarios. In practice this means that the Market Sales Organization places its weekly order, but tells Heineken Netherlands Supply which shipments should be delivered at what address. This is quite similar to the way Heineken Netherlands Supply is currently working with Heineken Ireland, where part of the containers are driven directly to one of their customers right after they come off the boat.

The only choice left between scenarios 1 and 3 is whether or not to **create** mixed loads. Choosing to stick with mono loads is a logic decision, since the overall expectation is that starting to create mixed loads on a larger scale will add so much complexity to the warehouse operations that it cancels out all potential profits. But, it also enormously narrows down the potential range of customers and products eligible for Direct Deliveries.

Although the available data was limited in the Germany case, it already became clear that, even in a large export market like Germany, there is a possibility that there will not even be a single SKU-DP combination suitable for Direct Deliveries.

On the other hand, creating mixed loads greatly increases the potential for Direct Deliveries, but it requires extra storage space. As with the make-to-stock scenarios, this means outsourcing to Hartog & Bikker.

At this point it is therefore hard to make a decision about mixed loads. It is unknown how large the impact of creating mixed loads will truly be. The mixed container project for HUSA that is currently being tested can possibly provide more knowledge on this topic.

Considering what has been mentioned above, the following points also have to be taken into account when implementing Direct Deliveries:

- Maybe customers have to be persuaded to accept a mono truck, and a compensations for their inconvenience is required.
- (The customer is willing to accept a full truckload of a single SKU once in a while, if necessary in return for a small discount;)
- The customer is flexible in delivery arrival time, since it will probably be hard to deal with strict time slots when making a delivery from the Netherlands.
- The customer's warehouse has the right specifications and equipment to unload the trucks used by Heineken Netherlands Supply's carriers.

- The Market Sales Organization must make sure that the 'slow-movers' are not left behind because the 'runner' is passing their distribution center.
- The Market Sales Organization must manage the freshness of their products and make sure that Direct Delivery customers do not receive older products that come out of their stock.
- The local fiscal authorities must grant permission for a Direct Delivery of excise goods within the European Union.

9.2. Recommendations

It is clear that the biggest drawback in Direct Deliveries is the limited amount of SKU-DP combinations, greatly reducing Direct Delivery potential. Based on the case study and the available information, it became clear that even the largest German customers only have demand per DP of 3 to 4 FTL per year, which means that mono truck Direct Deliveries can only take place every 4 to 3 months. Taking into account the products expiration date and the sell-by-date of two months after production, this is not enough to make Direct Deliveries feasible. For Direct Deliveries to work, the SKU-DP combinations need to be increased. Possible ways to do that are:

1. **Consolidate customer DPs:**
   Customers have to be persuaded to receive the products from multiple of their DPs into a single DP, and then further distribute the products themselves. This allows HNS to deliver FTLs directly to a single DP. The customer may require compensation for their extra logistical expenses.
2. **Consolidate customer orders:**
   Customer have to be persuaded to order less frequent but increase order sizes. This allow HNS to deliver FTLs directly to the customer DP. The product expiration date has to be taken into account. The products can not be stored longer than two months before they have to be sold to the consumer, so this limits the order consolidation. Also, the customers may require compensation for their extra storage costs.
3. **Start creating mixed loads:**
   Creating mixed loads can greatly increase the number of eligible SKU-DP combinations, and thus increase Direct Delivery potential. However, this solution is also the one with the most (expected) impact on the HNS operations.

More generally, some recommendations for Heineken Netherlands Supply will be made:

1. Let the Market Sales Organization together with the HNS Market Business Partners find SKU-DP combinations that show a large enough demand to qualify for Direct Deliveries.
2. Choose the most simple scenario where the Market Sales Organization tells Heineken Netherlands Supply what the new ship-to address of a certain delivery will be (based on the Ireland model).
3. Start with mono trucks, expand to mixed later on (based on experiences with the HUSA mixed container project).
4. This report turns out to be just a preliminary indication of the impact of Direct Deliveries.
   - For accurate costs a much more specific and detailed case study is required where more data is available.
   - For accurate impact experiences in Direct Deliveries are required.

Direct export deliveries: an impact analysis of bypassing the Heineken distribution center in Germany

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***Abstract*—The Heineken supply chain goes from the production units, through local distribution centers, to the wholesale and retail customers in the market. Heineken Netherlands Supply is interested in bypassing the distribution center in Germany when possible. It is expected that these so-called direct deliveries have the potential to save on transport-, handling- and storage costs. A system analysis defined the Direct Delivery model, and showed that there are sixteen future scenarios, based on choices for the contacting party, supply model, degree of pallet handling and carrier party. All sixteen scenarios were evaluated against several qualitative impact parameters, i.e. customer satisfaction, order complexity, warehouse complexity, and carrier performance. Also a case study was performed to calculate the quantitative impact parameters, i.e. supply chain costs. It was found that the supply chain cost savings are marginal, and that none of the sixteen scenarios have no expected decrease in quality. More detailed case studies are required to determine direct delivery feasibility.**

***Keywords*—Heineken, distribution center bypass, supply chain, delft systems approach.**

I. Introduction

THE Heineken Company is operating a global production and supply network with different company units, all responsible for their own tasks. The production (brewing and packaging) and global distribution is done by the Operating Companies (OpCo) spread around the world. The OpCos deliver pallets with beer, wrapped in plastic, which are called Stock Keeping Units (SKU).

