UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

ACADEMIEJAAR 2014 – 2015

The use of mobile technology in B2B markets:

The case study of Dynafleet in the trucking sector

Masterproef voorgedragen tot het bekomen van de graad van

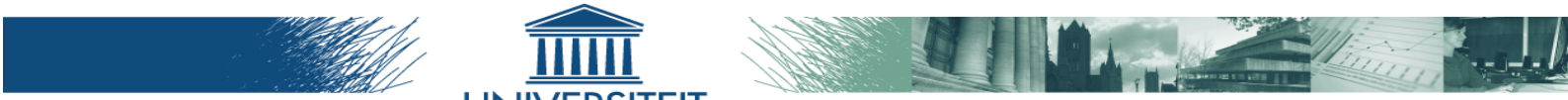
Master of Science in de

Toegepaste Economische Wetenschappen: Handelsingenieur

Matthias Sterckx

onder leiding van

Prof. Dr. Steve Muylle
Mr. Willem Standaert



UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

ACADEMIEJAAR 2014 – 2015

The use of mobile technology in B2B markets:

The case study of Dynafleet in the trucking sector

Masterproef voorgedragen tot het bekomen van de graad van

Master of Science in de

Toegepaste Economische Wetenschappen: Handelsingenieur

Matthias Sterckx

onder leiding van

Prof. Dr. Steve Muylle
Mr. Willem Standaert

PERMISSION

Ondergetekende verklaart dat de inhoud van deze masterproef mag geraadpleegd en/of gereproduceerd worden, mits bronvermelding.

MATTHIAS STERCKX

Nederlandstalige samenvatting

Het initieel doel van deze thesis is onderzoek te doen naar het gebruik van mobiele technologie in de B2B-markt. Er is besloten om het concept van mobiele technologie voornamelijk te beperken tot smartphones en tablet computers omwille van hun hoog gebruikscijfer en hun steeds toenemende populariteit. Een uitvoerige bespreking wordt gehouden betreffende de markt van beide producten alsook de mobiele besturingssystemen.

Ook de B2B-markt is afgebakend tot de private transport sector en meer bepaald het truck segment. Deze keuze wordt gemaakt omwille van een paper uit 2011 dat duidelijk vaststelt dat er slechts beperkt onderzoek bestaat omtrent het gebruik van ICT-gebaseerde applicaties in de private transport sector. Vervolgens worden zeven relevante kwesties van naderbij bekeken en besproken, afkomstig uit de literatuur. Als laatste wordt een overzicht gegeven van alle resulterende onderzoeksvragen.

Om een eenduidig antwoord te formuleren op deze vragen is besloten om mobiele vloot management applicaties binnen de truck sector van naderbij te bekijken. Deze zijn de mobiele tegenhangers van de uitgebreide systemen gebruikt binnen een bedrijf om hun vloot te coördineren. De oudste onder hen dateren slechts van 2010. De aard van de eerder geformuleerde onderzoeksvragen en de beperkte kennis die er momenteel bestaat omtrent deze moderne applicaties maken deze een uiterst geschikt onderzoeksdomein. Omwille van de diepgaande informatie die vereist is om de corresponderende onderzoeksvragen op te lossen werd na onderling overleg met de thesis commissaris besloten om een gevalsstudie uit te voeren omtrent dit onderwerp. De meest geschikte mobiele vloot applicatie blijkt Dynafleet te zijn.

Vier uitvoerige interviews met zowel Volvo Trucks, Scania, FTO en De Rese vormen de hoeksteen van dit onderzoek. De laatstgenoemde hanteert Dynafleet uitvoerig en de voorlaatste is een sceptische niet-gebruiker. Beiden zijn transportbedrijven. Deze vier bronnen werden zo gekozen zodat een zo objectief mogelijk beeld kan geschetst worden van de voordelen en nadelen van dit vloot management systeem alsook het gebruik van smartphones en tablet computers in hun marktsegment.

Deze gesofisticeerde doch gebruiksvriendelijke mobiele applicatie is ontwikkeld door Volvo Trucks en uitgebracht in 2012. In de app wordt onder meer een brandstofscore weergegeven voor zowel de vloot als elke truck chauffeur en ook hun rijgedrag wordt beoordeeld. Op basis van elke individuele score wordt vervolgens een klassement opgesteld.

Truck chauffeurs hebben enkel toegang tot hun persoonlijke data terwijl de zogenaamde ‘vloot gebruikers’ alle informatie van iedereen binnen de vloot kunnen raadplegen. Tevens wordt er gesteld dat de zogenaamde zoekkosten een significant grotere rol spelen op smartphones dan op tablet computers.

Vervolgens wordt het effect van het klassement van naderbij bestudeerd. Uit het onderzoek blijkt dat de manier waarop dit wordt gebruikt binnen een bedrijf zowel positief als negatief kan werken. Er kan hieromtrent weliswaar geen uitsluitsel geleverd worden, ook niet vanuit de literatuur. Wel blijkt het zo dat de brandstofscores en de onderliggende parameters positief kunnen bijdragen aan het continu monitoren en verbeteren van het rijgedrag van de chauffeurs. Deze laatsten passen in het algemeen proactief hun rijstijl aan wanneer een slechte score wordt waargenomen. Ook kan het management specifiekere trainingen voorzien om eventuele kernproblemen te verhelpen. Uiteindelijk kan dit leiden tot brandstofbesparingen en de bijhorende hoge reducties in brandstofkosten voor een transportbedrijf. Deze kostenbesparingen worden gezien als de belangrijkste motivatie om dit systeem te implementeren. Volvo Trucks stelt overigens dat bedrijven tot 7% minder kunnen verbruiken wanneer ze Dynafleet intensief gebruiken.

De app is overigens ook in staat te vermijden dat chauffeurs de rijtijdenreguleringen overtreden en het geeft hen een gevoel dat hun acties werkelijk een verschil maken betreffende de winstgevendheid van een bedrijf. Zaken zoals routeoptimalisatie en verbeterde communicatie zijn minder vertegenwoordigd door de applicatie, doch gerealiseerd in de desktopversie van dit vloot management systeem. Klantenbinding daarentegen wordt volbracht door zowel de app als de desktopversie. Deze onderwerpen komen uitvoerig aan bod in deze thesis.

Als laatste worden de nadelen van deze mobiele app besproken. Voorbeelden zijn verhoogde afleiding tijdens het rijden, het gebrek aan uitleg om de app te gebruiken, de behoefte aan accessoires zoals een carkit, enz. Personen die zich niet klaar voelen om deze app te gebruiken kunnen overigens gevoelens van verhoogde stress en zelfs angst ontwikkelen.

Er kan besloten worden dat, desondanks de adoptie van smartphones en tablet computers sterk verspreid is in de sector, het gebruik van dergelijke mobiele vloot management systemen zich nog steeds in de kinderschoenen bevindt. Toch wordt verwacht dat deze waardevolle applicaties aan belang zullen winnen in de nabije toekomst.

Kernwoorden: *mobiele technologie, truck sector, Dynafleet, brandstofverbruik*

Acknowledgements

This study could never be realized without the help and effort of certain people and firms. Therefore this section will address those people in particular that deserve a special thank word.

First of all, many thanks go to Volvo Trucks Belgium and in particular Emry Tack, the current Key Account Manager regarding Transport Solutions of Volvo Trucks. The time he offered me and the amount of information he provided was remarkable. At the moment of the interview he was still working in the Belgian department of Volvo Trucks. Although now he is occupied in Volvo Truck's headquarter in Sweden. I would like to wish him the best of luck in his further career. Also Bert Leenaerts, the Business Solutions Manager of Volvo Trucks Belgium, deserves a special mentioning for the additional information about Dynafleet he provided me. Thanks to him, I was also able to perform an extensive interview with an important Belgian Dynafleet user.

Second, I would like to thank David Desmet (Product Manager regarding Fleet Management Services Benelux at Scania Belgium), Tim Bergiers (Logistics Coordinator at FTO nv in Lochristi, Belgium) and Johan Coopman (Fleet and Technics Advisor/Driver Trainer at De Rese in Bruges, Belgium) for the interesting and clarifying interviews we had and the effort they took to provide me the necessary insights. These conversations are the backbone of the research performed within this thesis.

Although, without having any physical contact, Inspector Christophe Provost of Police Zone TARL offered me important insights in the regulations about legal driving times and the corresponding fines. His fast responses and extensive information are definitely worth mentioning. Also the Swedish development team of Dynafleet situated in Sweden deserves a special thanks.

Next, thank has to be directed towards my thesis supervisor, Willem Standaert, for his time, effort, point of view and ideas to help me realize this study. Also many appreciations go to Fabrice Gierckens, being the Service Delivery Manager at Worldline as well as my current employer, for being so understanding and providing me the opportunity to focus full-time on my research, consequently postponing the job start date after the thesis deadline.

Finally, a special thanks goes to my girlfriend Florine Lecourt for the continuous support during these months of research. She was very involved in my work and was always ready for a conversation accompanied with a striking opinion about the subject. Next, my friends and especially Niels Torck were an important source of ideas and the persons with who I shared my experiences during the development of this thesis. Therefore, they are worthy to receive a wholehearted thank you. At last, the support of my parents, Olga Bockstal and Rudy Sterckx, deserves an important notification.

In general, I would like to address everyone who, in one way or another, contributed to the realization of this thesis. I am convinced the efforts of all these people have lift my work to a very high level.

Table of Contents

Nederlandstalige samenvatting i
Acknowledgements iii
Used abbreviations vii
List of tables viii
List of figures ix
CHAPTER 0: GENERAL INTRODUCTION 1
CHAPTER 1: PAST, CURRENT AND FUTURE MOBILE TECHNOLOGY MARKET 4
1. Definition 4
2. Smartphone market 6
3. Tablet market 9
4. Evolution in the mobile operating system of choice 12
CHAPTER 2: LITERATURE STUDY 14
1. Introduction 14
2. Conditions for firms to implement mobile technology 19
3. The importance of perceived ease of use 21
4. Services and customer retention 23
5. Continuous improvements 31
6. Driving time regulations 33
7. Environment 34
8. Implications of mobile technology 38
9. Overview of the different research questions 43
CHAPTER 3: RESEARCH DESIGN 46
1. Case study 46
2. Research methods 48
3. Information sources 49
CHAPTER 4: DYNAFLEET EXPLAINED 51
1. What is Dynafleet? 51
2. Dynafleet modules 51
3. Beneficial users 54
4. Research design 54
5. Differences between the desktop- and mobile version of Dynafleet 55
6. History and development of the Dynafleet mobile application 64
7. Differences in the presentation of information between mobile devices 65

8. Service requirements of the Dynafleet mobile application 68
9. Which employees have access to the Dynafleet mobile application? 68
CHAPTER 5: CASE STUDY FINDINGS 69
1. Utilization of mobile technology devices within the trucking sector 69
2. The effect of internal competition 71
3. Dynafleet's possible revenues and costs 77
4. Dynafleet as a service to the customer 94
5. Value of the Dynafleet mobile application 97
6. Conditions for firms to use Dynafleet 103
7. Implications of mobile technology regarding the Dynafleet mobile application 104
CHAPTER 6: GENERAL CONCLUSION, LIMITATIONS AND FURTHER RESEARCH 107
1. Research results and conclusion 107
2. Limitations and further research 109
REFERENCES i
APPENDIX xvii
1. Extensive mobile technology timeline xvii
2. Factors that make mobile technology possible xxiii
3. Past, current and future smartphone market xxv
4. Past, current and future tablet market xxxii
5. Ultramobiles xl
6. Servitization of the economy xliv
7. Continuous improvements xlvi
8. Driving time regulations xlviii
9. Environment l
10. Dynafleet explained lx
11. Dynafleet mobile application for those who have complete access (fleet users) lxi
12. Dynafleet mobile application for those who have limited access (truck drivers) lxvi
13. Dynafleet's possible revenues and costs lxvii
14. Research design lxix
15. Interview with Emry Tack lxxxiii

Used abbreviations

ASP:	Average selling price
BaP:	Benzo(a)pyrene
B2B:	Business-to-business
CO:	Carbon monoxide
CO_x:	Carbon oxide
C_6H_6:	Benzene
GDP:	Gross Domestic Product
GIS:	Geographical Information System
GPS:	Global Positioning System
GVW:	Gross Vehicle Weight
ICT:	Information- and Communication Technology
Km:	Kilometres
NH_3:	Ammonia
NMVOC:	Non-methane volatile organic compounds
NO_x:	Nitrogen oxides
PM:	Particulate matter
RFID:	Radio Frequency Identification
RIM:	Research In Motion
ROI:	Return On Investment
SO_2:	Sulphur dioxide
TQM:	Total Quality Management
VOC:	Volatile organic compound

List of tables

Table 1: Average market share of the top 5 smartphone manufacturers for 2007-2Q14 (source: Gartner, Mawston, 2014) 8
Table 2: Tablet market share by screen size for 2013-2018 (source: IDC, May 2014) 10
Table 3: Average market share of the top 4 tablet manufacturers for 3Q11-2Q14 11
Table 4: Total tablet market forecast for 2013-2018 (source: IDC, March 2014) 11
Table 5: Evolution in worldwide smartphone sales by operating system (source: Gartner) 12
Table 6: Evolution in worldwide tablet and 2-in-1 sales by operating system (source: Gartner) 12
Table 7: Real-life retention example (source: Van den Poel & Larivière, 2004) 28
Table 8: Popularity of the different mobile fleet management applications (numbers are retrieved on December 30, 2014) 46
Table 9: The different Dynafleet modules and the corresponding beneficial users 54
Table 10: Fuel costs and -savings, net profit and ROI for different fuel savings levels (case FTO nv.) 81

List of figures

Figure 1: Smart connected device market share (source: IDC, 2014) 7
Figure 2: Factors impacting fit and viability (source: Liang, Huang, Yeh & Lin, 2007) 19
Figure 3: Fit-viability model (source: Liang, Huang, Yeh & Lin, 2007) 20
Figure 4: Technology satisfaction model (source: Lee & Park, 2008).....21
Figure 5: The real cost of trucking (US) (source: ATRI, 2013) 24
Figure 6: The service profit chain (source: 'Putting the service-profit chain to work', Heskett, Jones, Loveman, Sasser & Schlesinger, 1994) 27
Figure 7: Continuous and radical improvements (source: SatiStar) 32
Figure 8: Impact of different air pollutants (source: EEA) 35
Figure 9: Michael Porter's five-forces model of competition (source: Porter, 2008) 49
Figure 10: Fleet size variability 84
Figure 11: Driving distance variability 85
Figure 12: Fuel consumption variability 86
Figure 13: Diesel price variability.....87
Figure 14: Synergy of Volvo Driver Development and Dynafleet (source: interview Volvo Trucks).....99

CHAPTER 0:
GENERAL INTRODUCTION

Saturday the 20th of December 2015. A massive pile-up takes place on the ring around Brussels. Several wounded and a traffic congestion of multiple kilometres are the tragic result. Fortunately no one was badly injured. Nevertheless, Marnix De Rese, CEO of transport firm De Rese, has his hands in his hair. Not only because he finds himself currently in this huge traffic jam as well, but more important, how will his trucks possibly deliver their freight on time to the customers in and around Brussels? Marnix' smartphone is ringing. There is already a phone call from Peter, one of De Rese's truck drivers. He is saying he is stuck as well and his GPS indicates the traffic jam is stretching for quite some kilometres. He is asking what he needs to do. There is no way he can deliver those goods on time. On top of that, according to the Belgium regulations regarding legal driving times, he needs to take a break soon. This situation was not foreseen. Did this especially need to happen on a Saturday, when almost no one is at the office? And so close to the Christmas holidays, a period during which shops badly need their stock to be replenished. Not to mention the promise of the firm to its customers ensuring shipments within 24h. He can already picture the angry letters piling up in his mailbox. His clients are counting on these deliveries. But wait. Did he recently not bought a new fleet management system? It was a big investment for the company but it is supposed to be more elaborated than the previous one. He heard his dispatcher was so enthusiast about it, declaring that fleet management became so easy. It came with a mobile application, right? Marnix takes his tablet. Time to turn that mobile data connection on and download this app. Found it! Within one minute it is installed and after logging in, Marnix' mouth falls open. In one glimpse he observes instantaneously the state of his entire fleet. He presses the Map button and suddenly a map of Europe appears giving the real time position of all his trucks. With two fingers he zooms in on the map so he can see the situation in and around Brussels in more detail. This is amazing! He clicks on the different icons representing the trucks currently in the south of Brussels. Good news. There the traffic jams are the least severe, he thinks by himself, as the accidents occurred in the north of Brussels. The name of each driver appears accompanied by his/her personal stats. Oh wait, it are Cedric and Marco, both one of his best and most loyal drivers. And they just had a break, perfect! Marnix takes his smartphone and quickly calls them to let them know plans are changed and they have to supply the customers in Brussels. At the same time, he communicates them the fastest route taking into account the accidents. Next he requests the app to provide the names of the

chauffeurs currently stuck in traffic. He directs them to leave the highway and deliver the goods to shops in their actual vicinity, other than Brussels. The ones close to a break can drop their truck off at a roadside restaurant and are allowed to rest. Ouf! Marnix sighs. The situation is solved in less than ten minutes. He leans back in his car chair, waiting for the traffic to start moving again. At the meantime, he takes a look at the other characteristics of this app that saved him from a lot of troubles. Apparently its functionalities are much more extended than he first thought.

