



Dutch Sea Container Trucking

Scenario-based strategy formation

Rotterdam University of Applied Sciences
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applied **research**

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I. Preface

This report is the result of a research project conducted by students of the Rotterdam University of Applied Sciences' (RUAS) International Management & Consultancy (IMC-)programme for Alliantie voor Zeecontainervervoerders and several of their member firms. The Alliantie is part of the industry organization Transport & Logistiek Nederland (TLN). The results were then critically summarized and expanded in a follow-up project by RUAS' Research Centre Business Innovation.

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III. Managementsamenvatting (Dutch)

Zoals alle bedrijfstakken heeft ook het wegvervoer van zeecontainers te maken met tal van externe ontwikkelingen die van invloed kunnen zijn op de toekomstige positie van ondernemingen in de sector. In samenwerking met TLN en een aantal leden van hun leden in de sector van zeecontainervervoerders hebben studenten van de minor International Management & Consultancy een scenario-onderzoek uitgevoerd. Daarin stond de vraag centraal hoe ondernemingen die zeecontainers van en naar de haven van Rotterdam vervoeren over de weg zich moeten voorbereiden op de bedrijfsomgeving in 2025. De resultaten zijn door de begeleiders in dit onderzoeksrapport samengevat en verdiept.

Het onderzoek is uitgevoerd door middel van de 'scenario-based strategy formation' methode van (De Ruijter, 2016). Eerst zijn trends en ontwikkelingen die relevant zijn voor de sector geïdentificeerd en geclusterd naar impact en onzekerheid. Vervolgens zijn vanuit deze trends en ontwikkelingen zes toekomstscenario's geschetst. Daarna is via stresstests bepaald wat het effect van elk van deze toekomstscenario's op de typische strategische posities en plannen van kleine en (middel)grote ondernemingen in de sector zou zijn. Tenslotte is zowel voor kleine als (middel)grote vervoerders een strategische roadmap opgesteld waarmee zij zich beter op de verschillende mogelijke toekomst die de scenario's schetsen kunnen voorbereiden.

Vanuit een brede inventarisatie hebben de studenten ruim twintig clusters met trends en ontwikkelingen rondom strategische sleutelvariabelen opgesteld. Drie van deze clusters rondom strategische sleutelvariabelen scoren het hoogst op impact en onzekerheid. Andere clusters, zoals brandstofsoort (over alternatieven voor dieselaandrijving) en arbeidsaanbod, zullen de sector zeker ook beïnvloeden, maar zijn minder beslissend voor de toekomst dan deze drie.

De eerste strategische sleutelvariabele is het aantal containers dat jaarlijks over de weg van en naar de haven van Rotterdam wordt getransporteerd. Dit aantal wordt (als resultante van de totale containeroverslag in de haven van Rotterdam) bepaald door verschuivingen in de modal split, veranderingen in het marktaandeel van de Rotterdamse haven in het Hamburg-Le-Havre-Range en (Europese) economische groei. De bandbreedte waarbinnen het totale aantal containers dat over de weg wordt vervoerd in 2025 kan uitvallen, ligt tussen de 3.73 (meest ongunstige) en 8.86 (gunstigste ontwikkeling) miljoen TEU. Hoe deze variabele daadwerkelijk uitvalt in 2025 is in belangrijke mate afhankelijk van de wijze waarop financiële condities en economische groei, geopolitiek en handelsbeleid en het aandeel van wegvervoer in de modal split zich ontwikkelen.

De tweede strategische sleutelvariabele is het percentage actieve trucks dat gebruik maakt van zelfrijdende technologie op SAE-niveau 3 en 4. Dit percentage wordt direct bepaald door de snelheid waarmee autonome rijsystemen zich technologisch tot een veiliger alternatief voor menselijke chauffeurs ontwikkelen, de mate waarin wet- en regelgeving (volledige) vervanging van menselijke chauffeurs toestaan en investeringen in infrastructuur. De twee extreme mogelijkheden voor 2025 zijn dat 20-40% van de trucks SAE-niveau 3 autonome technologie gedurende 20-40% van hun rijtijd in het platooning model gebruikt (langzame adoptie) en dat 20%-40% van de trucks gebruikt SAE-niveau 4 autonome technologie op snelwegen in het exit-to-exit model (snelle adoptie) gebruikt.

De derde strategische sleutelvariabele is "uberisatie" van het zeecontainervervoer aan de landzijde. Hiermee wordt de opkomst van een digitale intermediair (zoals Uber) bedoeld die vraag en aanbod van vervoer bij elkaar brengt en optimaliseert. "Uberisatie" kan voor het containervervoer op twee niveaus een disruptieve factor zijn. Het eerste niveau is dat van marktarbitrage: het aandeel van het volume (in containers of ritten) dat via een digitaal platform wordt aangeboden en (per bieding wordt) geaccepteerd. Op dit niveau kan een Uber-achtig platform een bedreiging vormen voor expediteurs en grotere vervoerders. Het beïnvloedt ook klantrelaties en concurrentieverhoudingen. Het tweede niveau is dat van ondersteunende diensten bij de containerwegvervoerders: het platform kan een substituut vormen voor planning, coördinatie en administratie van bedrijven en daarmee direct concurreren met de backoffice van middelgrote en grote containerwegvervoerders. Op basis van recente ontwikkelingen en marktkenmerken zijn twee extremen voor 2025 te onderkennen: ten hoogste 10% van het totale containervolume wordt 'verhandeld' via een

digitaal platform (laag scenario) en tenminste 25% van het volume en een tot dominantie uitgroeiend aandeel wordt via een digitaal platform afgehandeld (hoog scenario).

Op basis van deze drie strategische sleutelvariabelen zijn zes scenario's uitgewerkt waartegen de typische strategische posities en strategische plannen van kleine en (middel)grote bedrijven zijn gestresstest. Daar de impact en onzekerheid van het containervolume en de adoptie van autonoom rijden het grootste zijn, zijn deze twee variabelen gekozen als de primaire perspectieven voor drie basisscenario's. Per scenario is vervolgens een onderscheid gemaakt tussen een lage (A) en een hoge mate (B) van "uberisatie".

Het eerste scenario (1A) lijkt het meest op de huidige marktomstandigheden: een relatief hoge volumegroei, langzame ontwikkeling en adoptie van zelfrijdende technologie (waardoor chauffeurs net als nu op vrijwel het volledige rijtraject zelf blijven rijden of actief betrokken moeten zijn) en verwaarloosbare uberisatie (minder dan 10% marktarbitrage via een platform). Dit scenario biedt zowel voor kleine als grote bedrijven kansen tot verdere groei vanwege de hogere volumes. Daar staat evenwel de bedreiging tegenover dat het tekort aan chauffeurs naar alle waarschijnlijkheid groter wordt. Uit de stress-tests blijkt dat de huidige strategische posities en plannen van (middel)grote en kleine bedrijven op dit moment enkele kansen onbenut zouden laten wanneer de toekomst zich richting dit scenario ontwikkelt. (Middel)grote bedrijven spelen over het algemeen nog niet in op de kans om multimodale transportoplossingen aan te bieden (als oplossing voor chauffeurstekort en potentieel hogere marges per gereden kilometer) en kleinere bedrijven richten zich slechts beperkt op de kansen die first/last-miletransport van containers biedt die middels andere modaliteiten worden vervoerd.

Het tweede scenario (1B) is gelijk aan het eerste scenario, behalve hier ook een aanzienlijk aandeel van de containervolumes via een digitaal platform wordt afgehandeld. Daarmee ontstaan kansen op het gebied van efficiencywinst en toegang tot goedkope capaciteit via het platform. Maar het platform creëert tegelijkertijd toenemende prijsconcurrentie van partijen die tegen lage prijzen ritten dreigen over te nemen. Indien dit scenario werkelijkheid wordt, zullen grotere bedrijven weinig moeite hebben om de kansen die het platform biedt te benutten. In tijden van overcapaciteit zou hun backoffice met gemak extra orders via het platform kunnen binnenhalen. In tijden van capaciteitstekort zou hun backoffice orders via het platform kunnen wegzetten. Daar staat evenwel tegenover dat (middel)grote bedrijven op dit moment niet voorbereid zijn om met de substitutiedreiging van het platform ten aanzien van hun back-officeactiviteiten (en de daaruit volgende intensivering van de prijsconcurrentie) om te gaan. In vergelijking met de geautomatiseerde marktarbitrage en operationele ondersteuning door een platform, wordt de toegevoegde waarde van back-offices kleiner en wordt hun overhead problematischer. Kleinere bedrijven zullen vrij eenvoudig op de constante vraag op het platform kunnen inspelen. Maar zij zijn minder goed voorbereid om met toenemende prijsgevoeligheid en de overstaprisico's onder bestaande klanten die het platform ook creëert om te gaan.

In het derde scenario (2A) is sprake van een daling van het totale containervolume dat over de weg wordt getransporteerd, langzame adoptie van autonoom rijden en verwaarloosbare uberisatie. De daling van het volume en een neerwaartse prijsspiraal vormen de grootste bedreigingen in dit scenario. Daar staat als kans (vooral voor grotere bedrijven) tegenover dat subcontracting aanzienlijk goedkoper wordt. Toch zullen (middel)grote en kleinere bedrijven over het algemeen slecht voorbereid zijn op dit scenario. Veel bedrijven beschikken niet over de financiële reserves om nogmaals een plotselinge daling van de vraag (vergelijkbaar met 2009) en structureel afnemende volumes en de resulterende prijsdruk te overleven. Vooral kleinere bedrijven, die in grote mate afhankelijk zijn van de restcapaciteit van grotere bedrijven, zullen geraakt worden door het verdwijnen van deze bron van inkomsten. En hoewel het faillissement van concurrenten ook kansen biedt om hun klanten en chauffeurs over te nemen, zullen er weinig (middel)grote bedrijven zijn die hier strategisch, operationeel en financieel op voorbereid zijn.

Het vierde scenario (2B) komt overeen met het derde scenario, behalve dat hier wel sprake is van aanzienlijke "uberisatie": een kwart van het volume wordt via een platform afgehandeld. Dit platform versterkt de kansen en bedreigingen van het voorgaande scenario door subcontracting en prijsconcurrentie via het platform laagdrempeliger te maken. De mate waarop kleine en grote bedrijven voorbereid zijn op dit scenario komt overeen met het vorige, met als enig verschil dat het platform de negatieve prijsspiraal zal verergeren.

In het vijfde scenario (3A) is sprake van een stijging van het volume, snelle adoptie van autonoom rijden en verwaarloosbare uberisatie. Dit biedt enerzijds de kans van efficiencywinst door de adoptie van zelfrijdende technologie in vrachtwagens en anderzijds de dreiging dat derde partijen de markt betreden met autonoom rijdende trucks. De stress-testresultaten laten zien dat (middel)grote en kleinere bedrijven op dit moment nog slecht voorbereid zijn op veel van de bedreigingen die dit scenario kenmerken. Ten dele is dat begrijpelijk, daar de introductie van geavanceerde zelfrijdende technologie nog niet in de nabije toekomst verwacht wordt. Toch is de dreiging van nieuwe toetreders wanneer dat gebeurt dusdanig groot dat voorzorgsmaatregelen van belang zijn. En met name op dit punt lijkt de sector te weinig met en vanuit het gemeenschappelijk belang van hogere toetredingsbarrières te doen.

Het zesde en laatste scenario (3B) combineert een sterke stijging van het containervolumes met een snelle adoptie van autonoom rijden en een sterke groei van "uberisatie" in het containerwegvervoer. Daarmee intensificeert het de dreiging dat derde partijen niet alleen autonoom rijdende trucks gaan aansturen maar ook de marktarbitrage en afhandeling van transporten via een eigen digitaal platform gaan leiden. Ook hier lijkt de sector niet voorbereid op de dreiging van mogelijke nieuwe toetreders en is het gebrek aan gezamenlijke inspanningen om toetredingsbarrières te verhogen nog problematischer.

Als laatste stap zijn de tekortkomingen die in de stress-tests naar voren kwamen, gebruikt voor de ontwikkeling van twee strategische roadmaps: één voor (middel)grote en één voor kleinere bedrijven. Beide roadmaps bestaan voor een deel uit een kernplan van strategische acties die in alle gevallen geadviseerd worden en een contingentieplan dat bestaat uit strategische acties die alleen geadviseerd worden indien de toekomst zich in de richting van bepaalde scenario's beweegt. Daarmee beantwoorden deze strategische roadmaps de vraag hoe transportbedrijven zich kunnen voorbereiden op de verschillende mogelijke toekomstige waarmee zij (zoals de scenario's laten zien) geconfronteerd kunnen worden.

Het kernplan van de strategische roadmap voor (middel)grote transportbedrijven bestaat uit een viertal strategische acties. Het eerste advies is om zo veel mogelijk financiële reserves op te bouwen. Hiermee kan tijdig in de adoptie van ADS-technologie worden geïnvesteerd (scenario's 3A&B), is het mogelijk om groei te financieren (scenario's 1A & 1B), maar kan ook een plotseling krimp en structurele daling in de vraag worden overleefd (scenario's 2A&B). Het tweede advies is om de flexibiliteit van het wagenpark en de chauffeurs te vergroten. Daarmee bereid het bedrijf zich voor op autonoom rijden (minder chauffeurs – scenario 3A&B) en volumekrimp (minder ritten – scenario 2A&B). Ten derde wordt (middel)grote bedrijven geadviseerd om met partners een eigen digitaal platform te ontwikkelen voor de automatisering van orders van vaste klanten en de operationele ondersteuning van transporten. Dit geeft op korte termijn efficiencyvoordelen, maar kan op lange termijn ook een drempel vormen voor nieuwe toetreders ("Ubers") van buiten de transportsector. Tot slot wordt geadviseerd om multimodale transportproposities te ontwikkelen die als aanvulling op de huidige dienstverlening worden aangeboden en vanuit de backoffice worden ondersteund. Dit geeft (middel)grotere bedrijven meer flexibiliteit in alle scenario's, verhoogt de toegevoegde waarde van hun back-offices en draagt bij aan de toetredingsbarrières voor mogelijke toetreders.

Het kernplan voor kleinere bedrijven bevat een tweetal strategische acties die specifiek op hun huidige strategische positie zijn toegesneden. De eerste actie is om het huidige klantenbestand te diversifiëren en zich (daarbij) waar mogelijk in niche markten te specialiseren om beter gewapend te zijn tegen prijsdruk en het verlies van individuele klanten. Het tweede advies is om zo veel mogelijk als partner mee te doen aan digitale (bij lancering waarschijnlijk nog besloten) platforms voor ladinguitwisseling. Daarmee kan ervaring worden opgebouwd en wordt de flexibiliteit verder versterkt.

De contingentieplannen in de strategische roadmaps van kleinere en (middel)grote bedrijven zijn gebaseerd op leidende indicatoren die in een vroeg stadium aangeven richting welke toekomst de strategische sleutelvariabelen zich waarschijnlijk zullen ontwikkelen. Hierbij wordt voor de ontwikkeling van het containervolume naar het inkoopmanagerssentiment in Europa (economische verwachtingen) en scheepvaartindexen (vraag/aanbod scheepscapaciteit) gekeken. Waar het gaat om de ontwikkeling van autonoom rijden gaat het om signalen als updates van de verwachtingen van truckfabrikanten omtrent de introductie van zelfrijdende technologie, de uitvoering van pilots waar regelgevende instanties bij betrokken zijn en aanpassingen in de wetgeving. Signalen voor eventuele uberisatie zijn aankondigingen van

marktpartijen om digitale platforms te starten of om bestaande initiatieven uit te breiden richting West-Europa. Voor elk van deze signalen voorzien de strategische roadmaps in meerdere contingentieacties waarmee vervoerders kunnen reageren om zich voor te bereiden op de scenario's die ermee bevestigd worden (zie hoofdstuk 6).

Container trucking wordt geconfronteerd met grote onzekerheden. Hoewel het onduidelijk is hoe de bedrijfsomgeving er in 2025 uit ziet, blijkt uit dit onderzoek dat deze ingrijpend zou kunnen veranderen. Om ondanks deze onzekerheden toch voorbereid te zijn, kunnen de scenario's en de strategische roadmaps in dit onderzoeksrapport kleine en (middel)grote vervoerders helpen. Daarbij is het evenwel van belang dat bedrijven (1) zich middels de "no regret actions" uit het kernplan tegen de onzekere toekomst wapenen, (2) de ontwikkelingen omtrent de strategische sleutelvariabelen (zie hoofdstuk 2) nauwgezet te volgen en (3) de juiste contingentieacties (zie hoofdstuk 6) ondernemen wanneer de leidende indicatoren erop wijzen dat een bepaalde toekomst werkelijkheid wordt.

IV. List of Abbreviations

ADS	Autonomous Driving System
AZV	Alliantie van Zeecontainervervoerders
BRI	Belt an Road Initiative
BDI	Baltic Dry Index
GDP	Gross Domestic Product
PMI	Purchasing Managers Index
TCCT-R	The total amount of sea containers that is continentally transported to and from the Port of Rotterdam per annum (by road, rail or barge)
TCCT-R-Bg	The total amount of sea containers that is continentally transported to and from the Port of Rotterdam <i>by barge</i> per annum
TCCT-R-Rd	The total amount of sea containers that is continentally transported to and from the Port of Rotterdam <i>by road</i> per annum
TCCT-R-RI	The total amount of sea containers that is continentally transported to and from the Port of Rotterdam <i>by rail</i> per annum
TCTS-HLH	Total aggregate container transshipments of all the ports in the Hamburg-LeHavre range per annum
TCTS-R	Total container transshipments in the Port of Rotterdam per annum
TLN	Transport & Logistiek Nederland

1. Introduction

Dutch sea container trucking is a sector where much of what is good about traditional ways of doing business has survived. Because of the trust that exists between trucking companies and many of their customers, gentleman agreements still tend to prevail over legal contracts. The fact that the roles of truck drivers and back-office workers have long stayed the same makes that many business activities still rely on employees and their intimate, implicit knowledge of the sector. The close involvement and commitment of business owners in everyday business operations commands respect among their employees.

With so much being good about the traditional ways of working in the sector, there is a healthy suspicion of change. A telling example of such suspicion is reflected by one of the stories that was shared with us by the owner of one of the trucking companies during the kick-off of this research project. Once upon a time there had been a trucking firm that hired a consulting firm. After that consulting firm researched the sector and the company for a while, it concluded that the trucking firm had to change everything to survive – and advised them so. The firm refused. And, five years later – as the narrator concluded the story, much to his content – it was not the trucking firm, but the consulting firm that was out of business!

Such a healthy suspicion of change can, however, become a risk when it turns into a reflex based on the presumption that things will always remain the same. The trust that exists between container trucking firms and their customers can grow into confidence that these customers will continue to be there. The reliance on the intimate knowledge of the sector can become a conviction that nothing will fundamentally change in their work processes. The close involvement of business owners in everyday operations could come at the expense of the type of long-term strategic planning that helps prepare for the fundamental changes that do come over time.

This report will not and (by the very nature of its design) cannot advise business owners with certainty that they have to change everything to survive (as the now-demised consulting firm once did). It does, however, explore what fundamental changes *could* happen (where it remains uncertain if they would) and how trucking companies *could* adapt if they do (once it is certain that they will). This makes the findings and the advice in this report more cautionary and compelling at the same time. They are cautionary in the sense that we do not claim to know what the future will hold. Yet they are compelling in showing how container trucking firms can prepare for the different possible futures we have found and respond to them as one materializes.

1.1. Research Background

This research project was supported by Transport & Logistiek Nederland's Alliantie voor Zeecontainervervoerders (TLN/AZV) because they saw a number of trends and developments that could lead to disruptive changes for the Dutch sector of container trucking in the future. Most of the trends and developments that could lead to these disruptive changes are already known. Yet there is a high degree of uncertainty about if, when and how they will play out. The fact that autonomous driving systems are being developed is widely known, but it is uncertain when and to what extent this will influence the (container) trucking industry. The disintermediation by uber-like platforms has been omnipresent in the popular business literature, yet it is uncertain if- and to what extent this will affect the sea container trucking sector in the Netherlands. In order to prepare for a future that could potentially be defined by such disruptive yet uncertain changes, container trucking firms require a grasp of what could come and plans to adapt if it does.

The goal of this report is to help TLN/AVZ's member firms to prepare for the uncertain, but potentially disrupted and transformed business environment for continental container trucking in 2025. Given the inherent and specific geographic nature of the sector, this goal will be pursued by answering the following research question:

How should Dutch container trucking companies prepare for the business environment of 2025?

As it is phrased, this research question quite naturally falls apart in the following two-sub questions:

1. What could the business environment of continental sea container transport look like in 2025?
2. How could firms prepare for that environment?

1.2. Research Method

The main research question and both sub questions are answered using the method of scenario-based strategy formation (Ruijter, 2016). There are many methods, frameworks and tools that could be used and can indeed be helpful when developing business strategies that prepare firms for the future. Yet scenario-based strategy formation has the unique quality that it does not assume away, but factors in key uncertainties about what that future may look like. As such, it provides a much more cautious and comprehensive approach to developing strategies that make firms future proof than other methods of strategy formation.

1.3. Reading Guide

The following chapters follow the steps of scenario-based strategy formation. After the organizational context of TLN/AVZ and the industry profile of the Dutch container trucking firms have been discussed in chapter 2, chapter 3 presents the clusters of trends & developments with the highest potential impact on the strategic position of container trucking firms and uncertainty about their outcome. Chapter 4 presents six scenarios of the future business environment for Dutch container trucking firms. After that, chapter 5 stress-tests to what extent the typical smaller and larger container trucking firm is currently prepared for each of these futures. Chapter 6 then presents two strategic roadmaps (one for smaller and one for larger firms) that help these firms to better prepare. This is followed by a conclusion and recommendations for further research in chapter 7.

2. Organizational Context & Industry Profile

2.1. Organization profile

Transport & Logistiek Nederland (TLN) is a sector organization that represents the interests of logistical service providers in the Netherlands and supports their businesses with knowledge and expertise. It has 5,500 members in 16 different submarkets (e.g. building materials transport, car transport and cattle transport). The Alliantie van zeecontainervervoerders (AZV) is a subunit of TLN (henceforth designated as TLN/AZV) that represents the interests and supports the business of sea container trucking firms (i.e. hauliers) in the submarket of sea container transport, which are predominantly based in and around the Rotterdam region.

An analysis by Van der Vliet (2016, p. 18) showed that TLN had 241 members in 2016, of which 22% are independents (companies with 1 trucking license), 32% are small companies (1 < licenses > 10), 35% are medium-sized companies (10 < licenses > 50) and 10% large companies (licenses ≥ 50). Whereas independents and smaller companies consist mainly of drivers that take care of coordinating and administrative tasks themselves, medium-sized and larger companies typically have a separate back-office department with support staff that is dedicated to coordination and administrative tasks and a pool of truck drivers.

2.2. Industry Profile

Haulage by trucking companies is the most common modality used as the first and last link in the supply chain for sea container shipments. As a whole, this supply chain is relatively complex due to the number of actors involved and the contractual relations between them (Van der Vliet, 2016). Figure 2.1 visualizes the supply chain for a container shipment from the port of departure to its destination when its final delivery is done by truck. Shipping lines transport containers from the port of departure to the port of arrival, where a terminal operator unloads the container from the ship and loads it onto a truck, which in turn delivers the container at destination (the shipper or the recipient if the latter is a party other than the shipper).