The OpCos sell their products, for an internal price called the *transfer price* (TP), to the Market Sales Organizations (MSO), which are the Heineken representatives in a specific country or region. The MSOs have their own local office with a customer service department, and one or more distribution centers from where they distribute the products they buy from the different OpCos into the market.

The MSOs sell the products, for the commercial price, to the *first customers*. These customers are the wholesalers and retailers operating their own distribution centers, which are called *demand points* (DP), from where they then further distribute the products to supermarkets and bars. A schematic representation of the Heineken supply chain can be seen in in Figure 1.

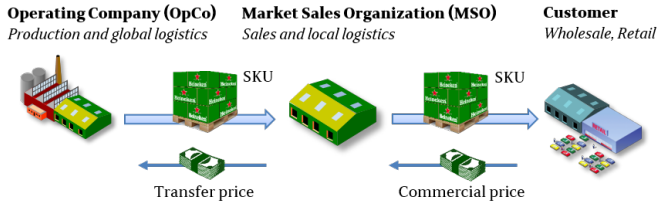

Fig. 1. Schematic representation of the Heineken supply chain.

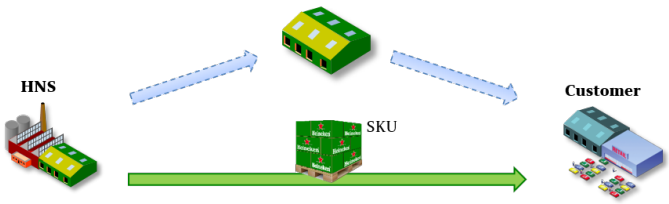

Fig. 2. Schematic representation of a direct delivery.

Heineken Netherlands Supply (HNS) is one of the OpCos. HNS is operating three breweries: one in Zoeterwoude, one in Den Bosch and one in Wijlre. With an annual production of 17,5 million hectoliters (mhl), HNS is Heineken's largest OpCo worldwide. 30% of the production is for domestic distribution; the remaining 70% is destined for export to more than 140 countries.

A. Problem definition

Several MSOs from neighboring export markets have asked HNS for the possibilities of direct deliveries to the customers, as shown schematically in Figure 2. Heineken Germany, one of the MSOs, has so far shown the most progress in exploring the opportunities. They believe that occasionally delivering shipments directly to the customer, bypassing the MSOs' distribution center(s), has the potential to save on handling, storage and transportation costs.

At first impression it seems like direct export deliveries can thus have some supply chain benefits. However, at this point HNS does not have a clear overview of the consequences of direct deliveries on their own organization. HNS wants to know what the potential savings are, what impact direct deliveries will have on their export departments, and what else has to be taken into account, before they can decide whether or not to implement direct deliveries for export customers. HNS does not want to give in on their *quality*.

This scientific paper was written in partial fulfillment of the requirements for the degree of Master of Science in Mechanical Engineering of Fedde Reijnders at the Delft University of Technology, the Netherlands, in September 2017, under direction of Dr. R.R. Negenborn.

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The goal of this research is to provide HNS with the required insights into the impact of direct export deliveries on their organization, so they can make a well-grounded decision on the implementation.

This research will focus on direct export deliveries to Germany, and will evaluate the impact of these direct deliveries on the order handling process and the HNS export operations.

II. Methods

A. Analysis

A system analysis was performed to take a more detailed look at the supply chain between HNS and the customers in Germany. A Process-Performance (PROPER) model from the Delft Systems Approach [18] was used to to identify the inputs, outputs, requirements and performance metrics of the industrial beer transportation system.

Based on the PROPER-model a steady-state model was constructed to create a clear overview of the processes in both the order- and material flow, and the related stakeholders.

Removing the MSO distribution center from the material flow defines a Direct Delivery. The Direct Delivery model shows that four components in the system are affected: the contacting party (MSO or customer), the supply model (make-to-order or make-to-stock), the degree of pallet handling (only mono or also mixed loads), and the means of transport (drop-off or pick-up).

For each of these components a choice has to be made between two options, resulting in 16 different Direct Delivery scenarios, as shown in Table I.

The relevant impact parameters are divided into qualitative and quantitative impact parameters. The qualitative parameters are the customer satisfaction, the order complexity, the warehouse complexity and the carrier performance. The quantitative parameters are the transport costs and the warehousing costs.

The analysis leads to the following research question:

Which Direct Delivery scenarios for Germany have the highest potential cost savings without reducing the Heineken Quality?

B. Literature review

The direct delivery model that is going to be researched is sometimes also called a ”distribution center bypass”. Although it is difficult to find any scientific work for this term that is not medical related, several supply chain websites use it. Most of these web pages come with the same list of obvious benefits.