Although this example is based on a completely fictive scenario, the reality is not that far away. This becomes clear in the remainder of this thesis. The main ingredient in the previously mentioned solution-driven fleet management system is mobile technology. The latter is embedded in our everyday life, and this increasingly accounts from a business perspective as well.

Mobile technology has been of significant help even in the development of this thesis. While travelling by train from and to university or to interviews, a laptop and a mobile data connection made possible to read scientific articles, make grammatical adjustments, send emails to different companies and institutions, prepare interview questions, etc. It facilitates thus a way to work while being on the move. Moreover, mobile technology is available these days for different purposes, for all ages and for people from different backgrounds. Think about young children who are spending hours playing games on their tablet or elder people who can check their health status by a simple mobile application and are consequently able to inform their doctor when something odd occurs. Managers on the other hand are able to verify the condition of their fleet of trucks, check the status of the security system of their house or video chat with their wife and kids when being abroad. This is all feasible from wherever they might be. The possibilities are infinite, though all accessible on one single compact device.

These latter examples are all driven by mobile applications and -devices built for the specific needs of a variety of people. Though, not only a B2C environment benefits from mobile technology. Also in a B2B context people come in touch with the extraordinary advantages of this technology. The opening case points out the revolution that is reshaping the way firms conduct business, with a strong focus on the road transport sector. This forms the dominant part of this thesis.

The first chapter of this work expounds mobile technology as a whole and addresses those specific appliances that currently know an increased popularity and use. This part in particular strongly takes into account the latest data regarding mobile technology, while focusing on possible future trends within a short to a longer term perspective. Chapter 2 provides a literature study about those domains within B2B, and trucking sector in particular, that are affected by mobile technology. The necessary research questions are also formulated in this section. Further, chapter 3 clarifies the way the research is executed and why certain methods are chosen above others. Next, the characteristics and functionalities of one particular fleet management system are broadly elucidated in chapter 4. Chapter 5 on its turn consists of the actual research and aims to solve those research questions originating from chapter 2. Finally, chapter 6 provides an overview of the limitations of the conducted research accompanied by all the findings within this thesis and an overall conclusion.

CHAPTER 1:
PAST, CURRENT AND FUTURE MOBILE TECHNOLOGY MARKET

"*To know your future, you must know your past*,"

George Santayana (1863-1952) – Spanish writer, poet and philosopher

1. Definition

The term 'mobile technology' is composed of two components, namely 'mobile' and 'technology'. The first refers to "*the ability to move or be moved freely and easily*" (Oxford dictionary, n.d.). The latter is formulated as "*a machinery or device developed from scientific knowledge used for particular purposes, especially in industry*" (Oxford dictionary, n.d.).

According to James Bucki (n.d.), director of Computing Technology at Genesee Community College located in the US, mobile technology can be defined as "*a generic term used to refer to a variety of devices that allow people to access data and information from wherever they are. This includes cell phones and portable devices*". Research shows that "*the most significant features of mobile technology are mobility and portability. The ability to access services ubiquitously, on the move, and through wireless networks and various devices*" (Liang, Huang, Yeh & Lin, 2007). Essentially, every technological device whose portability is not limited by cables or wires and which offers the opportunity to access information is considered a technological mobile device. In short, mobile technology refers to any kind of technologic device that is portable.

As the title of this work articulates, the focus of the research is the business-to-business (B2B) environment (cfr. infra). Therefore, the concept of mobile technology is here limited particularly to those versatile devices that run applications, will know an increased implementation in the future and which are explicitly used in a B2B setting. As a consequence, smartphones and tablet computers will form the Achilles' heel of this thesis (cfr. infra).

According to the opening citation of this chapter, past behaviour is certainly as important as future trends. Considering these wise words, the next section will sketch the recent evolution that preceded those mobile technology devices that are now so essential in our everyday lives, namely the smartphone and the tablet computer. It also provides the

expectations regarding the importance of these devices on the short- to middle long term. Finally, the transition in the popularity of various operating systems is discussed.

An even further elaborated timeline that elucidates how mobile technology evolved from the early beginning is provided in the Appendix (section 1). Here, certain topics are exemplified using striking situations and modern illustrations. In addition, the Appendix (section 2) provides an overview of several factors that make mobile technology possible. In that part, a strong focus is put on the mobile data connection evolution. At last, a very extensive description of the past, current and future smartphone and tablet market can be found in the Appendix (section 3 and 4).

These overviews are made by gathering information from different research firms. Most of the data are coming from the quarterly and yearly reports published by Gartner, a worldwide leading company in IT research, and IDC, a global provider of market intelligence regarding the IT, telecommunications and consumer technology markets. The findings originating from these research firms are intertwined with other sources of information. Consequently, all the corresponding references to these sources can be found in the previously mentioned parts of the Appendix. The goal is to elucidate the massive use of smartphones and tablets in our everyday life.

2. *Smartphone market*

"*We want to reinvent the phone*"

Steven P. 'Steve' Jobs (1955-2011) – co-founder and CEO of Apple

Although the first smartphone has been developed by IBM in 1994, the large breakthrough came with the first iPhone, developed by the American firm 'Apple'. It was launched in June 2007 and 270.000 of them were sold during the first 30 hours of its launch. The latest version, the iPhone 6 and the iPhone 6 Plus released in September 2014, had a combined sales of over 10 million during the 72 hours after their launch. The Appendix (section 1) provides a clear overview of what made this device so extraordinary in comparison with its competitors back in the days. In short, its physical design, internal specifications, capabilities and extreme user-friendliness allowed Apple to differentiate from the competing products of Nokia and RIM. The latter was the former company name of the currently known 'BlackBerry'.

The introduction of the iPhone contributed to the growing interest of using smartphones for private as well as business purposes. Over the period 1Q07-1Q08, worldwide smartphone sales increased by 29%, which never happened before. In 2011, for the first time in history, the total smartphone sales overtook the number of personal computer sales. The latter consists of the small netbooks, the powerful notebooks and the fixed desktop computers.

According to Cummings and Krajci (2014), this change in the overall number one position is caused by three main factors. First, people strive for constant and open communication in their professional and social life. Next, smartphones and tablets can be obtained at a lower price while possessing new interesting features. Finally, the increased availability and user-friendliness of mobile applications boost the demand for these easy-to-use good-looking mobile devices.

In 2014, the combination of smartphones and phablets represents 70% of the so-called *smart connected device market*. The so-called *phablets* are part of the smartphone family but equipped with a larger screen, usually between 5,5 and 7 inch. The other devices which are part of this market are tablets, hybrids, portable computers and desktop computers. The difference between each category is extensively clarified in the Appendix (section 5). In 2018, smartphone and phablet sales are expected to further increase up to 75,6% of the global market share. This growth is mainly due to the enhanced popularity of the larger screen

phablets, whose market share is expected to more than double over the next 4 years. In addition, the market share of portable and desktop computers as well as regular smartphones is expected to decline, though the latter would be still occupying more than half of the market. The following figure represents this evolution. In the remainder of this thesis, no further distinction is made between regular smartphones and phablets. Both are categorized and denominated as smartphones. (cfr. Appendix, section 3.1)

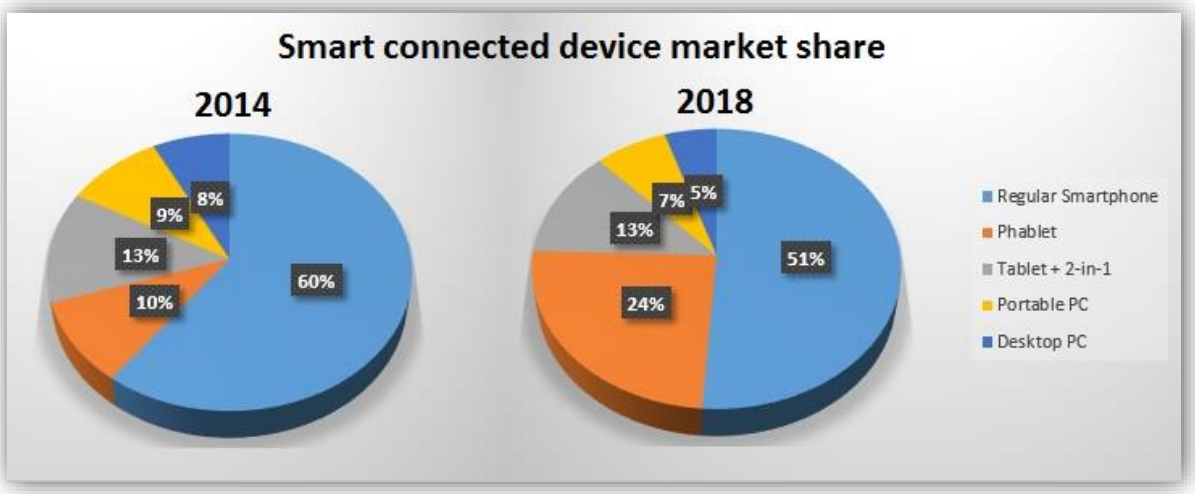


Figure 1: Smart connected device market share (source: IDC, 2014)

From the following figures it can be deducted that the smartphone hype is not stagnating. In 2007, roughly 122.316.000 smartphones were sold. This number skyrockets to around 1,2 billion pieces in 2014, which comes down to nearly a tenfold of sales in just 7 years. Furthermore, 2Q14 was a special quarter, during which the worldwide smartphone sales moved past the 300 million shipments in one quarter for the first time in history. By 2018, it is estimated that nine out of 10 phones will be smartphones. The current number lies around 66%.

The smartphone's popularity is expected to further increase in the near future, but at a slower pace. The annual growth of smartphone sales declines from 24% in 2014 to 8,3% in 2017 and 6,2% in 2018. The reason behind this is the upcoming saturation of large mature markets. Who drives then the previously mentioned growing trend? Gartner indicates that the increase in global smartphone sales nowadays is fed by the emerging and Asia-Pacific markets. eMarketer (2014) further declares that in 2015, 50% of the inhabitants of the US, Canada, most countries in Western Europe and big parts of the Asia-Pacific region will own at least one smartphone. They also elucidate that the Asia-Pacific region is currently responsible for more than half the global demand, roughly supplying 951 million users in

2014. This is a major difference regarding the situation in 2010 when Western Europe and North America accounted for 52,3% of the market. (cfr. Appendix, section 3.2)

At last, the smartphone segment is not only supplied by products of Apple, BlackBerry or Nokia (cfr. supra). Obviously, other companies all over the world try to take over a piece of this lucrative market. According to Mawston N. (2014), the six largest smartphone manufacturers in terms of sales at the moment are, from largest to smaller; Samsung, Apple, Huawei, Lenovo, Xiaomi and LG. Second place holder Apple is the sole American founded company in this sequence. All others have a Chinese or South-Korean origin. As the subsequent table shows, the top five of smartphone manufacturers is completely shifted when comparing 2007 with 2Q14 and even 2013.

Average market share of the top 5 smartphone manufacturers for 2007-2Q14 (in thousands of units)

Top 5 in 2007		2008	Growth '07-'08	Top 5 in 2013		Growth '12-'13	Top 5 in 2Q14		Growth 2Q14-'13
Nokia	49,9%	43,7%	-12,4%	**Samsung**	31,0%	2,3%	**Samsung**	25,0%	-19,4%
RIM	9,6%	16,6%	72,9%	**Apple**	15,6%	-18,3%	**Apple**	12,0%	-23,1%
Sharp	5,6%	3,8%	-32,1%	**Huawei**	4,8%	20,0%	**Huawei**	7,0%	45,8%
HTC	3,0%	4,2%	40,0%	**LG Electronics**	4,8%	26,3%	**Lenovo**	5,0%	11,1%
Apple	2,7%	8,2%	203,7%	**Lenovo**	4,5%	40,6%	**Xiaomi**	5,0%	177,78%
Others	29,6%	23,5%	-20,6%	Others	39,3%	-0,8%	Others	46,0%	17,0%

Table 1: Average market share of the top 5 smartphone manufacturers for 2007-2Q14 (source: Gartner, Mawston, 2014)

Apple is the only remaining company in the top 5 since 2007. It is currently second after Samsung, which holds quarter of the market. Both are considered premium smartphone manufacturers, holding 46,6% of the market in 2013. Huawei, Lenovo and Xiaomi form an Asian front of new and rather smaller low-price smartphone manufacturers. Their popularity does not go unnoticed. Megha Saini (2014), research analyst at IDC, states that "*at the time when the smartphone and tablet markets are showing early signs of saturation, the emergence of lower-priced devices will be a game-changer*". (cfr. Appendix, section 3.3)

The B2B market segment can therefore offer a valuable opportunity to these premium smartphone -and tablet- manufacturers. Companies have the intention to pay for well-functioning customized services based on cutting-edge technology. This phenomenon and trend is exemplified by the partnership of Apple and IBM to provide business applications.

3. *Tablet market*

"A society's competitive advantage will come not from how well its schools teach the multiplication and periodic tables, but from how well they stimulate imagination and creativity."

Albert Einstein (1879-1955) – German physicist, inventor and philosopher

"*We want to kick off 2010 by introducing a truly magical and revolutionary product*," announced Steve Jobs in 2010 (Jobs S., 2010a). Furthermore, he stated that: "*In order to create a new category of devices, those devices have to be far better at doing some key tasks. Better than the laptop, better than the smartphone*". In 2007 he declared that there exist seven major parameters in which this new product must excel; browsing the internet, sending emails, taking photos, watching videos, listening to music, playing games and reading eBooks. According to his point of view, netbooks would not become this revolutionary item. "*They are slow, have low quality displays and run old PC software. They are just cheap laptops*". Jobs explained that the appliance shining in the parameters cited above would be Apple's iPad. He was right. On the 2nd of June 2014, the current CEO of Apple, Tim Cook, announced that the global number of sales of the iPad series had crossed the 200 million mark since the launch of the first one in April 2014 (Cook, 2014).

Nonetheless, according to Gralla (2011), the iPad was not the first tablet ever produced. Already in 2001, Bill Gates, former CEO of Microsoft, introduced a prototype of the so-called 'Tablet PC'. Though, he made some critical mistakes in the development of this device (which are all extensively explained in section 4.2 of the Appendix) which held the device back from becoming extensively adopted.

Apple's iPad is part of the tablet computer family. A tablet computer, or simply tablet, is defined as "*a wireless portable personal computer with a touch screen interface. The tablet form factor is typically smaller than a notebook computer but larger than a smartphone*" (Margaret Rouse, n.d). It distinguishes itself thus from a smartphone due to its large interactive screen that makes it possible to provide more information simultaneously. Another characteristic of the tablet is its increased battery longevity. Third, it is a thin and light-weighted device that can be easily moved and handled from one place to another. By outshining in this category it sets itself apart from the larger and heavier notebook. These three outstanding features make the versatile tablet increasingly imbedded in people's private life, but recently also in a business environment (cfr. infra).

In 2014, roughly 256 million tablets were sold. According to Usablenet.com (2013), it is expected that by 2015 more tablets will be shipped than desktop computers and laptops combined. This is confirmed by Ranjit Atwal (Gartner, 2014c), research director at Gartner. In that year, the total computer market will sell roughly 316,7 million devices, while the number of sold tablets will rise up to 321 million. Nevertheless, Atwal declares that "*2014 will be marked by a relative revival of the global PC market*". The interested reader can find an elaborated clarification in sections 4.3, 4.4 and 5 of the Appendix.

By 2017 and 2018, expectations are that tablets will hold between 13% and 16,5% of the smart connected device market (cfr. supra). Moreover, the global accumulated sales of tablets will continue to skyrocket to far over 1 billion units shipped. Considering data of both IDC (2013) and Gartner (2013, 2014c), it is expected that this magical number will be already attained in 2016. (Appendix, section 4.3)

Atwal also announces the increasing favourability in mature markets of larger screen tablets to the credit of the ones with a smaller screen (Gartner, 2014c). This trend is confirmed by IDC (2014). The latter is the outcome of, among others, the increased search costs on smaller screen devices (cfr. infra). The following table illustrates this trend.

Tablet market share by screen size for 2013-2018

Year	7 - 8 inch	8 - 11 inch	>11 inch
2013 actual	55,0%	44,1%	0,9%
2014 forecast	50,8%	47,3%	1,9%
2018 forecast	44,5%	48,9%	6,6%

Table 2: Tablet market share by screen size for 2013-2018 (source: IDC, May 2014)

In general, a tablet's screen size is between 7 inch and 12 inch (Hwang, 2013). It is clear that <8 inch tablets know a significant decrease in market share, while the 11+ inch devices are growing sharply. In addition to the lower search costs, the decrease in ASP of phablets and larger screen tablets possibly explains this trend. (Appendix, section 4.4)

Although the majority of the information is based on quarterly data of IDC and Gartner (cfr. supra), these figures can be subject to heavy fluctuations because of new product launches. In order to provide rather stable results, the following table in this section is averaging each manufacturer's market share over the last three years.