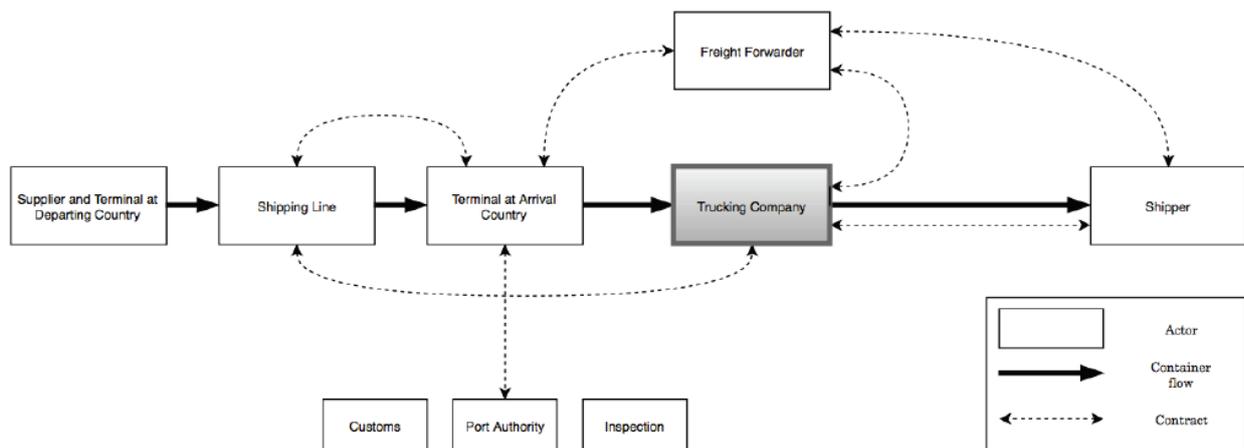


Figure 2.1 Container shipment supply chain (adopted from Van der Vliet, 2016)

At the level of the supply chain there are two different models of contractual relations and corresponding coordination responsibilities. The first model is carrier haulage, where the shipper outsources sea transport *and* the arrangement of continental container transport to the shipping line. This makes the shipping line the customer of both the terminal and the trucking company. The second model is the merchant haulage, where the shipper arranges continental container transport either directly with the trucking company itself or outsources this to a freight forwarder. Under this model the shipping line remains the customer of the

terminal, but the trucking companies have the shipper or the freight forwarder as their customer. The latter model makes coordination more complex and can result in coordination problems and misunderstandings because terminals and trucking companies have different customers and no direct contractual relationships (Van der Vliet, 2016, p. 16), yet depend on each other for the timely transshipment of the same container.

Though cost efficiency is an important customer need, it is not necessarily the overriding factor in purchasing decisions. The homogenous nature of container trucking (i.e. the interchangeability of the services provided by different container trucking firms) makes cost efficiency one of the most important customer needs that hauliers need to satisfy. But it is not the only customer need. Besides costs, time efficiency is also important for most- and sometimes even more important for some customers. Then there are also reliability and flexibility: the nature of the business of some shippers/recipients is such that is not enough for hauliers to provide superior cost and time efficiencies on average, but that deliveries have to meet deadlines consistently (reliability) and that unexpected adjustments can be dealt with (flexibility). Closely related is the need for transparency and traceability among customers who require real-time information on the status and whereabouts of their shipments. Finally, there are customers with the need to outsource the coordination of container transport (beyond contracting a shipping line entirely).

At the most basic level, these customer needs are satisfied by the transport of containers by truck. Beyond that, the need for the outsourcing of planning and coordination can be fulfilled either by truck driver coordination (which is typical for independents and smaller firms) or dedicated back-office employees (typical for medium-sized to large firms). The need for flexibility and reliability can be fulfilled by the availability of a reserve pool of trucks and drivers or collaborations with other firms and independents for the resolution of undercapacity. Transparency and traceability can be satisfied by direct contact between driver and customer or IT-systems.

Van der Vliet's (2016) study of Dutch container trucking market also provides additional insights into the average number of customers for smaller, medium and larger firms (see Table 2.1), the percentage of customers by order frequency for smaller, medium and larger firms (see Table 2.2) and the average share of wallet per customer segment for smaller, medium and larger firms (see Table 2.3).

Table 2.1 Average customer base (yearly) for small, medium and large firms (Van der Vliet, 2016)

	Small	Medium	Large	Total
Avg # customers	5	52	132	64

Table 2.2 Percentage of customers by order frequency for small, medium and large firms (Van der Vliet, 2016)

	Small	Medium	Large	Total
Daily orders	70%	61%	66%	65%
Weekly orders	9%	1%	17%	13%
Monthly - Yearly orders	4%	14%	15%	12%
One-time orders	1%	6%	1%	3%

Table 2.3 Average percentage of total customers per customer segment for small, medium and large firms (Van der Vliet, 2016)

	Small	Medium	Large	Total
Shippers	26%	32%	21%	27%
Freight forwarders	12%	31%	47%	32%
Shipping line	17%	21%	18%	19%
Terminal operators	0%	2%	7%	3%
Other trucking companies	46%	14%	3%	17%

3. Trends & Developments

This chapter discusses three of the most important clusters of trends & developments for container trucking firms. It defines these clusters based on key variables through which their trends & developments will ultimately affect the strategic position of container trucking firms. Each cluster is also modeled in a way that captures the logic of how the various trends & developments that are part of it influence the key variables. The discussion of each cluster concludes with the extremes of the bandwidth of possibilities within which the key variable could develop as a result of these influences from now until 2025.

Though there are many clusters of trends & developments that could affect the strategic position of container trucking companies in 2025,¹ this chapter limits itself to a discussion of the volume of demand, the adoption of autonomous driving and “uberization”. Other clusters like ‘fuel type’ (e.g. fossil, electric or hydrogen) and ‘labour supply’ will also affect the industry, but they are not as decisive (i.e. impactful and uncertain) in determining what possible futures the Dutch sector of container trucking might face as the three that will be discussed here.

3.1. Volume: Size of the Total Addressable Market in 2025

The first key variable is the ‘total amount of sea containers that is continentally transported to and from the Port of Rotterdam by road per annum’ (TCCT-R-Rd). This variable determines the size of the total addressable market for sea container trucking in the Rotterdam region. It is a key determinant of growth opportunities (if it increases) or a powerful driver of competitive pressures (if it declines).

3.1.1. Model of cluster

Figure 3.1 provides an overview of the more immediate determinants of TCCT-R-Rd (in red) and the trends and developments that influence these determinants (in grey). The determinants consist of a series of higher-order variables regarding total container flows and the conversion rates between them. Together, these variables and conversion rates capture the funnel-like logic in accordance with which Eurozone GDP converts into total container flows at various levels all the way down to TCCT-R-Rd.

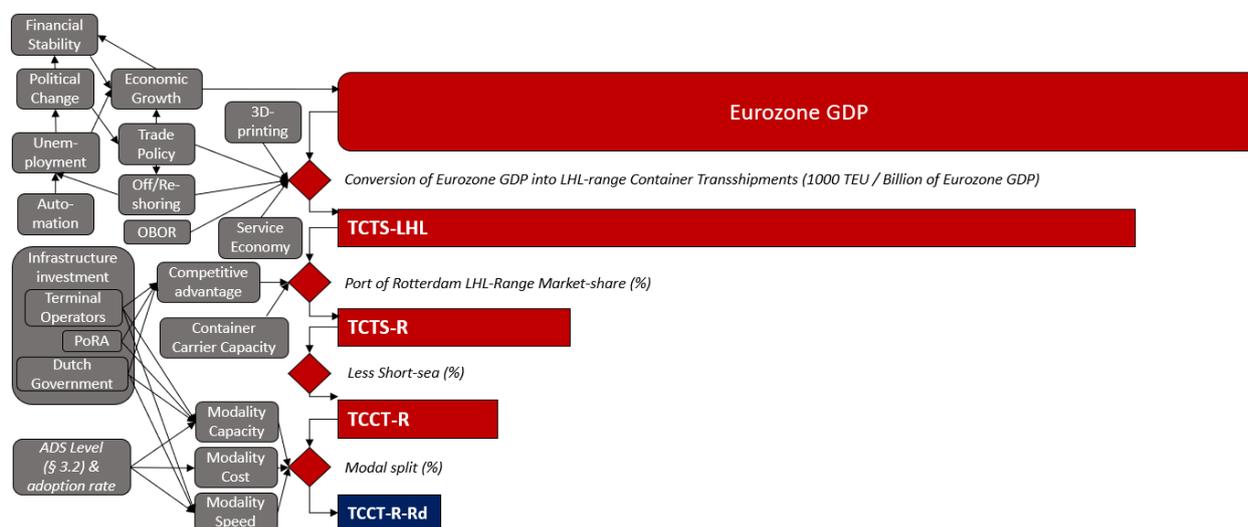


Figure 3.1 Model of how the conversion rates of Eurozone GDP to TCTS-LHL and (all the way down to) TCCT-R-Rd are influenced

More specifically, the right-hand side of Figure 3.1 (in red) shows how TCCT-R-Rd results from (1) the extent to which Eurozone GDP converts into ‘total container transshipments for the ports of the Hamburg-LeHavre range’ (TCTS-HLH), (2) the ‘market share of the Port of Rotterdam within the HLH-range’ that subsequently determines ‘the total amount of container transshipments in the port of Rotterdam’ (TCTS-R), (3) the exclusion

¹ Student teams came up with over 20 clusters of trends & developments. Most of these addressed similar elements as the three clusters in this chapter. Section 4.1 discusses why these three clusters are elaborated and not others.

of 'short sea' (i.e. sea/sea container transshipments) from the latter to (approximately) determine 'total continental container transport to and from the Port of Rotterdam' in general (TCCT-R) and (4) the modal split of TCCT-R between barge, rail and road that finally determines the total amount of containers that are continentally transported to and from the Port of Rotterdam by road (TCCT-R-Rd).

The left-hand side of Figure 3.1 shows the most important trends & developments that influence Eurozone GDP and each of the container flow variables and the conversion rates that determine TCCT-R-Rd. Here, the interplay and feedback loops between the variables of 'economic growth', 'financial stability', 'political change', 'automation', 'unemployment', 'trade policy' and the 'off/reshoring' dynamic are of particular importance because of their profound impact on 'Eurozone GDP' as a top-line driver of total container flows at the various levels in Figure 3.1. The conversion rate of 'Eurozone GDP' in 'TCTS-LHL' is also influenced by 'trade policy' and the 'off/reshoring' dynamic. Another novel and potentially significant variable that could influence this conversion rate is the shift (both geographic and modal) in container flows from Asia as a result of investments in the 'Belt & Road Initiative' (BRI) program by the Asian Infrastructure Investment Bank.² At this level of the model, the possible effects of '3D-printing' and 'off/re-shoring' dynamics on Eurozone GDP also influence total container flows at the level of TCTS-LHL. One level below, the 'market share of the Port of Rotterdam within the Hamburg-Le Havre range' is determined by its 'competitive advantage'. This competitive advantage, in turn, depends on (1) 'infrastructure investments' by the Port of Rotterdam Authority (PoRA), terminal operators and the Dutch government that affect docking fees and the relative cost and speed advantages of continental container transport and (2) increases in size and industry concentration by container carriers. One level below, infrastructure investments also influence the 'modal split' as the most immediate determinant of 'TCCT-R-Rd'. Finally, developments in 'autonomous driving technology' (see section 3.2) will also influence the modal split.

3.1.2. Historical Trends & Developments

Though TCCT-R-Rd (in TEU) has grown over the past two decades, much of that growth up to 2008 was lost in 2009 (see Figure 3.2). The overall amount of containers that were continentally transported to and from the Port of Rotterdam by road grew from 3.8 million in 2004 to 4.48 million in 2015 at an average annual rate of 1.8%. Upon closer inspection, this period actually consists of three different phases: two significant drops in 2008 and 2009 divide the development of TCCT-R-Rd into three distinct periods: one high growth period from 2004 to 2007 with an average annual growth of 7.7%, a crisis period from 2007 to 2009 with a -5.7% and a -18.4% decline, and a recovery period where TCCT-R-Rd grew from 3.64 million TEU in 2009 to 4.48 million TEU in 2015 at an average rate of 3,1% a year. The 2008 and 2009 declines were so sharp that by 2015, TCCT-R-Rd still had not recovered to the 2007 high of 4.75 million TEU, effectively declining with an average rate of -0.7% a year from 2007 to 2015.

The sharp 2008 and 2009 declines that divide the development of TCCT-R-Rd into three distinct phases can to a large extent be attributed to the effects of the financial crisis on the real economy and total container shipments at all levels in Figure 3.1.³ The fact that a financial crisis (with its origins in the U.S. housing market) eventually led to such sharp declines in overall container flows all the way down to TCCT-R-Rd shows how big of an influence financial (in)stability has in the model of Figure 3.1. Other variables like 3D-printing, off/re-shoring and changes in trade policies have not (yet) shown such a big influence to date.

² The Belt & Road Initiative (formerly known as One Belt One Road) consists of a series of investments in ports that could shift container flows from ports in the HLH-range to Southern European ports and a series of investments in road and rail infrastructure that could substitute container transport to and from Asia by sea by road and rail transport (Cosentino et al., 2018, pp. 49–59)

³ From 2008 to 2009, World GDP-growth (in PPP-based, 2011 constant USD) drop to 1.0%. Compared to its average annual growth rate of 5.7% over the 1990 to 2016 period this was a 3.92 sigma event. The European economy was hit much harder, with a YoY-decline in Eurozone GDP of -5.8%. These economic shocks also had an effect on total container flows that was amplified as it made its way down through the right hand side of Figure 3.1: total container flows dropped with -8.5% worldwide and -16% in the HLH-range. And although the Port of Rotterdam was not hit as hard as their LHL-range in general, with a drop of only -9.6%, total continental container transport to and from the Port of Rotterdam did drop with -15.4% across all modalities and -18.4% for TCCT-R-Rd (-Rd) in particular.

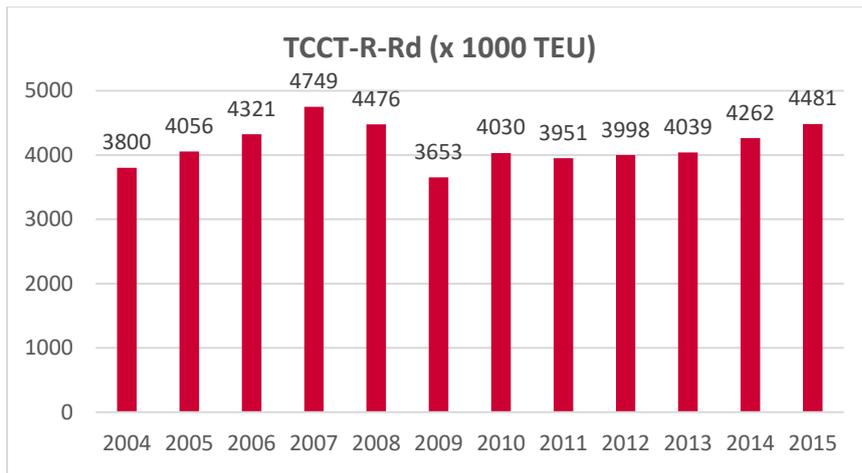


Figure 3.2 Total container volumes (x1000 TEU) transported to and from the Port of Rotterdam by Road (2004-2015)

Besides the negative effects of the 2008/9 financial crisis, TCCT-R growth has also been weak relative to general TCTS-R and TCCT-R growth in general (across modalities) for more structural reasons. TCTS-R and TCCT-R have grown at an average rate of 5.4% and 2.9% a year respectively over the 2004 to 2015 period. This is much higher than TCCT-R-Rd growth rate of 1.8% over the same period. The difference between TCTS-R and TCCT-R(-Rd) can largely be attributed to the increase of short-sea's (i.e. sea/sea transshipments) share of TCTS-R.⁴ But the gap between the annual growth rate of overall continental container transport (TCCT-R) and the road transport (TCCT-R-Rd) in particular cannot. This gap results from a steady decline in road transport's share of overall TCCT-R in the modal split between rail, road and barge transport. This share has steadily declined from 60.1% in 2004 to 53.3% in 2015 at an average rate of -1.1% per annum (see)

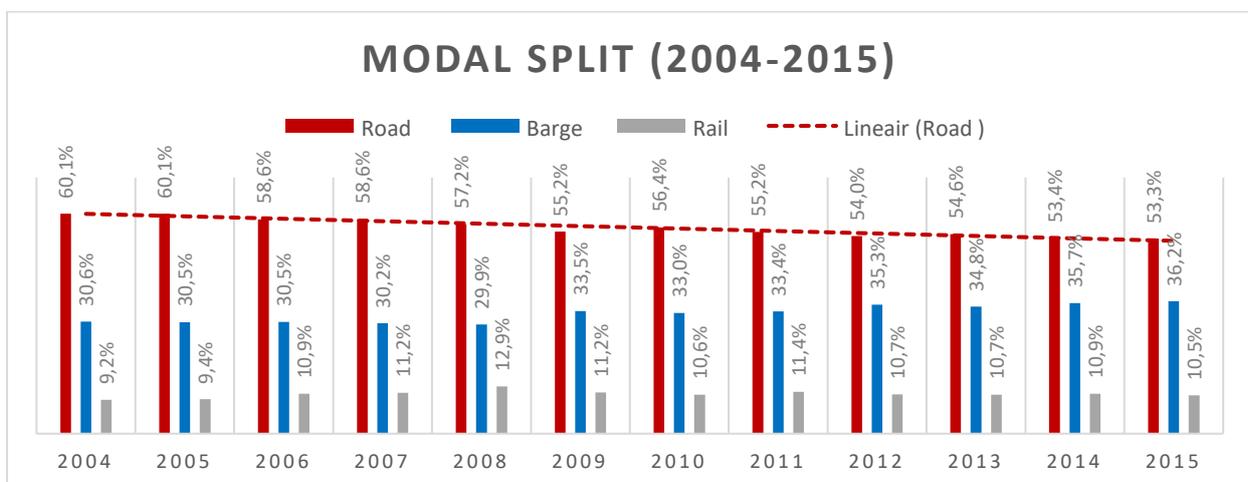


Figure 3.3 Development of the share of modal split for each modality (2014-2015)

With regard to the historical changes in the modal split to date, there are three important points to note. First, that there is a distinct difference in *how* the modal split changed before and after 2008. From 2004 till 2008, road transport suffered an overall net loss of -2.9% in its share of TCCT-R, which, together with a -0.8% net loss for barge, went to rail (which thus gained 3.7% over the same period). This changed from 2008 till 2015. Road transport's share of overall TCCT-R continued to decrease (with a further -3.9% overall loss). Yet where rail transport had managed to capture this decline in road transport's share before 2008, it also suffered a net loss of -2.4% in its share of TCCT-R from 2008-2015. Both net losses were a result of a 6.3% overall gain in barge's relative share of TCCT-R over the same period. The second point is that PoRA has made it one of its explicit CSR goals to reduce road transport's share of the modal split to less than 35% in its 2030 Harbor Vision. In order to achieve this, it funds several programs and other initiatives to promote rail

⁴ Short-sea's share of TCTS-R rose from 23.8% in 2004 to a high of 38.9% in 2011 and 30.5% in 2015.

transport over road transport (see PoRA, 2018). Third, that rail transport – in spite of PoRA’s efforts – has lost a substantial part of their share to barge in the modal split from 2008 till 2015 whilst barge is actually less sustainable than road transport (Van der Vliet, 2016, p. 23).

3.1.3. Forecasts

The bandwidth of possible outcomes for TCCT-R-Rd in 2025 is best defined based on a combination of quantitative extrapolations and qualitative differentiation in the assumptions underlying those extrapolations. These extrapolations must, on the one hand, recognize that trends & developments in the influencing variables on the left-hand side of Figure 3.1 (in grey) will ultimately decide the direction and degree in which TCCT-Rd will change from now until 2025. Here, the complexity of these variables and their historic effects make a qualitative grasp about the direction in which they develop most suitable. On the other hand, it should also be recognized that changes in TCCT-R-Rd will follow the funnel-logic on the right-hand side of Figure 3.1 (in red). And here, the rich quantitative insights about how the higher-order variables regarding total container flows have historically developed (also in response to changes in influencing variables) can be used to project the range within which TCCT-R-Rd could develop into 2025 under various circumstances.

A first step towards the definition of the bandwidth is to develop a baseline projection about the development of TCCT-R-Rd based on the historical average. Based on the assumption that TCCT-R-Rd will continue to develop at an average annual rate equal to the average annual growth rate for all the historical years on record (2004 to 2015) of 1.8%, this would yield a baseline projection of 5.9 million TEU in 2025 and an overall increase of the total addressable market of 31.6% compare to the 2015.

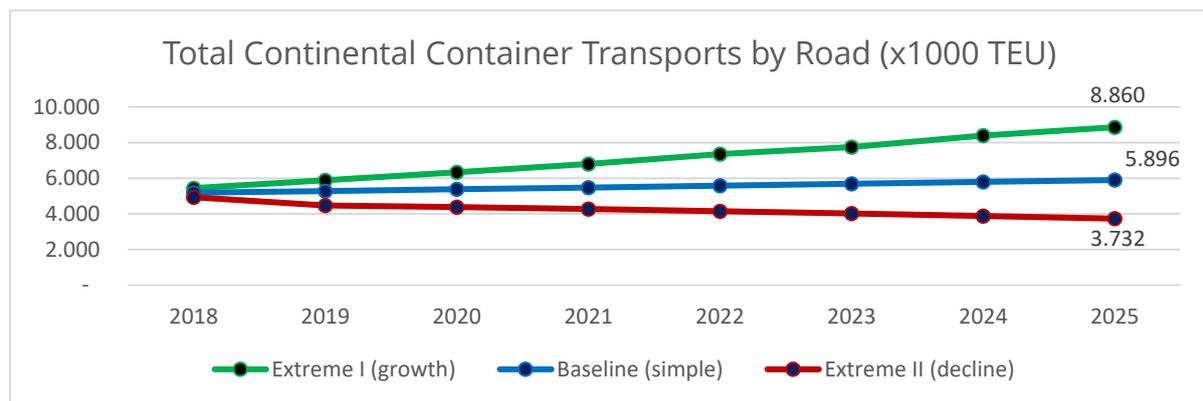


Figure 3.4 Projected development paths of TCCT-R-Rd under deviating qualitative assumptions (see table 3.1) about the continuation of trends at each of the levels in figure 3.1

The second step is to define two development paths that deviate from the baseline based on qualitative assumptions about the continuation of the various historical trends and potential influences that were found in each of the conversion variables of Figure 3.1. Table 3.1 shows an overview of both series of assumptions. Each series takes the least or most favorable trends from the time periods before during and after the 2008/9 financial crisis.

Table 3.1 Overview of the series of least favorable (left) and most favorable assumptions (right) about the continuation of trends at the various levels depicted in figure 3.1.