According to one these pages [1], a distribution center bypass has a number of significant benefits. It eliminates a shipment leg, thus decreasing the transport costs and transport time. It also eliminates a touch of the product, reducing distribution processing costs and product damage. Finally, a distribution center bypass can significantly reduce the total cycle time, which allows for inventory to be taken out of the system.

Askari and Nader [2] researched the impact of a distribution center bypass in the luxury fashion industry with a cost model, in which the transportation costs, facility holding costs, facility processing costs, ordering costs and pipeline costs were separately incorporated. It was found that the biggest impact on total costs are transportation and holding costs. They found that the benefits of centralization are a decrease in overall product touches, a decrease in total amount of inventory, and lead-time efficiency increase. As risks they mainly mentioned an increase in supply chain complexity.

In our situation, the MSO distribution center receives product streams from multiple OpCos, and distributes those product streams to multiple customers. The distribution center is a central hub in this system, which is called a hub-and-spoke system. A direct delivery system is seen as the counterpart of the hub-and-spoke system.

Liu et al. [3] studied a mixed truck delivery system that allowed both hub-and-spoke and direct shipment delivery modes. It was stated that the hub-and-spoke system is generally preferred, due to the higher delivery frequency, which is associated with a higher service quality, but that in cases where the delivery quantity is large enough to justify the shipping of goods with full truckloads, the direct delivery system is better. Therefore it is argued that a mixed delivery system can be better than either of the two pure delivery systems. The results showed that the mixed system can on average save around 10% of the total traveling distance compared to both pure systems. Since the transport costs are directly related to the travel distance, this would imply a reduction in transport costs as well.

To evaluate the impact on the supply chain, metrics are needed to measure the performance. Many metrics have been proposed over the years in literature about supply chain management. A comprehensive overview of these metrics was presented by Gunasekaran et al. [4] who performed a literature review on supply chain performance metrics and made a classification framework in the strategical, tactical and operational level.

However, more generally supply chain performance metrics are aggregated into four main categories, quality, service, cost and lead-time, as was presented first by Johansson et al. [5] in the total value metric, a means to calculate a supply chain's total value with the following formula:

$$Value = \frac{Quality \times Service}{Cost \times Leadtime} \tag{1}$$

They also argued that the four metrics have relative importance, and that this relative importance changes over time and that it needs to be evaluated continually. Agarwal et al. [6] used the Analytic Network Process (ANP) to determine this relative importance, and presented a pairwise comparison matrix based on expert opinions from supply chain management. Furthermore, Equation 1 is particularly helpful as it emphasizes the futility of improving one performance measure at the expense of worsening another [7].

These same four metrics were also used by Mason-Jones et al. [8] in the market winner-market qualifiers matrix when discussing the differences between lean and agile supply chains. They found that cost is a market-winner for the lean supply chain, while quality, lead-time and service level are market-qualifiers, but that service level is a market-winner for

TABLE I
SIXTEEN DIFFERENT FUTURE SCENARIOS.

FS 1.	MSO, MTO/Rep, Mono, Drop-off	FS 2.	MSO, MTO/Rep, Mono, Pick-up
FS 3.	MSO, MTO/Rep, Mixed, Drop-off	FS 4.	MSO, MTO/Rep, Mixed, Pick-up
FS 5.	MSO, MTS, Mono, Drop-off	FS 6.	MSO, MTS, Mono, Pick-up
FS 7.	MSO, MTS, Mixed, Drop-off	FS 8.	MSO, MTS, Mixed, Pick-up
FS 9.	Customer, MTO/Rep, Mono, Drop-off	FS 10.	Customer, MTO/Rep, Mono, Pick-up
FS 11.	Customer, MTO/Rep, Mixed, Drop-off	FS 12.	Customer, MTO/Rep, Mixed, Pick-up
FS 13.	Customer, MTS, Mono, Drop-off	FS 14.	Customer, MTS, Mono, Pick-up
FS 15.	Customer, MTS, Mixed, Drop-off	FS 16.	Customer, MTS, Mixed, Pick-up

the agile supply chain, while quality, cost and lead-time are the market-qualifiers. Lean thus focuses on costs, and agile focuses on service level.

Beamon [9] performed a literature review on supply chain design and analysis. A distinction was made between qualitative performance measures, and quantitative performance measures. Some of the most relevant qualitative performance measures are customer satisfaction, flexibility, information and material flow integration and supplier performance. The quantitative performance measures are all measures based on cost, and measures based on customer responsiveness, such as the fill rate and the lead-time.

The customer order decoupling point (CODP) is the point in the material flow where the product is tied to a specific customer order [10]. The position of the CODP is related to the supply model chosen, i.e. make-to-stock, assemble-to-order, make-to-order, and engineer-to-order [11]. The CODP is an interesting point in the supply chain for a number of reasons. The CODP divides the material flow in two: upstream (forecast-driven) and downstream (order-driven). It also coincides with the main stock point, from where the customer order process starts and the amount of stock should be sufficient to satisfy demand in a certain period [12].