Average market share of the top 4 tablet manufacturers for 3Q11-2Q14	
Manufacturer	Average market share
Apple	42,0%
Samsung	14,4%
ASUS	4,7%
Lenovo	2,7%
Others	36,3%
Total	**100,0%**

Table 3: Average market share of the top 4 tablet manufacturers for 3Q11-2Q14

Hereby, the clear dominance of Apple over the considered time period is made visible. Samsung on the other hand is on average involved in one out of seven tablet sales. Beside this, ASUS and Lenovo are small players but are becoming increasingly important. These four manufacturers combined possess on average 63,7% of the market. The remaining part is divided over a wide spectrum of firms. (Appendix, section 4.5)

IDC experts (2014) believe that tablet sales for commercial intentions will increase in the near future and take over a part of the consumer shipments. This is represented by the following table.

Total tablet market forecast for 2013-2018		
Year	Commercial	Consumer
2013 actual	11%	89%
2014 forecast	14%	86%
2018 forecast	18%	82%

Table 4: Total tablet market forecast for 2013-2018 (source: IDC, March 2014)

In addition, IDC also states that "*much of the tablet growth in commercial to date has been in verticals such as education, though tablets will continue to infiltrate small, medium, and large businesses around the world. This commercial growth is likely to benefit Microsoft's Windows over time*".

The latter refers to the Windows operating system. The major evolutions regarding operating systems are treated in the following section.

4. *Evolution in the mobile operating system of choice*

Mobile devices are not only categorized by the company that developed them, but also the operating system they are running. The latter are generally co-existing in addition to their traditional desktop brother. Examples are Linux and Android, Windows and Windows Mobile, OS X and iOS, etc. All have their own mobile derivative. Because this thesis provides a particularly mobile focus, the emphasis is on those mobile operating systems. Regarding the desktop versions, further reading is advised.

The evolution of the worldwide market share for smartphones and tablets is represented in the following two tables (Gartner, 2009 & 2014).

Evolution in worldwide smartphone sales by operating system

Top 6 in 2008		Top 3 in 2014		Top 3 in 2018	
Symbian	52,4%	**Android**	82,3%	**Android**	80,0%
RIM	16,6%	**iOS**	13,8%	**iOS**	12,8%
Windows Phone	11,8%	**Windows Phone**	2,7%	**Windows Phone**	5,6%
iOS	8,2%	NA	NA	NA	NA
Linux	7,6%	NA	NA	NA	NA
Android	0,5%	NA	NA	NA	NA
Others	2,9%	Others	1,1%	Others	9,8%

Table 5: Evolution in worldwide smartphone sales by operating system (source: Gartner)

Evolution in worldwide tablet and 2-in-1 sales by operating system

Top 3 in 2010		Top 3 in 2014		Top 3 in 2018	
iOS	83,4%	**Android**	67,7%	**Android**	64,0%
Android	14,3%	**iOS**	27,5%	**iOS**	24,5%
MeeGo	1,0%	**Windows**	4,6%	**Windows**	11,4%
Windows	0,0%	NA	NA	NA	NA
Others	1,3%	Others	0,2%	Others	0,0%

Table 6: Evolution in worldwide tablet and 2-in-1 sales by operating system (source: Gartner)

It is clear that there is no relative difference within the top 3 of the worldwide utilized mobile operating systems, at the moment as well as in the future, when comparing smartphone shipments with tablet sales. In both cases Android is by far the most preferred, followed by iOS and Windows. This is mainly due to the fact that iOS and Windows devices are offered by only one single company, Apple and Microsoft respectively. Android devices on the other hand are provided by a whole variety of firms.

Though, the dominance of Android is more overwhelming in the smartphone segment than in the tablet one. iOS on the other hand is larger within the tablet market. Windows currently holds 4,6% of the tablet market share in comparison with 2,7% of Windows Phone

sales. The top three for both segments remains the same in 2018, though Android and iOS are losing ground while Windows is doing great business. At last, it is clear that compared with 2008 and 2010, respectively the smartphone and tablet market has undergone significant changes.

Research

First, this thesis investigates how B2B-orientated companies expect the evolution in mobile devices to be in the near future. In addition, it is questioned which device would lose or gain ground compared with the current smart devices mobile market.

Furthermore, it is analysed whether the past transitions and evolutions within the smartphone and tablet market had an impact on the initial mobile operating system of choice from a business mobile applications developer point of view.

Finally, the previous sections made clear that although mobile technology is a widespread phenomenon, currently not everyone possesses a smartphone or tablet. This situation can cause trouble when firms opt to implement a mobile meant to be actively used by their employees. Therefore, this thesis investigates this obstacle in B2B environments.

CHAPTER 2:
LITERATURE STUDY

1. Introduction

This chapter explains the findings the existing literature offers regarding mobile technology in general and its use in a B2B environment. Gradually, the research topic evolves to the study of fleet management systems in the transport sector, a prime example of a B2B setting.

1.1 The value of mobile technology in a B2B context

The concept of B2B is clarified utilizing the definition of B2B marketing. The latter, short for 'business-to-business marketing' or 'business market management' is defined as "*the process of understanding, creating and delivering value to targeted business markets and customers. The former business markets are firms, institutions or governments that acquire products or services*". This definition is provided by Prof. Dr. Steve Muylle, B2B marketing teacher at the University of Ghent, Belgium. He also is the promotor of this thesis. Important to notice is thus that the selling and acquiring of goods and services in this context exclusively takes place between businesses. In a later stadium, these products and services could possibly be purchased by a non-business customer. The latter is not the emphasis of B2B, but rather part of B2C, which falls out of the focus of this thesis. Besides this essential difference, B2B markets have generally fewer partners, closer buyer-seller relationships, better technology and better information exchange compared to their B2C counterparts (Hutt and Spech, 1998).

Before mobile technology was widely adopted, various research has already demonstrated Information Technology (IT) to be positively linked to a company's performance and shown to have the potential of providing a significant competitive advantage to firms (Lee and Park, 2008; Sanders, 2007). 'Information technology' can be defined as "*a technological capability used to acquire, process, and transmit information for more effective decision making*" (Grover and Malhotra, 1997). For instance, Hammer and Mangurian (1987) reports that IT enhances inter-firm relationships and this on its turn improves the firm's performance. In addition, Stroeken (2000) shows that IT directly and positively impacts coordination and also leads to supply chain innovation. Furthermore,

increased coordination would also enhance the performance of a firm (Stank, Keller and Daugherty, 2001).

In 2008, just one year after the launch of Apple's first iPhone, Lee and Park state in their work that "*the interest in the use of mobile applications in the business environment is increasing*". This statement is dimensioned by IDC (2014) (cfr. supra). In addition, the transition to the business implementation is already mentioned at the beginning of the 21st century by several studies, such as the ones of Leung and Antypass (2001) and Varshney *et al* (2002, 2004).

As mobile technology is a clear-cut application of information technology, it is expected that the previously mentioned advantages of IT proceed in the mobile environment. The latter is confirmed by Varshney *et al* (2002), declaring that mobile technology is capable of automating and streamlining business processes that can possibly result in higher productivity levels, lower operational costs, enhanced efficiency, elevated customer satisfaction and increased decision making. This thesis investigates whether mobile technology is indeed capable of realizing the latter advantages (cfr. infra).

1.2 B2B and the freight transportation sector

While browsing through scientific articles exemplifying the advantages of mobile technology in various sectors, a particular paper caught the attention. Written by Perego, Perotti and Mangiaracina in 2011, their work '*ICT for logistics and freight transportation: a literature review and research agenda*' classifies the current research on ICT for logistics and freight transportation and suggests directions for further research.

In this paper, they state that, due to globalisation and internationalisation, the competitiveness within the transport sector increased over the past few years. According to them, cost considerations and service levels are the main drivers for companies when choosing their logistics provider. Consequently, this puts an additional pressure on the shoulders of these latter firms. Therefore, Perego, Perotti and Mangiaracina (2011) indicate that information and communication technology (ICT) based applications could be seen as a primary enabler to perform well on both drivers. Their statement is supported by a variety of previous research, of which the most recent is originating from Giannopoulos (2004).

Nevertheless, Perego, Perotti and Mangiaracina (2011) repeatedly emphasize the fact that the number of studies about the use of ICT based applications within the *private*

transportation sector is limited and relatively more recent. With the term 'private transportation', they refer to the private companies offering logistics and transportation services. Because of the lack of scientific research concerning this matter, it is decided that this thesis will contribute filling this gap by investigating the role of mobile technology particularly in the trucking sector. An important role is hereby devoted to mobile fleet management applications and the use of smartphones and tablets.

1.3 The various study domains of this thesis

Prior to any form of research regarding the advantages and disadvantages of mobile applications in the trucking sector, the variety of matters and issues concerning mobile technology are elucidated bellow, whether or not they are related to the former mentioned sector. These study domains are briefly listed in the remainder of this part and then further discussed in the next sections of this chapter. In addition, for each section one or more specific research questions are brought forward. Ultimately, the goal is to investigate their influence and role particularly within the transport sector and provide a suitable answer.

Within the transport sector, it is essential that the way trucks travel between their departure and destination is optimized. This is the so-called ***vehicle routing problem***. Cheung, Choy, Li, Shi and Tang (2008) research a more advanced model for scheduling the fleet, namely the '*Dynamic routing model*'. This allows companies to re-plan their transportation operations satisfactorily when facing dynamic data. The same topic is studied by Zeimpekis, Tarantilis, Giaglis and Minis (2007). These authors declare that real-time fleet management systems increase customer service from 60% up to 80%. Real-time fleet management and dynamic routing is generally made possible due to the development of new information- and communication technologies, such as RFID, GPS and GIS. Being mobile technologies, this thesis researches their role in fleet management systems.

Next, as already discussed, Varshney *et al* (2002) declares that mobile technology is likely to realize **higher productivity, efficiency and customer satisfaction, enhanced decision making and lower costs** (cfr. supra). In addition, a study performed by Bowden, Dorr, Thorpe and Anumba (2006) describes the beneficial use of mobile ICT in the construction industry. It contributes to a lower construction time, decreased operation- and maintenance costs, less defects, a reduction in the number of accidents, a declined waste level and finally an increased productivity and predictability. This thesis researches whether ICT is also beneficiary in the trucking sector and generates analogue improvements.

These advantages can also be retrieved in the concept of lean and more particularly when performing **continuous improvements**. The goal of lean management comes down to the reduction of waste in all possible forms, in order to be as efficient as possible. The role of IT in order to realize continuous improvements is broadly discussed in the book '*Lean enterprise systems: using IT for continuous improvement*' written by Steve Bell (2005). Whether the existing mobile technology in the transport sector makes it possible for firms to continuously improve their operations, is another topic to be investigated within this thesis.

Despite these possible large advantages, implementing a mobile technology system can ask significant efforts and money from a company. Jarvenpaa and Lang (2005) discuss in their work the possible **disadvantages of mobile technology**. Therefore, it is important that a firm is ready to make this transition. The **conditions a business needs to satisfy for mobile technology to be beneficial** are indicated by Liang, Huang, Yeh and Lin (2007). Ultimately, the importance of these guidelines when implementing mobile technology in a trucking company is verified by this thesis. In addition, the possible disadvantages of mobile technology in this sector are examined.

Another phenomenon that plays an important role in the business-to-business environment is ***customer retention***. According to a paper of Gounaris (2005), in most B2B exchanges, the ultimate goal of a firm is not solely to sell a product, but also to build and sustain a long-term relationship with its business customer. The book of Francis Buttle (2009) indicates that increased customer retention reduces the overall marketing costs, provides better customer insights and tends to generate more profits per customer. One way to enhance customer retention is by providing valuable services to the customer (Gemmel, Van Dierendonk & Van Looy, 2003). Customer retention and its implications are explained in a further part of this thesis. It is also investigated whether ICT based applications, developed to optimize operations within the trucking sector, are considered as services that are able to retain business customers within the latter sector. According to Urban and Sultan (2014), mobile apps in general should be capable of realizing this.

Further, a paper of Ghose, Goldfarb and Han (2012) explains the differences in the way people browse the internet on mobile phones compared with personal computers. According to them, **screen sizes** impact the effort for users to go through different kinds of information. This thesis investigates whether these so-called **search costs** differ between different types of mobile technology devices and what the possible complications can be.

Related to this is the fact whether **perceived ease of use** of mobile technology positively affects user satisfaction and perceived market performance. This is researched by Lee and Park (2008) and forms also an important topic within this thesis.

Next, from a previous self-conducted study around the concept of **green thinking**, it seems that some businesses aim to perform environmental friendly operations and consequently use this green image in their advantage. This research was performed in 2014 at the frozen vegetable processing company d'Arta, situated in Ardooie, Belgium. In addition, Perego, Perotti and Mangiaracina (2011) indicate that environmental issues in the transport sector have taken on a renewed importance. This thesis checks whether the concept of being a green company plays a significant role in the trucking sector and how mobile technology contributes in achieving this goal.

Finally, the transport sector is subject to strict **driver time regulations**. Violations can possibly lead to significant fines. An important research question in this thesis is consequently whether mobile technology is able to reduce the risk of exceeding these regulations.

2. *Conditions for firms to implement mobile technology*

Until 2007, the lion's share of mobile technologies are implemented in consumer-orientated areas. In the business world, such large-scale usages are fairly scarce. This is described in a research work of Liang, Huang, Yeh and Lin (2007). Though, Lee and Park (2008) state that technology adoption is rather considered mandatory in a B2B environment compared to B2C.

According to the former researchers, the function of mobile technology in business is twofold. First, it facilitates the communication between employees, customers and suppliers. As a result of this more efficient information exchange, organizational productivity and profitability are positively impacted. Second, it opens a wide array of possibilities for firms to access data or to provide new services to the customer.

In order to benefit from these advantages, a company must comply with certain terms before it can successfully implement and use mobile technology. Therefore, Liang and Wei (2004) developed the *fit-viability model*. Here, 'viability' measures the extent to which the organizational environment is ready for the application, such as economic costs and benefits, the employees' mentality regarding changes and the maturity of organization infrastructure to support mobile technology. In short, it refers to the economic, technical and social readiness of the organization. On the other hand, 'fit' measures the extent to which the capabilities of a certain mobile technology meet the requirement of the task. Five factors are thus impacting fit and viability, visually represented by the following framework.

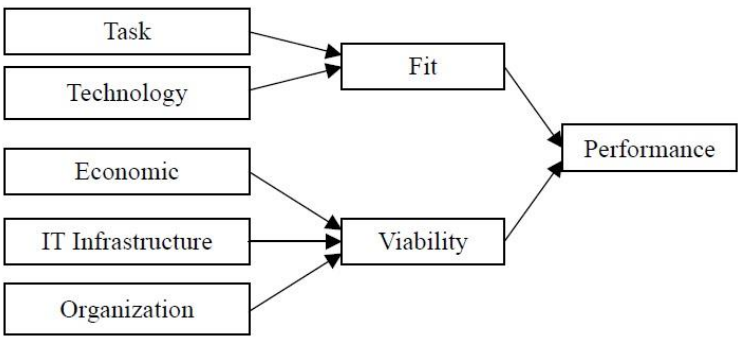


Figure 2: Factors impacting fit and viability (source: Liang, Huang, Yeh & Lin, 2007)

Using the two basic dimensions of this model, the following two-by-two matrix can be generated. It represents the way each company needs to act, based on its corresponding fit-viability scores. (Liang, Huang, Yeh & Lin, 2007)

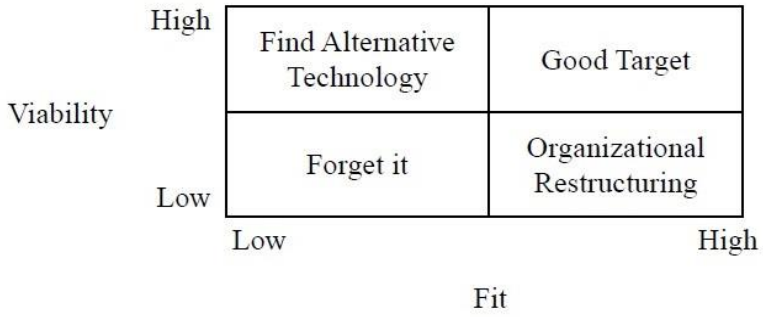


Figure 3: Fit-viability model (source: Liang, Huang, Yeh & Lin, 2007)

When a company is ready for the mobile technology (high viability), but this technology does not meet certain requirements (low fit), the best strategy for this firm is to find an alternative technology that does fit the nature of the task. Alternatively, when a technology does offer the required value to a business (high fit), but the company is not ready for it yet (low viability), the firm first needs to examine whether organizational restructuring could improve its economic prospects. Finally, when scoring low on both fit and viability, it is suggested to drop the idea of mobile technology. Only when high fit and high viability take place, then the company is immediately qualified to adopt and benefit from the advantages of mobile technology.