	Least favorable assumptions	Most favorable assumptions
Eurozone GDP	- Eurozone Real GDP growth over the 2018 to 2025 will be hit by another financial instability event like the 2008/2009 financial crisis in 2019 and will recover at an average growth rate that is equal to the 2009 to 2015, resulting in an overall growth of 9.5% in Eurozone GDP in 2025 relative to 2015. ⁵	+ Eurozone GDP continues to increase from 2018 onwards at an equal rate as in the post-crisis period of 2010 to 2017 of 2.8% per annum (equal to the average annual growth rate of the post-crisis recovery period of 2010 to 2017), resulting in an overall growth of 28.8% in Eurozone GDP in 2025 relative to 2015. ⁶
Conversion of Eurozone GDP in TCTS-LHL	- A baseline continuation of the overall decline in the conversion rate of Eurozone GDP into TCTS-HLH at the same average annual rate of the post-crisis period of 2009 to 2016 (-0.9% per year). - <i>An additional increase of this annual decline with an extra -0.3% per year, eventually resulting in an overall decrease of the conversion rate of -11.1% in 2025 relative to 2015.</i>	+ A reversion of the overall decline in the conversion rate of Eurozone GDP into TCTS-HLH relative to its pre-crisis record of 2007 (-0.3% per year on average) to the mean of +0.8% per year for the of the post-crisis recovery period of 2010 to 2017), resulting in an overall increase of the conversion rate with 8.2% in 2025 relative to 2015.
Port of Rotterdam's market share HLH-range	- A further decline of the Port of Rotterdam's market share within the HLH-range in accordance with the historical average (of -0.4% per year) to 28.2% in 2025.	+ A continuation of the Port of Rotterdam's recapturing of market share within the HLH-range at the same average annual rate as during the post-crisis recovery period of 2010 to 2017 of 1.6% per annum) to 33.5%.
TCTS-R share of short sea	- A rise in the share of overall TCTS-R lost to short-sea to 38.5% in 2025 (at an average annual increase of 3.0% per year, which is equal to the 2008 to 2015 crisis period).	+ A decline in the share of overall TCTS-R lost to short-sea to only 25% in 2025 (equal to 2007).
TCCT-R-Rd's share of modal split (as a percentage of TCCT-R)	- A continuation of the downward trend in road transport's share of overall TCCT-R's modal split to 50.5% in 2025 (at an average annual decline of -0.7% per year, which is equal to the 2008 to 2015 crisis period). ⁷	+ A complete reversion of the declining trend in road transport's share of overall TCCT-R's modal split, which after having dipped at 53.3% in 2015, will climb back to the 60.1% in 2025, driven by efficiency gains due to the rapid development and adoption of electric, self-driving trucks.

The outcome of these assumptions at the level of TCTS-R have been checked with the Port of Rotterdam Authority's own projections of container volume growth under their least and most favorable long-term scenarios in Figure 3.1. Our most favorable assumptions lead to an annual growth rate in TCTS-R over the 2018 to 2025 period that is virtually identical to the one assumed by PoRA. Our least favorable assumptions,

⁵ This analogue is based on calculating the growth rate deviations relative to the historical mean for each of the 2008 to 2015 years and projecting the same deviations for the 2018 to 2025 years relative to the GDP growth projection by the European Committee of 2.3% for 2018.

⁶ This average annual growth rate is optimistic in the sense that is above the near term growth rates of 2.3% and 2.0% that the European Committee projects for 2018 and 2019 respectively (retrieved from https://ec.europa.eu/info/publications/economy-finance/european-economic-forecast-spring-2018_en on 2018-08-14).

⁷ The Port of Rotterdam's Haven Visie 2030.

however, lead to an annual growth rate in TCTS-R that is more pessimistic than PoRA's assumptions about the growth in container transshipments under their least favorable scenarios. PoRA still projects slightly positive growth in Port of Rotterdam container transshipments, while our most negative assumptions result in the possibility of negative growth. The difference between these two projections comes from the potential compounding of several negative effects that our model allows for: the impact of declining demographics in Western-Europe, a major financial instability event and protectionist trade policy on Eurozone GDP growth, concomitant with significant negative effects on the conversion rate of Eurozone GDP into TCTS-HLH from the Belt & Road Initiative, 3D-printing and re-shoring plus a slight decline in the Port of Rotterdam's market share.⁸ This extreme, but possible set of concomitant negative influences would result in a -5.66% decline in TCTS-R in 2025 relative to 2015 according to our model.

3.1.4. Outcome Extremes and their Potential Impact and Uncertainty

The projected development paths for TCCT-R-Rd that have been presented in the section above translated into the following two extreme outcomes of TCCT-R-Rd in 2025.

1. *TCCT-R-Rd grows to 8.86 million TEU in 2025 (a 97.7% increase relative to 2015) as all of the most favorable assumptions in Table 3.1 play out in reality.*
2. *TCCT-R-Rd grows to 3.732 million TEU in 2025 (a -16.7% decline relative to 2015) as all of the least favorable assumptions in Table 3.1 play out in reality.*

While the most favorable outcome would create an abundance of opportunity for firms that are able to increase their scale, the least favorable scenario of a significant year-on-year drop and a structural decline in TCCT-R-Rd will have a severe impact across the sector. A 25% structural decline of the total addressable market for container transport by Road would lead to substantial overcapacity in the sector. This typically results in a vicious circle of competitive devaluations that is eventually resolved by the decommissioning or repurposing of a percentage of the assets to the same magnitude of the overcapacity. This extreme would put intense pressure on container trucking companies to either compete on price or to exit the market.

The (un)certainty of where TCCT-R-Rd will actually land in 2025 relative to these extremes is very high as well. On the one hand it does seem likely that the cyclical nature that is typical of the 'financial stability' variable will result in another event that negatively impacts Eurozone GDP. Whether that is as severe as the 2008/9 financial crisis is difficult to predict. This uncertainty is further compounded by the fact that more favorable trend shifts or continuations could off-set these, on average, over the long-run into 2025.

3.2 ADS Adoption: Level and Proliferation of Autonomous Driving Technology

The second key variable is the 'adoption rate of ADS-technology', which we define as the percentage of the total amount of active trucks that has each of the six SAE-levels of ADS-capability (see Table 3.2) installed, with the percentage of the highest two SAE-levels being key. This variable impacts the strategic position of container trucking firms, because it influences the average cost per kilometer of transport, capacity and lead times of competitors adopting higher levels of ADS.

⁸ These various negative influences have been incorporated in our projections by adding an additional -0.3% decline to annual rate of change in the conversion rate of Eurozone GDP into TCTS-HLH each year from 2018 to 2019 going forward.

Table 3.2 SAE levels of autonomous driving system (ADS-)capability

Level	SAE Name	SAE level definition
0	No automation	Full-time performance by human driver
1	Drivers assistance	Driving-mode specific execution by ADS
2	Partial automation	Part-time or driver-mode dependent execution of one or more driver assistance tasks by ADS
3	Conditional automation	Driving-mode specific performance of all aspects of dynamic driving task <i>with</i> requests of human intervention.
4	High automation	Driving-mode specific performance of all aspects of dynamic driving task <i>without</i> requests of human intervention
5	Full automation	Full-time performance of dynamic driving tasks by ADS under all conditions manage-able by a human driver.

3.1.5. Model of cluster

Figure 3.5 provides a model of the direct (dark red) and indirect (light red) determinants of the relative share of the various SAE levels adopted by active trucks plus the variables (grey) through which actual ADS adoption results in feedback effects on these (in)direct determinants.

The most obvious direct determinant of ADS adoption is the development of ‘ADS technological capability’ from now until 2025, which can be measured as the highest SAE level proven to lower accident risks than the level below it. But ADS technological capability is merely one necessary (and not a sufficient) condition for ADS adoption among active trucks. Each level that technological capability of ADS advances, has to be matched by ‘regulatory approval’ of its use outside of experimental settings to make adoption among active trucks possible. Besides the regulatory approval of certain SAE levels, ‘legislation on legal liability’ (in case accidents do occur) will also influences ADS-adoption. Another direct determinant of ADS adoption are the average ‘efficiency gains’ in terms of ‘total costs of ownership (TCO) per kilometer’, ‘time’ and ‘capacity’ of the highest available SAE level for individual trucks and entire fleets compared to the SAE level below it. These direct determinants of the ADS adoption rate are in turn determined by ‘investments in the development of ADS technology’, ‘investments in ADS-supporting infrastructure’ and ‘political support’, which are themselves influenced (indirectly) by the impact that actual ADS-adoption has on ‘road safety’, ‘(un)employment’ and the ‘environment’ through ‘media coverage’, ‘public opinion’ and ‘lobbying’.

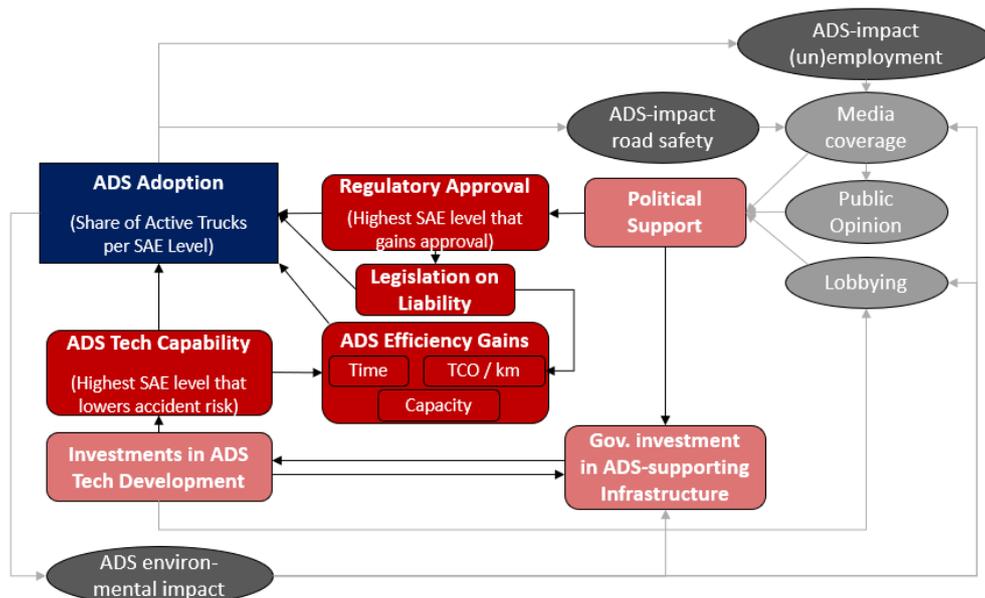


Figure 3.5 Model of the variables that influence ADS adoption among active trucks

3.2.2. Historical Trends & Developments

The level of ADS capability operational in trucks currently lags that in passenger cars. One of the more prominent examples of where ADS is adopted in trucks comes from US Express, who outfitted its entire fleet of 7.000 trucks with autonomous braking and collision systems (Dougherty, 2017). But this type of driver assistance is SAE level 2 at best and such large scale adoption within a trucking company's fleet is still the exception rather than the rule. In contrast, several high-end models of BMW, Mercedes and Hyundai already have integrated highway pilots (a narrow form of SAE level 3) while Tesla even claims that their autopilot offers SAE level 3 across a much broader range of dynamic driving tasks.⁹

In spite of this lag in ADS adoption among trucks compared to cars, investments in the development and testing of self-driving trucks is increasing exponentially. The New York Times reports that total investments in ADS for trucking in 2017 saw a ten-time increase to 1 billion USD in 2017 compared to 2016 (Dougherty, 2017).

Here, it is important to note that the current testing of ADS integration on the road is not focused on full automation. Lead developers in the space stress that it is a big misconception that there will suddenly be an ADS that is able to drive a truck all the time and that the eventual adoption of SAE level 5 will be an evolution, rather than a revolution.¹⁰

Instead, there are three different models of first generation self-driving technology integration in trucks being tested at this time. The first of these models is *platooning*, where a series of trucks forms a digitally connected convoy in which a lead truck is closely followed by autonomously driven tail trucks. This technology is being tested by Daimler Trucks (in the U.S.) and a collaboration between DAF trucks, TNO and other parties in the Netherlands. The second model is *exit-to-exit* autonomous driving on highways, where a human driver drives the truck to the highway, the ADS takes over from there until the highway exit, where the driver takes control again. This model was first tested by Google's Waymo (Hawkins, 2018), Uber (McFarland, 2018) and has also attracted start-up competitors like Embark (Walker, 2017). The third model is *remote-first/last-mile* operation, where the ADS operates the truck without a driver for most parts of its route (highways in particular), but where a human does take over driving for some parts of its route (Walker, 2017) (potentially overseeing multiple trucks at the same time), which is currently being pursued by start-up Starsky Robotics.

While current regulations provide some substantial constraints, regulatory bodies are developing ADS guidelines that seek to balance safety assurance with facilitation of innovation. On the one hand, the main regulatory constraint found by students is that most traffic laws are based on international treaties that specify that control of the vehicle must at all times be with the driver. The United Nations did add the rule that 'systems that autonomously steer a car are permissible if they can be stopped by the driver at any time' (Heutger & Kückelhaus, 2014, p. 8). But this only accommodates ADS up to SAE level 3 and any changes beyond this would begin to interfere with the legal principles that 'liability for damage to property and person [resides] with the driver or vehicle owner' and liability for the vehicle (e.g. for construction or manufacturing defects) resides with the manufacturer (*idem*, p. 11). On the other hand, a regulatory body like the U.S. Transportation Department's NHTSA and the Dutch government have communicated their motivation to facilitate the development and introduction of ADS because of the safety, logistic and environmental benefits. The NHTSA have, for example, issued a Voluntary Guidance report with 12 priority safety design elements for developers (NHTSA, 2016) and the Dutch government is enabling and supporting ADS test projects (Ministerie van Infrastructuur en Waterstaat, 2015).

⁹ The section on Tesla's website about its autopilot ADT technology (https://www.tesla.com/nl_NL/autopilot, accessed 21-08-2018) touts "fully driving technology" and video states "The person in the driver's seat is only there for legal reasons. He is not doing anything the car drives itself." On the one hand, these claims suggests dynamic driving performance by the ADS under all conditions. Yet Tesla's ADS still relies on human interventions when requested, as Tesla released the following statement after a fatal crash with a Tesla on autopilot in Mountain View, California on March 23rd of 2018: "The driver had received several visual and one audible hands-on warning earlier in the drive and the driver's hands were not detected on the wheel for six seconds prior to the collision". This shows that Tesla's official stance regarding its autopilot is that the driver still has respond appropriately to request to intervene (SAE level 3).

¹⁰ The first point is derived from Uber's head of self-driving truck (see Dougherty, 2017) and the second point comes from a presentation by Mercedes Benz Trucks (see Timp, 2018).

3.2.3. Forecasts

In order to define the bandwidth of possibilities regarding the level and rate of ADS adoption in 2025, expert views regarding the technological developments of ADS capabilities, regulations and efficiency gains will be discussed first. Here, the technological development of ADS capability is the most important of the direct determinants of ADS adoption, as higher levels of automation first need to be viable before they can be adopted.

Expectations about the level of ADS capability operational in trucks in 2025 are best developed in relation and comparison to expectations about the level of ADS capability in cars, on which there is more information. Figure 3.6 shows at what point in time each of the major car manufacturers expects ADS capabilities to above level 2 to be integrated and operational in (their) cars.

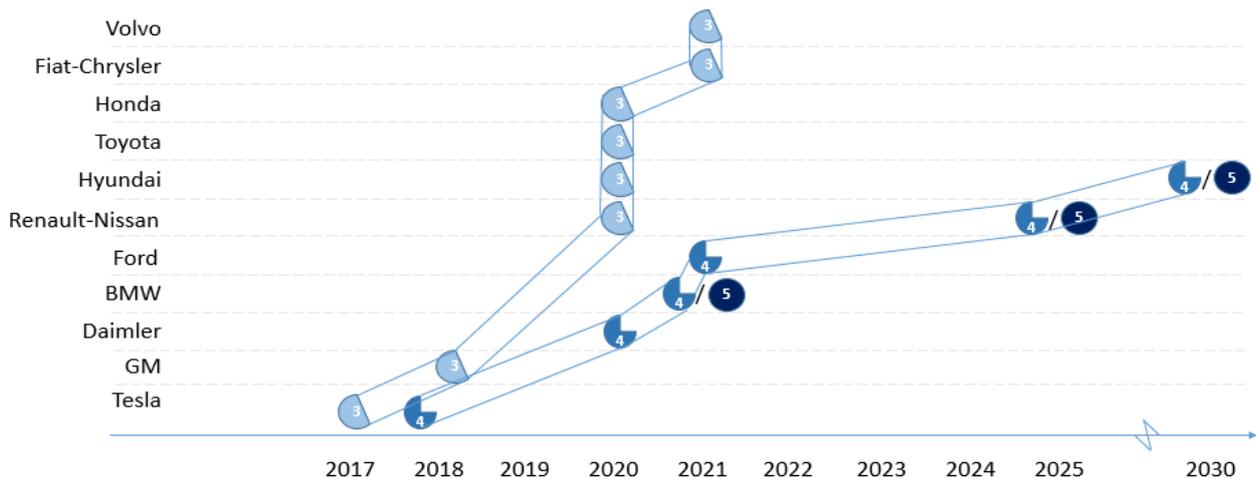


Figure 3.6 Years in which the 10 biggest global car manufacturers expect to see SAE level 3, 4 and/or 5 adoption in cars¹¹

Though Tesla and GM are clearly more confident and optimistic than others, there is a clear, more general consensus that SAE level 3 autopilots for highways will be integrated and operational in cars before or in 2021 at the latest (within the next three years). The expectations for level 4 are much further apart, with Tesla seeming to claim that they are offering ADS capabilities that meet level 4 requirements already (or are on the threshold of doing so soon). Noteworthy is that Ford plans to skip level 3 because they found that human drivers are not attentive enough to respond to requested interventions during testing (Walker, 2018).

Expert opinions about the pace of development in higher levels of ADS capability for trucks relative to cars vary. On the one hand, the typical use of trucks over long stretches of highways makes them more amenable for automation (Bergen, 2017). So does the fact that trucking companies are more sensitive to financial incentives (Dougherty, 2017). On the other hand, trucks are much more demanding on ADS response time, as they have longer braking paths and less maneuverability than cars because of their size and weight (Walker, 2017) – which also makes them a bigger risk in terms of accident impact. A truck driver’s job is also less susceptible to full automation, because it involves ‘loading and unloading, maintaining the vehicle, fueling, negotiating, and completing paperwork’ in addition to driving (Harris, 2018). To add to the uncertainty, two of the biggest players in the space also have different perspectives: where Google’s head of Waymo expects that self-driving trucks will be operational before self-driving taxi’s, Uber (which has tested its ADS over four times as many miles as Waymo in 2017) has withdrawn from testing self-driving trucks to focus on self-driving cars first (Gilroy, 2018). This makes it uncertain whether trucks will adopt level 3 automation before cars or the other way around. But it is also unlikely that either moment will be far removed from the other in time for SAE level 3. The increased safety risks due to higher impacts for trucks do make it more likely that level 4 and 5 automation will be adopted in cars sooner than in trucks.

¹¹ Reference to article about autonomous driving predictions.

Concrete predictions for the operational use of ADS in trucks vary across the three models mentioned in section 3.2.3. TNO (n.d.), one of the key partners in the Dutch platooning pilot project, expects that platooning will be operational in 2020. Likewise, Daimler expects that platooning will be ready for market in just a few years (McGee, 2016). The other two models that aim to be primarily reliant on ADS for most of the driving, have not communicated such a clear time horizon. The exit-to-exit model could operate at SAE level 3 as long as an alert back-up driver remains in the truck to respond to intervention requests. This could also be true for the remote-first/last-mile model in theory (with a remote intervention upon request), but that does come with risks regarding remote operator availability and capacity. The latter model thus seems to require SAE level 4 capability for highways in order to work whereas the former could be introduced using SAE level 3. So although it seems highly likely and likely that platooning and an exit-to-exit model with an alert driver model will be technologically viable in 2025, the more advanced remote-first-and-last-mile model seems subject to uncertainty about the viability of SAE level 4 for highways in 2025.

Though government (regulatory bodies) explicitly state their motivation to aid the adoption of autonomous driving, actual regulatory approval of autonomous driving could be a drag on adoption. On the one hand, the Dutch government (like the NHTSA) explicitly states their commitment to aid the introduction of self-driving vehicles.¹² On the other hand, a regulatory body like the NHTSA does not project fully automated safety features and high way autopilot (SAE level 3) before 2025 on their timeline for ADS adoption (NHTSA, 2016). This would imply a regulatory lag of at least four years compared to the projections of the big automakers (see Figure 3.6). Unlike the U.K., the Dutch government has neither communicated a start nor committed to a deadline of a regulatory review process for autonomous driving vehicles, but merely states that they want to collaborate with other countries to change international regulations. This refers to the EU, where regulatory lenience to the testing of autonomous vehicles is stricter than in the U.S (Campbell, 2018; Nicola, Behrmann, & Mawad, 2018).

Another important regulatory hurdle are changes in the ways liabilities are distributed between truck manufacturer, the ADS software developer, the (back-up) vehicle operator and the trucking companies who own the vehicles, as well as insurance products that cover these liabilities in ways acceptable to all parties. Truck manufacturers and ADS software developers will not install ADS technologies that still requires human intervention while all or some liability for accidents where their system was involved is transferred to them. Truck drivers could refuse to use ADS if they remain liable for accidents the ADS creates and trucking companies will not adopt ADS if drivers can hold them liable for accidents as the result of defective equipment. In this regard, the more rational assessment of costs and benefits by businesses compared to consumers may actually impede the adoption of autonomous driving technology beyond SAE level 3 in trucks.

For the relative efficiency gains of ADS (third direct determinant of ADS adoption) much will depend on the SAE level and their model of operational integration. In general, the most obvious cost reduction of fully automated (level 5) ADS technology would come from the fact that human drivers are no longer needed. This will significantly reduce labor costs *and* significantly increase the utilization rate of trucks, as their use will no longer be constrained by the maximum drive-time regulations for truck drivers. Morgan Stanley therefore expects that autonomous driving technology will eventually cut industry costs in half (Hsu, 2017). Most of these savings would come from the 43.8% of the total cost of operating a truck for a year spent on labor costs for the driver (Van der Vliet, 2016, p. 27). The same efficiency gains would apply to a successful introduction of the remote-first-and-last-mile model, albeit to a lesser extent. At lower levels of automation, the platooning model was tested capable of achieving fuel cost reductions of around 4% for lead trucks and up to 10% for tail trucks (North American Council for Freight Efficiency, n.d.). For the exit-to-exit model, efficiency gains could come from the time that a human driver could spend on other activities when an ADS autopilot takes over on highways, a concept called value-added trucking.¹³ The latter would also apply to platooning when drivers are present but able to disengage in tail trucks. Depending on the SAE level of the ADS and the model of its operational integration, efficiency gains can therefore range from cost savings of 7% on fuel to a halving

¹² <https://www.rijksoverheid.nl/onderwerpen/mobiliteit-nu-en-in-de-toekomst/zelfrijdende-autos>, accessed 21-09-2018

¹³ See <https://vil.be/project/v-a-t-value-added-trucking/> (accessed on 21-09-2018) for recent research on the opportunities in this area by a Belgian sector association like TLN.

of total costs, and from no capacity gains to the disappearance of capacity constraints on truck use due to drive-time limitation.

Finally, the indirect determinant of ADS-supporting infrastructure looks to be a positive contributor to ADS adoption moving forward. The Dutch government accord states that the design, development and maintenance of road infrastructure should take self-driving vehicles into account (Regeerakkoord, 2017). The same is true at the level of the EU, where 450 million EUR in subsidies has been committed to investments in roads and telecom networks needed to support driverless vehicles (Campbell, 2018).

3.2.4. Outcome Extremes and their Potential Impact and Uncertainty

Based on the expected developments and uncertainties described above, the bandwidth of possible outcomes for the adoption of various levels of ADS can be defined by the following two extremes.

1. *20-40% of active trucks uses SAE level 3 autonomous driving technology during 20-40% of the time that they are operational under the platooning model.*

This conservative extreme would occur when technological developments and regulatory approval of more advanced forms of ADS adoption are stalled for various reasons. The most important of these reasons would be that both ADS developers and regulators will come to the same conclusion as Ford: when it comes to improving road safety, it is all or nothing for autonomous driving. The ADS should either be able to perform all functions of the autonomous driving task without the need for human interventions under predefined conditions, or the human driver has to remain alert to a degree that his physical presence and attention cannot be dispensed with. Because the SAE technology has either not developed, been sufficiently tested or approved at SAE level 4 to the extent that trucks could do without the presence and attention of human drivers on highways, the actual use of ADS among active trucks remains limited to platooning. Only when a human driver in the lead truck is fully alert and engaged with the driving task, can tail truck drivers relinquish control to their ADS to the extent that they can disengage to do other things. As such, only a limited amount of trucks will be outfitted with this level of ADS technology and can only use it during the limited amount of time when lead trucks are available.