In our case there are two ways to look at the supply chain between HNS and the customer. The first way to look at it is how the supply chain is currently working. HNS and the MSO have a supplier-customer relationship, and the MSO and the customer have supplier-customer relationship as well. Both relationships have their own supply model, and thus their own CODP somewhere in the chain. According to Olhager [10] this is the company perspective, where the CODP can be positioned inside the manufacturing operations.

However, HNS and the MSO are both Heineken units. Although they are running their own businesses, with their own budgets, overall they have the same interests, which is to make Heineken a successful company. The second way to look at the supply chain is therefore from a more integral approach, as the supply chain between Heineken and the customer. Now Heineken and the customer have a supplier-customer relationship, with one supply model and one CODP. According to Olhager [10] this is the supply chain perspective, where there is typically one dominant CODP along the entire supply chain flow. From the supply chain perspective, the MSO distribution center clearly is the CODP, which makes the entire supply chain a make-to-stock model.

Naylor et al. [13] states that the CODP also has another function, namely as a divider between lean and agile operations in supply chains. Supply chain management knows two main approaches: lean and agile, described by Naylor et al. [13] as follows: *"Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place. Leanness means developing a value stream to eliminate all waste, including time, and to ensure a level schedule."*

The lean concept tends to work well when the demand is relatively constant and the product variety is low. The focus in lean is with cost effectiveness and level scheduling. Agile concepts on the other hand work well when the demand is relatively volatile and product variety is high [7]. Yusuf et al. [14] suggested that the agile approach originated from the need for flexibility and speed, both of which were constrained by mass automation when cost became the dominant factor after the introduction of lean manufacturing.

Another distinction between lean and agile is made by Purvis et al. [15], stating that the fundamental difference is the fact that they have different requirements for different types and levels of flexibility. Flexibility is the promptness and degree to which a firm can adjust its speed, destinations, and volumes [16].

Although lean and agile are mostly discussed as separate supply paradigms, both Naylore et al. [13] and Towill and Christopher [17] suggest that lean and agile do not necessarily have to be seen isolated, but can also be combined in a hybrid form: the leagile supply chain.

According to literature about leagile supply chains, upstream of the CODP there should be a make-to-stock model, while downstream of the CODP there should be a make-to-order model. Oddly enough, this is exactly the opposite of how we would describe the current supply chain between HNS and the customers.

C. Direct Delivery consequences

Interviews with people from different tiers of the affected departments were being conducted. Based on the interviews and related literature, the four components and their related choices were separately evaluated against the relevant KPIs, resulting in a comprehensive overview of all consequences of the variances, and other things that have to be taken into account.

The transport- and warehousing costs are dependent on the kilometers driven and the amount of pallets handled, so these parameters are case specific. They will be evaluated further

in the case study. The customer satisfaction, order complexity and carrier performance are more scenarios specific, and will be discussed below.

1) Contacting party: Keeping the MSO between HNS and the customers for the order flow means that the MSO must update HNS with a new ship-to address. This slightly increases the order complexity, the rest is business-as-usual. Removing the MSO from the order flow, thus letting the customers order directly at HNS, creates several issues. It creates a language barrier, which greatly reduces customer satisfaction [19], [20]. Extra orders for both customer and MSO are required for non-HNS and non-Direct Delivery products. Again, this decreases customer satisfaction. For HNS it means extra customer management, which increases the order complexity.

2) Supply model: The make-to-order supply model is the current way of working for HNS, so sticking with that model does not change the order handling. Skipping the MSO distribution center means a fresher product for the customer, increasing customer satisfaction. However, the lead-time for the customers is increased drastically, in its turn reducing the customer satisfaction. Also, the customer has to adjust to the weekly HNS drumbeat for its orders, also decreasing the customer satisfaction. In case of disturbances, extra work is required for the HNS export department, because the products may already be at the customer instead of in the MSO distribution center, increasing order complexity.

In addition to the things mentioned above, the replenishment model means an extra service for the customers, increasing the customer satisfaction. However, extra DP management from HNS is required, further increasing the order complexity.

Switching to make-to-stock means the customer will receive the same service level that it was used to, keeping the customer satisfaction the same. However, extra storage space is required at HNS, consequently moving to Hartog & Bikker third-party logistics. This is very expensive, increasing the storage costs, that we were set out to decrease. Keeping all products in stock increases the risk of obsoletes, and thus the dumping costs. Daily order management by HNS is required, dramatically increasing the order complexity for the export department as this is not their current way of working.

3) Pallet handling: The obvious model would be to only deliver mono trucks, as this is the current way of working for HNS and prevents the warehouses from blocking. This would have no impact on the warehouse operations. However, it means that either customers can only order *full truckloads* (FTL) per SKU, which would decrease the HNS flexibility and in turn decrease the customer satisfaction, or it would mean that the Direct Delivery potential stays low because only SKU-DP combinations that show a large enough demand are eligible for Direct Deliveries.

On the opposite, also creating mixed loads would make Direct Deliveries available for many more SKU-DP combinations, and thus greatly increases the Direct Delivery potential. However, it also increases the warehouse complexity and the risk of warehouse blockage and loading errors. Also more storage space is required because products cannot be loaded directly but have to wait for other products to finish. As with the MTS scenario, extra storage space needs to be rented at Hartog & Bikker and increases the storage costs. If products for the same mixed truck are produced in different breweries, more inter-brewery transport is required, increasing the transport costs.