Research

This thesis investigates whether the factors that impact the fit and viability requirements are also taken into account when implementing a mobile technology in a real B2B transport firm setting.

3. *The importance of perceived ease of use*

Lee and Park (2008) developed the *technology satisfaction model* (TSM) in which they investigate how the perceived ease of use of mobile applications impacts user satisfaction, perceived usefulness and perceived market performance. The model they created is derived on the one hand from the *technology acceptance model* (TAM) of Ajzen and Fishbein (1975), and on the other hand from later research of Davis, Bagozzi and Warshaw (1989). The TSM model is presented below.

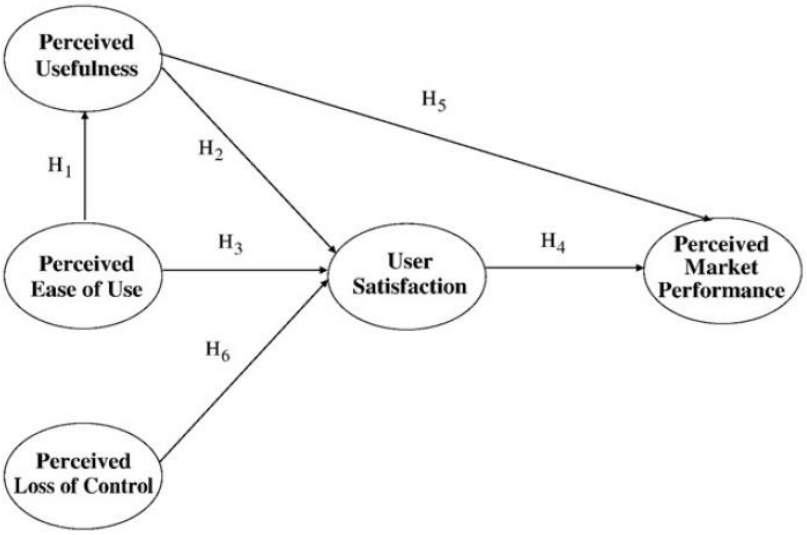


Figure 4: Technology satisfaction model (source: Lee & Park, 2008)

The model of Lee and Park (2008) focuses on the perceived ease of use of a mobile technology, rather than its actual usage. The latter is part of TAM. According to both researchers, the former is generally more suitable in a B2B environment compared to B2C markets.

Starting from right to left in the figure, perceived market performance in business depends significantly on the user satisfaction regarding a specific mobile technology. Both are positively related to each other. User satisfaction on its turn is firstly negatively affected by perceived loss of control when using the technology. The other side of the coin implies that, when a mobile technology offers employees more control, their satisfaction increases. In addition, user satisfaction is also significantly influenced by perceived usefulness and perceived ease of use, though the positive effect of the perceived usefulness is larger. This relation is confirmed in the work of Adamson and Shine (2003).

Research

Whether the previously mentioned relations and associations also occur in the trucking sector is researched further in this thesis.

4. *Services and customer retention*

"Don't give people what they want, give them what they need."

Joss Whedon – American screenwriter, director, producer and actor

4.1 Servitization of the economy

Gemmel, Van Dierendonk and Van Looy (2003) define services as "*all those economic activities that are intangible and imply interaction to be realised between a service provider and consumer"*. They also state that the service sector is increasingly important in the way business is conducted nowadays. This phenomenon is denominated as the *servitization of the economy*. The following figures speak volumes. In 2012, roughly 80% all US workers were active in this particular market segment (United States Department of Labor, 2013). For EU-27, this share was slightly lower, namely 65% (European Commision, 2013). Worldwide, the service sector contributes to roughly 70% of the global GDP. Further details can be retrieved from section 6.1 in the Appendix.

4.2 Contributors to the servitization of the economy

But why is this servitization evolution not slowing down? First, customers are no longer satisfied with the good alone. The latter has to come with certain services that offer customers the chance to get maximum efficiency out of their product. Additionally, customers increasingly recognize the importance of dealing with the so-called *life-cycle costs* of products, rather than just the purchase price alone. In other words, they aim to decrease those costs that occur over the product's lifetime.

Specifically for the trucking sector, fuel, spare parts and maintenance are striking examples of major cost-intensive subjects that a company has to deal with during the lifetime of a truck. The aggregation of these costs is often much larger than the purchase cost of an average truck. The combination of fuel, insurance, repairs and maintenance mount up to 51% of the overall costs, compared with 14% for the tires and the truck itself. Drivers on the other hand take on 33% of the overall trucking costs. These findings are represented by the following pie diagram and are based on a study of the American Transportation Research Institute (2013). The data apply for the situation in 2012, though over the years these costs did not undergo significant fluctuations. Due to a lack of recent figures, this thesis assumes that these numbers are more or less the same on the European Continent.

Companies such as Mercedes-Benz use the growing importance of life-cycle costs to their advantage. In a former marketing campaign they threw a large light on the fact that the price of a truck constitutes only about 15% of its total average lifetime cost. Small improvements can mean huge differences in the necessary costs to keep a fleet running. Therefore, extensive fuel saving systems and efficient after-sales services were offered to their (potential) customers. This phenomenon still takes place to date.

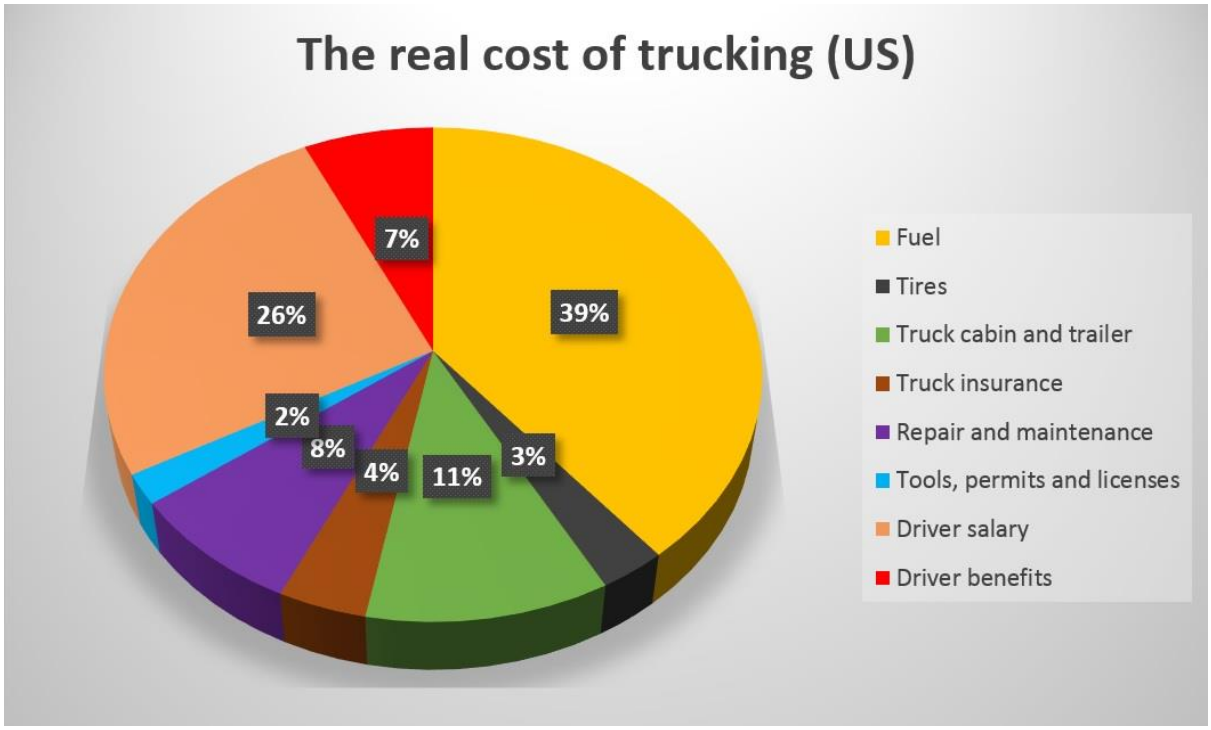


Figure 5: The real cost of trucking (US) (source: ATRI, 2013)

A second reason for companies to step on the servitization train is the fact that it permits and facilitates differentiation. Traditionally, competition between manufacturing firms was mainly focused on the goods they produce. Firms gained customers because their goods were simply better than the competition or were heavily advertised. Though, after some time, their products fell victim to copied counterparts produced by other firms. This left little room to differentiate in order to attract customers. Services have completely changed this status-quo environment. Offering a better service than the competition can render an important competitive advantage. According to a study performed at 138 German companies, 76,9% of those surveyed mentioned services as the most effective long-term differentiation tool. In their book, Gemmel, Van Dierendonk and Van Looy declare that goods are becoming an order qualifier whereas services are the order winners. According to them, the unique mixture of goods and services a company can provide is able to induce more satisfied and

loyal customers (cfr. infra). The latter are consequently less eager to buy products offered by the competition when the original ones have to be replaced.

Third, a change in mind-set takes place within manufacturing firms. Companies no longer consider services as an addendum to the goods they produce. A classic example here are after-sales services such as maintenance contracts. Servitization goes thus beyond this traditional approach and sets goods and services on the same value level. An important driver for this transition is the fact that manufacturers realize that goods accompanied by necessary services lift the combined value to a higher level. Higher value to the customer can be translated into a higher selling price for the developer. Both parties win. Ultimately the goal is to sell goods and services as an integrated package.

Fourth, technological developments in microelectronics and telecommunications assisted significantly to the creation of new types of services such as software.

The last parameters that positively contribute to this service boom are of a sociological and demographic nature. First, the increase of people's disposable income is an important driver. *Engel's Law* states that "*people with higher incomes tend to spend relatively more on services and less on goods*". Next, the increasingly common phenomenon of dual-income families negatively impacts the overall free time though increases the family budget. Consequently, many household tasks, such as ironing and cleaning, are outsourced to service providers. Furthermore, a higher overall income leads to a longer life expectancy that on its turn results in a greying population. These elderly people have specific demands and needs, very likely related to services. At last, the increasing complexity of life leads to the demand of receiving help or advice from professional people, often given through services. Examples are lawyers, notaries and consultants. (Gemmel, Van Dierendonk & Van Looy, 2003, p.8-10, 41-44)

Research

These former trends, though to a lower extent the sociological and demographic factors, could possibly contribute to the development of fleet management tools. Therefore, this thesis verifies which trends contribute to the importance of fleet management services in the trucking sector.

4.3 Services impact customer retention

Another advantage of services is the fact that it induces customer retention. The latter is defined as "*the customer behaviour characterized by a positive buying pattern during an extended period (measured by means of repeat purchases, frequency of purchase, wallet share or other indicators) and driven by a positive attitude towards the company and its products or services*" (Gemmel, Van Dierendonk and Van Looy, 2003). Moreover, these loyal customers neglect the opportunity to acquire their products at a competing firm even if these goods have a slightly better quality or are just a little bit less expensive. Profoundly satisfying the needs of its customers can possibly be translated into customer retention which ultimately leads to a higher profitability for a firm (cfr. infra). The latter is confirmed by Reinartz, Thomas and Kumar (2005) as well as by Benoit and Van den Poel (2012) and De Rijcke (2012). All state that, because of this profitability maximizing ability, customer retention is a key factor contributing to the business success of many firms in the current economy. In general, '*the process of acquiring and retaining customers in a lucrative way*' is defined as CRM, short for Customer Relationship Management (De Rijcke, 2012).

Though, this customer retention focus has not always been the goal of many businesses in the past. According to Gemmel, Van Dierendonk and Van Looy (2003), former important performance parameters such as market share, cost structure and company size are currently fading. The economy is stepping of the traditional transaction-oriented way to sell goods and turns into relationship marketing. The factors that lay on the basis of this relationship based transition can be found in the Appendix (section 6.2).

In relationship marketing, the emphasis is thus on the development and sustainability of mutually beneficial customer relationships rather than striving to sell as many products as possible. Mutually beneficial customer relationships are achieved when a product or service adds value for the user as well as its developer. More specifically, value has to be achieved for both firms and consumers simultaneously, through both active and passive participation. This concept is described by Larivière *et al.* (2013) as *value fusion*. Another way to create tight buyer-seller relationships is by the means of extensive communication and trust (cfr. infra).

Initially, tight business relationships stand or fall if a firm is able to realize a significant value to its customer. Services are definitely a crucial factor to achieve this. They can be deployed to customize a particular product regarding the individual needs of multiple

clients, increasing the value to and the satisfaction of the customer (cfr. supra). The latter is impacted by the way a client's expectations and the perceived performance of a company, product or service overlap.

The interconnections between the service value and the profitability of a firm are visualized on the right-hand side of the following picture, representing the *service profit chain*. The left-hand side is mainly Human Resource related and is less relevant regarding the study domain of this thesis. Also Noe, Hollenbeck, Gerhart and Wright (2012) recognize that the competitiveness of a firm is based on the company effectiveness which in turn is related to the way a firm satisfies the needs of its stakeholders. The latter encloses all stockholders, customers, employees and the community. Customers are here thus also a crucial target group.

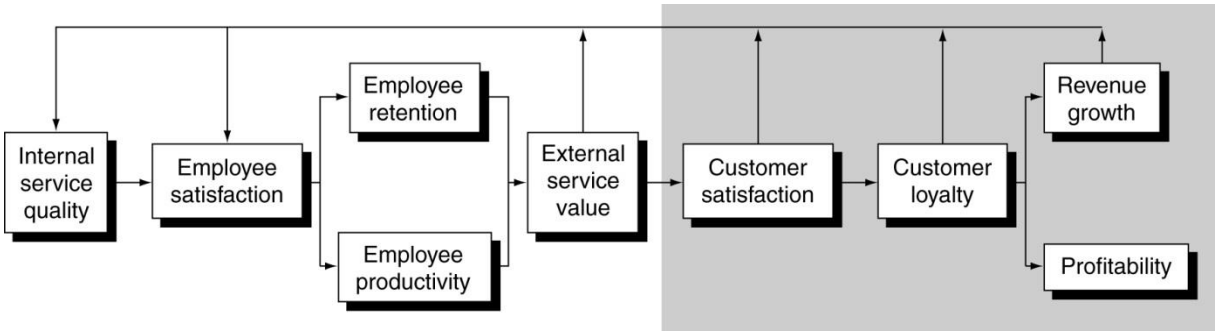


Figure 6: The service profit chain
(source: 'Putting the service-profit chain to work', Heskett, Jones, Loveman, Sasser & Schlesinger, 1994)

4.4 Benevolent mobile applications

According to a very recent research of Urban and Sultan in December 2014, certain firms design mobile applications capable of building trust with the user. They are called '*benevolent mobile applications*'. The concept is exemplified by a mobile app provided by an American sea emergency towing company and rescue service. This app offers important information to boaters regarding local tide times, weather forecasts, GPS coordinates, etc. At first sight, this could possibly undercut the firm's business. Nonetheless, when an accident would occur, the firm expects boaters to be more inclined into contacting their company.

Thus, Urban and Sultan (2014) declare that "*the value of these apps is not directly tied to selling products but rather to advancing consumers' interests and advocating for their needs ahead of a company's own corporate profit. When customers sense benevolence from providers, they are inclined to trust them more*". The next paragraph investigates whether this feeling of trust is also financially beneficial for a company.

4.5 Customer retention impacts revenues and profitability

First, the fact that a firm possesses more customers, who spend on average the same amount of money, obviously leads to a higher overall profitability. A real life example is provided by Van den Poel and Larivière (2004), based on the following table.

Real-life retention example

Retention rate (RR)	No. of customers (thousand)							Average contribution per year (in Euro)	Total contribution after 25 years (thousand Euro)	Additional contribution over 93% retention situation (thousand Euro)	Additional contribution over 75% retention situation (thousand Euro)
	Start	Second year	Third year	Fourth year	Fifth year	···	25th year				
75%	1.000	750	563	422	316	···	1	50	174.688	/	0
93%	1.000	930	865	804	748	···	175	50	392.213	0	217.525
94%	1.000	940	884	831	781	···	227	50	419.757	27.544	245.069
100%	1.000	1.000	1.000	1.000	1.000	···	1.000	50	682.518	290.305	507.830

Table 7: Real-life retention example (source: Van den Poel & Larivière, 2004)

The conclusion here is that, when a company starts with 1 million customers that spend each on average €50 per year, a customer retention rate of 94% yields the firm roughly €27,5 million more than a retention rate of 93%. This is considered over a time period of 25 years. Slight changes in customer retention levels can thus imply huge changes in possible revenues.

Second, Gemmel, Van Dierendonk and Van Looy (2003) state that in a situation of elevated customer loyalty, clients are less price sensitive and participate intensively in word of mouth. The latter, being one of the most essential forms to market a product (Bughin, Doogan, & Vetvik, *McKinsey Quarterly*, 2010), reduces the costs of additional marketing channels. According to a work of Buttle (2009), an advertising agency declares that "*at least 20 times more money is spent to recruit a new client than it does to retain an existing customer*".