2. *20% to 40% of active trucks uses SAE level 4 autonomous driving consistently on highways, predominantly using an exit-to-exit model with a disengaged human driver and a growing minority of trucks beginning to adopt the remote-first/last-mile model.*

This progressive extreme would occur when technological developments of ADS follow the more optimistic projections of Daimler, BMW and Ford regarding SAE level 4, which will have proved safer than human drivers on highways in tests before 2020/21 and have gained regulatory approval in 2021/22. Although adoption will be slow at first, relative efficiency gains for innovators and early adopters among hauliers will bring in an early majority that has to remain competitive and pushes the adoption rate past 20%. The cost savings that can be gained with an exit-to-exit model where a substantial amount of back-office activities can be transferred to drivers and utilization rates of trucks are increased due to fewer limitations from maximum driving-time regulations for human drivers. Some of the bigger hauliers who have or are able to attract sufficient investment capital will also have begun experiments with the remote-first/last-mile model, but this will not be dominant in 2025 as new types of schooling and “tele-driver licensing” will probably delay its regulatory approval.

The impact of the latter extreme on the strategic position of trucking firms will be substantial. Those firms who are able to adopt this technology can be expected to lower their cost basis up to 20% through efficiency gains by 2025 – and, more importantly, are on a trajectory to reap further efficiency gains when the ADS technology develops further. With room to use these cost-savings for lower prices and to funnel higher profits in to further investments on SAE level 4 outfitted trucks, there will eventually be a watershed between firms who are willing and able to ride the wave of automation and those who stick to human drivers. Here, the competitive dynamic will eventually drive out the latter. The impact of the first extreme is less severe, as the limited utilization rate of ADS level 3 (whose efficiency gains are partially off-set by the additional investments required) does not decisively tip the scales of the competitive advantage to ADS-adopters as the second extreme would.

Whether the first or the second extreme will happen is highly uncertain. On the one hand, it is likely that regulatory lag will be longer than the 2 to 3 years implied by the second extreme, but this could easily be offset by a surprisingly fast development of ADS technological capability. Either one extreme therefore seems as likely to happen at this point as the other.

3.3. Uberization

The third key variable is 'uberization', which measures the degree to which an application like Uber will disrupt the sector for continental container trucking. In more specific and measurable terms, such disruption could occur on two levels. The first is the percentage of market arbitration (i.e. the matching of supply and demand) that is automated through a digital platform. At this level, an uber-like platform could substitute the intermediating role of freight forwarders, shipping lines and terminal operators. Additionally, it could also substitute for direct customer relations and competition on those occasions where the trucking companies act as freight forwarders themselves. At the second level, uberization impacts the strategic position of container trucking firms by offering a digitalized and automated substitute for supporting activities like planning and coordination, administration and financial settlement. Here, an uber-like platform would especially compete with the back-offices of medium-sized and large trucking companies.

3.3.1. Model of cluster

Figure 3.7 provides a model of the conditions that will determine whether an uber-like platform will be introduced, would acquire sustainable market share, become the dominant platform for market arbitration and digitalize and automate operational support processes for arbitrated truck transports. As such, this model shows that uberization would effectively consist of two components: market arbitration (the share of continental container transports that is arbitrated through the platform) and process automation (the degree to which planning, coordination and the administrative functions that support the operational execution, transactions and financial settlements are automated by the platform).

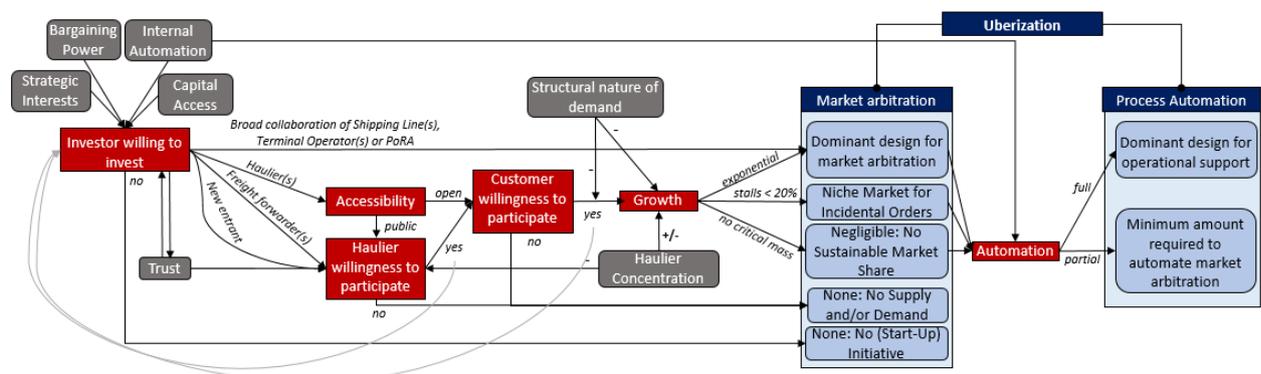


Figure 3.7 Model of conditions and influencing variables that determine if and what role an uber-like platform could obtain

The most important (pre)condition for the introduction of an uber-like platform is whether or not an investor is willing to invest in the development of one. If this condition is not satisfied, the degree of uberization of container trucking in the Rotterdam region in 2025 will be none, since there will not have been any (start-up) initiative to create an uber-like platform. If, however, this condition is satisfied (there is an investor), the eventual degree of uberization will be significantly influenced by whom the investor is. This could either be (1) a broad collaboration of shipping lines, terminal operators (and/or) the Port of Rotterdam Authority (PoRA), (2) a collaboration of container trucking firms (hauliers), (3) -freight forwarder(s) or (4) a new entrant that currently is not part of the supply chain. Whether or not one of these actors will develop an uber-like platform and – if so – which of these actors that would be, is influenced by their strategic interest, bargaining power, degree of internal automation and ease of access to investment capital.

The type of investor is such an important determinant of the degree of uberization, that it defines what other determinants do- and do not play a role. A sufficiently broad coalition of the big shipping lines or terminal operators in the Port of Rotterdam (supported or even sponsored by PoRA) would have sufficient bargaining

power (based on their market share in carrier haulage) to force an uber-like platform upon the sector and grow it into a dominant design. If a new entrant would introduce an uber-like platform, on the other hand, the degree of uberization their platform could achieve would be determined by 'haulier willingness to participate', 'customer willingness to participate' on the platform and the 'growth' they are able to realize as a result of that. The same logic would apply for a big freight forwarder (e.g. Kuehne & Nagel) to the extent that they do not have their own trucks or beyond the point that their own trucks are able to meet demand. Finally, if a (collaboration of) haulier(s) would introduce an uber-like platform, the degree of uberization will depend on whether or not their platform will be open (accessible to other hauliers) or private (limited to partner firms) and the degree to which customers would want to participate.

At the level of market arbitration, there are five possible outcomes. There could be no market share for two reasons: (1) there are no investors willing to invest (which means there would be no start-up initiative to launch the application) and (2) hauliers (and/or) customers are not willing to switch to the use of a platform. If both hauliers and customers are willing to participate on the platform, the growth rate will determine the degree of uberization regarding market arbitration. Here, it is possible that (3) the market share remains negligible (when insufficient customers and hauliers participate to gain the critical mass in supply and demand to create a healthy and competitive offering on platform). It is also possible that (4) the platform arbitrates a minority, yet sustainable share of market transactions that mostly limits itself to orders that are more incidental in nature. Finally, it is possible that (5) the platform becomes the dominant design for market arbitration, matching the supply and demand of more than half of the continental container transports by truck.

The nature of demand (structurality and concentration) and industry concentration are two important influencers that affect the growth rate when a platform would emerge. The more structural and concentrated the demand for continental container transport will be, the more likely customers are to prefer their own, direct negotiations about long-term contracts or agreements about prices with hauliers. Conversely, the more concentrated hauliers are, the more likely the hauliers are to prefer to negotiate with customers directly.

Finally, the second aspect of uberization (the degree to which planning, coordination and other operational support processes are automated) can either be partial or full. Partial automation is where the minimum degree of automation to digitalize market arbitration supports the platform. Full automation would be when all communication and transactions between customer and haulier are carried out by the platform, without the need for any other communication and transaction activities beyond the listing of an order and its acceptance. Which of these two outcomes obtains will be influenced mostly by the willingness of all involved parties to share their data.

3.3.2. Historical Developments

The first condition that there has to be an investor willing to invest in an uber-like platform has already been met in the market for regular freight haulage and the Singaporean market for continental container transport by truck. Uber has long demonstrated that the technological viability of a digital and automated market arbitration application in the ride-hailing industry (launching in San Francisco in 2010). Platforms like Cargomatic, Convoy and Transfix in the U.S. and Full Truck Alliance in China have both proved that this concept can be extended to freight haulage in general. Investors are also eager to back them, with Cargomatic having raised around 60 million USD (Smith, 2018), Transfix raising 79 million USD so far, Convoy raising 185 million USD in its latest investment round led by Google's parent company Alphabet Inc. (Phillips, 2018) and China's Full Trucking Alliance raising 1.9 billion USD so far (Chen, 2018). More importantly, however, one recent start-up in Singapore named Haulio has launched a platform that targets continental container trucking in particular.

Haulio proves that a new entrant is able to find customers and hauliers willing to participate on a platform and grow to what seems to be a sustainable market share in the Singaporean market. Though Haulio acknowledges that freight forwarders and trucking companies had some resistance to their platform at first, they have managed to find ways to overcome that. Haulio claims to have been very successful in subscribing both freight forwarders and especially smaller hauliers (< 10 trucks) to their platform by building relationships (explaining how their platform works over coffee), emphasizing they do not want to steal their business and

positioning them as an outlet for overcapacity and a supplier of work at times of under capacity (Wei, 2018). Using this approach, they managed to subscribe over 60 hauliers to their platform by April (*ibid.*) and 86 in September of 2018.¹⁴ This suggests that the reluctance of customers and hauliers to subscribe to the platform can be overcome with the right entry strategy.

Haulio also shows that it is able to out-compete other forms of market arbitration for at least some share of the total market. They report that the transport of 67.413 TEU has been arbitrated by their platform (Haulio, 2018) since its launch in May of 2017, and they have supposedly realized a month-on-month growth rate of about ~30% in traffic so far (NUS Enterprise, 2018).

With regard to the willingness of third parties to share data, it is not completely clear to what extent Haulio receives and shares data with shipping lines, terminal operators and customs. Their website does boast partnerships with customs,¹⁵ but details about the extent of data sharing and digitally automated interfaces with them, as well as information about data sharing and automated communication and coordination with shipping lines and terminals is not available. It is possible that planning, coordination and administrative tasks do not go beyond payments on Haulio's platform (and that all other transactions remain the responsibility of shippers and hauliers). But it could also be that the planning and coordination of loading times with terminal operators and the administrative procedures with customs are (close to) fully automated. Here, further research into the degree of automation is recommended.

3.3.3. Forecasts

Though the development and introduction of an uber-like platform could – in theory – come from each of the types of potential investors listed in Figure 3.7, it is unlikely that some- and more likely that other types of investors will actually invest. Appendix 2 assesses how likely it is for each type of potential investor that they would actually develop and introduce an uber-like platform based on the four influencing variables depicted in Figure 3.7 in grey.

Given their strategic interests, bargaining power, access to capital and potential entry strategies, terminal operators, PoRA and hauliers are less likely to develop and introduce an (open) uber-like platform themselves. Although terminal operators could be seen to have a strategic interest of reaping profits from forward integration through the launch of a platform, as well as access to the capital required to do so, they lack the bargaining power required for their likely entry strategy. They have little to no contractual relations with shippers and hauliers¹⁶ and are entirely dependent on shipping lines for their business. It is therefore unlikely that shipping lines are willing to give up the margins they are currently making on the arbitrage of carrier haulage in negotiations about an unload & *delivery* service from terminal operators. This is likely to reduce the perceived probability of success for terminal operators to the extent that they are unlikely to take the risks. It also seems unlikely that a (collaboration of) haulier(s) would develop an *open* uber-like platform. Adoption of an uber-like platform might be in the interest of hauliers as a collective at the level of intra-modal competition with barge and rail. But for individual firms, a platform is likely to be seen as undermining and cannibalizing their existing business based on long-term relations with customers: it makes their service offering perfectly substitutable and unpredictable by subjecting it to a dynamic, real-time pricing- or auctioning mechanism of market arbitration. Finally, the Port of Rotterdam is unlikely to initiate the launch and development of such a platform itself, due to its impartial role.

New entrants, shipping lines and freight forwarders are more likely candidates for the development and introduction of an (open) uber-like platform. New entrants have no vested interest in the existing arrangements and much to gain from the inefficiencies of supply and demand mismatches of current market arbitration mechanisms (as Haulio's successful introduction shows). Haulio is already eyeing Indonesia, Malaysia and Thailand for international expansion (Ellis, 2018). If they are able to deliver a proof of concept

¹⁴ Haulio's website lists the amount of hauliers active on their platform as 'Haulier partnerships made' (see <http://haulio.io/Company>), which read 86 when accessed on 22-09-2018.

¹⁵ Singapore customs is listed under "our partners" on the Haulio website (<http://haulio.io/Company>, accessed on 22-09-2018)

¹⁶ Terminal operators only make up 3% of the total client-base for hauliers (Van der Vliet, 2016, p. 32)

in two major ports, attempts to enter other major ports by them or me-too competitors – analogue to the emergence of many competitors in the space of regular freight haulage – can be expected to follow quickly.

Shipping lines also have a strategic interest in launching an uber-like platform, as it would allow them to improve their margins for carrier haulage (where shippers contract with shipping lines for end-to-end transport). Similarly, freight forwarders would have a strategic interest in developing and introducing an uber-like platform because it could help them drive down trucking costs for their end-to-end service offering of container transport and improve their competitive edge and their margins. Based on their tremendous bargaining power over trucking companies (Van der Vliet, 2016) large freight forwarders and shipping lines are most likely to grow a platform to a dominant position. Both of these players also have high degrees of internal automation. Maersk, the biggest shipping line in the world, has even developed a platform for freight forwarding of container transport by sea, which it could move to extend to continental container transport in the future.¹⁷ Yet, for all these more likely investors, much is still likely to depend on the extent to which Haulio is going to be successful.

Of these more likely investors in the development and introduction of an uber-like platform, the only one that seems to be able to force a platform for market arbitration of continental container transport upon the sector is a broad coalition of shipping lines. Only such a coalition would have the bargaining power to do so based on their current share of market arbitration through carrier haulage. Yet such a coalition would have to be sufficiently broad to immediately subject the majority of market arbitration to it. If a smaller collaboration or a single shipping line would develop and introduce the platform, it would follow the same path as the 'freight forwarder(s)' arrow from 'investor willing to invest' in Figure 3.7.

Beyond the primary question who would be willing to invest, the expected outcomes of the factors that determine the degree of uberization in Figure 3.7 are best discussed in comparison to Haulio (this being the one example of an actual introduction of an uber-like platform in this specific market).

The first of these factors is the extent to which hauliers in the Rotterdam region would be willing to market their supply and demand through the platform. On the one hand, hauliers who have been and are successfully competing on price could see the platform as an opportunity to further leverage their competitive edge in general. For other hauliers the platform could prove itself valuable on a more incidental basis: when trucking firms are shy for business in times of overcapacity or when they have to forward orders during times of undercapacity. On the other hand, structural differences in market make-up between Rotterdam and Singapore could lead to very different outcomes for similar value propositions and introduction strategies. One of these differences could be in the size of container trucking companies. Where (smaller) container trucking companies without dedicated commercial and administrative staff would benefit from the equalizing effect of a platform on supply-side access, firms with dedicated commercial and administrative staff gain a new form of competition (from substitution) at the level of their front- and back-offices. Geographic markets without much supply side concentration (predominantly independents and smaller firms) will therefore be more easily penetrated by a platform than ones made-up of more medium-sized and larger firms. In Rotterdam, where the majority of trucks is operated by medium-sized and large companies (see section 2.1) there could be much bigger barriers to entry than in Singapore (if the latter market is substantially less concentrated).

The second factor that determines the overall degree of uberization is the extent to which shippers and intermediaries for the Rotterdam region would be willing to market their supply and demand through the platform. On the one hand, the value proposition of an uber-like platform in Rotterdam would be highly similar to Haulio's in incentivizing adoption. Whereas third party freight forwarders can charge up to 30% (Brovkin, 2017) or 40% (Abrosimova, n.d.) on every transaction for freight haulage in general, Haulio only takes a 3-5% cut (Wei, 2018). Such overall advantages to disintermediation provide strong incentives for adoption on the demand side of continental container trucking. On the other hand, differences between the extent in which shippers, intermediaries and trucking companies engage in long-term relationships and or

¹⁷ See <https://www.twill.net/> (accessed on 18-10-2018) for more information about Maersk's platform for container transport by sea.

contracts (between Singapore and Rotterdam) could also adversely affect the adoption rate of an uber-like platform. The nature of demand for freight haulage in general and container trucking in particular makes it much less amenable to uberization of market arbitration than cab rides. Where the latter is often incidental and “contracted” on a one-by-one basis, the demand for freight haulage and continental sea container trucking is much more structural: on average 65% of the customers of Dutch hauliers require daily-, 13% weekly- and 5% monthly services. Only 10% percent is either a one-time customer, requires services every six months or once a year. When shippers have a more structural, long-term need for continental container transport, forging long-term business relations and/or negotiating long-term contracts with hauliers around more favorable terms, disincentives customers from subjecting their orders to the type of real-time, transport-by-transport market arbitration that is typical of uber-like platforms in the ride-hailing industry. For this reason, the research director of transportation and technology at Gartner expects that large companies will keep shipping 90-95% of their business through core partners in regular freight haulage (Barnett, 2018). The same rationale suggests that it is unlikely that an uber-like platform – as we know it – will become the dominant platform for the arbitration of structural demand and replace the trust-based long-term business relationship (and contracts) that currently dominate the sector.

These inhibiting factors do not imply that there is no market for an uber-like platform in the Rotterdam region at all. Looking at the share of total customers in each customer segments for small, medium-sized and large firms (see Table 2.3), there seem to be several niche markets that offer opportunities to replicate the successful introduction strategy of Haulio. The clearest of these resides in the small firms who have other trucking companies as 46% of their customers (which is also true of 14% and 3% of the customers of medium-sized and larger firms respectively, see Van der Vliet, 2016, p. 35). The nature of the demand in this particular type of customer relation is typically incidental (with one firm acting as an outlet for overcapacity at other firms), it is much more amenable to uberization.

Besides the degree in which market arbitration is uberized, an uber-like platform could also change the degree in which operational support and administrative processes are automated. This determinant is influenced most by the willingness of third parties to share their data and link their systems to the platform. Here, too, there are bigger obstacles to the digitalization and automation of planning, coordinating and administrating continental container transport than to ride-hailing and car sharing. An uber ride only involves two parties (driver and customer) that directly transact (through the platform) and can be hailed at will by the customer. Continental container transport depends on coordination between shipping lines, customs and terminal operators for the scheduling of loading times. In order to substitute back-office employees, a platform would have to digitalize and automate the coordination and communication of information without the need of human intervention, which is difficult to realize with so many interdependencies between different parties. These interdependencies were also mentioned as a major obstacle to the uberization of freight haulage by Gartner’s research director for transportation and technology (Barnett, 2018). Though it is possible that some supporting activities will be further automated, it is thus unlikely that an uber-like platform will fully displace the back-offices of medium-sized and large trucking firms over the next seven years. It is more likely that some planning, coordination and administration will still happen outside of the platform after the platform has fulfilled its market arbitrating function of matching supply and demand.

3.3.4. Bandwidth, Impact and Uncertainty

Based on the expected developments and uncertainties described above, we believe that the bandwidth of possible outcomes for the degree of uberization is defined by the following two extremes:

1. *The percentage of total container transports that is arbitrated and supported by an uber-like platform in 2025 is either none or stalls out below 10%.*
2. *The percentage of total container transports that is arbitrated by an uber-like platform exceeds 25% and is on a growth trajectory to become the dominant form of market arbitration.*

The impact of the latter scenario will be biggest, but very unevenly distributed across firms. Not much will change for the strategic position of container trucking firms under the first extreme. The second extreme, however, will have an impact on firms that increases with the extent they are dependent on orders of intermediaries – especially if they are other truck companies – that are more incidental in nature. On the one

hand, this portion of their business will be threatened by a more transparent and dynamic form of competition on a platform that replaces their direct relations with intermediaries. On the other hand, this does provide opportunities for those who are able to offer more attractive prices and availability around peak demand. If such a platform is able to offer more attractive terms to buyers and better access to demand for sellers, it could continue to grow into a dominant form of truck load matching that arbitrates everything around the more structural demand of long-term (contracts) relationships.

Though both extremes are possible, it seems a bit more likely that the entry barriers to the Dutch container market will either deter investors of an attempt to enter it with an uber-like platform before 2025 or obstruct them from gaining a sustainable market share. That is not to say that the latter extreme cannot happen, but rather that – if a percentage would have to be attached – the probability that we would assign to the former would lie in the 65-70% range as opposed to 30-35% for the latter.

4.Scenarios

The previous chapter clustered various trends & developments around key strategic variables. This chapter constructs scenarios based on the key variables with the biggest impact and highest uncertainty (section 4.1).

4.1 Key Uncertainties

Scenario-based strategy formation (Ruijter, 2016) constructs scenarios based on key variables of clusters of trends & developments that have the highest impact on the firm and the highest degree of uncertainty. Figure 4.1 shows an overview of the relative impact (i.e. the effect on the strategic fit of trucking firms) and uncertainty of each of the key variables that were discussed in chapter 3. It also plots some other key variables that the students researched, but which chapter 3 did not discuss in detail (for reasons of time and space) because of their lower relative scores on these two dimensions.

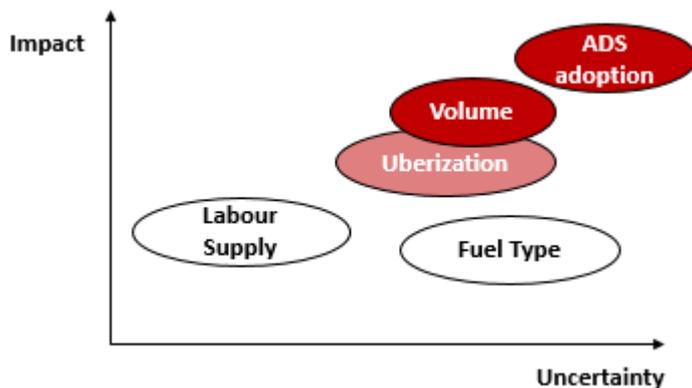


Figure 4.1 Key uncertainty selection matrix

Of the three key strategic variables discussed in the previous sections, ADS-adoption has the highest relative impact. The extreme outcome that ADS-lvl-4 is adopted by 20% to 40% of active trucks would have a significant impact: it would demand disruptive *qualitative* changes in the (human) resource base as well as new organizational competences of trucking firms to remain competitive in such an environment. Such qualitative changes are much harder to make successfully than the type of quantitative changes that a decline in volume would demand. However painful it may be, a -16.7% decline in volume over the next six years (see section 3.1.3) would – in and of themselves – be easier to survive over the long-term than the disruptive qualitative changes that high levels of ADS-adoption require. Yet such a decline would still have a bigger impact than uberization, as it would eventually force around the same percentage of current assets and drivers to exit the sector. This impossibility to stay in business for 16.7% of the sector's current capacity makes the impact of this extreme higher than uberization, which still allows for some form of adaptation. The emergence of an uber-like platform as the dominant form of market-arbitration will also have a significant impact on the sector, to be sure. Price competition will become even more important and the relative advantages that larger firms derive from having a front- and back-office will disappear. But since such a change would still leave more room for adaptation than the sheer disappearance of one-sixth of the market, figure 4.1 plots ADS-adoption above volume and volume above uberization on the vertical dimension of impact.