4) Carrier party: Currently, all products are being dropped-off by HNS's trusted carriers. Sticking to the drop-off scenarios means that the carriers receive a different ship-to address and have to drive a little further to a new destination, but nothing else changes.

The opposite of a drop-off, a pick-up, is not preferred by HNS. There are multiple reasons for that. If foreign carriers come pick up the products at the HNS warehouses, there is less destination certainty, and products have a higher risk of ending up in *grey markets*. Foreign carriers introduce language barriers. All truck drivers have to pass a safety test before entering the brewery terrain. The risk of failed safety tests increases with foreign truck drivers. This decreases carrier performance. HNS sets high standards for the transport equipment, and with unknown carriers the risk increases that they bring equipment that does not qualify the HNS safety standards. Also, the carriers are HNS's business cards to the customers, so everything needs to look trustworthy. Not only can the equipment be of poor quality, it can also be the completely wrong equipment. For all the above reasons, HNS prefers to work with a select group of trusted carriers.

5) Other things to consider: Besides the scenario specific consequences of Direct Deliveries, other things need to be taken into account.

Besides the fact that the carrier needs to bring suitable equipment to the HNS warehouses, the compatibility at the DP is also important. Not all DPs have the right facilities to unload the HNS trucks, so this needs to be researched before selecting a Direct Delivery DP.

Within the European Union excise duties have to be paid on alcohol. To track the movements of alcoholic products, these products can only be moved between registered tax warehouses. If the DP is not a tax warehouse, Direct Deliveries to this DP are not possible, unless permission is granted by the local fiscal authorities. This permission is needed before executing any Direct Deliveries.

With Direct Deliveries, products bypass the MSO distribution center, and thus the safety stock. This creates issues when the customer suddenly requires more product, or when production fails in any way. A first in first out (FIFO) distribution center organization model is not possible with Direct Deliveries, so the freshness of the safety stock is older than the products being delivered directly. Active freshness management by the MSO is required to make sure customers do not receive older products.

Direct Deliveries are most likely going to take place for *fast-movers*, products that always sell in large quantities. Fast-movers are often used as a *runner* for the *slow-movers*, i.e. a truck with a few pallets of slow-mover is filled up with fast-mover pallets. When the fast-movers skip the distribution center, there is not running to transport the slow-movers. The MSO needs to take this into account.

TABLE II
AVERAGE FTL PER SKU PER CUSTOMER DP PER YEAR.

D. Case study

A Direct Delivery case study for Germany was performed to calculate the potential savings and the impact of the different scenarios. For the case study, a Direct Delivery DP needed to be selected. With the available information from Heineken Germany, a suitable SKU-DP combination was selected. This turned out not to be very easy, since the product stream fragmentation is so high after the MSO distribution center, that the yearly FTL per SKU per DP is too low to allow for a regular Direct Delivery route. The maximum FTL/SKU/DP observed is 6,38 for the DPs from customer Winkels and the highest ranking SKU, as can be seen in Table II. Two DPs from Heineken Germany's largest customer, in Berlin and Munich, were selected based on the assumption that the FTL/SKU/DP could be increased to 12 for the highest ranking SKU by DP- and order consolidation, allowing for one Direct Delivery per month for both DPs.

III. RESULTS

The results can be seen in Table III. The qualitative impact is counted as the times impact is expected according to the scenario evaluation. We are not interested, for now at least, in the exact size of the impact, but merely in whether impact is expected or not. Counting the times that the parameters are mentioned will therefore suffice. A lower value means more expected impact on the quality. This is of course undesirable.

The calculated savings for transport and warehousing summed in the last column to show the project total savings for each scenario. For the cost parameters, the impact as compared to the estimated total costs in current situation is shown as percentages. A positive sign means that the savings are positive, thus a cost reduction. A negative sign means that the savings are negative, thus a cost increase.

The calculated savings are [redacted] on the transport costs, and [redacted] on the warehousing costs, adding up to a total savings of [redacted] for 24 Direct Deliveries per year. The impact of these savings on the total costs is 0,49%. In the MTS scenarios, the pallets are being stored at an external logistics operator. It was calculated this requires extra expenses of [redacted], which reduces the costs savings to [redacted] and subsequently the impact to only 0,13%.

All scenarios show negative impact on the quality, but it is clear that scenarios 9-16 score bad because of the direct contact with the customer, and that scenarios 2,4,6,8,10,12,14,16 score low because of the pick-up option. Scenarios 1,3,5,7 score equally at -4, however, scenarios 5 and 7 have a cost savings reduction because of the external storage.

IV. DISCUSSION

Based on the case study it can be concluded that the cost savings for that particular case are marginal. The biggest drawback in Direct Deliveries is the limited amount of SKU-DP combinations, greatly reducing Direct Delivery potential. It became clear that even the largest Heineken Germany customers only have a demand per DP of 3 to 4 FTL per year, which means that mono truck Direct Deliveries can only take place every 4 to 3 months. Taking into account the products expiration date and the sell-by-date of two months, this is not enough to make Direct Deliveries feasible. This can be overcome by increasing the FTL per DP. Possible ways to do that are:

1) Consolidate customer DPs;
2) Consolidate customer orders;
3) Create mixed loads.