Third, it is said that customer loyalty and solid buyer-seller relationships gradually increase the absolute turnover per client after each period of time. Buttle (2009) exemplifies this topic declaring that an average clothing customer spends 67% more money during the months 31 to 36 than he/she did during the first 6 months. For grocery customers this is 23%.

4.6 Marketing strategies

Too often marketers are already satisfied turning a prospect into a customer, hoping the value of the offered good and/or service is strong enough to retain them. Though, firms need to proactively undertake steps to keep these people or businesses as their client. In other words, in today's economy a transition takes place from customer recruitment to customer retention.

Customer retention can be realized using price incentives to secure customer loyalty. Free gifts, loyalty bonuses and money-off coupons are just a few of the many examples. Nevertheless, this is the weakest level of relationship marketing because it can be easily imitated by the competition. Also, the danger exists that after some time people are led by the promotions, rather than the value of the product or service. An alternative strategy is maintaining the social aspects of a relationship mainly realised by extensive communication between buyer and seller accompanied by a quality service offering. This induces feelings of trust and comfort. Customers feeling at ease with a certain firm tend to share extensive and sometimes rather confidential information. On its turn, the seller can use these vital insights to offer more precisely tailored goods to that specific customer. Moreover, it is assumed that communication positively contributes to the relationship strength. Notice that the pricing strategy is more suitable for maintenance based services, while task- and personal services might benefit more from the second strategy.

Examples of relationship marketing strategies are airline companies that reward loyal customers with mileage prizes, showing recognition and providing special privileges. For their part, employees working at the Ritz-Carlton hotels greet their customers by their name and provide the services they explicitly requested during their previous stay.

Though, not all customers should be made loyal. There is no point to build up a lasting relationship with unprofitable clients. Moreover, analogue to the Pareto principle, a firm should allocate 80% of its resources to 20% of its most profitable customers. When ultimately new customers are attained, the goal is to find and reward loyal clients and less focus on the bargain-sensitive ones. (Gemmel, Van Dierendonk & Van Looy, 2003, p.55-69)

Another reason clients opt to stay with their service provider is their resistance to change. "*Although creativity is one of the critical success factors for organizations in today's rapidly changing business environment, it is difficult for most people and organizations to engage in this level of change*". This is stated in the work of Hon, Bloom and Crant (2014)

and is confirmed by a wide variety of scholars and researchers. Generally speaking, people are change averse and hold on to status-quo, routines and habitual behaviours (Ford, 2008; Ford & D'Amelio, 2008; Oreg, 2003). Two other studies declare that people are sensitive to uncertainty and riskiness (Jermier, Knights & Nord, 1994; Jones, 2001). As a consequence, they step away from creativity and a changing environment. Ultimately, services initially used by a certain company will have a hard time being replaced by others just because of this resistance to change.

Research

This thesis investigates whether and how mobile technology or mobile applications are able to realize customer retention within the trucking sector and whether this is profitable for a company. It is also researched whether trucking companies make use of benevolent mobile applications.

5. *Continuous improvements*

"*Standing still is the fastest way of moving backwards in a rapidly changing world*."
Lauren Bacall (1924-2014) – American actress and model

The concept of continuous improvement is a phenomenon that is integrated in a lot of companies to date. When well implemented, firms can reduce their costs, be more efficient and faster in what they do and deliver more quality work. This could then possibly result in higher customer service levels, increased flexibility and elevated profit margins. Though, continuously improving asks a lot of time and effort and the whole company culture needs to be adapted according to it. (Chalmet, 2012; Raa, 2013)

Continuous improvement originates from Japan just after the Second World War and more specifically from the firm Toyota. Its original name is 'kaizen', Japanese for 'good change'. This denomination is to date still adopted in many firms all over the globe. This should signify the importance of this concept. Moreover, Raa (2013) even states that "*continuous improvement is a condition for survival*".

Bessant et al. (1994) define continuous improvement as: "*a company-wide process of focused and continuous incremental innovation*". In addition, Kossoff (1993) declares that "*total quality can be achieved by constantly pursuing continuous improvement through the involvement of people from all organizational levels*". In general, the concept of continuous improvement is seen as a collective term that utilizes an arsenal of quality initiatives such as 'TQM', 'Six Sigma' and 'Lean thinking'. These methods search for sources of problems, waste and variation and offer guidelines to minimize them (Bhuiyan & Baghel, 2005). The way continuous improvement is realized in practice is broadly discussed in section 7 of the Appendix.

Taking the previously mentioned statements into account, Bhuiyan and Baghel (2005) provide a more general description that views continuous improvement as "*a culture of sustained improvement targeting the elimination of waste in all systems and processes of the organization. It involves everyone working together to make improvements without necessarily making huge capital investments*". The latter is confirmed by Raa (2013).

Bhuiyan and Baghel (2005) also declare that improvements can take place under the form of incremental or radical changes, which are the result of an innovative idea or a new

technology. Particularly for this thesis, the results and implications of mobile technology are researched. Furthermore, the duo also indicates that often many small incremental improvements lay on the basis of larger radical enhancements. This is represented by the following graph.

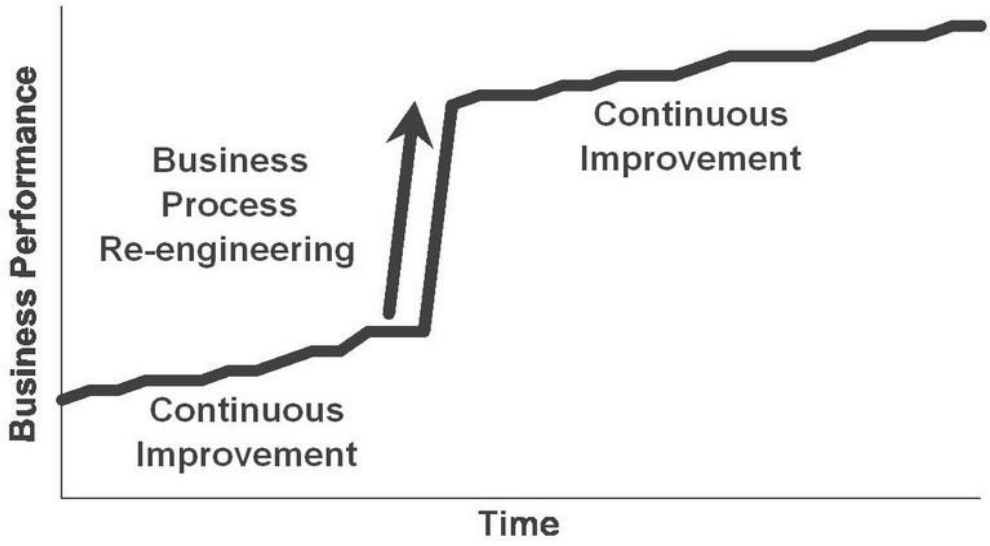


Figure 7: Continuous and radical improvements (source: SatiStar)

Due to its abstractness though completeness, Bhuiyan and Baghel's definition is utilized to research whether continuous improvement can be achieved by using mobile technology in the trucking sector. Although concepts like lean manufacturing and TQM are rather defined in terms of the production of goods, this thesis discusses the principles and methodologies for continuous improvement from a service point of view, applicable in the trucking sector.

Research

First, this thesis investigates whether the concept of continuous improvement, as defined by Bhuiyan and Baghel (2005), can be realized by the use of mobile technology or mobile applications in the trucking sector. Moreover, it is analysed whether the corresponding benefits of continuous improvements are large enough for all the necessary efforts and costs that it implies.

6. *Driving time regulations*

It is well-known that trucking companies have to comply with driving time regulations. The European Regulation that provides the harmonisation of social legislation regarding road transport and other older regulations is represented as the Regulation EC 561/2006. The last numbers refer to the start date of this regulation, namely the 15th of March 2006. This law provides '*a common set of EU rules for maximum daily and fortnightly driving times, as well as daily and weekly minimum rest periods for all drivers of road haulage and passenger transport vehicles, subjected to specified exceptions and national derogations*'. Moreover, this regulation applies to both national and international governments, long and short distances driven and for drivers working for a company and for their own account. The goal of this regulation is to align the driving times within the European Union. On the other hand, it aims to improve the safety on the road for all motorists and make sure a minimum to the drivers' working conditions is set.

Compliance to these regulations is supervised on a national and international level by the police, which is checking the corresponding tachograph records of the trucks. The weight of the fine depends on the legislation of the national governments. Technical details regarding European driving time regulations and the possible fines truck drivers risk when violating this law is broadly clarified in section 8 of the Appendix. There, the fines are based on the Belgian legislation as regulated by the Royal Decree of April 22, 2007.

It seems that, when the uninterrupted resting time decreases and the daily driving hours increase beyond the legal parameters, the fine goes up. In that case, the amount can vary from €40 to €1600 per violation. In addition, a fine can range from €20 up to €2000 when the unauthorized uninterrupted driving time increases and the longest uninterrupted breaking time decreases.

Consequently, it can be concluded that fines are able to rise up to considerable amounts of money. If a certain fleet management system is able to reduce the risk of violation, this can offer significant value to the user.

Research

The thesis investigates whether mobile technology or mobile applications are able to realize a lower chance of violating the imposed driving time regulations.

7. Environment

"The direct or indirect human input of materials and energy in the atmosphere whose actions are so damaging that the health of human beings is in danger, damage is caused to biological resources and ecosystems, material goods are affected and harm is done to the recreational value and other rightful use of the environment."

Definition of air pollution by VLAREM II

Transport companies are responsible for the emission of large amounts of noxious gasses. Therefore, this section elaborates the various consequences of this form of pollution. Here, the focus will be particularly on the hazardous effects of those exhaust fumes which are emitted by the trucking sector.

7.1 Impact of different pollutants

The causes of air pollution can be very diverse, ranging from natural occurrences to human caused pollution, from local interferences to global disturbances all taking place in a gaseous, liquid or solid state. Pollutants directly emitted into the atmosphere are called *primary air pollutants*. When formed in the atmosphere rather than directly emitted, they are described as *secondary air pollutants*. Consequently, as the impact of the trucking sector on air quality is investigated, the focus lays on the former primary pollutants.

A glimpse of all polluting matter caused by the road transport sector can be found in the figure bellow. The most important detrimental gasses and particles are particulate matter ($PM_{2,5}$ and PM_{10}), non-methane volatile organic compound (NMVOC), nitrogen oxide (NO_x), benzo(a)pyrene (BaP), sulphur dioxide (SO_2), carbon oxide (CO_x) and toxic metals. Their impact is shortly discussed below. Though, an extensive overview concerning the origin of each of the former mentioned emissions, their relative evolution and consequences can be found in the Appendix (section 9).

Generally, the main causes of air pollution within the transport sector are (incomplete) fuel combustion in the vehicle engine accompanied by tyres- and road wear particles. Dependent on the type of pollutant, they affect three aspects essential for the life on Earth. These are human health, climate and ecosystems. Though also a fourth category is considered, namely the deterioration of materials and buildings. Each part is discussed below. It is followed by a brief description of the important ozone depletion process and the

photochemical smog production that impacts all four categories. Because of its important overall impact, it is decided to address a special section to the latter type of pollution. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p. 2-3, 39-41, 45-47, 51-52, 60-63; EEA, 2014, p. 13-25, 27-28; EPA, n.d.)

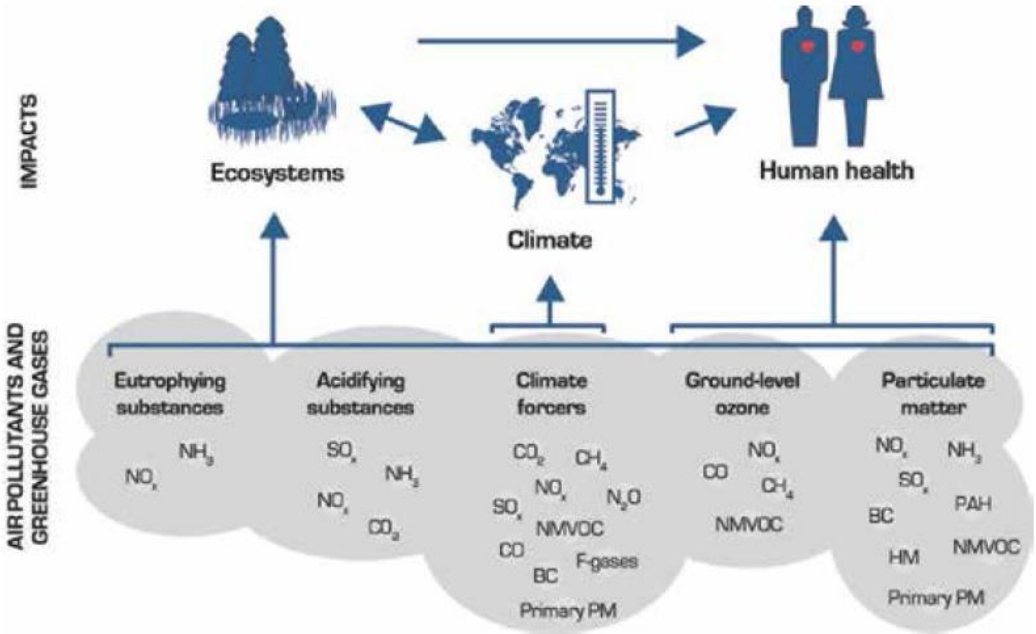


Figure 8: Impact of different air pollutants (source: EEA)

7.1.1 Human health

Realizing a human being needs every day on average between 10 and 15kg of air, deteriorated air quality can have devastating consequences. Currently, PM is seen as one of the most important pollutants that has a hazardous impact on human- and animal health. Hereby, it has to be said that only those parts with a diameter smaller than 10µm are able to reach the lungs. On the short term, health problems as a coughing fit, airway infections and asthma occur. People with weakened heart- and lung functions, in particular elderly people, can also die because of these small particulate matters. On the long term, chronical health effects can take place such as reduced lung functions, chronical lung ailments and even a shorter life expectancy. According to the World Health Organization, long term exposure to very small PM is so severe that it can decrease a person's life expectancy by one to three years.

Estimates of such premature deaths in Europe mount up to 400.000 casualties in 2010 and 2012. In addition, various air pollutants give rise to a wide range of diseases or

malfunctions such as cancer, anaemia, deterioration of the immune systems, reproduction issues and respiratory and cardiovascular implications.

7.1.2 Ecosystems

Pollutants such as nitrogen dioxides (NO_x), sulphur dioxides (SO_2) and ammonia (NH_3) are causing the acidification of soil, lakes and rivers, impacting and harming the animal and plant life. Moreover, these pollutants are raising the acidity level of rainfall, the so-called *acid rain*.

7.1.3 Climate

CO_2, accompanied by methane (CH_4) and nitrous oxide (N_2O), are the prominent sources of a phenomenon called the *greenhouse effect*. They lead to the well-known problem of global warming and all of its consequences. In order to give an idea about the impact of this phenomenon, due to these greenhouse gasses, the temperature of the Earth rose over the centuries by 33 degrees Celsius, from -18°C to +15°C. Possible consequences are the shifting of climatic zones and increasingly long periods of extreme heats and dryness. Moreover, it contributes to the desertification of certain parts of this planet. Additionally, the melting of icecaps and glaciers are currently raising the sea level to worrying numbers. Furthermore, diseases like malaria and yellow fever are expected to be spread over larger areas of the world, due to higher overall temperatures. At last, it has been brought up that the Gulfstream can possibly diminish to such a level that the Northern-Europe's temperature would decrease significantly.

7.1.4 Materials and buildings

Deterioration of materials and buildings occurs mainly by acid rain (cfr. supra). Concrete, stone, metal, paint and glass are all corroded by this type of pollution. A prime example of such damage is the Acropolis in Athens. The European Commission declares that in 2010, the costs to materials and buildings caused by air pollution have mount up to 1 billion euros in the European region.

7.1.5 Effects of ozone depletion and photochemical smog

NO is responsible for the depletion of the ozone layer. The latter is an important defence tool that protects all life on Earth. O_3's main function is to absorb ultra-violet radiation emitted by the Sun. Depletion of the ozone layer would therefore raise the UV-

intensity on the surface of the Earth significantly, degrading on its turn all organic material on this planet. Organic material refers to those chemicals composed of carbon, which are found among others in soil, plants, animals and the human skin. A very thin ozone layer would therefore have a disastrous impact on the Earth's ecosystems, crops and wildlife. Moreover, it would increase the risk of skin cancer and other illnesses.

The former kind of ozone is different from its ground level located counterpart, the so-called *bad ozone* or *photochemical smog*. Its name is chosen as a contraction of 'smoke' and 'fog' to form 'smog', and describes how this phenomenon exactly looks like. Photochemical smog is created due to a chemical reaction of NO_x, volatile organic compounds (VOC) and sunlight. A variety of health problems can occur when breathing this type of ozone. Additionally, it also impacts vegetation and ecosystems. Even certain materials, buildings and pieces of art are deteriorated by this pollution. In summer, when longer periods of strong sunlight occur, these smog concentrations can rise significantly. Therefore, the Belgium government decided to lower the maximum speed on highways from 120 to 90km/h when determined necessary. Lower speed limits mean less fuel consumption which results in lower emission amounts of NO_x and VOCs that on their turn decrease the amount of photochemical smog.