When it comes to uncertainty, the key variables of ADS-adoption scores highest. The speed with which ADS-lvl-4 will prove itself safer than human drivers on highways is very hard to predict (as evidenced by the big differences between the 10 major global car manufacturers predictions about the matter). This creates a degree of uncertainty that is further compounded by potential lags in regulatory approval, making it truly uncertain (50/50%). The volume of sea containers is also highly uncertain, but not as perfectly so. Though the scope and diversity of the trends & developments that affect this variable is much vaster, the cyclical nature of the key influencing variable of financial stability and the revival of protectionism on international trade are more likely to negatively impact total container volumes at some point between now and 2025 than not. That

is not to say, however, that total container flows and their transport is bound to structurally decline over the whole period. We assign a 60%-70% probability to a substantial drop in total container volumes at multiple levels in Figure 3.1 due to a financial instability event and/or adverse international trade policies for at least one or two full years over the 2018 to 2025 period. Yet with regard to the long-term structural changes in total container volumes we lean slightly more towards overall growth than to a decline over the same period (50%-60% probability). The degree of uberization is a bit more likely to result in the extreme of reaching a >25% share of market arbitration and being on the path to dominance. The strategic interests, bargaining power and internal degree of automation of some players (e.g. shipping lines and freight forwarders) are simply too great not to expect a successful attempt at launching an uber-like platform. Yet, on the other hand, the entry barriers posed by the structural characteristics of the market in the Rotterdam region are still likely to resist adoption. We therefore only subscribe a probability of 60% to the extreme where uber-like platforms are on their way to dominate market arbitration, making it the least uncertain key variable. Figure 4.1 thus plots ADS-adoption above volume and volume above uberization on the horizontal dimension of uncertainty.

The relative impact and uncertainty of the key variables discussed above and depicted in Figure 4.1 dictates that the rate and level of ADS-adoption, the total volume of sea containers transported by road in 2025 and uberization be used as the basis for the construction of scenarios in the following paragraphs.

Table 4.1 The total amount of theoretically possible scenarios, their characteristics, real possibilities and names.

	#1	#2	#3	#4	#5	#6	#7	#8
ADS-adoption	Slow	Slow	Slow	Slow	Fast	Fast	Fast	Fast
Volumes	Growth	Growth	Decline	Decline	Growth	Growth	Decline	Decline
Uberization	Negligible	Dominant	Negligible	Dominant	Negligible	Dominant	Negligible	Dominant
Possible	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Realistic scenarios	Scenario 1A	Scenario 1B	Scenario 2A	Scenario 2B	Scenario 3A	Scenario 3B	x	x

Although this selection of three strategic variables as key uncertainties yields ($2^3=$) eight possible scenarios in theory (see first row of Table 4.1), only six of these are considered realistically possible futures. This is because a materialization of a structural decline in the total container volumes that are transported to and from the Port of Rotterdam *by road* is highly improbable in conjunction with the adoption of ADS-lvl-4 in 20-40% of active trucks, as these extreme will tend to cancel each other out in both directions. On one hand, a sudden year-on-year drop and a secular decline in overall container volumes (at all levels in Figure 3.1) would result in significant decline in sales and overall revenues over an extended period of time for most firms. This would imply that many firms do not have the financial leeway to invest in ADS-upgrades in and of itself. But it is also likely to result in a degree of overcapacity at the sector level that would force many trucking firms to operate at a loss to at least cover some of their fixed costs. This would decrease the relative efficiency gains of investing in ADS-lvl-4 capabilities when prices of fully human-driven truck transport are already so low.

Nevertheless, deteriorating sales and revenue do not preclude the possibility that some industry incumbents or new entrants will actually seize the opportunity that ADS-lvl-4 offers to transform their business in a way that makes them much more competitive. However, if this would happen on a scale that leads to the adoption of ADS-lvl-4 in more than 20% of active trucks, this would cancel out the conjunction of both extremes the other way around. The adoption of ADS-lvl-4 in more than a fifth and a rapidly increasing percentage of active trucks would off-set the transfer of a structural decline in container transshipments in the HLH-range (TCCT-HLH) or the Port of Rotterdam (TCCT-R) to total continental container transports by road (TCTS-R-Rd), as it would substantially increase the latter's share in the modal split. Absent ADS-lvl-4 adoption in 20-40% of active trucks an overall decline in TCCT-HLH and TCCT-R would cascade into an amplified decline in TCTS-R-Rd. Yet with ADS-lvl-4 adoption in 20-40% of active trucks road transport would become much more cost-competitive while retaining and probably improving its speed and flexibility. As a result, shippers, shipping lines and freight forwarders will opt for road transport more often – increasing its share of the modal split to the extent that it will significantly compensate and off-set the overall decline in volumes at the level of TCCT-

R-Rd by 2025. So although it is still possible that ADS-lvl-4 would somehow still (in spite of the adverse economic conditions) be broadly adopted during times of a structural decline in total container transshipments (at the higher order levels in Figure 3.1), this would stop the decline of volumes in continental container transports *by road* enough to cancel out the possibility of there being an ADS-lvl-4 adoption rate of 20-40% *and* a structural decline in TCCT-R-Rd of 20% (in 2025 relative to today) at the same time (excluding scenarios #7 and #8 in Table 4.1). If ADS-lvl-4 would be adopted by more than 20% of active trucks in a period of adverse economic conditions and overall declines in TCCT-HLH and TCCT-R, this would transpose in scenario 3A or 3B.

Given that the impact and uncertainty of the volume and ADS-adoption is the highest, these two variables will be used as the primary differentiators of three main scenarios (1, 2 and 3), with each being subdivided into an A and B version based on a different outcomes for the uberization variable. The six theoretically possible scenarios are thus presented as three main outcomes of the Volume and ADS-adoption variables that are further specified by the state of Uberization variable in each throughout the following paragraphs.

4.2 Scenario 1A: Volume Growth, Slow ADS-Adoption, Negligible Uberization

The first scenario is one that resembles the current business environment for Dutch container trucking firms the most. It is defined by prolonged, substantial growth in the volume of containers that is continentally transported to and from the Port of Rotterdam by truck (TCCT-R-Rd) of +76% relative to 2015, slow ADS-adoption (with 20% to 40% of active trucks using ADS that does not exceed level 3 during less than 20% of their operational use) and negligible uberization in 2025 (less than 10% of container transport being arbitrated through an uber-like platform).

4.2.1 Route to this Scenario

Looking back, the turmoil at the end of 2018 and the beginning of 2019 turned out to only be a small hick-up in financial markets that was quickly cushioned by a continuation of accommodating monetary policy. By the beginning of 2020, the Federal Reserve had not only lowered interest rates again, but also reverted back from quantitative tightening to quantitative easing (QE) to stabilize financial markets. Other major central banks (ECB, BOJ and PBoC) never truly managed to leave their low-interest rate and QE policies, further lowering interest rates and increasing their asset purchases in 2019 and 2020. As a result, vast monetary accommodation, a lower dollar and inflation were able to counter the deflationary pressures of demographic decline in Western economies, loosen balance sheet constraints from high levels of corporate and household debt (by inflating existing debts away) and usher in a prolonged period of above average GDP growth (> 2.8%) in Western Europe.

Besides this accommodating monetary policy, the renewed boom in the Western-European economy was also driven by large-scale reshoring programs that relocated or expanded manufacturing in Germany, the Netherlands, Belgium and France at a rate that outpaced servitization. Automation and digitalization capabilities had already quietly passed the tipping point of making smart manufacturing more efficient than low-wage labor in the 2015-2018 period. But it was not until the reinstatement of trade tariffs following the Trump administration's trade dispute with China and Brexit in the 2018-2020 period (which eventually found an equilibrium and did not escalate into a full-blown trade-war) that one major multinational after another began to relocate to- or expand manufacturing in Western Europe where state of the art digitalization and automation technologies along with access to the human capital they required began to be more cost effective (overall) than producing in low wage labor countries. These developments significantly boosted overall container transshipments in the HLH-range to the point that the negative trend in the number of TEU processed per million Euros of Eurozone GDP actually turned, slightly increasing with about 0,8% percentage points on average per annum over the 2018 to 2025 period.

More importantly for trucking firms, the total amount of containers that will be transported to and from the Port of Rotterdam by road (TCCT-R-Rd) has continued to grow. The overall growth of container volumes in the HLH-range benefitted the Port of Rotterdam's market share especially, as it was the only harbor close to the expanding Ruhr-region and Dutch smart-manufacturing complex where the world's largest container ships could dock. This steadily increased its market share for containers from 31,0% in 2017 to 33,5% in 2025 at an average of 0.3 percentage points per year. Moreover, the need for speed and flexibility required by the

economic boom came to counter-balance the relative cost advantages of barge transport, which stabilized road transports share in the modal split.

ADS-adoption does not exceed the use of SAE-level 3 in more than 20% of active trucks during more than 20% of their operational use under this scenario due to delays in technological developments and regulatory approval. These delays in the actual introduction of ADS-lvl-4 in trucks relative to expectations have resulted from two mutually reinforcing developments. On the one hand, the more conservative developers of auto-pilot software will – during tests – find that machine learning and AI capabilities will continue to remain inferior to human drivers when it comes to dealing with exceptional circumstances. As a result, by the end of 2020, some of the leaders in this space will have postponed their projected introductions of ADS-lvl-4 capabilities for passenger cars and trucks with 2 to 5 years. On the other hand, increasing media-coverage and politicization of accidents with SAE-level 3 driven passenger cars manufactured by some of the (more hubristic) front-runners in this space (e.g. Tesla) will undermine legislative support. Whether these accidents were caused by irresponsible use by consumers or the irresponsibly fast introduction of the technology by the car manufacturer was inconsequential. Far more important was that these accidents swayed public opinion to an extent that political pressure on regulatory bodies and lawmakers led to severe scrutiny and delays of the regulatory approval for ADS-lvl-4 capabilities. As a result human drivers thus have to remain present and engaged with driving in active trucks.

These two developments were aggravated by car manufacturers who were more conservative or slower in their development and introduction of ADS seizing these accidents as an opportunity to discredit the front-runners and win regulatory bodies for their more thorough approach. At the industry level this added to the delay. As a result, ADS-developing and(/or) integrating car and truck manufacturers had pushed back their expected introduction dates with at least 2 years by 2020, regulators had issued negative rather than positive guidance about the approval ADS-lvl-4 in the 2020-2023 period and the Dutch government will forgo the type of infrastructure investments that would incentivize SAE-level-4-investments for container trucking firms in the Rotterdam region.

The fact that market arbitration and operational support will not have been uberized to a significant extent under this scenario was due to several reasons. The first is that the combination of volume growth and slow ADS-adoption discussed above had – due to the limited availability of drivers – made capacity even more scarce as it was in 2017 and 2018. As a result, larger structural clients wanted to avoid the day-to-day dependence on a platform for availability and move to secure long-term contracts or informal agreements with the larger trucking-firms more than before. This shift to secured long-term contracts and(/or) informal agreements was first noticeable in 2021-2023 period with some major shippers, shipping lines and freight forwarders negotiating for guaranteed longer-term capacity with the larger firms, but turned into the dominant form of market arbitration in the years 2024 and 2025 (with more than 50% of the industry's capacity committed for the coming 2 to 3 months or longer).

4.2.2 Scenario 1A's Industry Environment

The overall volume of containers continentally transported to and from the Port of Rotterdam in 2025 has grown to 7.9 million TEU, which is a 76% increase relative to 2015. Slow ADS-adoption and negligible uberization make that container trucking – at the operational level – functions in much the same way as it does today: trucks are driven by human drivers whom either perform the planning and coordination activities themselves (independents and smaller firms) or are supported by back-office employees.

The only marked difference with 2018 is that the scarcity of human drivers has increased and that the longer-term contracts and informal agreements that the larger shippers, shipping lines and freight forwarders use to secure capacity have accelerated industry concentration: a few of the larger-firms with superior front-office capabilities (i.e. direct customer contacts and customer relationship management), risk-appetite and access to financial resources have doubled or even quadrupled their order intake, growing their fleet size and their network of flexible independents. Other larger firms have grown in line with the overall market growth. As a result larger firms have increased their market share to around 70% of all transports.

On a strategic level, this specific version of the future industry environment is defined by the opportunities and threats listed in Table 4.2.

Table 4.2 Opportunities & threats under Scenario 1A

Opportunities	Threats
- Overall volume growth	- Employee shortage > capacity constraints / drain
- Scarcity driven need for reliable future capacity on the end of shippers, shipping lines and freight forwarders	

4.3 Scenario 1B: Volume Growth, Slow ADS-Adoption, High Uberization

This scenario is similar to Scenario 1A in that it is predominantly defined by continued TCCT-R-Rd volume growth, slow ADS-adoption, but differs from it because more than 25% of all container transports by truck is arbitrated by an uber-like platform.

4.3.1 Route to this Scenario

The route towards this scenario is similar to that of Scenario 1A regarding the growth in volumes and the slow ADS-adoption (see paragraph 4.2.1): benign financial and economic conditions will drive growth in overall container flows while ADS-adoption remains slow due to delays in the development of its technological capabilities and regulatory approval.

The only difference is that market arbitration, in this scenario, is increasingly uberized and that an uber-like platform is on a trajectory of becoming the industry standard. Under this scenario an uber-like platform was launched as an exclusive platform that digitalized and automated market arbitration between one or more major shipping lines and freight forwarders and a collaborative of at least two major trucking firms before 2021. Given the stake of the larger trucking firms and the competitive advantages they reaped from being exclusive, the platform remained exclusive for the next two to three years, but did expand by allowing independents and smaller trucking firms to subscribe as accredited partners. As the platform began to process the majority of orders from the larger firms who initiated the platform, it gradually came to supplant not only their front-office and back-office activities (due to digitalization and automation). After opening up the platform, its share of market arbitration will have rapidly risen to exceed >20% by 2023 or 2024 at the latest and will continue to grow exponentially in 2025.

Contrary to Scenario 2B (see section 4.5), uberization, in this scenario, will not be driven by the need to drive down costs on the platform initiator's end nor aided by overcapacity in attracting trucking firms. The continued growth in volumes and shortage of drivers will actually create supply shortages on the side of container truckers that drive up prices. In this environment delays due to undercapacity and the need to curb prices and make the sector more efficient will be the main driver to initiate a platform.

4.3.2 Scenario 1B's Industry Environment

As a result of the developments described above, the overall volume of containers continentally transported to and from the Port of Rotterdam in 2025 has grown to 8.25 million TEU (which is slightly more than Scenario 1A due to the positive effect of the uber-like platform on road transports share of the modal split) and ADS-capability remains below SAE-level 3 and is adopted by 20-40% of trucks.

The big difference with Scenario 1A is the effect that the uber-like platform has had on industry make-up and competitive dynamic. Arbitrating 25% of all container transports in the Rotterdam region in 2025 and being on an exponential growth trajectory to becoming the industry standard, this platform has tilted the balance of power in the industry away from larger firms (with the exception of those who have a stake in the platform). As the amount of orders that is tendered through the platform increases, the competitive edge that larger firms derive from their front and back-offices diminishes. The platform's dynamic form of market arbitration commoditizes access to orders and further reduces the competition to price leadership. Whereas scenario 1A was characterized by industry consolidation, the presence of a platform will at the very least counter the

trend of consolidation or even reverse it into fragmentation. Substituting both front-office and back-office activities and fueling price-competition, the platform will on the one hand force larger firms to cut overhead costs and capitalize on economies of scale to remain attractive, while enabling independents and cost-efficient smaller- and medium firms to grow their volumes through attractive pricing on the platform.

Given that the industry environment is similar to that of Scenario 1A in most regards with the exception of the higher degree of uberization and its effects, Table 4.3 presents all the opportunities and threats for container trucking firms in this scenario, with those that are unique to it printed in bold.

Table 4.3 Opportunities & threats under Scenario 1B

Opportunities	Threats
- Overall volume growth	- Employee shortage > capacity constraints / drain
- Scarcity driven need for reliable future capacity on the end of shippers, shipping lines and freight forwarders	- Price-competition from no/low-overhead competitors on the platform
- Automated and digital platform offers easier access to demand and cost-efficient operational support	
- Forwarding excess demand via the uber platform	

4.4 Scenario 2A: Decline in Volumes, Slow ADS-Adoption, Stalling Uberization

This scenario is defined by a decline TCCT-R-Rd in 2025 (-16.7% relative to 2015), slow ADS-adoption (with less than 20% of trucks outfitted with ADS-lvl-3 at most) and negligible uberization in 2025 (less than 10% of container transport being arbitrated through an uber-like platform).

4.4.1 Route to this Scenario

Looking back from 2025, the 2018 to 2020 period was a major turning point for the global economy and international trade. This was the period when all the trends that had driven economic growth and global trade since the 1980's would reverse. The demographic decline of western economies (with baby-boomers moving from peak-spending to retirement age), a turning of the tide in economic globalization (from trade liberalization to protectionism), tightening financial conditions (from a secular decline in interest rates since the 1980's and quantitative easing post-2008 to rising interest rates and quantitative tightening in a world with record debt) and geopolitical instability (from a stable U.S.-led world order after the fall off the Berlin Wall to a multipolar world with growing geopolitical tensions) far outweighed the positive effects of innovation and automation on economic growth and international trade for Western Europe. The turmoil on financial markets in the last quarter of 2018 was merely a prelude to a much more severe and protracted crash of the major financial markets in 2019/20 that crippled the real economy with negative GDP prints for two consecutive years and lackluster growth over the 2022 to 2025 period.

Apple's lower guidance on sales volumes and revenue in early 2019¹⁸ was a sign of things to come, with more major producers and suppliers reporting negative growth and worse expectations in the second and third quarter. Financial conditions in Europe and the United States became significantly tighter, driven by a strengthening dollar, a yield-curve inversion in U.S. treasuries, widening corporate bond spreads and a bear market in U.S. and European equities. Hurting European banks and consumer credit conditions, Eurozone GDP turned out negative for 2019 and seemed to have dropped off a cliff, declining with 7-9% in 2020 (which is more than 2009). This economic downturn created a significant decline in total container flows for the Port of Rotterdam (TCTS-R), which dropped below 12.5 million TEU in 2020 (compared to 13.75 million TEU in 2017). As in the wake of the financial crisis of 2008, this decline in GDP and TCTS-R was amplified as it worked its way down through Figure 3.1's funnel to total container transports to and from the Port of Rotterdam by truck (TCCT-R-Rd). Not only did tighter financial conditions, falling demand and rising inventories lower total

¹⁸ <https://www.cnn.com/2019/01/02/apple-warns-on-q1-results.html>

container volumes for the HLH-range and the Port of Rotterdam. Pressure on shippers to cut costs and a decreased importance of logistical lead times also moved them to redistribute a bigger slice of the remaining demand to barge at the expense of truck transport (continuing and aggravating the trend of truck transport's declining share of the modal split to the benefit of barge transport since the 2008/9 financial crisis. As a result, TCCT-R-Rd will have suffered a YoY-decline of around 10% in 2019 or 2020, turn out lower in 2020 than it was in 2015 (<4.48 million TEU) and continue to decline with about -2.0% annually over the 2021 to 2025 period.

The difference between the 2008/9 and 2019/20 recessions is that the latter – in this scenario – was not followed by a recovery and growth in total container flows. A declining share of Western Europe in the world economy (demographically driven), servitization of the western economy, a (geo)political climate that constrains global trade, a loss of market share of the Rotterdam harbor to other harbors in the Hamburg-le-Havre-range and the new logistical hubs of the Belt & Road Initiative will keep TCTS-R below 12.5 million TEU from 2020 till 2025, which means that containers will no longer be a growth market for the Rotterdam harbor and suffer small year-on-year declines instead.

One result of these adverse economic conditions and the secular decline in TCCT-R-Rd is that it will block the adoption of higher SAE-levels of ADS-adoption for financial reasons. Regardless of the speed at which ADS-capability develops or gains regulatory approval, the vast majority of firms will not be able or willing to invest in new trucks or ADS-upgrades of existing trucks for two reasons. One is that tightening financial conditions made corporate credit expensive and hard to come by. The other, more important reason, is that falling demand will result in a substantial overcapacity of trucks, which will drive down prices below cost price for the majority of trucking firms (as the need to cover fixed costs forces them to operate at a lesser instead of a greater loss). Given the protracted nature of the economic recession and the secular nature of the decline in TCCT-R-Rd, these financial constraints at the level of the trucking firms will persist into 2023 and possibly 2025, blocking a speedy and widespread adoption of ADS-lvl-4 systems whether the technology was available and the regulatory approval granted or not.

Lower prices as a result of overcapacity also stood in the way of uberization. Like trucking companies, the players that could use their bargaining power to enforce a platform on the industry (e.g. major shipping lines and freight forwarders) also suffered severe losses from the economic recession and the decline in global trade in 2019 and 2020. Under this scenario, their strategic response is defensive: cutting costs, decommissioning assets and scrapping or postponing investment programs, including the potential introduction of an uber-like platform.

4.4.2 Scenario 2A's Industry Environment

As a result of these development, the sea container trucking market of 2025 is an industry in decline with little prospect for future growth. Sizeable (re)investments in assets are being postponed as much as possible at all levels of the supply chain, which means that container ships, the physical infrastructure in the Rotterdam Harbor and the Dutch highway network and trucks will look pretty much the same as today. Market dynamics are characterized by cut-throat price competition. Profit & loss statements are bleeding from operational losses for firms with cost-bases around or above the industry average. More importantly, trucking firms are somewhat helpless, as much of the competitive violence that deepens the decline in demand occurs outside of their reach in earlier phases of the supply chain: the Port of Rotterdam losing ground to other HLH-harbors and the new logistical hubs of the Belt & Road initiative while what still comes through the Port of Rotterdam is increasingly transported by other modalities (rail and especially barge). As a result the sector has been and remains in a long and painful process of shaking-out excess capacity. The more a trucking firm had direct business relations to order originators, operated by forwarding a share of their orders to a flexible network of partners and independents (lowering their fixed cost basis) and build-up financial reserves, the likelier it is to have survived the 2020-2025 period. As a result, the industry has consolidated: smaller firms and independents that served as flexible capacity of the larger firms have largely been shaken out and some medium-sized and larger firms that could not survive on their own have merged or have been taken over in order to meet price pressures with bigger economies of scale. Digitalization and automation have continued to advance, but will – contrary to the expectations – remain limited to incremental efficiency gains, as the disruptive breakthroughs that were envisioned at the start of the 21st century cannot be financed in the depressed economic climate.

On a strategic level, this environment is defined by the opportunities and threats for container trucking firms presented in Table 4.2.

Table 4.4 Opportunities and threats for Scenario 2A

Opportunities	Threats
- Order bundling	- >10% one year drop in total demand in 2019/20
- Business of bankrupt competitors is up for grabs	- Structural decline in demand
- Fire sale on assets (trucks)	- Negative price spiral / intensified cost-competition
- Low-cost subcontracting	

4.5 Scenario 2B: Secular Decline in Volume, Slow ADS-Adoption, Uberization

Scenario 2B is similar to Scenario 2A in terms of TCCT-R-Rd volume growth and slow ADS-adoption, but distinguishes itself by high uberization: more than 25% of all container transports by truck is arbitrated by an uber-like platform.