From the scenario evaluation it can be concluded that the MSO should remain between HNS and the customers as a contacting party, because of the high penalties to the customer satisfaction. Customer pick-ups are not preferred since they go against the HNS policy trend. HNS wants to work with a select group of trusted carriers to maximize the delivery quality. This eliminates all pick-up scenarios. Make-to-stock scenarios require moving the buffer stock to HNS, and that means outsourcing the storage and handling to an external logistics operator. As became clear in the case study, this is more expensive than leaving the stock in Germany.

As an answer to the research question, it can be concluded that none of the 16 scenarios have no expected quality reduction. However, the exact size of this reduction is unknown, an needs to be further evaluated. If it turns out that the -4 quality reduction can be overcome or is not high in reality, there are two scenarios that still show relative high cost savings, i.e. scenarios 1 and 3. These scenarios still qualify for Direct Deliveries.

The only choice left between these scenarios is whether to create mixed loads or not. Sticking with mono loads is the safe option because it guarantees that nothing will change in the current way of working. However, this greatly decreases the number of possible SKU-DP combinations that are suitable for Direct Deliveries. Creating mixed loads on the other hand, increases the potential for Direct Deliveries, but requires extra storage space.

A. Recommendations

Some general recommendations for Heineken Netherlands Supply can be made:

1) Let the Market Sales Organization together with the HNS Market Business Partners find SKU-DP combinations that show a large enough demand to qualify for Direct Deliveries.
2) Choose the most simple scenario where the MSO tells HNS what the new ship-to address of a certain delivery

TABLE III
IMPACT MATRIX FOR THE GERMANY CASE STUDY. (CS=CUSTOMER SATISFACTION, OC=ORDER COMPLEXITY, WC=WAREHOUSE COMPLEXITY, CP=CARRIER PERFORMANCE, TS=TRANSPORT SAVINGS, WS=WAREHOUSE SAVINGS)

will be, and then change the destination of the delivery last-minute.

3) Start with mono trucks, expand to mixed later on if this turns out to be possible.
4) More detailed case studies with more data are required for accurate cost savings calculations.
5) Direct Delivery experience is required for accurate impact determination.

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B

Production process

The production process is left out of the scope of this research, because it is irrelevant to the implementation of Direct Deliveries. However, some basic knowledge about the HNS production process can help to better understand the way of working and the complexity of certain other processes.

With 'production' is meant the complete process of transforming raw materials and packaging materials into *finished product*. The production process therefore consists of two stages: brewing and packaging.

The brewing process takes the longest. Brewing Heineken beer, for example, takes 28 days, and therefore has to be completely based on forecasts. The brewed beers and ciders are stored in tanks, as a semi-finished product waiting for packaging.

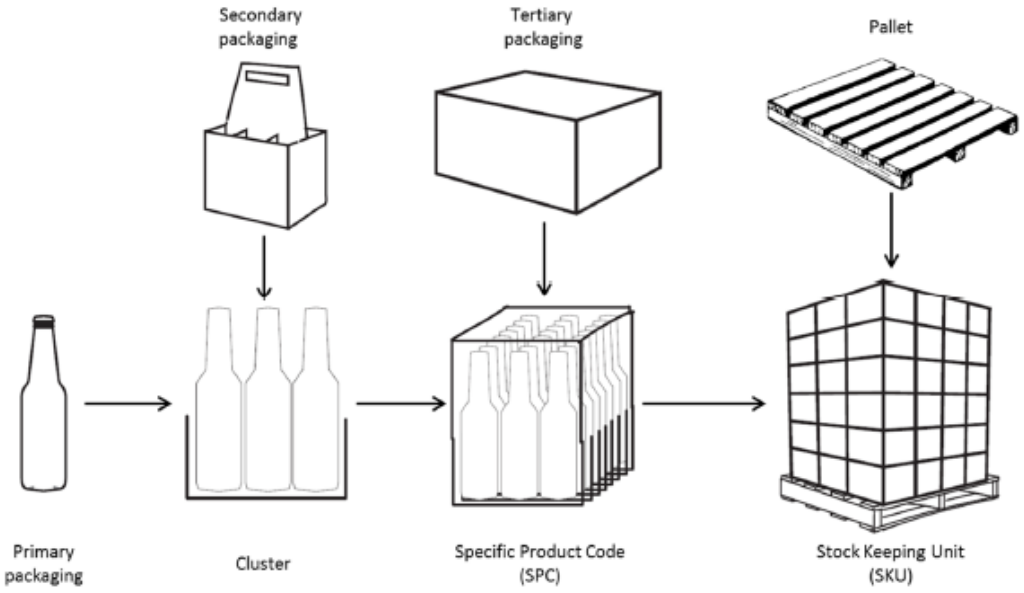

Figure B.1: From primary packaging to stock keeping unit (SKU).[25]

Packaging the product starts with the filling process. Filling can be done in bottle, cans or kegs, in different shapes or sizes. This is called the *primary packaging*. Sometimes the primary packaging needs to be clustered, for example in a twelve-, six-, or four-pack. This is called the *secondary packaging*.