7.1 Are we on track?

Due to regulations, policies and standards, Europe's air quality has noticeably improved over the last 20 years. An extensive overview regarding this subject is provided in the Appendix (section 9.5). Though, we are still far from achieving acceptable pollution levels from an environmental as well as health point of view.

Research

This thesis investigates whether mobile applications are able to reduce the fuel consumption of a firm's fleet of trucks. If this would be the case, it is researched whether environmental consideration are the main reason for a firm to acquire these mobile applications.

8. *Implications of mobile technology*

"The trouble is, all of these features saddle the poor little device with a complexity that will boggle even the veteran cell fan. Just looking up your own phone number requires eight button presses."

David Pogue (2005) – Founder of Yahoo Tech, technology columnist

Mobile technology is supposed to simplify life. But what if this mobile technology boom would in fact complicate things and cause feelings such as anxiety and avoidance? These issues form the topic of this section. Finally, a part is also dedicated to the so-called search costs that can occur between different mobile technology devices.

8.1 Paradoxes

According to Jarvenpaa and Lang (2005) "*unlike desktop or even laptop computers, the mobile phone is typically always with its user. It is rarely separated from its owner, and it is in use, or ready for use, all the time*". Consequently, they state this close relationship elicits paradoxical user experiences. In their study, a paradox is defined as "*a situation, act or behaviour that seems to have contradictory or inconsistent qualities*". Consequently, both authors emphasize the conflict between the user's expectations of a mobile technology device and what they actually observe, the so-called '*technology paradoxes*'. The work of Chae and Yeum (2010) confirms these findings. While the former researchers describe the different paradoxes, Chae and Yeum formulate the way users generally experience and deal with this contradictory behaviour. Ultimately eight paradoxes are formulated and discussed.

First, the '*Empowerment/Enslavement paradox*' declares that mobile technology makes it possible to communicate with other people 24/7. Though these people - family, friends or business related – are on their turn also able to contact you anytime and anywhere. This can lead to situations when one has contact with a certain person who he/she rather wants to avoid or when certain conversations are considered inappropriate. Ultimately, mobile technology can result in enhanced flexibility and efficient coordination, but can also cause less personal time, increased work pressure, closer monitoring and supervision and employees being unable to take sufficient distance from work.

Second, the '*Independence/Dependence paradox*' clarifies that the main stimulus for this continuous connectivity is the fear to miss important calls or messages. Therefore,

mobile technology is seen as an electronic ankle chain that one is not able to leave home or switch off. The latter is paradoxical with mobile technology seen as a tool to be independent of place and time.

The third contradiction is the '*Fulfils/Creates Needs paradox*'. It states that mobile technology takes care of a variety of issues which were occurring in the past, but creates new problems at the same time. A prime example is the hands-free car kit that needs to be purchased and installed in order to be able to make phone calls in the car. Also fast battery drainage occurs when the phone is extensively used. Consequently one has to bring along his/her phone loader everywhere he/she goes. Finally, expensive cell phones are the victim of many burglaries. This creates security and protection issues.

Further, the '*Competence/Incompetence paradox*' emphasizes again the capabilities and functionalities of mobile technology, among others the ability to perform a wider array of tasks and to solve them in a more efficient and better way. As a consequence, devices become inevitable more complex to operate. Sometimes special courses are required on how to use the device. Additionally, mobile applications are expected to provide an answer to all possible issues and to adapt themselves to changing situational factors. When they are not able to realize this, users are displeased and complain about their limited functionalities. In the end, people aim to be a more competent user but ultimately these sometimes unforeseen shortcomings could make them feel less competent than before.

Next, according to the '*Planning/Improvisation paradox*', mobile technology tends to help people to better schedule and plan meetings, appointments, interviews and group sessions. Consequently, this leads to less unproductive time. Nonetheless, the other side of the coin indicates that people generally make less preparations and tend to improvise more, as it is easier to plan and make presentations on the spot. This former phenomenon also brings along a change in social behaviour. As everyone is able to contact each other from wherever they are, being late has become acceptable as long as one updates the others where he/she is exactly and when he/she will arrive.

Six, the '*Engaging/Disengaging paradox*' presumes that mobile technology enables users to participate in a wider variety of discussions, whenever and wherever they want. Though, people are not capable to perform parallel activities in a desirable way. One can encounter a decreased level of interaction with his/her environment when opting to step into a particular conversation. For example, everyone certainly recognizes the moment someone

needs to leave a certain conversation in order to answer his/her phone. It is stated that the heavy use of mobile technology can also lead to detrimental family life and social interaction. Moreover, it could incite people disengaging from face-to-face activities. This is mostly the case with the rather younger users of mobile technology.

As a last example, it has been proved that making a phone call behind the wheel increases the reaction time of the driver and negatively impacts safe driving conditions. A study done by the Belgian Institute for Road Safety (BIVV, 2014) shows that 3,2% of the Belgian drivers call without a hands-free kit or are texting behind the wheel. The former's chances of having an accident are 3 to 4 times higher than when using a hands-free kit. Moreover, texting increases the chances up to 23 times the normal risk. There are four different matters identified that cause this problem. First, the driver needs to divide his attention over the phone call or the message, as well as to driving. This is causing a lower overall focus to both subjects. It consequently decreases his/her reaction speed and enhances the chances of having an accident. Second, the chauffeur only holds his/her wheel with maximum one hand, which makes it increasingly difficult to act to certain unforeseen situations. Third, when sending a message or answering the phone, a driver does not remain visual contact with the road. If anything would happen at that moment, he/she is will be too late to react. Additionally, vital information provided by road signs is ignored. At last, because of the sound a phone emits when answering it or when it rings, the driver is possibly unable to hear important traffic sounds like a siren or claxon. Ultimately, on a cognitive, physical, visual and auditory basis the chauffeur is distracted from its prominent task namely driving. In general, this phenomenon increases the overall reaction time of the chauffeur by 30% to 70%. Also odd driving behaviour, such as cutting corners and drifting from left to right takes place. Calling or texting behind the wheel forms thus a prominent example of the *Engaging/Disengaging* paradox.

The second last issue is comprised by the '*Private/Public paradox*' and encloses the fact that mobile technology is considered to be a personal tool for private communication. Though, more and more of these 'private' calls are made in public areas, where it is rather easy to follow the complete conversation. It also creates unwanted noise hindrance. Moreover, people often perform subconscious expressions or gestures relating to the call that can be seen as inappropriate in public places.

Finally, the '*Illusion/Disillusion paradox*' discusses the topic whether user demands are met when acquiring a new phone. The camera is supposed to take flawless razor-sharp pictures, the phone would enable extremely fast and smooth Skype and FaceTime conversations, etc. Many of those expectations are fed by commercials and marketing. Afterwards, it seems that the pictures are not that great especially when it is dark, that the phone sometimes jams, that the battery runs down quickly and that some places have low internet connection so video conversations are nearly impossible. All these issues can possibly result in disappointed misled people. (Jarvenpaa & Lang, 2005, p. 10-19)

Chae and Yeum (2010) declare that the *Competence/Incompetence* and *Empowerment/Enslavement* paradoxes hold a positive relationship with stress and anxiety. Moreover, they indicate that these paradoxes are also experienced the most frequently. On the other hand, users tend to see the *Planning/Improvisation* and *Private/Public* paradoxes rather beneficial than harmful, though this relationship was not significant. In other words, the ability of mobile technology to induce improvisation is regarded helpful and the usage of mobile phones in public places is generally speaking not considered problematic, but favourable. Both can be the result of changing social norms adapting to a mobile technology world (cfr. supra).

Finally, their study points out that, the more stress and anxiety is experienced, the more avoidant users become. This is in particular the case for the *Competence/Incompetence* and *Empowerment/ Enslavement* paradoxes. (Chae & Yeum, 2010, p. 130-133)

Research

This thesis researches whether the previously mentioned paradoxes also play a significant role in mobile technology implemented by businesses and more particularly in the trucking sector.

8.2 Search costs

"*The smaller the screen size of different mobile devices, the higher the effort for the user to browse through the variety of information*". This is stated in a research of Ghose, Goldfarb and Han (2012). They denominate this phenomenon as the so-called increased *search costs*. This subject further encloses whether the user can easily surf from one website to another and how user-friendly it is to compare for example a list of products based on certain characteristics. Nonetheless, due to the rise of the Internet, the search costs of browsing for information are significantly decreased. Though, because of different screen sizes, they are not zero. Additionally, it is also stated that these search costs are higher for mobile devices than for desktop computers.

Furthermore, their work elucidates that these search costs reinforce on their turn the *ranking effect*, in which users tend to click more on information appearing at the top of a list. This is supported by a wide array of works, whereby the most recent ones are performed by Yao and Mela (2011) and Agarwal, Hosanagar and Smith (2011). The findings of Ghose, Goldfarb and Han (2012) show that, when a link is moved one place higher in a list presented on a mobile phone, the chances of being clicked increase by 37%. This is 32% higher compared with desktop computers. Consequently, the *ranking effect* on mobile phones is higher than on desktop computers.

The importance of search costs is also translated in a transition concerning the preferences of smartphone users regarding screen sizes. According to Melissa Chau (IDC, September 3, 2014), a senior research manager at IDC, "*large screen smartphones become the new norm*". Phablets, which are smartphones with a massive screen between 5,5 and 7 inches, are becoming very popular. They are expected to take over 32% of the smartphone market in 2018. This is a significant increase compared with 14% in 2014.

Research

This thesis investigates whether the presentation of information within mobile fleet management applications differ over various mobile devices. In addition, it is researched whether this difference leads to increased search costs and a higher playing ranking effect.

9. *Overview of the different research questions*

What is the value of mobile technology within the context of the trucking sector? The following research questions aim to eventually provide an elaborated answer to this uncertainty.

Research question 1:

Which mobiles devices are expected to gain popularity or lose ground in the future trucking environment?

Research question 2:

Did past evolutions within the smartphone and tablet market had an impact on the initial mobile operating system of choice from a business mobile applications developer point of view?

Research question 3:

Does the fact that the adoption of mobile technology is not evenly spread over all layers of the population bring along difficulties when firms opt to implement an application that is meant to be actively used by all employees?

Research question 4:

Does transport firms take into account the necessary fit and viability requirements when implementing a mobile technology in their operations?

Research question 5:

Does the perceived ease of use of a mobile technology positively affects user satisfaction and consequently perceived market performance in a B2B environment, such as the trucking sector?

Research question 6:

Is the use of mobile technology in the trucking sector able to tighten the buyer-seller relationship and consequently appears to increase revenues over time? When this is the case, is this achieved by using benevolent mobile applications or are other trust building mechanisms applied?

Research question 7:

Is mobile technology able to continuously improve the variety of operations within the trucking sector?

Research question 8:

Are the corresponding benefits of a (mobile) fleet management system large enough for all the necessary efforts and costs it implies?

Research question 9:

Are mobile applications in the trucking segment able to reduce the chances of violating the imposed driving time regulations?

Research question 10:

Are mobile applications able to reduce the fuel consumption of a fleet of trucks? When this is the case, are environmental considerations among one of the main reasons to purchase and utilize these applications?

Research question 11:

What are the negative implications of mobile technology utilization in the trucking segment?

Research question 12:

Does the presentation of information within mobile fleet management applications differ over various mobile devices? If yes, does this difference leads to increased search costs and a higher playing ranking effect?

The figure on the following page visually represents the previously mentioned research questions. Every conclusion in the remainder of this thesis aims to provide a suitable answer to at least one of these research questions.


USE OF MOBILE TECHNOLOGY IN THE TRUCKING SECTOR
Evolution mobile devices
Evolution mobile operating system
Mobile technology adoption issue
Fit-viability conditions
Perceived ease of use
Customer retention
Continuous improvements
Dynafleet's benefits and costs
Driving time regulations
Environmental considerations
Mobile technology paradoxes
Search costs
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12

CHAPTER 3:
RESEARCH DESIGN

This section expounds how the answers to the previously mentioned research questions regarding the use of mobile technology in the trucking sector are found. More specifically, it elucidates the thinking patterns, the corresponding research methods and information sources applied in order to formulate the necessary findings and conclusions.

1. *Case study*

When browsing the Internet looking for mobile technology utilization in the trucking sector, it is clear that fleet management systems play a prominent role. Furthermore, it seems that generally every fleet management system today is accompanied by a mobile application counterpart. The latter are only available since 2010. It also appears that these fleet management systems are launched by a wide array of providers, ranging from truck manufacturers to GPS manufacturers and software developers. The subsequent table provides a small overview of several fleet management mobile applications currently on the market, followed by the number of downloads and their rating, according to the operating system they are running. Important to notice is that the details of applications offered in the Apple App Store are generally not publicly available. It is namely up to the developers of these mobile applications to permit access to these figures, though this is most of the time not the case.

Popularity of the different mobile fleet management applications

Name of the app	**Google Play**		**App Store**	
	Number of downloads	Rating	Number of downloads	Rating
Dynafleet	5.000	4,4/5 (202 ratings)	?	?
FleetBoard	1.000	3,4/5 (37 ratings)	?	?
Scania Fleet Management	10.000	4,2/5 (85 ratings)	9.200	4,2/5
TomTom WEBFLEET mobile	5.000	4,0/5 (139 ratings)	?	?
MZone Fleet Manager	1.000	4,2/5 (35 ratings)	?	?

Table 8: Popularity of the different mobile fleet management applications (numbers are retrieved on December 30, 2014)

Dynafleet, FleetBoard and Scania Fleet Management are designed by truck

manufacturers; namely Volvo Trucks, Mercedes-Benz and Scania Group respectively. The latter two apps in the table are launched by GPS and software developing firms, in this example respectively TomTom Telematics and Scope Technologies. Generally speaking, regarding the decent number of downloads and the relatively high user scores, it can be stated that mobile applications play a proper role within fleet management. The figures in the table are updated on the 30th of December 2014 in order to offer an overview of the most recent situation. Though they did not undergo significant changes compared with the months before, when the initial steps of this research took place. The major alteration here is in the number of ratings, though not in the rating itself.

Next, based on the research questions derived from the current literature about mobile technology in the trucking sector, a decision has to be made whether providing a general study of this market can possibly offer the necessary answers. Another option exists in elaborating a case study, in which one representative mobile app is completely investigated into detail. The preference goes to the latter. First, because of the nature of the research questions. These are requiring in-depth data, something a market research is generally unable to deliver. Second, the diversity of the enterprises, their location and the varying characteristics of each app, would make it practically very difficult to conduct a worthy research that would provide the sought-after, rather detailed, information.

Subsequently, a choice has to be made which mobile application possesses the necessary characteristics in a way that it offers a feasible possibility to conduct an extensive and representative study for the use of mobile technology in the trucking sector. Because of the fact that Dynafleet's mobile application has the highest relative number of ratings, possesses the highest overall score and is downloaded a decent amount of times, this app gets already an edge over the others. In addition, regarding the specifications mentioned in the mobile app store and on the different corresponding websites, Volvo Trucks' mobile app seems to be the most elaborated and advanced of them all. Particularly the different fuel consumption parameters catch the attention. Furthermore, the Volvo Trucks' website provides a very strong focus and extensive explanation about the advantages of its mobility and other abilities. Additionally, in order to exhibit its capabilities, Volvo Trucks provides each interested user the possibility to access the Dynafleet mobile app through a completely free demo version. It also is the only mobile fleet management app for which one has access to its demo by pushing only one button. This user-friendliness can be further retrieved through the whole app (cfr. infra). All these qualities ensure the fact that this mobile app is

ideal to conduct a worthy and valuable study regarding mobile fleet management applications. In addition, the thesis supervisor Willem Standaert as well as the thesis promotor, Professor Steve Muylle, share a common vision of large interest for this particular mobile application.

2. *Research methods*

In order to obtain the required details, figures and information to perform an extensive study, a research method needs to be chosen accordingly. Generally, the choice is between quantitative and qualitative techniques. Examples of quantitative techniques are questionnaires, online or postal surveys and interviews by telephone. While these methods generate fast opinions and responses originating from a wide range of sources, the depth of the obtained information is generally rather limited. In contrary, qualitative techniques such as personal interviews require more planning and the number of responders is much lower. Nonetheless, they offer more detailed insights and non-verbal information. Because this technique is more personal, people tend to generally provide more information when compared to, for example, impersonal phone conversations. In addition, certain nuances are more distinct. Knowing that the previously mentioned research questions require detailed information (cfr. supra), it is obvious that personal interviews are in this case the research method of choice. (De Pelsmacker & Van Kenhove, 2010; De Rijcke, 2012)

According to the designations used by De Pelsmacker and Van Kenhove (2010), the interview technique utilized in this thesis is the so-called *depth-interview*. Here, the interviewer confronts only one interviewee with, among others, those subjects prepared in advance. Particularly for this thesis, *semi-structured questionnaires* are used, each time adjusted to the company in question. In this case, a list of questions are formulated before the interview takes place. The utilized questionnaires can be found in section 14 of the Appendix. Though, the way these questions were asked and their relative sequence generally depended on the flow of the conversation. The advantage is that the topics for which information is definitely required are not forgotten. Additionally, it leaves room for the interviewee to talk about certain other objects that the interviewer did not think about at first. Furthermore, an often used technique here is *probing*, in which the interviewer signals the interviewee to provide more information on certain topics which are considered unclear or important.