4.5.1 Route to this Scenario

The route towards this scenario is almost completely similar to that of the previous scenario regarding the decline in volumes and slow ADS-adoption (see paragraph 4.4.1): adverse economic conditions will lead to a decline in overall container flows and the resulting financial constraints will slow ADS-adoption regardless of the development of its technological capability and regulatory approval. The only difference is that the adverse economic conditions and the resulting negative price spiral, on the route to this scenario, will actually have worked as a catalyst for uberization and that uberization will have worked as a catalyst of that negative price spiral.

The distinctly different outcome regarding uberization and the much more active role of uberization in shaping the industry environment resulted from a quite subtle difference in timing and strategic behavior. Whereas the adverse economic conditions of the previous scenario would prevent the development of an uber-like platform for sea container trucking in the Rotterdam region under the former scenario, this scenario – to an important extent – will have played out because one of the major shipping lines or freight forwarders had already made significant progress in developing and adopting an uber-like platform. When economic conditions soured and total container volumes dwindled, this major shipping line or freight forwarder saw this as an opportunity to launch its platform: with significant overcapacity in the sector, trucking firms were scrambling for work and subscribed to the platform at rapid pace. With large amounts of independent truckers and trucking firms subscribing in times of overcapacity, the platform managed to significantly drive down prices while remaining assured of sufficient capacity. This made the platform a reliable and attractive channel for tendering their own continental transports.

Getting the timing right, this platform will have launched in 2020 or 2021 at the latest as a private platform for a minority share of the freight forwarders' or shipping line's own container shipments. Within a year or two, the scramble for business of individual truckers and trucking firms in an environment of overcapacity will prove so powerful in driving down prices (whilst remaining reliable in finding just-in-time transport) that the shipping line or freight forwarder that launches the platform will quite naturally shift the arbitration of the majority of its own container shipments to the platform within two years (by 2023 at the latest). However, the real transformation happened when the platform-initiator made the strategic decision to open-up the platform in a strategic play to grow its platform's network to pre-empt me-too competition from rival (freight forwarders or shipping line)s somewhere between 2021 and 2023. As a result, the platform will rapidly grow to arbitrate more than 25% of total continental container transports by truck in 2025.

4.5.2 Scenario 2B's Industry Environment

The business environment and the industry structure are the same as the first scenario in terms of economic conditions and ADS-adoption. TCCT-R-Rd volumes will also have declined, but slightly less as the efficiency increases and lower prices brought about by the uber-like platform will have managed to make trucking somewhat more attractive relative to barge and train than under Scenario 2A.

The most important difference, however, is that the rapid rise of the uber-like platform will give significant counterweight and even somewhat off-set the consolidating dynamic of the first scenario. With a significant share of volumes being arbitrated through the platform, independent truckers and smaller firms that had once depended on filling the gaps for larger firms and freight forwarders, now find their work through the platform – which, although paying less per transport, does provide them with more opportunities to operate at or close to their full capacity. The growth of the platform and its dynamic pool of independents and smaller firms who are willing to operate for lower prices has in fact ran a quite a few medium-sized firms out of business. Their burden of relatively high overhead costs compared to independents without the economies of scale the larger firms employ to set this off, made the downward pressure on prices too much to handle for some.

Given that the industry environment is similar to that of Scenario 2A in most regards with the exception of the higher degree of uberization and its effects, Table 4.5 presents all the opportunities and threats for container trucking firms in this scenario, with those that are unique to this one printed in bold.

Table 4.5 Opportunities and threats for Scenario 2B

Opportunities	Threats
- Uber-like platform provides constant demand	- >10% one year drop in total demand in 2019/20
- Business of bankrupt competitors is up for grabs	- Structural decline in demand
- Fire sale on assets (trucks)	- Negative price spiral intensified by platform
- Forwarding excess demand via the uber platform	

4.6 Scenario 3A: Volume Growth, Fast ADS-Adoption, Slow Uberization

The third scenario is characterized by high volume growth (97.7% relative to 2015), fast ADS-adoption (with 20%-40% of trucks outfitted with ADS-lvl-4 capabilities) and slow uberization (with less than 10% of container transports arbitrated through an uber-like platform).

4.6.1 Route to this scenario

The path towards this scenario is similar to that of Scenario’s 1A and 1B in terms of volume growth. Monetary policy (in the U.S.) returns and remains (in the rest of the world) highly accommodative, fueling economic growth, which together with a reshoring of smart manufacturing to Western-Europe drives a continued growth in total container volumes processed in the HLH-range and the Port of Rotterdam in particular (growing >3.5% and 4.6% per annum on average respectively). As a result, total container volumes in the HLH-range will surpass 50 billion TEU in 2020 or 2021. For the Port of Rotterdam, total volumes will top 15 million TEU in 2019 and near 18 million TEU in 2023.

The big difference with the previous scenarios is that ADS-technology has developed to SAE level 4 and been adopted by a large share of trucks. Under this scenario SAE-level 4 technology has proven itself safer and more efficient for trucks than human drivers during trials that met the conditions of a regulatory body in Europe or the U.S. by the year 2020 or 2021. These positive results provided sufficient political support for a series of regulatory changes in Europe in the 2021-2023 period that effectively divorced legal culpability for accidents as a result of the dynamic driving task from the “driver” under the conditions that (a) a regulatory approved SAE-level 4 ADS was engaged at the time of driving and (b) that this system was used in a lane and segment of the Dutch/European highway system designated for autonomous trucks. Additionally, these regulatory changes also provided the legal groundwork for new forms of insurance policy that cover the risk

of legal liability for any accidents that could still happen on the part of truck manufacturers, ADS-developers and truck owners.¹⁹

Though the development of SAE level 4 ADS-capability and regulatory approval provided the preconditions for the introduction of truly autonomous trucks (i.e. where the driver – if present – is completely disengaged), the actual rate of adoption in the Rotterdam region was driven mostly by infrastructure investments of the Dutch government in autonomous trucking. These investments started in 2020 or 2021 with the installation of way markers and smart traffic control units that readied and designated one lane of a specific segment of the Dutch highway system (the A15) for autonomous driving. In a bid to improve the Port of Rotterdam's competitive position, this lane would subsequently become dedicated to autonomous and non-autonomous trucks in 2022 and 2023 and autonomous trucks only from 2024 onwards. As a result of these developments, the growth in the share of autonomous trucks accelerated from 2021 onwards and surpassed 20% in 2023 or 2024 at the latest.

Given the novelty of SAE-level 4 ADS, trucks outfitted with this capability will – with few exceptions – meet the strictest emission standards or be fully electrical. One important consequence of the rapid rise of these trucks, their relative environmental friendliness and their increased efficiency is that the Port of Rotterdam will abandon their goals of reducing the share of trucks in the modal split. By 2020, this goal will be dropped from the list of key performance indicators in their annual report. By 2021 the Port of Rotterdam will act as one of the most prominent lobbyists for investments for autonomous trucking infrastructure along the A15. Due to these favorable developments for trucking, the steady decline in trucking's share of the modal split up until 2015 has reversed, exceeding 57% in 2021 and topping 60% in 2024.

Finally, uberization failed to develop towards the dominant form of market arbitration mostly because of timing. Before any serious push was made to launch an uber-like platform, volume growth and the efficiency gains of autonomous trucks had already driven industry consolidation led by a few larger firms. Their superior value propositions using ADS-lvl-4 capabilities combined with the structural nature of demand enabled these industry leaders to corner a notable share of the market with longer-term contracts in 2021 and 2022. This form of securing market contracts took root and developed into an industry standard followed by many other firms in 2023 before any uber-like platform was launched or at the expense of those that did. That means that by the year 2021, there will either have been no launch of an uber-like platform in the Rotterdam region or it will have remained marginal due to a shift towards longer-term contracts.

4.6.1 Scenario 3A's Industry Environment

The combination of substantial volume growth and the rapid rise of ADS-lvl-4 outfitted trucks have profoundly transformed the business environment for Dutch container trucking as well as the industry's structure. The total amount of containers transported to and from the Port of Rotterdam has grown to over 14.7 million TEU (a near doubling compared to 2015). Between 20% to 40% of the trucks is outfitted with ADS-lvl-4 capabilities which are used during most if not all highway segments of pick-up and delivery routes. Two outside lanes of the A15 (one in both directions) are now completely dedicated to autonomous trucks. As such, they appear to have changed into the busiest "train tracks" in the Netherlands. Series of up to 20 trucks in a row form automatically and follow each other autonomously at such a close distance (for aerodynamic reasons) that they seem to be connected. Each platoon of trucks is followed by another at a mandatory interval of 200 meters to allow for timely stops. Though all of these trucks are still manned, the employees or truck owners present in their cabins are allowed to fully disengage. These "drivers" will occupy themselves with planning & coordinating or commercial activities that were traditionally executed by front- and back-office employees, various forms of training or educational programs or new forms of value adding activities.

Though ADS-lvl-4 capabilities have not yet replaced human drivers, their adoption does provide such a significant competitive advantage in terms of relative efficiency gains that it has transformed the industry structure. The utilization of ADS-lvl-4 capabilities extends the operational capacity of each truck (time-wise,

¹⁹ Though truck manufacturers and ADS-developers will become culpable for accidents that can be attributed to the failure of the ADS-system to comply to traffic laws, this new regulatory framework also specifies that the owner and operator of the truck does not comply to instructions and(/or) fulfills the maintenance requirements.

as the legally enforced breaks for human drivers can – at least partially – be scheduled while driving autonomously) and reduces fuel costs and driving times through automatic optimization. The latter is especially true when autonomous trucks use one of the driving lanes designated to autonomous trucks in a platoon configuration, where maximum speeds are much higher and other trucks significantly reduce air resistance. These relative advantages of ADS-lvl-4 outfitted trucks in terms of capacity, speed and costs and their access to the designated autonomous driving lanes with much higher maximum speeds makes that they easily outcompete traditional trucks. As a result, firms with ADS-lvl-4 outfitted trucks have begun to drive out firms that have not been able or willing to upgrade their trucks. The effective advantage on a truck-by-truck basis are so significant that the introduction of ADS-lvl-4 capabilities works as a watershed moment. The have's will be able to capture the majority if not all of the additional volume growth from 2022 and 2023 onwards, while the have not's are left to scramble for the remaining demand at lower prices.

The opportunities and threats on a strategic level partially correspond to those in previous scenarios, but also are unique for those that relate to the fast adoption ADS-lvl-4. Table 4.6 presents all the opportunities and threats for container trucking firms in this scenario, with those that are unique to this one printed in bold.

Table 4.6 Opportunities and threats for Scenario 3A

Opportunities	Threats
<ul style="list-style-type: none"> Overall volume growth 	<ul style="list-style-type: none"> Competition from forward integration of major freight forwarders that invest in ADS-lvl-4 fleets.
<ul style="list-style-type: none"> Capacity growth through ADS-lvl-4 adoption 	<ul style="list-style-type: none"> Front-running pioneers of remote-first/last-mile- and completely driverless business models
<ul style="list-style-type: none"> Cost efficiencies through ADS-lvl-4 adoption 	
<ul style="list-style-type: none"> Technological developments that enable a remote-first/last-mile- or even a fully driverless model 	
<ul style="list-style-type: none"> Common interest with other trucking firms to raise entry barriers for new types of competitors 	

4.7 Scenario 3B: Volume Growth, Fast ADS-Adoption, Uberization

The final scenario is similar to the previous in that it is also characterized by high volume growth, fast ADS-adoption but differs from it in that it also includes high uberization.

4.7.1 Route to this Scenario

Under this scenario, volumes have grown and ADS-lvl-4 capabilities have been adopted following the same route as Scenario 3A and the launch of the uberization platform has followed a route similar to that outlined in Scenario 2B.

The one thing that is (somewhat) different, is that the development and integration of ADS-lvl-4 capability in trucks and the operational support functions of an uber-like platform have coalesced and became intertwined somewhere in the 2023 to 2024 period. That is to say that those human “drivers” who are still present in the cabin of autonomous trucks no longer have to perform any intermediating function between the acceptance of an order by (them/their) firm via the uber-like platform and the designation of that order to their truck and the programming of its destination and route. By 2023, the Port of Rotterdam will even have completed a pilot project with an ADS-software add-on and supporting physical infrastructure that allows for fully digitalized and automated pick-ups and drop-offs of containers by ADS-lvl-4 trucks in the harbor, as well as a clearance for autonomous driving during the first and last-mile segment between the A15's designated autonomous driving lanes and the destination or pick-up point in the port.

Under this scenario, the initiator of the uber-like platform is less important (it could either be a major shipping line or freight forwarder, an outside party like Uber or Haulio or a collaboration of trucking firms) than the fact that the dominant platform has started to collaborate with the Port of Rotterdam Authority by 2022 at the latest, start the pilot for the fully automated pick-up and delivery ADS-software patch by 2023 or 2024 and make this available to accredited autonomous trucks in 2025.

4.7.2 Scenario 3B's Industry Environment

Like the previous scenarios, the Western economy is in a prolonged boom and total container flows in the Rotterdam harbor have been driven to more than double (relative to 2015) by the smart industry clusters in the Rotterdam, Eindhoven and Ruhr regions. Like Scenario 3A, Highways leading to these smart industrial hubs have dedicated lanes for autonomous trucks that ensure a constant, stable almost seamless high-speed flow of trucks, aided by smart way markers and traffic lights that manage the smooth passage of trucks onto, on and off of these lanes.

But whereas Scenario 3A was characterized by a merger of the truck driver and the back-office role, the extensive automation of back-office functions under this scenario is close to- and moving towards fully driver- and back-officeless continental container transport. As a result, continental container transport by road is hands-down the fastest and cost-effective modality for continental container transports due to the massive decrease in costs from automating the functions of truck drivers and back-office employees.

The industry structure has not only changed into a more consolidated one (for much of the same reasons as under scenario 3A), but the nature of the major competitive players has also changed. Under this scenario it is no longer sufficient to merely acquire ADS-lvl-4 outfitted trucks (which requires capital) to maintain and grow market share (as it was under scenario 3A), it also requires the installation, monitoring and maintenance of an IT-infrastructure that connects and integrates the autonomous driving systems of the firm's fleet with the uber-like platform (which requires IT-competences). With the exception of a few larger, innovative firms most traditional trucking firms will not have managed to make this transition. One of the biggest changes in the industry is that a couple of new entrants that do have the capital and capabilities required in this new environment have moved aggressively into this market. On the one hand, one or more major freight forwarders have begun to forward-integrate into the container trucking market. Another party is the operator of the platform itself, who – just like uber – sees autonomously driving trucks as an opportunity to not only gain their revenues from platform users, but by executing part of the orders themselves without the costs and financial risks of having to hire employees.

These new players are not so much attracted to the execution of container trucking as it is in 2025 (where human drivers are still present in the cock-pit for part of the route that is not yet cleared for fully autonomous driving). They are eyeing the fully driverless future where capital, economies of scale and superior IT-capabilities will transform the container trucking industry into one that resembles that of regular logistical carriers: dominated by a few major global players (e.g. UPS and DHL) complemented by one or two big local players (e.g. Post-NL) and a handful of smaller players who handle niches and negligible volumes at the margin. For them, the remote-first/last-mile model is only an intermediate short next step towards a fully automated future which they hope to capture with their systems and autonomous fleet of trucks.

The opportunities and threats on a strategic level for this last scenario are presented in Table 4.7, with those that are unique to this scenario printed in bold.

Table 4.7 Opportunities and threats for Scenario 3B

Opportunities	Threats
- Overall volume growth	- Competition from forward integration of major freight forwarders that invest in ADS-lvl-4 fleets.
- Capacity growth through ADS-lvl-4 adoption	- Front-running pioneers of remote-first/last-mile- and completely driverless business models

- Cost efficiencies through ADS-lvl-4 adoption	- Well capitalized new-entrants (e.g. tech firms) who aim to develop a fully driverless and platform-integrated fleet.
- Technological developments that enable a remote-first/last-mile- or even a fully driverless model	
- Common interest with other trucking firms to raise entry barriers for new types of competitors	
- Forwarding excess demand via the uber platform	

5. Stress-testing

The previous chapter presented six scenarios of what the future business environment for Dutch container trucking firms could become. This chapter tests to what extent existing container trucking firms are prepared for each of these scenarios. To that end, paragraph 5.1 outlines the typical current strategic position and for two types of trucking firms in general: independent and/or small firms (henceforth: smaller firms) and medium-sized and larger firms (henceforth: larger firms). Paragraphs 5.2 to 5.7 will then test these strategic positions against the six scenarios to see how these types of firms would fare in each of them. The outcome of these stress-tests provides the basis for developing a strategic roadmap (in chapter 6) that would enable these firms to achieve strategic fit with each of these scenarios in 2025.

5.1 Typical Strategic Positions & Plans of Small & Larger Container Trucking Firms

The method of scenario-based strategy formation (Ruijter, 2016) normally stress-tests the strategic position and the existing strategic plans of a specific firm against the scenarios that have been developed. Yet as this report focuses on the Dutch sea container trucking sector as a whole, it will stress-test the strategic position and some of the strategic plans that are typical for (a) smaller and (b) larger firms more generally.

Figure 5.1 depicts the typical strategic position of medium to larger firms. The strengths of these firms are based on the size of their truck fleet, which allows for (a) cost reductions through economies of scale (e.g. fuel costs and truck purchases), (b) provides them with the capacity to process big orders and (c) makes them flexible and fast in executing orders. In addition, their front and back-office capabilities enable them to secure orders and plan and coordinate their execution in an efficient way. The downside of the size of their truck fleet and their back-office capabilities is the high fixed cost basis of that part of their truck fleet that is owned (instead of leased), drivers' salaries and the overhead costs of the front- and back-office employees that lead to relatively higher break-even prices.

Smaller firms have the advantage of not having any overhead and managing customer relationships themselves. Their weaknesses are that their capacity is too limited to handle bigger orders. They also tend to depend on fewer clients and intermediaries for a larger share of their total order portfolio, which makes them vulnerable to the loss of individual clients or freight-forwarding partners.

Larger firms	Strengths	Fleet size
		Back-office coordination capabilities
	Weaknesses	Overhead > high break-even prices
		High fixed cost basis
Smaller firms	Strengths	No overhead & wage costs
		Personal CRM
	Weaknesses	Limited capacity
		Dependence on few clients & intermediaries

Figure 5.1 Current strategic position of smaller and larger firms

To satisfy the demand for lower prices, larger firms will typically reduce costs by (1) pursuing economies of scale by expanding their truck fleet to achieve economies of scale (e.g. lower fuel prices by buying in bulk, discounts on multiple truck purchases and spreading overhead across more trucks) and (2) increase their capacity utilization rate by (a) optimizing back-office coordination and (b) truck-load matching (either on an internal basis only or in collaboration with partners). Smaller firms, on the other hand, will typically exploit (1) the fact that they have no overhead cost to offer lower prices and (2) – especially in the case of independents – work more hours to be able to lower prices while still covering their fixed costs.

Larger firms satisfy the demand for availability and speed by using back-office coordination to leverage (1) the size of their fleet to ensure (near) instant availability and efficient execution of haulages and (2) a developed network of flexible independents and partners in times of excess demand. Smaller firms typically

satisfy this need by planning and scheduling themselves or relying on the back-office capabilities of intermediaries (freight forwarders or larger firms that outsource some of their orders).

With regard to the opportunity of exceptional volume growth in the current environment, larger firms will typically try to seize an outsized share of the marginal growth in container volumes by expanding their fleet size and leveraging their network of independents to process surplus acquisitions. Smaller firms and especially independents could follow the same path to organic growth, but lack the back-office capabilities to coordinate growth beyond a certain size and would face a fixed cost cliff if they would establish one. The more common response to exceptional volume growth (concurrent with truck driver shortages) for smaller firms is to increase their utilization rate (more work) and favor higher priced orders (better paying work).

The opportunity of there being a shared interest in efficiency gains across firms is mostly exploited in an active way by larger firms who (1) engage in collaborations around truck-load matching and (2) further forms of back-office integration with partners. Here, in a more passive way, smaller firms will (1) join the networks of larger firms with the need to forward surplus orders, (2) develop their own networks with smaller firms to increase their own utilization rate.

In response to the threat of substitution by barge transport, smaller and larger firms alike will (1) rely on their relative speed of execution to differentiate themselves and (2) seek to fulfil the last-mile transport by road for the business they do lose to barge.

Finally, the shortage of drivers is more of a threat to larger than smaller firms. For larger firms, who rely on economies of scale and the availability and speed of execution that come from a sizeable fleet, the shortage not only provides a constraint on growth, but a risk of drivers switching for a better offer. The natural response is to try and attract new drivers and keep current drivers with attractive terms of employment (e.g. paying for the driver license of novice drivers or wage increases for current drivers).

The following paragraphs will test these current strategic positions and (implicit) strategies against the opportunities and threats of each of the scenarios under the assumption that the firms will not change when the environment does.

5.2 Stress-testing Scenario 1A

This paragraph tests the future strategic positions of smaller and larger firms (see Figure 5.2) against Scenario 1A (see paragraph 4.2), which is defined by continued volume growth in the volume of containers that is continentally transported to and from the Port of Rotterdam by truck (TCCT-R-Rd), slow ADS-adoption and negligible uberization.

Scenario 1A			Opportunities				Threats	
			Volume growth		Collective interest in efficiency gains		Substitution (by barge)	
					Driver shortages			
Larger firms	Strengths	Fleet size	++	+		+	-	
		Back-office coordination capabilities	+	+		+		
	Weaknesses	Overhead > high break-even prices	+			-		
		High fixed cost basis				-		
Smaller firms	Strengths	No overhead & wage costs		+		+		
		Personal CRM		+		+		
	Weaknesses	Limited capacity		+		-	++	
		Dependence on few clients & intermediaries	+	+				

Figure 5.2 The future strategic position of smaller & larger firms under Scenario 1A

Since this scenario resembles the current industry environment for container trucking firms the most, the existing strategic positions and strategies of smaller and larger firms would mostly ensure strategic fit. The sustained growth in the volume of containers continentally transported to and from the Port of Rotterdam will provide an even bigger opportunity that benefits larger firms that are already actively growing their fleet especially. But the magnitude of this continued volume growth will also benefit smaller firms, who albeit being constrained in their capacity, will increasingly be able to grow their revenue by maximizing their utilization rate and profiting from rising prices due to volume growth and truck driver shortages.

The only thing that the current strategic positions and strategies of smaller and larger firms do not explicitly plan to exploit, is the opportunity that is also presented by the rise of multi-modal container transport. Though barge and rail do substitute a significant portion of the distance that a container would normally travel by truck, trucks are still needed for last-mile transport. Given that rail and barge transport are not end-to-end solutions, back-offices of container trucking firms could actually book barge or train transport themselves while still employing the firm's trucks for the last-mile deliveries. This would earn them a margin on the barge or rail transport, increase their capacity and could potentially make the use of their truck capacity more profitable per kilometer.

Table 5.1 Overview of the preparedness of smaller and larger firms for Scenario 1A

		Prepared	Unprepared
Larger firms	Threats		
	Opportunities	<ul style="list-style-type: none"> Seizing share of marginal volume growth by growing fleet size 	<ul style="list-style-type: none"> Multi-modal freight-forwarding and first/last-mile transport
Smaller firms	Threats		
	Opportunities	<ul style="list-style-type: none"> Maximizing utilization rates 	<ul style="list-style-type: none"> First/last-mile transport for multi-modal transports

5.3 Stress-testing Scenario 1B

This paragraph tests the future strategic positions of smaller and larger firms (see Figure 5.3) against Scenario 1A (see paragraph xx), which is defined by continued volume growth, slow ADS-adoption, but *high* uberization.