The *tertiary packaging* can be a crate, tray or box. This can also be called a *collo*. Generally a collo contains 24 units of the primary packaging. Every collo gets a Specific Product Code (SPC). This is the product identifier. Every unique combination of drink type, primary-, secondary- and tertiary packaging, in a specific language, with required labeling according to the target market's regulations, gets

its own SPC. This totals to many different products. HNS for example is producing over 900 unique products.

Finally, the colli are piled on a pallet. The amount of colli per pallet depends on the dimensions and the piling pattern, and ranges from 6 (for 50L kegs) to 160 (for trays of cans). A pallet is the smallest unit size in which products can be ordered at HNS. A stacked pallet is called a Stock Keeping Unit (SKU). HNS distinguishes approximately 1.200 different SKUs. The terms *SPC* and *SKU* are often used interchangeably to talk about the different products, since pallets contain only colli of a single SPC. HNS is not making mixed pallets.

So, the production process produces stacked pallets, wrapped in plastic, and delivers them to the warehouse. An SKU in the warehouse, ready for shipment, is called a *finished product*. An overview of the packaging types can be seen in Figure B.1.

C

Orders, deliveries and shipments

In the order management system, HNS distinguishes between *orders*, *deliveries* and *shipments*. In 2016, the export department of HNS, Customer Service Export (CSE), received a total of 25,990 orders from 141 export markets. These orders were then processed into a total of 74,614 deliveries, which were then grouped into 29,072 shipments.

The amount of orders seems a bit much, knowing that MSOs can only order once a week. On average 3.5 orders were placed per MSO per week. How this is possible and the differences between the three will be briefly explained here.

CSE is order-driven. Orders are entered into the order management system once a week. The make-to-order MSOs send their orders to HNS themselves. For the replenishment MSOs, CSE creates the orders based on the forecasts. An order is the MSO's total need of products for a certain week in the future, depending on the MSO's specific leadtime. The order contains information about the MSO, the products, the quantities per product and in which specific brewery these products are produced. The order size is at least one container or truckload per product, because HNS does not create mixed loads. From the order, CSE creates *deliveries* and *shipments*.

A *delivery* is a group of pallets equaling either one container or one truckload. The delivery information is important for the loading department. It contains information about which SKUs need to go into which container or truck, the type of container, the loading pattern, the carrier and the route of the delivery.

A *shipment* is a group of deliveries from the same order being transported together, for example a group of containers going onto the same ship or train. The shipment information is important for the carrier. It contains information about that carrier, the boat name or truck license plate, the destination and the departure and arrival dates. In the case of truck transport, every truck is its own shipment Trucks are not grouped into shipments because they do not travel together.

Depending on the MSO and the means of transportation, three different ways of working with orders, deliveries and shipments exist: *1-10-1*, *1-10-10* and *1-1-1*. The three different ways will be graphically explained below.

1-10-1

The MSO places one large order. The order is cut into multiple deliveries, and the deliveries are grouped onto one ship or train. This is mostly the case for container transport. For example the orders for the United States are handled this way.

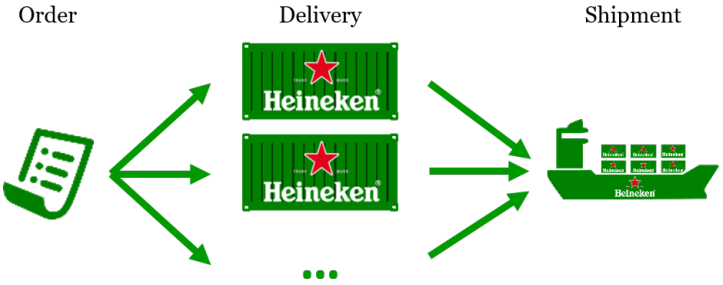

Figure C.1: 1-10-1 order handling model.

1-10-10
The MSO places one large order. The order is cut into multiple deliveries, and the deliveries all get their own shipment. This is mostly the case for truck transport.

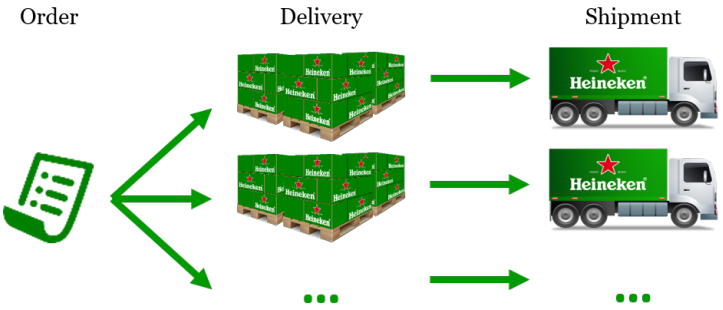

Figure C.2: 1-10-10 order handling model.