Next, every interview was also recorded, making possible to listen to particular subjects once again or to rephrase the exact words of the interviewee. It also offers the

opportunity to make a transcription of the whole interview when considered necessary. Though the latter is a very time-consuming task. The most important interview, the one with Volvo Trucks itself, is written down completely and can be found in section 15 of the Appendix. Finally, recording the interview is beneficial for the interviewer to remain completely focused on the conversation, rather than writing everything down at the same time. This greatly improves the flow of the interview and is more pleasant for the person who he/she is talking with.

Next, because of the lack of proximity of certain specialised people, there is also opted to utilize extensive email correspondence. This occurred especially with Volvo Trucks Belgium and Volvo Trucks Sweden (cfr. infra). Finally, demo- and complete versions of mobile applications, websites and manuals are consulted as well.

3. *Information sources*

In order to generate a strong basis of diverse information, the chosen data sources are based on Michael Porter's (2008) five-forces model of competition. A visual representation of the latter can be found below.

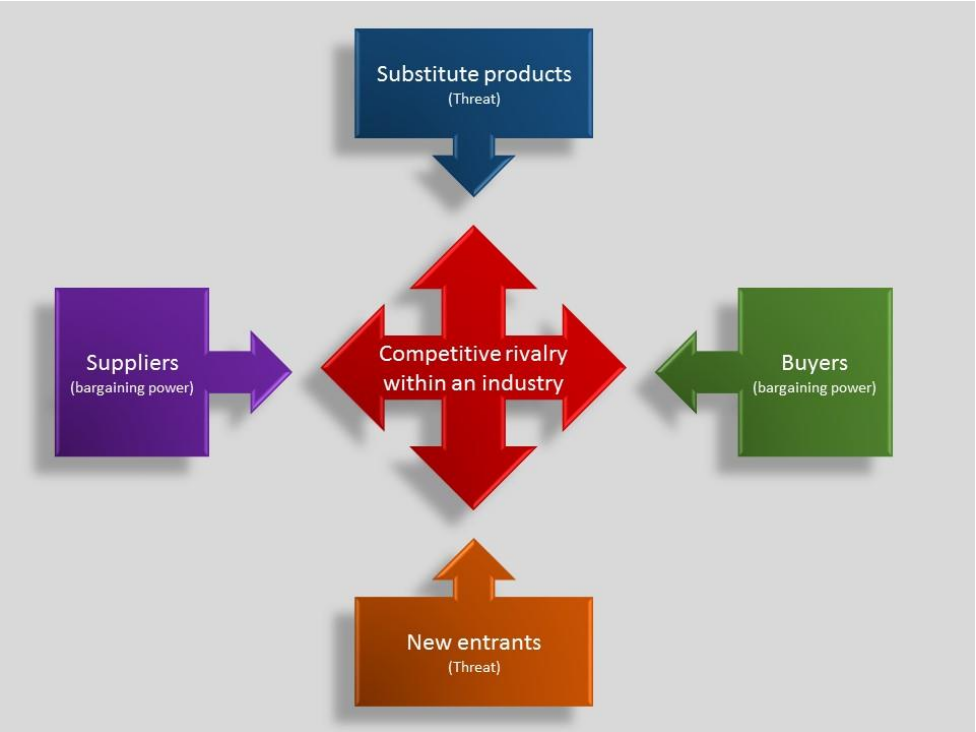


Figure 9: Michael Porter's five-forces model of competition (source: Porter, 2008)

This model is originally designed and generally used to facilitate the analysis of a certain business environment from the point of view of a particular company. Though, it is

here adjusted and employed to determine which sources of information are important to contact and to avoid certain players being overlooked. The respective business in this case are mobile fleet management applications. More specifically, this thesis discusses the subject mainly from the point of view of Volvo Trucks and Dynafleet. In order to get detailed information about the latter program, an interview took place with Emry Tack, the current Key Account Manager regarding Transport Solutions of Volvo Trucks Belgium. An additional conversation was held with Bert Leenaerts, Volvo Trucks' Business Solutions Manager.

Next, a direct competitor within Volvo Trucks' mobile fleet management industry is Scania, providing the Scania Fleet Management mobile app. In order to get access to their point of view, a third interview was conducted with David Desmet, the Product Manager regarding Fleet Management Services Benelux of Scania Belgium. This company in particular is chosen because its mobile application is in some aspects different than Dynafleet but also because of its higher number of downloads. This consequently offers a different point of view on the topic in question.

As (potential) customers of Dynafleet, a difference is made between Dynafleet users and non-users. The latter forms the basis of the fourth interview, held with Tim Bergiers, the Logistics Coordinator at FTO nv in Lochristi. Thisis a firm specialised in conditioned transportation of flowers, plants and also deep-frozen products. This conversation in particular was meant to receive a critical view about Dynafleet and to expose its weaknesses. Its strengths on the other hand were emphasized by the large transport firm De Rese in Bruges, and more particularly by its Fleet and Technics Advisor/Driver Trainer, Johan Coopman. This company is already a loyal Dynafleet user for over a decade and employs all possible modules within Dynafleet, with a strong focus on the Dynafleet mobile app (cfr. infra).

Mostly because of the distance issue, Volvo Trucks Sweden, the developer and provider of Dynafleet, is mainly contacted by email exchange and a forwarded list of open questions. Within the five-forces model, this headquarter of Volvo Trucks is seen as the supplier of Dynafleet.

Finally, information about new entrants and substitute products is mainly accessed by websites and demo versions of mobile applications.

CHAPTER 4:
DYNAFLEET EXPLAINED

1. *What is Dynafleet?*

Dynafleet is a fleet management system developed by Volvo Trucks and chiefly sold to European trucking firms. Volvo Trucks is a truck manufacturing company that profiles itself as extremely innovative and progressive. Dynafleet's US counterparts are Volvo Link and Volvo Trip Manager. The program, which comprises a desktop and a mobile version, allows the user to easily manage its entire fleet of trucks. Its capabilities range from fuel monitoring to delivery route optimization and communications facilitation.

Dynafleet's clear business-to-business orientation accompanied by its large array of functionalities and possibilities make it a striking example of the current use of mobile technology in such a B2B environment. Therefore, this interesting application is chosen to be broadly researched and described in the complete remainder of this thesis.

2. *Dynafleet modules*

Dynafleet consists of four different modules that can be purchased and used independently or combined. Each one costs €15 per month and per truck. Acquiring all four will consequently cost the client €60 per month and per truck. The parts involved are 'Fuel & Environment', 'Driver Times', 'Positioning' and 'Messaging', each of which are getting an extensive clarification in the section below.

Finally, the way these modules contribute to the Dynafleet mobile application in particular, which remains the main focus of this research, is clarified in a further section of the thesis. (Tack, 2014; Volvo Trucks Belgium, n.d.)

2.1 Fuel & Environment

This particular module contributes to the clarification of different facets that impact the fuel consumption and the way different chauffeurs drive their vehicle. Therefore, it facilitates and eases the representation of multiple data concerning a fleet of trucks, reducing analysing times and efforts significantly. Moreover, the module in question permits Dynafleet to produce vehicle statistics and fuel efficiency scores. It even offers the possibility to send, in an automated way, specific environmentally related reports to the customer. Fuel &

Environment indicates thus those domains ready for fuel efficiency improvements. Consequently, this module is chiefly interesting for fleet managers and trucks drivers.

Furthermore, the module also signals when significant deviations in fuel levels occur in a very small amount of time. The latter occurs chiefly when fuel is stolen out of a particular truck.

Finally, the 'Environment' part of this module emphasize the way fuel consumption is represented within Dynafleet. This is not only done in litres per 100km, but also by expressing the amounts of noxious particles and gasses one has emitted.

2.2 Driver Times

As its denomination already signifies, the module Driver Times deals especially with monitoring the time intervals of driver activities. The Dynafleet user can quickly and easily observe the activities of a particular truck driver on a given moment in time. He/she is able to trace in real time whether one is currently driving, resting, available, etc. Though, it is important to know that only people with a fleet manager login have access to all parameters of each individual driver. Users with a truck driver login on the other hand can only retrieve their personal work and rest times, not the ones of other drivers within the fleet. Moreover, their personal information can only be consulted through the Dynafleet mobile app (cfr. infra). All these time-related data are generated within the tachograph of the truck.

The fact that figures about driving and resting are stored within the Dynafleet portal, renders good news for the salary administration department. Linking these generated data to the firm's accounting system makes it possible to calculate and book wages in an automatized way. It is needless to say that this system can possibly save employees significant amounts of time and effort, which are available to be deployed in another domain.

As a conclusion, this module is popular for a wide spectrum of people within the company's workforce, ranging from trucks drivers to dispatchers, accountants and administration.

2.3 Positioning

Positioning focuses on rendering the exact location and speed of a truck. Street level detailed information held by the GPS of the vehicle is transmitted in real time to Dynafleet Online - which is the desktop version of Dynafleet - and stored, using mobile data

connections. Based on these updates, the user can track every truck in the fleet at any given moment in time, whether it is in the past, present or future.

The positioning module also offers the opportunity to implement so-called geofences whereby the dispatcher receives automatically generated messages when a truck goes from one geographic area to another. This facilitates the tracking work for the dispatcher and renders him crucial information about a certain area.

Though, in rather smaller transportation firms, the role of the dispatcher is often executed by the fleet manager himself. If a customer requires a certain emergency delivery, the manager can still decide whether this is possible or not, even when he/she is currently not at the office. The latter is made possible by the mobile version of Dynafleet that can be consulted on a smartphone or tablet computer (cfr. infra). From this point of view, this module can be of great value for the dispatcher as well as the fleet manager.

2.4 Messaging

All the information and actions performed in the previous modules, especially in Driver Times and Positioning, need to be provided to the different truck drivers in a very easy, safe and cost-efficient way. Here steps the Messaging module in the story. The latter sends all the necessary information to the cabin of the truck driver, where it is displayed in a clear manner on a small screen. In this way, expensive misunderstandings can be avoided.

This makes the Messaging module an ideal tool for maintaining a continuous information flow between chauffeur and dispatcher.

2.5 Fuel Advice

Fuel advice is seen as an additional fifth module to the Dynafleet package. It is in fact an additional service providing personalized fuel consumption reports, conclusions and suggestions to the customer. These are based on all the information the Dynafleet portal possesses concerning that particular customer. The handover of these piece of advice is realized through direct face-to-face communication as well as email exchange. This way, different data no longer need to be analysed by the trucking company itself. Volvo Trucks does it for them. Volvo Trucks thus takes here the role of a consultant, providing personalized solutions to the client's specific problems. In order to make use of this service, the client has to pay an additional €20 per month per truck.

3. *Beneficial users*

The following table provides a clear overview of the four plus one Dynafleet modules and to whom each of them seems to be the most useful.

The different Dynafleet modules and the corresponding beneficial users

Dynafleet modules	Chauffeur	Dispatcher	Administration	Management
Fuel & Environment	X			X
Driver Times	X	X	X	
Positioning		X		X
Messaging	X	X		
Fuel Advice	X			X

Table 9: The different Dynafleet modules and the corresponding beneficial users

CONCLUSION

It is clear that the possible benefits of the different Dynafleet modules are in general evenly spread over each of the four user categories.

4. *Research design*

During this research, the Dynafleet mobile application is examined on a smartphone with a 4,5 inch display. The device is running the Android operating system, version 4.2.1. The Dynafleet mobile app is of the latest version, namely 1.0.1, and is lastly updated on June 23, 2014. Volvo Trucks provided a log in to research all functionalities of the application even though this was not necessary knowing the demo version offers insight to all of them.

This mobile app provides exactly the same kind of information regardless the type of mobile device. Nonetheless, the amount of data appearing simultaneously on the screen is different. This deviation is addressed in more depth in the next chapter of this thesis.

Before using the application, it is important to make sure that the mobile device is connected with the Internet. Without this, the Dynafleet mobile app is unable to work (cfr. infra).

5. *Differences between the desktop- and mobile version of Dynafleet*

By now it should be clear that the Dynafleet portal consists of an extensive desktop version, called *Dynafleet Online*, as well as a mobile counterpart. This section enlightens the difference in functionalities between the two interfaces.

5.1 Functionalities of Dynafleet Online

Dynafleet Online is a computer portal that collects all the information received from each truck that is equipped with Dynafleet. After, the user is able to select and browse through those figures considered relevant. Finally, the current situation of the individual truck (driver), as well as the entire fleet, can be extensively monitored and analysed. Dynafleet Online is considered a desktop application because it can only be efficiently accessed on a desktop computer or notebook. It is not made to be used on smaller screen, less powerful devices.

Dynafleet Online also contains the algorithms and tools to generate the information which is displayed by the Dynafleet mobile app. As a consequence, the desktop version is much more elaborated and is capable of performing a wider array of functions when compared to its mobile counterpart.

As the focus of this research regards mobile technology, the attention is drawn to the use of the mobile app, rather than the capabilities of the desktop portal. For more information about the latter subject, further reading is strongly advised.

5.2 Functionalities of the Dynafleet mobile application

The mobile application can be freely downloaded on Google Play as well as on the Apple App Store and is consequently capable of running on Android and iOS operating systems. At the moment of writing this thesis, the latest version of the mobile app is 2.0 in the App Store and 1.0.1 in Google Play. The difference in version occurs because of the fact that the mobile app was firstly launched on the iOS platform (cfr. infra). Nonetheless, both versions are currently exactly the same.

When booting the application, a menu is provided in which the user can choose to log in, register as a driver, view a free demo of the application or to receive more information. A difference is thus made between the log in of a truck driver and a so-called fleet user (cfr. infra). This impacts the type of information provided. The demo version offers potential

buyers free insights about the true value that Dynafleet is possibly able to deliver to their company (cfr. supra). Finally, pressing the 'More Information' button automatically directs the user to a Volvo Trucks webpage which offers clear information about the different capabilities of the mobile app.

After entering the login data or choosing for the demo version, the user can clearly see that the mobile Dynafleet app consists of five tabs, displayed at the bottom of the screen. These are: Dashboard, Vehicles, Drivers, Position and Settings. As already mentioned, Dynafleet offers different types of information to different kind of users (cfr. supra). It means that a manager is able to view the complete range of information for each truck and driver in the fleet while truck drivers on the other hand are only limited to their own personal data. This is realised since the launch of version 2.0 of Dynafleet and is thus imbedded in the mobile app for both operating systems.

Consequently, a clear distinction between the differences in information, based on the person who logs in, is certainly made in the remainder of this section. A profound description of all the characteristics of the mobile application can be found below. In addition, extracts of how each part of the application looks like for both groups of employees are provided in the Appendix (sections 11 and 12).

5.2.1 Dynafleet mobile application for those who have complete access (*fleet users*)

a. Dashboard

'Dashboard' provides a general overview of the state of the entire fleet. This tab automatically opens when the user enters his/her login information or opts for the demo version. In addition, within Dynafleet Online, the user has also the option to choose the trucks he/she wants to include in the analysis and the ones he/she rather neglects.

On top of this tab, the number of vehicles can be found that are part of the fleet and monitored by Dynafleet. Next, key figures offer the opportunity for a quick view of the condition of the fleet. The user can adjust the time period over which the data are generated, choosing between today, yesterday, the last 7 days and the last 30 days. The mobile app is here limited compared to the desktop version, where the user can freely choose which data are displayed and is consequently not bounded by any period constraints. First, the total time the fleet is on route (in hours) is displayed, followed by the total distance driven (in km), the

average speed (in km/h), the average fuel consumption (in litres/100km), the total CO_2-emission (in tons) and the average vehicle usage (as a percentage).

Next, a global fuel efficiency score is granted for that particular period of time, presented as a value from 1 to 100. Hereby, the higher the score, the better the driving behaviour and consequently the fuel economy of the fleet. It is important to remark that the fuel efficiency score is thus not directly related to fuel consumption but rather to the way a truck driver handles his/her truck. This important remark is easily overlooked by non-Dynafleet users (cfr. infra). Nevertheless, at the end of the day, a better driving behaviour will probably lead to a lower overall fuel consumption.

This grade is integrally developed based on data and algorithms implemented in the desktop version of Dynafleet. It is available for the entire fleet, but also for individual vehicles and drivers (cfr. infra) and over different time periods. A corresponding colour is assigned, being red, yellow or green. Green implies that the performed driving behaviour is excellent, while red indicates the way of driving is rather poor. Yellow on the other hand refers to a situation which is certainly not bad, but there is still a lot of room for improvement. This threesome of colours is repeatedly used in the mobile app, providing a very rapid overview of the state of a certain subject.