Scenario 1B			Opportunities Volume growth Demand for reliable future capacity Platform = access to constant demand Platform = outlet for order surpluses Threats Driver shortages Platform increases price competition Substitution of back-office coordination									
Larger firms	Strengths	Fleet size		++	++	+	-			-		
		Back-office coordination capabilities		+	+		+					--
	Weaknesses	Overhead > high break-even prices		+	+						--	
		High fixed cost basis			+						-	
Smaller firms	Strengths	No overhead & wage costs				+						+
		Personal CRM			+	-						-
	Weaknesses	Limited capacity								+		
		Dependence on few clients & intermediaries		+	+	+						-

Figure 5.3 Stress-test of the typical current strategic positions of smaller and larger firms against Scenario 1B

The focus in testing the typical current strategic position and strategies of smaller and larger firms against this scenario will be on the opportunities and threats that result from high uberization (marked yellow in Figure 5.3). Other opportunities and threats as well as the preparedness and unpreparedness of smaller and larger strategic firms to face these are similar to Scenario 1A (see Table 5.1).

The opportunities that high uberization would offer are mostly in favor of smaller firms. Their lack of overhead and wage costs provides them with sufficient pricing flexibility to exploit the constant, real-time demand on the platform in a way that would decrease their current dependence on only a few clients and intermediaries. On the down-side, doing business through a platform would undo the advantages that some smaller and independent firms derive from their more personal customer relationship management. The opportunities that high uberization provides are also somewhat beneficial to the current strategic positions of larger firms. For them, the constant demand on platforms can be tapped into in times of overcapacity. As a virtually limitless outlet for order surpluses, the constant availability of supply also provides the flexibility to take on more and larger orders, shrinking their safety margin and its drag on overall contribution margins. At the same time, this constant availability of supply on the platform also detracts from the competitive advantage that larger firms derive from the availability and flexibility of a larger fleet.

The threats that high uberization brings about will have the most negative impact on the current strategic position of larger firms. The competitive edge that their back-office coordination capabilities provide will be effaced by the integrated coordination functionalities of the platform: whereas a back-office can increase utility rates by efficiently allocating acquired orders across trucks at the firm level, firms that are active on an uber-like platform merely have to signal their availability for automatic matching with all orders on the platform. And as this advantage disappears, the constraints that back-office overhead costs put on pricing flexibility will become more problematic due to the pressure that automated market arbitration through the platform puts on the average industry price level. To an extent, this undermining of some of the key competitive strengths is good news for smaller firms. For them, the integrated coordination functionalities of the open market arbitration platform provides easy, plug-and-play access to a tool for utilization rate optimization that have cost large firms much time and resources to develop and significant cost to maintain. Unfortunately, this equalizing effect also extends to customer relationship management (as the platform separates drivers and clients as an intermediary) and poses a risk that the few clients they historically had outside the platform (at higher margins than the industry or platform average) will switch to channel their orders through the platform or reference its rates to renegotiate.

The uber-like platform is likely to be accessible enough as an outlet for order surpluses or a source of additional demand in times of excess capacity is likely to be accessible to not require any special strategic preparation. However, larger firms are currently not prepared for the substitution of back-office capabilities by the platform. And both smaller and larger firms are not prepared for the increased price competition on the platform and the risk of clients switching through the platform.

Table 5.2 Overview of the preparedness of smaller and larger firms for Scenario 1B

		Prepared	Unprepared
Larger firms	Threats		<ul style="list-style-type: none"> Substitution of back-office capabilities Platform increases price-competition and risk of clients switching
	Opportunities	<ul style="list-style-type: none"> Source of demand for excess capacity Seizing share of marginal volume growth by growing fleet size Outlet for order surpluses 	<ul style="list-style-type: none"> Multi-modal freight-forwarding and first/last-mile transport
Smaller firms	Threats		<ul style="list-style-type: none"> Platform increases price-competition and risk of clients switching
	Opp.	<ul style="list-style-type: none"> Stable source of demand 	<ul style="list-style-type: none"> First/last-mile transport for multi-modal transports

5.4 Stress-testing Scenario 2A

This paragraph tests the future strategic positions of smaller and larger firms (see Figure 5.4) against Scenario 2A (see paragraph 4.3), which is defined by a secular decline in the volume of containers continentally transported to and from the Port of Rotterdam by road, slow ADS-adoption, and negligible uberization.

Scenario 2A			Opportunities	Threats	
			Business of bankrupt competitors	>10% drop in demand	
			Order bundling by clients	Secular decline in demand	
			Fire sale on assets	Overcapacity > prices below average costs	
			Low cost subcontracting		
Larger firms	Strengths	Fleet size			
		Back-office coordination capabilities	+	+	+
	Weaknesses	Overhead > high break-even prices	+		
		High fixed cost basis	+		
Smaller firms	Strengths	No overhead & wage costs			+
		Personal CRM			
	Weaknesses	Limited capacity		-	
		Dependence on few clients & intermediaries			-

Figure 5.4 Stress-test of the typical current strategic positions of smaller and larger firms against Scenario 2A

Although the negative growth environment of Scenario 2A still offers some opportunities for larger firms (as Figure 5.4 depicts), it does depend on the financial resources and contingency plans for a declining market if a specific larger firm is prepared. There will be – as an inevitable consequence of the sharp and sustained decline in volumes – plenty of business of bankrupt competitors up for grabs that could help to cover overhead and other fixed costs. Another opportunity that would favor the larger firms, is that clients (freight forwarders and shipping lines especially) are likely to bundle orders into bigger contracts. Other opportunities are that industry-wide overcapacity severely reduces prices of trucks and end the driver shortages. Each of these opportunities does, however, only favor firms that (a) were able to outlast competitors, (b) are actively searching and pursuing opportunities to increase market share in a declining market and (c) are able to offer competitive prices when the opportunity presents itself.

The strategic position of smaller firms does not match any of the opportunities of this scenario in a positive way. Instead, the tendency to bundle orders would emphasize their weakness of only having limited capacity. For them, the threats of a sharp and sudden drop and secular decline in demand and increased price competition will also pose great risk for their dependence on relatively few clients and intermediaries. Especially the risk of losing business that was forwarded to them by larger firms as flexible independents/partners is high. Their only advantage would be that they do not have the drag of high overhead and fixed costs in an environment of severe price pressure.

For all of the opportunities that a few resilient larger firms may find in this scenario's business environment (see above), most larger firms will be severely threatened by the declining volumes on two points. The first is that the year-on-year percentage decline in demand will – on average – translate into an equal amount of overcapacity in their operational fleet. The bigger their fleet, the more overhead and other fixed costs each truck that does remain operational will have to cover. The second is that while this share of overhead and fixed cost that needs to be covered per truck rises, average prices will drop substantially – squeezing the short-term profitability and long-term solvability of the firm. As such, firms who have above average break-even prices and below average capital reserves will be most likely to become one of those competitors whose business will eventually be up for grabs.

Table 5.3 Overview of the preparedness of smaller and larger firms for Scenario 2A

		Prepared	Unprepared
Larger firms	Threats		<ul style="list-style-type: none"> • Price pressure from overcapacity
	Opportunities		<ul style="list-style-type: none"> • Financial reserves to outlast competitors? • Ability to offer attractive bulk prices? • Plans to grab market share
Smaller firms	Threats		<ul style="list-style-type: none"> • Losing business from partner firms
	Opp.		

It is not possible to say whether smaller and larger firms will have the financial reserves to outlast competitors- or that larger firms have the ability to offer attractive prices for larger orders in general (hence the question marks in Table 5.3). What can be said is that larger firms are not likely to be prepared for the drop in demand in combination with the price pressures that result from overcapacity and that they are also unlikely to have contingency plans to expand their market share in such a declining volume environment. Smaller firms are likely to be less prepared for the threat of losing business that is forwarded to them by (larger) partner firms who currently use them as an outlet for excess demand.

5.5 Stress-testing Scenario 2B

This paragraph tests the future strategic positions of smaller and larger firms (see Figure 5.5) against Scenario 2B (see section 4.5), which is defined by a secular decline in the volume, slow ADS-adoption, but high uberization.

Scenario 2A			Opportunities	Business of bankrupt competitors	Platform = access to constant demand	Fire sale on assets	Low-cost subcontracting	Threats	>10% drop in demand	Secular decline in demand	Platform aggravates negative price spiral
Larger firms	Strengths	Fleet size		+	+				--	--	
		Back-office coordination capabilities	+								
	Weaknesses	Overhead > high break-even prices	+								--
		High fixed cost basis	+								--
Smaller firms	Strengths	No overhead & wage costs		+							+
		Personal CRM		-							
	Weaknesses	Limited capacity									
		Dependence on few clients & intermediaries			+				--	-	

Figure 5.5 Stress-test of the typical current strategic positions of smaller and larger firms against Scenario 2B

Given that Scenario 2B is a combination of the previous scenario (2A) and Scenario 1B, there are no truly unique opportunities and threats that characterize its future business environment compared to those already discussed. The combination does, however, give two of these opportunities and threats a different quality in relation to each other and in the scenario as whole. The addition of an uber-like platform to the sudden drop and sustained decline in demand will, on the one hand, positively affect smaller and larger firms by allowing them to fill overcapacity by tapping into the constant demand of the platform. Yet, on the other hand, the use of such a platform for these purposes will aggravate the negative price spiral as the structural overcapacity at the industry level (due to the sudden drop and secular decline in demand) will cause supply surplus on the platform (far outweighing demand) to drive down prices on the platform and – given the platform's dominance – on average in the industry as whole. So even though the platform seems to provide an opportunity to acquire additional demand during the downturn, smaller and larger firms will be less prepared for the much faster shake-out of excess capacity.

Table 5.4 Overview of the preparedness of smaller and larger firms for Scenario 2B

		Prepared	Unprepared
Larger firms	Threats		<ul style="list-style-type: none"> Platform catalyzes negative price spiral
	Opportunities	<ul style="list-style-type: none"> Source of demand for excess capacity 	<ul style="list-style-type: none"> Capital reserves to outlast competitors? Plans to grab market share? Ability to offer attractive bulk prices?
Smaller firms	Threats		<ul style="list-style-type: none"> Losing business from partner firms
	Opportunities	<ul style="list-style-type: none"> Source of constant demand 	

5.6 Stress-testing Scenario 3A

This paragraph tests the future strategic positions of smaller and larger firms (see) against Scenario 3A (see paragraph 4.6), which is defined by a secular decline in the volume, fast ADS-adoption and negligible uberization.

		Scenario 3A								
		Opportunities	Volume growth	Capacity growth through ADS-lvl-4 adoption	Cost efficiencies through ADS-lvl-4 adoption	Further benefits from remote first/last-mile model	Common interest in raising entry barriers	Threats		
Larger firms	Strengths	Fleet size > economies of scale & availability	++				+			
		Back-office coordination capabilities	+							
	Weaknesses	Overhead > high break-even prices	+	+	+	+		--	--	--
		High fixed cost basis		++	++	++		--	--	--
Smaller firms	Strengths	No overhead & wage costs			-	--		--	--	--
		Personal CRM								
	Weaknesses	Limited capacity						+		
		Dependence on few clients & intermediaries	+							

Figure 5.6 Stress-test of the typical current strategic positions of smaller and larger firms against Scenario 3A

Compared to the scenarios that were used for stress-testing so far, the opportunities and threats that characterize this scenario have the biggest impact on smaller and larger firms. On the positive side, the advent of level 4 autonomous driving systems and dedicated truck lanes provides an opportunity – for larger firms especially – to drive down their cost basis: it enables substantial increases in the operational capacity per truck whilst making them more cost and time efficient. Though these benefits are already significant in a platooning model where a human driver is still present, the remote first/last-mile model would be a complete game changer as it also allows for reductions in wage costs. For smaller firms, however, these efficiencies will be less. They are less able to coordinate platooning themselves and, more importantly, lack the fleet size to make the first- and last mile model attractive.

The flip side of the significant opportunities that lvl-4 ADS-adoption offers, are the threats posed by competitors who either adopted it first or on a larger scale. Once ADS lvl-4 enables significant increases in operational capacity per truck (driver) and efficiency gains, firms that adopt it first will achieve cost reductions that enable them to offer significantly lower prices or reinvest excess profits in faster adoption – which, again, will be especially true for successful pioneers of the first/last-mile model. Larger firms that lag these early adopters or new entrants will be less profitable in the early stages of adoption (when prices are not yet affected) and will be selected out once ADS-lvl-4 adoption will begin to lower prices. One particular threat is that the diminishing importance of having a pool of truck drivers (especially with a remote first/last-mile model), lowers entry barriers for vertical integration by deep-pocketed players like shipping lines or freight forwarders. One opportunity that could help to fend off the latter threat, is the common interest of incumbents to collaborate in maintaining these or developing new entry barriers.

Generally speaking, most smaller and larger firms will not have the contingency plans or even lack the resources for timely ADS-adoption. Here, firms that do not have the financial resources to renew or upgrade their truck fleet with ADS-technology are the least prepared. More generally, smaller and larger firms lack the contingency plans to ensure timely adoption of ADS-technology once it provides substantial advantages by themselves and especially in collaboration with each other (to maintain entry barriers).

Table 5.5 Overview of the preparedness of smaller and larger firms for Scenario 3A

		Prepared	Unprepared
Smaller & larger firms	Threats		<ul style="list-style-type: none"> • Early ADS-adopters lowering their cost basis • Forward integrating shipping-lines of freightforwarders • New entrant pioneers of first/last-mile model
	Opportunities		<ul style="list-style-type: none"> • Common interest in maintaining entry barriers • Capacity growth through ADS-level 4 adoption • Cost-efficiencies through ADS-level 4 adoption • Wage cost reductions through first/last-mile model • Common interest in maintaining entry barriers.

5.7 Stress-testing Scenario 3B

This paragraph tests the future strategic positions of smaller and larger firms (see) against Scenario 3B (see paragraph Scenario 3B: Volume Growth, Fast ADS-Adoption, Uberization4.7), which is defined by a continued growth in the volumes, fast ADS-adoption and high uberization.

Scenario 3B		Opportunities Volume growth Capacity growth through ADS-M4 adoption Cost efficiencies through ADS-M4 adoption Further benefits from remote first/last-mile model Common interest in raising entry barriers Threats Early ADS-M4 adopting competitors Forward integrating shipping lines New entrant pioneers w/ first/last-mile model New entrant that integrates platform & fully driverless fleet													
Larger firms	Strengths	Fleet size > economies of scale & availability	++					+++							
		Back-office coordination capabilities	+												
	Weaknesses	Overhead > high break-even prices	+	+	+	+					--	--	--	----	
		High fixed cost basis		++	++	+++									----
Smaller firms	Strengths	No overhead & wage costs													----
		Personal CRM													
	Weaknesses	Limited capacity									+				
		Dependence on few clients & intermediaries	+												

Figure 5.7 Stress-test of the typical current strategic positions of smaller and larger firms against Scenario 3B

Compared to the previous scenarios, this scenario merely adds one new threat. Yet this threat would have the biggest impact of them all. In an environment where market arbitration and haulage coordination are predominantly automated through an uber-like platform and fast ADS-adoption, the biggest threat current incumbents face is from a well-capitalized new entrant with IT- & logistics capabilities (e.g. Google or Uber) that partners with truck OEM's (e.g. Daimler's leasing arm) to create a fully autonomous fleet that is seamlessly integrated with the(ir own) platform. Such a new competitor would undermine both components of the traditional business model of larger firms: substituting their pool of drivers and their back-office capabilities with a massive reduction in wage costs. This would render the traditional business model of larger and smaller firms alike completely obsolete.

The only positive about such a business environment, is that the threat of such a competitor is so big that it would significantly boost the common interest of incumbents to collaborate in raising entry barriers.

In terms of preparedness, smaller and larger firms alike would not be able to fend-off the threat of a competitor that would integrate a sizeable, fully automated truck fleet with their platform – nor is it likely that any contingency plans already exist to collaborate with other incumbents to raise entry barriers.

Table 5.6 Overview of the preparedness of smaller and larger firms for Scenario 3B

		Prepared	Unprepared
Smaller & larger firms	Threats		<ul style="list-style-type: none"> • Early ADS-adopters lowering their cost basis • Forward integrating shipping-lines • New entrant pioneers of first/last-mile model • New entrant that integrates platform & fully driverless fleet
	Opportunities		<ul style="list-style-type: none"> • Capacity growth through ADS-level 4 adoption • Cost-efficiencies through ADS-level 4 adoption • Wage cost reductions through first/last-mile model • Strong common interest in maintaining entry barriers.

6. Preparing for the Future: A Strategic Roadmap

This chapter presents two strategic roadmaps, one for smaller and one for larger firms, that contain the strategic (contingency) plans necessary to achieve strategic fit for each of the scenarios developed in chapter 4. These plans were designed off-of the stress-testing results (chapter 5). Each shortcoming of the current strategic position in light of (one of) the scenarios was translated in design requirements for the strategic contingency plans of the roadmap.

Both roadmaps consist of two elements. The first is a core action plan that contains strategic actions that have to be undertaken to secure or improve strategic fit with the future business environment regardless of which of six scenarios materializes. The second are the strategic contingency options that have to be undertaken on top of that core action plan to prepare for one or more specific scenarios.

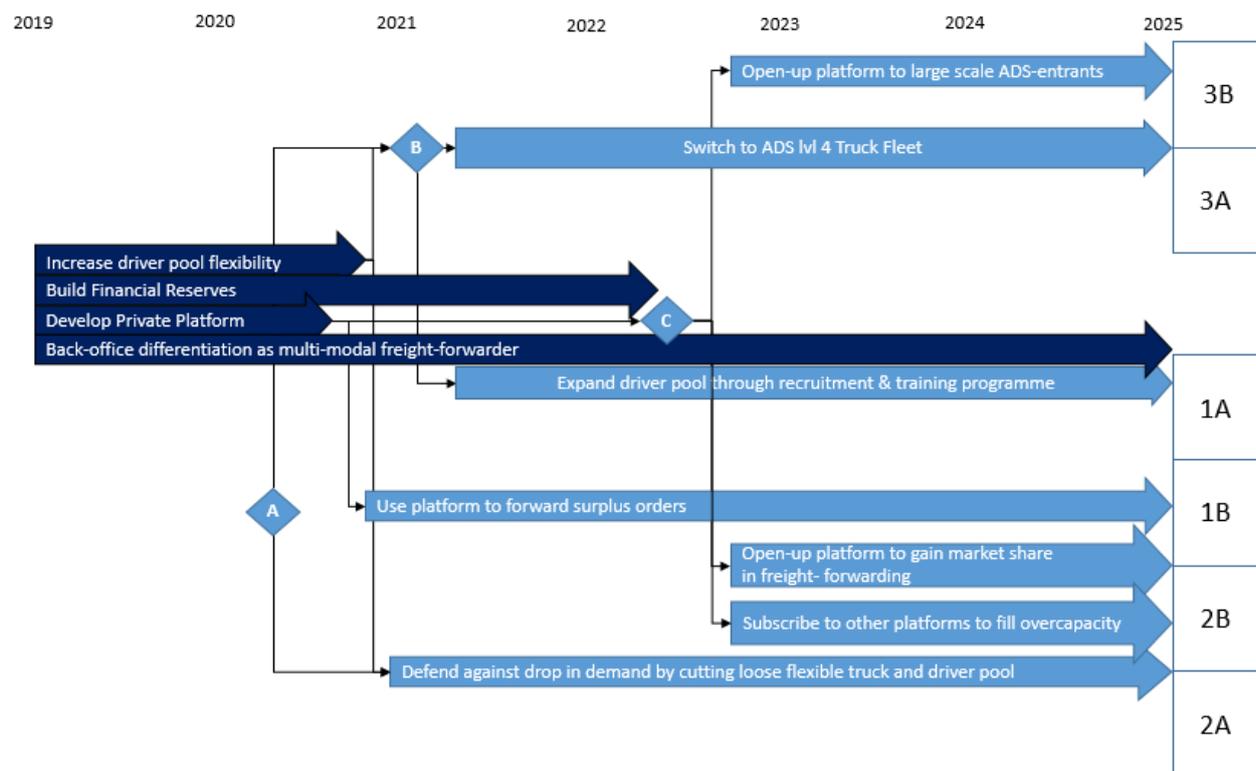


Figure 6.1 The Strategic Roadmap for Larger Firms

6.1 The Core Action Plan for Larger Firms

Many of the strategic actions recommended in the roadmap are contingent. Yet the robust options that are part of the core action plan (dark blue in Figure 6.1) are recommended regardless of what scenario plays out. Each of these strategic actions is therefore a “no regret option” that is or could be necessary to maintain strategic fit (if some scenario plays out).

6.1.1. Build multi-purpose financial reserves

Though the advice to “build financial reserves” may sound gratuitous (this is almost always a good idea for every firm in any industry), trucking firms can be expected to need them for multiple reasons no matter which of the six scenario plays out. In order to prepare for a future where an uber-like platform will become the dominant design for market arbitration, larger firms will be required to invest in scaling- and opening-up their own private platforms (see section 6.1.3) in order to keep their back-office activities competitive. Similarly, the fast adoption of higher levels of ADS will require the financial resources to invest in retrofitting or replacing their existing trucks and the development of human resources and capabilities to operate and support an autonomous truck fleet. There is also the possibility that adverse economic conditions will not only lead to a secular decline in container volumes, but a swift and sudden one-year drop in demand similar

to the -18.4% drop from 2008 to 2009 that firms have to be able to survive. Finally, even if none of these disruptive changes would happen and volumes would continue to grow, financial reserves will be very useful for timely investments in truck and driver pool expansion that will allow a firm to capture an outsized share of market growth in scenarios with high volume growth.

The amount of financial reserves required is hard to quantify (even in relative terms), as this does depend on what scenario plays out. Yet because a swift and sudden drop in demand of around 20% under the scenarios of stark volume decline (2A and 2B) could potentially be lethal, we recommend that firms should strive to build enough reserves to cover the losses that would result from a 20-25% drop in revenues compared to 2018 over the period of a full year.

6.1.2. Increase truck- and driver pool flexibility

Larger firms are also advised to increase not only their truck-, but also their driver pool flexibility for much the same reasons. A sudden drop in demand of around 20%, fast adoption of ADS-level 4 and dominant uberization will all be easier to adapt to for firms that have the built-in flexibility of not having to many of their active trucks and drivers on their own balance sheet and pay roll. Though many larger firms already lease a substantial share of their trucks and work with a network of flexible independents, we recommend that firms who have not yet built in truck and driver flexibility of 30% and 20% respectively to do so.

6.1.3. Develop a private platform with trusted partners

Though it is still uncertain whether the majority of continental container transports will be arbitrated through an uber-like platform in the future, we do recommend larger firms to build their own private platform for (semi-automated) order arbitration, -allocation and operational planning and support with trusted partners for two reasons. The first is that a private platform could drive down costs even if it remains exclusive for partner firms and their flexible network of trusted independents in various ways. It could, for example, (a) improve the utilization rate of proprietary trucks through improved truck-load matching, (b) decrease the amount of flexible independents required to satisfy demand and (c) automating much of the planning and coordination activities of back-office employees. The second reason is that a private platform that is limited to trusted partners can be scaled- and opened-up (see section 6.4.1) and compete with new entrants from an advantageous position: the platform is already operational and has its initial volume to build on, whereas new entrants will start from scratch on one or both of these points.

6.1.4. Back-office differentiation as a multi-modal freight forwarder

Probably the most controversial, but equally important robust option that we recommend is for larger firms to diversify their back-office activities by adding multi-modal freight-forwarding services (that include barge or rail transport). Though this would take back-offices beyond an own-fleet-first focus and position them as semi-separate businesses, it would strengthen the position of the firm as a whole under all of the scenarios. In times of adverse economic conditions and a decline in demand, back-offices that offer such a multi-modal service will not only enable their firms to retain clients who have become more price sensitive, but to capture similar clients from other firms as well. Conversely, in times of continued economic and container volume growth, such a service would help trucking companies with the driver shortage by enabling firms to handle more orders (that will be mostly transported inland by truck or barge, with the last-mile pick-up and delivery still done by road) with less trucks. Finally, firms with such a multi-modal freight-forwarding capability would be able to outperform mono-modal firms in an environment where an uber-like platform has become the dominant form of market arbitration and price competition has become even more transparent and intense.