1-1-1
Some MSOs place orders that are always equal to one container or truckload. So, every order equals one delivery, and thus one shipment. This also means that MSOs that order like this can place multiple orders at the same time to meet their total demand. Examples of markets that order like this are Canada (containers) and Germany (trucks).

Figure C.3: 1-1-1 order handling model.

In very rare cases multiple orders are grouped into one delivery, for example when samples of new products need to be shipped to the MSO for promotion.

D

Excise duties on alcohol

The EMCS is an electronic system used by EU customs, in which every step of the excise goods movement is documented through an electronic Administrative Document (eAD). The EMCS allows excise goods to be under a duty suspension arrangement while in transit. The working of the EMCS can been seen in figure D.1.

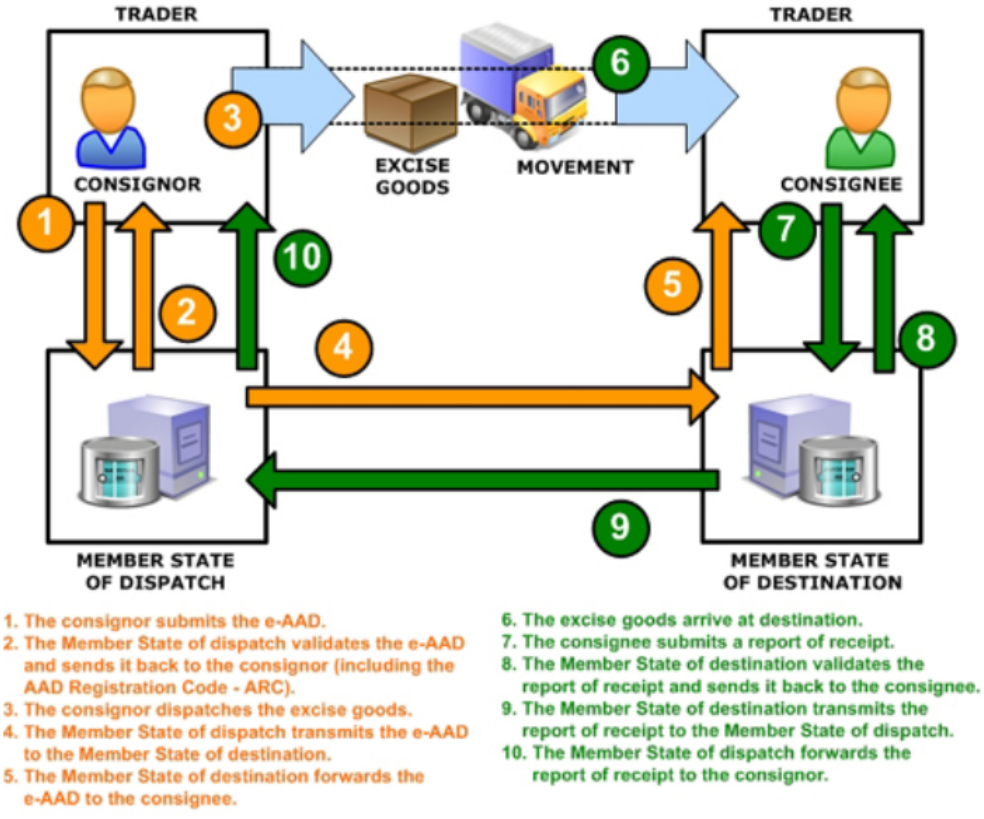

Figure D.1: Excise Movement & Control System. Source: European Commission[1].

Before shipping excise goods to another Member State, the shipment details have to be submitted into the EMCS. The shipment details also have to contain the ship-to address. This address has to be selected from a list of registered tax warehouses, which means it is impossible to submit a shipment for an unregistered location.

[1] http://ec.europa.eu/taxation_customs/business/excise-duties-alcohol-tobacco-energy/excise-movement-control-system/emcs-how-it-works_en

Fortunately, an exception to the rules exists. The legislation concerning the general arrangements for excise duty in the EU can be found in Directive 2008/118/EC from the European Council[2]. According to this directive:

> *"[...] the Member State of destination may, under the conditions which it lays down, allow excise goods to be moved under a duty suspension arrangement to a place of direct delivery situated on its territory, where that place has been designated by the authorised warehousekeeper in the Member State of destination or by the registered consignee. That authorised warehousekeeper or that registered consignee shall remain responsible for submitting the report of receipt [...]"*

An authorized warehouse keeper can apply at the local fiscal authorities for permission to let the excise goods be shipped to a different address than their own tax warehouse. The requirements for such permission are determined by the local fiscal authorities, and are different per Member State. The authorized warehouse keeper stays responsible for the correct delivery of the excise goods and the submission of the report of receipt.

[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:009:0012:0030:EN:PDF

E

Germany case data

Table E.1: SKUs from HNS that were delivered to Heineken Germany in 2016.

Table E.2: Top-5 customers of Heineken Germany by volume.[1]

Table E.3: Average FTL per SKU per customer DP per year.

[1]Information adapted from Heineken Germany[9].

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