In broad strokes, we recommend that larger firms...

1. Research how big of a share of their orders would be sensitive to switching to a multi-modal transport service...
 - a. under current economic conditions
 - b. under adverse economic conditions
 - c. based on market research among existing clients
 - d. based on market research among lost clients (have they switched to multi-modal already)
2. Research the relative profitability of trucks dedicated as last-mile solutions in this multi-modal service
3. Start a pilot for a select group of customers with a limited amount of trucks available to manage switching rates
4. Scale-up if
 - a. Multi-modally employed trucks are more profitable on aggregate.
 - b. Driver shortages constrain order intake that multi-modal solutions could alleviate.
 - c. Economic conditions increase switching costs.

6.2 Decision Point A: Volume Growth

Besides the no regret options that constitute the core action plan, there are many more contingent strategic actions that larger firms should undertake *if* certain contingency conditions are met. From the firms perspective, these contingency conditions can be related to a number of time-bound strategic decision-points.

The first of these strategic decision points on the roadmap is based on contingencies related to the future development of container volumes. Even though the total volume of containers in 2025 remains highly uncertain now, there are some lead-indicators that could foretell whether it is likely to rise or to decrease relative to the present point in time. The European Manufacturing Purchasing Index (PMI) and the Baltic Dry Index (BDI), for example, could serve as reliable early warning signals about changes in economic growth and the volume of container transports by sea as (direct) determinants of the total amount of containers transported to and from the Port of Rotterdam by road. Actual confirmation of a directional change in this number would, however, only come from the official numbers on container transshipments published by the Port of Rotterdam. But as their publications significantly lag real-time economic events, firms are best advised by looking for confirmations of directional changes foretold by the PMI and BDI in their own order books.

Given that changes in the economy are hard to time, this strategic decision-point and the monitoring of the leading indicators related to it will remain important until 2025. Yet as the economic cycle is likely to be in the late stages of its expansion right now, the second half of 2019 and the year 2020 are an especially important period to watch for early warning signals and confirmation of directional changes in (the economic drivers of) total container volumes.

6.2.1 Decision Point A: Decline in Growth

A sustained drop below 50 in the European Manufacturing Purchasing Index (PMI) could signal an economic contraction in Western Europe that would negatively affect total container volumes. Similarly, a sustained downward trend in the Baltic Dry Index would indicate that overall trade and sea transport volumes are declining.

Actual confirmation of a decline in volumes would come from a decreasing number of total container transshipments in the Port of Rotterdam for two quarters in a row. Yet given the time lag with which these numbers are reported, the most accurate indicator would come from the firm's own order book. If the total volume per customer decreases for two quarters in a row and does not pick up in the third while the PMI and BDI continue to sour, this would confirm that a prolonged decline in total container volumes is highly likely and that the future will unfold in the direction of Scenario 2A or B.

Once a prolonged decline in volumes is confirmed, larger firms should absorb this by matching the fall in the demand with an equally big reduction in the share of flexible trucks and drivers, shedding (some of) the flexibility that was already developed so far (as per the recommendation outlined in section 6.1.2).

6.2.2 Decision Point A: Continued Volume Growth

If, conversely, the amount of orders per customer continues to increase over the past two quarters and PMI remains above 50 while the Baltic Dry Index remains stable or regains an uptrend, this would confirm that – for the time being – volume growth will continue. In that case, firms should continue the actions from the core action plan (see paragraphs 6.1.1 to 6.1.4) and await confirmation on decision point B about how a strengthening of their strategic position and further growth should be pursued.

6.3 Decision Point B: ADS-Adoption

The second decision point upon which many of the strategic actions are contingent depends on the speed at which higher levels of ADS are adopted.

Though it is highly uncertain what SAE-level will be adopted by (20% to 40% of) active trucks in 2025 from our present point in time, more reliable indications and confirmations can be expected in the year 2021 (as this is the earliest expectation of ADS-lvl-4 adoption in general from some of the more established automotive manufacturers – see Figure 3.6). Early warning signals that could predict the speed of adoption will be updates by the most optimistic automotive manufacturers about when they expect ADS-lvl-4 to be technologically ready, tests of ADS-lvl-4 in which Dutch and/or European regulatory bodies participate, and forward guidance from regulatory bodies about their recommendations to lawmakers. Confirmation, however, will ultimately depend on legislation passing that allows for the disengagement or absence of a human driver under specified circumstances at the national (Dutch) or transnational (European Union) level.

6.3.1 Strategic Responses to Slow ADS-adoption

There are several ways in which the early warning signals could indicate that ADS-adoption is becoming more likely to remain slow (i.e. will not exceed level 3 in 2025). The first is that automotive manufacturers who are most optimistic (e.g. Ford, BMW and Daimler) will postpone their projections for the introduction of ADS-lvl-4 with more than one or two years before the year 2021 is reached. Another is that, even if these automotive manufacturers continue to signal their confidence in the technological capabilities of their level 4 ADS, regulatory bodies either remain uninvolved in open road testing or non-committed and hesitant in their forward guidance about their advice to law makers.

Yet even if all these leading indicators are positive, delays or a lack of political support in the legislative processes required to allow disengagement of a human driver under specified circumstances would in and of itself be enough to confirm slow ADS-adoption until this changes.

If this is the case, *and* continued volume growth has been confirmed on decision point A, firms are advised to invest in a recruitment and training programme for new drivers that are needed to enable growth. Yet of all the strategic actions, this recommendation is issued with a highest degree of caution: though confirmation of the contingency conditions may indicate that ADS-adoption will be slow until 2025, this – in all likelihood – will only be a delay, not a suspension of ADS-lvl-4 adoption at a future date entirely. In expanding the driver pool, firms should therefore still aim to build-in the flexibility to cut loose or phase out drivers when ADS-lvl-4 does get adopted at a further point in time than 2025.

6.3.2 Strategic Responses to Fast ADS-adoption

Fast adoption of ADS-lvl-4 among a sizeable share of trucks would, on the other hand, require that all the leading indicators remain positive and that there is a clear timeline for the necessary legislation to be tabled, passed and implemented by the end of 2020 or the beginning of 2021. Once legislation is passed, fast ADS-adoption would be fully confirmed.

If fast adoption of ADS-lvl-4 is confirmed, firms are recommended to expand and switch their fleet to ADS-lvl-4 at the fastest rate possible and adjust their rates to the more competitive price levels that cost reductions could enable. This switch rate would, in theory, only be limited by the total amount of orders that can be

acquired at the more attractive rates on the one hand and the amount of fixed contracts with drivers on the other.

6.4 Decision Point C: Uberization

The last major decision point upon which many of the contingent strategic actions on the roadmap depend are connected to the degree of uberization.

Here, too, there are early warning signals that could indicate what the business environment of 2025 is going to look like in terms of uberization. The first is the announcement of a partnership or unilateral initiative regarding the development of a market arbitration platform for inland container transport by one of the major freight forwarders already active in this space. Other things to watch for are the development of the volumes processed and active user base growth on Haulio's platform in Singapore (as a proof of concept), announcements about their plans to expand internationally or announcements from similar tech firms that they plan to enter the Rotterdam market. Finally, collaborations between larger incumbents on a private platform that enables them to grow their network of trusted partners and their order intake at rates that substantially outpace the market could also signal that uberization is commencing its rise to becoming the dominant form of market arbitration.

Confirmation that uberization will rise exponentially to the dominant form of market arbitration would, however, wholly depend on the success of a platform after its introduction in terms of total volume of containers processed by the platform on a quarter-to-quarter basis. Early tell-tales about the direction and sustainability of volume growth could come from the increase in the amount of independent truckers and trucking firms and the growth and decline in the amount of containers transported per firm.

6.4.1 Decision Point C: Dominant Uberization

If the overall amount of containers arbitrated through the platform would increase exponentially and is set to increase to over 10% in the first two years of the platform's existence, the following strategic actions are recommended contingent upon the outcome of the previous two decision-points:

- *if volumes decline* (decision point A), then firms who have developed a private platform are advised to open-up their platform to grow their market share in the freight-forwarding market. Firms who do not have their own private platform are recommended to subscribe to the upcoming platforms to access the platform's demand.
- *if volumes grow* (decision point A) and *ADS-adoption is slow* (decision point B), then firms who have developed a private platform are advised to (1) grow the trusted partners who are active on the platform to increase order intake and forward orders in time of undercapacity and (2) open-up the platform to increase their market share in freight-forwarding at the level of market arbitration.
- *if volumes grow* (decision point A) and *ADS-adoption is fast*(decision point B), then firms who have developed a private platform are advised to (1) open-up their platform and try to subscribe and integrate new entrants with large autonomous trucking fleets.

6.4.2 Decision Point C: Negligible Uberization

If, on the other hand, there are no platforms launched or if the total volume of containers processed on aggregate by those platforms who are launched remains weak, then the above actions should not be undertaken. Instead, those firms who have developed private platforms should increase back-office automation and organically grow their network of trusted partners, especially if volume continues to grow.

6.5 The Strategic Roadmap for Independents and Smaller Firms

Many of the strategic recommendations for larger firms that were provided above (e.g. developing a private platform and differentiating as a multi-modal freight forwarder) are not feasible or suitable for smaller firms. The scale, capacity and resources of their business makes it hard to adapt to the scenarios of fast automation and uberization: upgrading to autonomous trucks is unlikely to be competitive for small fleet owners and leadership in the development of a private platform is beyond the reach of their resources and capabilities. As such, it will be more challenging for smaller firms to cope with the scenarios that depart the most from the benign business environment of the last couple of years.

That does not mean that independents and smaller firms cannot prepare for these scenarios. The following subsections discuss the robust and contingent strategic actions that can help them improve their strategic positions in general and if specific scenarios unfold that together constitute the roadmap depicted in Figure 6.2.

6.5.1 Core Action Plan for Independents and Smaller Firms

Though independents and smaller firms will not need them for all the same reasons as larger firms, the first robust strategic action (i.e. “no regret option”) we recommend is that they also build financial reserves. Even if independents and smaller firms will not need them to invest in the development of a private platform, they would need them to survive a swift and sudden drop and secular decline in volumes. Financial reserves would also help to cover the transition costs of differentiation and diversification when needed (see section 6.5.3). The second robust strategic action recommended to independents and smaller firms is to differentiate and specialize in niche markets that are relatively stable in demand and are likely to resist automation. Examples of such niche markets are cooled containers or last-mile transport of barge and train containers.

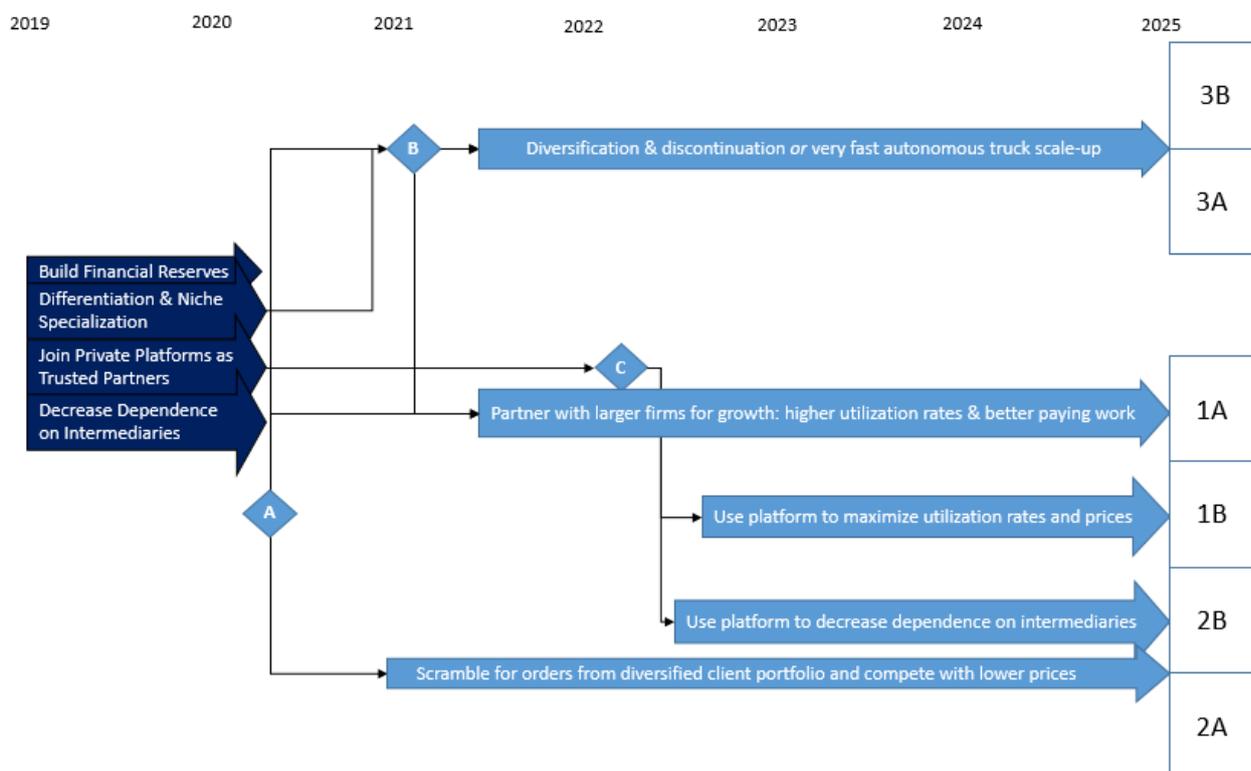


Figure 6.2 The Strategic Roadmap for Smaller Firms

The third robust strategic action is to join as many private platforms for container forwarding developed by larger firms and intermediaries (see sections 6.1.3 and 6.4.1) as possible. Finally, the fourth robust strategic action is to decrease their dependence on specific clients and intermediaries by diversifying their client portfolio. These last two strategic actions will help smaller firms to maximize their utilization rate and opt for better prices in times of growing volumes and increase their chances of acquiring sufficient business if volumes were to drop.

6.5.2 Decision Point A: Volume Growth (for Independents & Smaller Firms)

If a decline in volumes would be signaled and confirmed (see section 6.2), independents and smaller firms are advised to scramble for orders among their diversified (fourth robust action) client portfolio and compete with other firms by lowering their prices while covering fixed costs with their financial reserves (first robust action) when needed. If, on the other hand, continued volume growth would be confirmed, independents are advised to develop closer partnerships with larger firms who offer the most attractive prices at the expense of diversification as long as volumes continue to grow.

6.5.3 Decision Point B: Automation (for Independents & Smaller Firms)

If fast adoption of ADS-lvl-4 is confirmed (see section 6.3), this will eventually undermine the strategic position of smaller firms in the general container trucking market over the long term. There may be a few independents who are able to make a leap by rapidly expanding to the size of larger firms (>20 trucks) and sustain that growth by aggressively investing in a larger autonomous truck fleet early on. But this is a very high risk option and not within the means of independents and most smaller firms. We therefore recommend a choice or combination of one of the following strategies: (1) full differentiation into special(ized) forms of container transport that resist automation, (2) a harvest strategy that accepts and plans the phasing-out of drivers and truck capacity over a time-frame that matches the rate at which human drivers are being replaced by ADS-lvl-4 and is acceptable to the entrepreneur from a career planning perspective or (3) diversification into new markets where there is a need for trucks with human drivers.

If, on the other hand, ADS-adoption is confirmed to be slow, this would affirm the previous recommendation of developing partnerships with larger firms who offer the most attractive prices.

6.5.4 Decision Point C: Automation (for Independents & Smaller Firms)

Confirmation of dominant uberization (see section 6.4) would trigger the contingent action of subscribing to and using the open uber-like platform to secure orders. Here, the platform could be used for attractively priced orders in an environment of growing volumes or for decreasing the firm's dependence on intermediaries and maximization of their utilization rate (even at a loss to cover fixed costs) in times of declining volumes.

7. Conclusion & Recommendations for Further Research

The previous chapters have presented the possible futures that Dutch container trucking firms could face in 2025 and two strategic roadmaps that help smaller and larger firms to prepare for them.

7.1 Key findings

There are six possible futures that Dutch container trucking firms could face and should prepare for. Which of these possible futures will materialize, depends on how the total number of containers transported to and from the Port of Rotterdam by road-, the speed with which autonomous driving systems are adopted- and the share of uber-like platforms in market arbitration will develop over time. Of the six scenarios, the scenario where container volumes continue to grow, the adoption of autonomous driving systems is slow and uberization is negligible is the one that resembles the current business environment the most and – as such – poses the least threats. The scenario (3B) that is characterized by a fast adoption of autonomous driving systems and dominant uberization is the most disruptive and challenging of the six.

To prepare for these possible futures, larger firms are advised to follow a core action plan, monitor specific developments in their business environment and engage in a number of contingent strategic action under certain conditions. In short, the core action plan requires larger firms to start building multi-purpose financial reserves, -increase truck and driver pool flexibility, -develop a private uber-like platform with trusted partners and to differentiate by developing their back-offices into multi-modal freight-forwarders. Besides these core actions, there are three main contingency conditions that have to be monitored. The first is the state of the economic environment (based on lead indicators and actual orders) to see whether the firm can continue to invest in growth or that it should shed (some of) its flexible drivers and trucks. The second is the speed of autonomous driving system adoption, which decides whether firms should (continue to) invest in recruiting new drivers to expand or should invest in switching their truck fleet to autonomous trucks. The third contingency to watch is whether market arbitration will increasingly become uberized or not, as the former would enable the use of these platforms to fill undercapacity and forward overcapacity.

Differences in size, resources and capabilities prevent smaller firms from following the same roadmap as larger firms. Yet they, too, can prepare for the future based on their own roadmap. Here, the core action plan also includes building financial reserves, but differs in recommending differentiation through specialization in niche markets and joining as many private uber-like platforms of larger firms as possible to maximize utilization rates. Although smaller firms have to monitor the same things as larger firms, their contingent actions are also different. If container volumes continue to grow, they could focus on and commit their capacity on higher paying customers, whereas a decline in volumes would have to be met by lowering prices and diversifying their client portfolio. More importantly, fast adoption of automation would have to be met by diversifying into market(segment)s where human drivers are still necessary. Finally, the emergence of an open uber-like platform as the dominant form of market arbitration should make smaller firms subscribe to that platform to maximize their utilization rate.

7.2 Recommendations for further research

Having concluded this study into the possible futures that Dutch container trucking firms might face in 2025 and how they should prepare for them with two strategic roadmaps, there are two types of further research we recommend.

The first type is a natural consequence of applying the method of scenario-based strategy formation. All of the scenarios developed in this report and the roadmap are based on analyses (of what the key strategic variables for this sector are and how they might develop) that were carried out in 2018 and the beginning of 2019. Although the objective of these analyses was to grasp and capture the uncertainty of how these trends could develop into the future within the bandwidth of two extremes, two forms of uncertainty remain. One is what outcome of the key strategic variables will actually materialize within the bandwidth of the extremes. The other is whether or not other unforeseen trends & developments could emerge or come to the fore as

more prominent. The former requires a constant monitoring of the key strategic variables defined in chapter 3 and their direct determinants to establish into which of the six scenarios (see chapter 4) the future will unfold. The latter requires a periodic re-evaluation of the selection and scoring of the clusters of trends and developments and their strategic key variables.

We recommend that TLN/AZV will invest in (a) a follow-up project that defines a (more elaborate and detailed) set of indicators that helps to determine how each of the strategic variables will develop and (b) informs their members about which of the six scenarios is becoming the most likely outcome for 2025 on a periodic basis.

The second type of research relates to the concrete strategic actions that are recommended either as part of the core action plan or as contingencies depending on the decision points defined in chapter 6. Here, all of the strategic actions that were recommended in chapter 6 provide directions rather than concrete plans with detailed elaborations on a tactical level. We therefore recommend further research aimed at translating these strategic directions into more concrete guidelines and tactical plans. Specifically, we recommend follow-up studies focused on (1) the development of private platforms by larger firms, (2) the development of multi-modal freight-forwarding services by the back-offices of larger firms and (3) the possible need to switch to higher level autonomous trucks.

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Appendix 1

SAE Level	SAE Name	SAE Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System capability (driving modes)	BAST Level 	NHTSA Level 
Human Driver monitors the driving environment								
0	No Automation	the full-time performance by the human driver of all aspects of the dynamic driving task	Human Driver	Human Driver	Human Driver	N/A	Driver only	0
1	Driver Assistance	the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration	Human Driver and Systems	Human Driver	Human Driver	Some Driving Modes	Assisted	1
2	Partial Automation	Part-time or driving mode-dependent execution by one or more driver assistance systems of both steering and acceleration/deceleration. Human driver performs all other aspects of the dynamic driving task	System	Human Driver	Human Driver	Some Driving Modes	Partially Automated	2
Automated driving system ("system") monitors the driving environment								
3	Conditional Automation	driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task - human driver does respond appropriately to a request to intervene	System	System	Human Driver	Some Driving Modes	Highly Automated	3
4	High Automation	driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task - human driver does not respond appropriately to a request to intervene	System	System	System	Some Driving Modes	Fully Automated	3/4
5	Full Automation	full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver	System	System	System	Some Driving Modes		

Figure 0.1 Detailed description and differentiation of SAE levels of automation (retrieved from <https://www.automotive-iq.com/autonomous-drive/articles/first-level-3-automated-vehicle-road-iso-functional-safety-and-analysis> 21-09-2018)

Appendix 2

	Positive Interest	Negative Interest	Value Chain Depen-dence	Bargaining power over other parties	Access to investment capital	Possible Entry Strategy as the Initiating Investor
Shipping line	+ Profits from forward integration + Competitive edge relative to other shipping lines in carrier haulage market + Collaborate with other lines to expand share of carrier haulage	- risk of mismatch between pricing and trucking rates	Customers	Yes, over hauliers, (as a customer point and arbitrators of carrier haulage) and terminal operators and the Port of Rotterdam by deciding how to route containers.	Out of pocket costs for biggest shipping lines	Launch platform based on existing carrier haulage
Terminal Operators	+ Profits from forward integration	- risk of mismatch between pricing and trucking rates	Shipping Lines	Little, no direct contact with customers.	Out of pocket costs for biggest shipping lines	Negotiate with shipping lines to offer unload + delivery service for carrier haulage
Port of Rotterdam	+ HLH-competitive edge by lower prices and higher speed of hinterland logistics	- investments in process optimization of a modality whose share in the modal split it wants to diminish - Has to remain impartial	Shipping Lines	Influencer	(Partial) subsidizers of initiatives by other parties only.	Sponsor platform initiator and support digital integration
Hauliers	+ lower overhead from front- and back-office + first mover advantage + private platform with partners	- undermining existing customer relations and - undermining existing competitive advantage from back-office operations	Shipping lines, freight forwarders, customers, other hauliers	None	Access to bank credit or collective investments required	Offer transparent and flexible supply for merchant haulage
Freight forwarders	+ expansion of market share (broad) + Improved product offering (transparent end-to-end logistics portal)	- Cannibalization of existing margins. - Loss of business by paving the way for me-too competition	Shipping lines, customers	Over hauliers when merchant haulage is routed through them	Out of pocket costs for biggest (global) freight forwarders	Leverage existing merchant haulage demand.
New entrant	+ Make profits by developing a solution for current supply chain inefficiencies	- Investment risk	Hauliers, shipping lines, customers, forwarders	None, but can partner with parties that do have clout	Seed money (potentially PoRA subsidies) for start-up	Provide an outlet for excess supply in times of overcapacity and work in times of undercapacity (like Haulio)