The global score is based on four different categories each with its own parameters. The former can be found by scrolling down the screen. These four main categories receive a mark always expressed as points on 100. Each score is calculated using the weighted average of its specific parameters. They can be accessed by pushing the display button of the main category of choice. In order to deliver precise information, the driver of the vehicle must drive at least 30 kilometres and must be on route for minimum 60 minutes. The total score is on its turn the average of the four main category marks. Important to notice is that these data here are still related to the entire fleet. Though they can also be found in the ‘Vehicles’ and ‘Drivers’ tab of the mobile app.

The first category that evaluates the driving behaviour is ‘Anticipation and braking’. Here, a closer look is given to coasting and the brake/stop relation. Second, the ‘Engine and gear utilization’ contains figures regarding the use of I-shift in P, A and M, the utilization of the highest gear, the engine load, the amount driven above and within economy and whether a high amount of revs has been used frequently. Here, the I-shift and the corresponding letters need probably a more detailed explanation. I-shift is an automated gear box, supported by

powerful software, designed to make gear changes as fuel efficient as possible. This is very important because each gear change is equal to fuel consumption. The A refers to 'Automatically', a mode in which the gear box computer decides itself when gear changes take place. Sometimes certain gears are skipped in order to hold on to an elevated fuel efficiency level. Next, the truck driver can put the I-shift also in 'Manual' mode, or M. Here, the chauffeur regulates the gear changes himself/herself, with a touch on the plus or minus button on the side of the gear lever. Despite in Manual, I-shift avoids being too long in the red zone of utilizing too many revs. Finally, P or 'Power' forces the gear box to go through each gear, not taking into account the quantity of revs used. As a consequence, the truck accelerates faster, explaining the denomination 'Power'. Nonetheless, it then consumes considerable amounts of additional fuel.

The section 'Speed adaption' addresses the use of the cruise control and whether the fleet generally drove too fast or not. Finally, the menu 'Standstill' focuses on the consumption when the fleet did not drive at all. Figure 7 in section 10 of the Appendix provides an overview of all these categories and parameters that define the global fuel efficiency score.

In order to explore these subcategories, a smartphone user has to scroll down the entire list. As a consequence, the components of maximum two main categories can be displayed simultaneously.

b. Vehicles

By default, a list is offered overviewing the name of each truck accompanied by the name of its corresponding driver. The list only provides those trucks of that part of the fleet the manager is responsible for. A manager occupying a higher position in the firm's hierarchy has consequently access to the same depth of information but over a larger range of trucks. A small logo is added next to the name of the driver representing its current status (cfr. infra). A search bar on top provides the user the opportunity to quickly look for a particular truck based on the vehicle's name or the name of its driver. When the user wants to have an overlook of its fleet on a map, he/she can press the 'Map' button in the top right corner of the screen. As a result, the exact location of all the trucks in the fleet is displayed at a specified time. The user is also able to zoom in and out of the map. A small arrow indicates the direction a truck is heading. By selecting a certain truck on the map, the same information appears than when the user would pick a truck out of the previously described list.

The top of this detailed sheet renders again the name of the truck, the name of the driver and a corresponding logo. A small detailed part of the map also offers a clear visual view of the truck's current location, at a particular moment. Underneath, its position is mentioned providing the name of the road the truck is currently driving on or the name of a nearby city, along with its destination, remaining distance and the estimated time of arrival. In addition, the total number of kilometres of the truck, its current speed (in km/h) and fuel level (as a percentage) is presented. These three parameters can also be found on the physical dashboard of the vehicle. Again, in order to see all the parameters, the user is required to scroll down the screen.

Next, the same figures are provided as described in the previous 'Dashboard' section. Although in this case the data are specified for one truck only.

At last, the user has the choice of displaying more parameters of a certain truck. When pressing this button, instead of a score, the actual numbers for certain subcategories are provided. The average amount of braking as well as stops are displayed. Both are expressed as the number of hits per 100km. When comparing these two parameters, a deduction can be made of the frequency a truck completely stops after using the brake. Next, the percentage of the time a truck uses its Power Take-off and cruise control is presented. In addition, this menu also shows how long a truck is stationary and how long it drives within or above economy or at a higher speed than officially allowed. As a percentage of the distance, it is also mentioned how far a truck drives without giving gas, how long it is in highest gear and how often the motor is overloaded. Finally, the amount of CO_2-emission (in ton) is displayed, followed by the amount of carbon monoxide, hydrocarbon, nitrous oxide and parts discharged in the atmosphere (in kg).

c. Drivers

Analogue to the 'Vehicles' section within the Dynafleet mobile app, only the records of those truck drivers are accessible that fall under a specific manager's command.

A distinction is made between vehicles and drivers because sometimes one truck is driven by two different chauffeurs, working in shifts. This is mostly the case when larger distances need to be covered. In order to get specific driver details in that case, a division between trucks and chauffeurs is certainly at its place.

Regarding the types of data which are provided, the ‘Drivers’ section is to a very large extent identical to the ‘Vehicles’ part. The app provides a list of the drivers and their location on a map. The user is able to switch between these data by pressing the corresponding tab. Hereby, the geographic information, the fuel consumption score and its corresponding factors are presented in the exact same way as in the ‘Vehicles’ section.

A difference can be remarked regarding the presence of certain symbols. These are the official symbols used by the tachograph device. From left to right, these icons represent the chauffeur’s ‘driving time’, ‘other work’, ‘period of availability’, ‘break or rest time’ and ‘logged in time’. The meaning of the first one is quite obvious and measures the time someone is driving the vehicle. The second symbol represents all work other than driving the vehicle. For example, when a truck driver is (un)loading his/her vehicle. The third icon represents the waiting time only if the driver knows in advance how long this will be. The fourth one covers the time a driver took a break or had its daily or weekly rest periods. Finally, the total time a person logged in to the tachograph is provided. In general, the meaning of these standard icons are well-known by all truck drivers.

Consequently, the user is able to retrieve from the Dynafleet mobile app the moment a driver made the transition between different statuses and how long he/she was in that condition. This can be done by pressing the bar ‘Driver Times Graph’. It can be an important tool to check whether the official guidelines regarding the legal driving- and rest times are lived up to. Finally, the user is able to estimate the loss of time when breakdowns or repairs occur.

Important for this section is that the possible time periods during which the user is allowed to consult the information differ in comparison with all the other sections. Generally, data of maximum 30 days ago can be accessed. Here, this is limited to a period of only two weeks. The reason is that the maximum legal amount of driving time is reset every two weeks (cfr. section 8 in the Appendix). The user can choose between five time options: current session, previous session, today, this week and the last two weeks. In the first case, all the corresponding time periods are displayed since the last valid daily or weekly rest. The second possibility represents the time periods between the last two valid daily rest periods. Option three contains all information for the current day starting at midnight. The next one measures it over the whole current calendar week. Finally, the two weeks option refers to the data of the current and the previous calendar week.

d. Ranking

This tab offers a general overview of the performance of all the truck drivers of the fleet. Based on their relative fuel consumption score, which can be retrieved in the 'Drivers' tab, each driver is allotted a particular position on the overall ranking list. The ranking is updated every 60 minutes and is based on figures generated over the last 30 days. Only drivers with more than 60 minutes of driving time and a covered distance of more than 30 kilometres are displayed.

This section cannot be addressed by the individual drivers. Drivers only have access to their relative position within the ranking system (cfr. infra). Though, it is considerably interesting for managers in order to particularly focus on those drivers who are at the bottom of the list. Accompanied with the necessary training and formation, those driver's performance can be increased significantly. Consequently, a higher overall fleet performance can possibly be achieved. On its turn, this can lift the overall fuel efficiency of a firm and decrease its fuel costs (cfr. infra).

e. Settings

Within Settings, the help button offers the user general information about the accessibility of the app, its capabilities and subcomponents and finally the Dynafleet service requirements.

In the 'Settings' menu certain parameters can be adjusted. First, the user can choose how the map, used in both the 'Vehicles' and 'Drivers' tab, is displayed. Three options are offered which consist of a road map, a geographical satellite version or a combination of both. Second, whether the names of vehicles or corresponding truck drivers appear on the map can be turned on and off. Next, it can be chosen to present certain points of interest on the map, such as a particular part of the fleet and/or the Volvo dealers. Furthermore, the user has the option whether to update the map and driver times automatically or not. At last, a log out option is provided.

5.2.2 Dynafleet mobile application for those who have limited access (*truck drivers*)

This section provides an overview of how the Dynafleet mobile application looks like for those who have only limited access to the app. These are mainly truck drivers.

The biggest advantage of making the mobile app also accessible for truck drivers is that they have access to all their personal information anywhere and anytime they want in a very user-friendly manner. In addition, truck drivers cannot manipulate the displayed information. Because all data is coming from Dynafleet Online -the portal to which truck drivers have no access- chauffeurs can press every button within the mobile app without causing lasting and/or damaging changes to the original configuration. This can significantly reduce the stress for truck drivers when utilizing the mobile app for the first time.

a. Dashboard

Logged in as a truck driver, the 'Dashboard' section looks slightly different than normally. On top, the five different parameters of the tachograph provide information about his/her current driving and rest times (cfr. supra). Next, the 'Dashboard' menu informs about his/her personal driving times as well as his/her driving behaviour, just as the 'Drivers' section in the normal version. The considered time period can be selected by the chauffeur himself/herself. He/she has the choice between consulting information about today, yesterday, the past week or the past month. In case a driver was assigned to different vehicles, details of all those sessions are accessible accompanied with the name of those trucks.

Furthermore, a fuel efficiency score is offered comparable as the one discussed in the previous sections. This also includes the four different subcategories and the corresponding parameters. It is formulated from figures generated by all vehicles the truck driver has operated during the time period of choice. The chauffeur can here thus only consult his/her personal driving statistics, not the ones of the entire fleet or other truck drivers.

On the bottom of the 'Dashboard' menu, the driver's overall relative ranking in the fleet is provided. The chauffeur can only see his/her position, not the ones of other drivers within the same fleet.

b. Me

The ‘Me’ view is quite similar to the ‘Dashboard’ menu but includes more information and the possibility to view Driver Times information in a wider variety of time periods (Current session, Previous session, Today, This week, Two weeks). The ‘Me’ menu also includes the driver times graph and the possibility to see data for more parameters in a similar way as it works for fleet users.

c. Map

The ‘Map’ tab displays a map with the current position of the driver. This position is deducted from the GPS in his/her currently used mobile device, not from the vehicle itself. If the user has enabled to show points of interest (for example Volvo dealers) they will also be displayed on the map. The map does not show any other vehicle, only the driver’s current position and optionally the chosen points of interest. Consequently, a driver user does not have the possibility to see the position of any other vehicle within the fleet.

d. Ranking

This section implies a very important deviation from the fleet users’ version. In the limited access version, Dynafleet does not allow to publicly display a complete ranking of the truck drivers within a certain transportation firm (cfr. supra). Though, it provides a truck driver with specific information about his/her individual relative position within the ranking. As a result, this ranking number is still able to incite positive competition between the chauffeurs (cfr. infra).

e. Settings

The ‘Settings’ menu is completely analogue to the one used in the complete fleet version of the mobile application.

CONCLUSION

The Dynafleet mobile app encloses a broad array of functionalities that can be valuable to different types of employees within a trucking organisation. The main benefactors are fleet managers and truck drivers in particular.

6. *History and development of the Dynafleet mobile application*

The roots of Dynafleet as a whole go back to the track and trace boom during the nineties. Nonetheless, the current version is in many ways more extensive than the original one. The first version of its mobile application was launched on March 13, 2012. The updated second version was introduced on October 24, 2013. At the moment of writing this thesis, the latter is consequently also the most recent version of the Dynafleet mobile app.

At the Volvo Trucks headquarter in Sweden, it was initially chosen to develop the application solely on the iOS operating system. According to Bert Leenaerts and Emry Tack, this was a conscious decision of Volvo Trucks. The reason was twofold.

First, a research was conducted by the Volvo Trucks headquarters before initiating the development of the mobile app. It was investigating which brand of mobile devices was the most utilized in the trucking segment at the time and consequently for which operating system Volvo Trucks had to choose when launching the app. In addition, it was also examined how the mobile market's popularity would evolve in the future. This was an important decision, because at that time, apps on different operating systems required different ways of development. Volvo Trucks came to the conclusion that the iOS platform was by far the most adopted within this particular transport sector.

Second, Volvo Trucks had always profiled itself as high-quality product and service provider, therefore located in the upper price segment of the market. In order to translate this image in their offerings, they were looking for a mobile device provider which expressed the same kind of flair. As the products of Apple were seen as innovative prime quality devices at the time, this fell perfectly in line with Volvo Trucks' mind-set. Based on these two arguments, the iOS operating system was chosen as the initial platform of choice for the Dynafleet mobile application.

CONCLUSION

It is clear that Volvo Trucks took the evolutions within the mobile device market into account when initially choosing between the different mobile operating systems.

7. *Differences in the presentation of information between mobile devices*

From the interview with Emry Tack as well as from own research it appears that no content-wise difference in the mobile application of Dynafleet occurs when comparing the smartphone- with the tablet version of the app. Moreover, no deviation takes place when the app is running on different operating systems, like Android and iOS. Though, noticeable visual variations in the Dynafleet app show up when running it on a smartphone and a tablet. The latter is caused by differences in screen size and consequently the ability to provide more information at once to the user.

This is the subject of the following section. Hereby, a thorough distinction between the app on two mobile technology devices, namely a smartphone and a tablet, is made accompanied by the corresponding implications. It is explained by means of screenshots of various sections within the app while running it on the different devices. These screen captures can be retrieved in section 11 of the Appendix. It initially seems that the character size on the tablet computer is smaller than the one of the smartphone, though due to the former's larger screen, the situation is actually reversed in reality.

To conduct this study, two mobile devices are used. First, a tablet computer with a screen size diameter of nearly 10 inch was employed. The smartphone on the other hand remains the same device as previously mentioned. The latter is equipped with an 4,5 inch touchscreen display (cfr. supra). Both devices are running the Android operating system.

First, the home screen of the mobile app is investigated. No significant difference is found here. After opting to log in or use the demo version, the first deviations show up in the 'Dashboard' tab. On the smartphone version, the details about the fleet and its corresponding fuel efficiency score are displayed underneath each other as a list. Consequently, the user has to scroll down to retrieve each of the four categories that influence the global fuel efficiency score. This elevates the corresponding *search costs* and increases the previously mentioned *ranking effect* (cfr. supra). It is a major difference compared to the tablet version, where all information is provided on one single screen. The four categories are ordered two-by-two next and under each other. This enhances the clarity of the overall picture significantly.

On a smartphone, search costs are even a larger issue when the user wants to consult the corresponding parameters that lead to these scores. Again, the user is obliged to scroll down the whole list of parameters in order to retrieve for example those ones that instigate a

lower fuel efficiency score. On a tablet, again, these subcategories are displayed on a single screen in a very clear manner.

Going to the ‘Vehicles’ tab, the visual differences become instantly clear. Where on the smartphone version the user has to make a decision whether to display the vehicles as a list or shown on a map, the tablet integrates both options into one screen. In addition, the tablet offers the opportunity to display more vehicles at once and even the map is by default more detailed. On the smartphone version, the overview of the vehicles and their corresponding names and dates is rather poorly organised. Overlap between different tags even takes place. The story repeats itself for the ‘Drivers’ tab. Needless to say that the tablet computer offers in both cases a significantly higher user-friendliness.

Finally, the ‘Ranking’ tab and especially the ‘Help’ option in the ‘Settings’ menu also offer some slight deviations in terms of quantity of information displayed at once. While a tablet can show around 23 drivers, the smartphone is only physically able to display roughly 10 drivers at once. The representation also is rather contradictory. When opening the menu, the best drivers are shown by default. Though, the focus has to lay on the ones at the bottom of the list who require immediate attention and adjustments. Therefore, the fleet manager is obliged to scroll down the list every time when launching the mobile app. This obviously takes more effort on the smartphone version, as the number of drivers displayed at once is lower. In addition, the mobile app provides no setting in the way this ranking can, for example, be reversed. The latter could be a valuable adjustment Volvo Trucks can implement in the app. Nevertheless, when the mobile app is not closed and remains active on the background of the mobile device, it remembers the latest browsing position of the fleet manager within the app.

At last, the ranking effect and the corresponding search costs play an even a larger role on the truck driver version of the mobile app when opened on a smartphone. The reason behind this is that even more data are listed underneath each other.

CONCLUSION

It can thus be concluded that the *search costs* and the *ranking effect*, as defined by Ghose, Goldfarb and Han (2012) (cfr. supra), play a major role when choosing one mobile device over another. Though, the largest problem areas are mainly present on the smartphone version of the mobile app because of the smaller screen size. Issues occur mainly in the menu providing the fuel efficiency parameters, but also the 'Ranking' tab. Both offer a long list of data, whereby the parameters located lower in the list -whether or not immediately visible on the screen- are risking to receive less attention from the user.

8. *Service requirements of the Dynafleet mobile application*

In order to run the Dynafleet mobile app, two things are absolutely necessary. First, each truck needs to be equipped with a smart computer and tachograph, in order to generate all the necessary data of the vehicle. Next, the Dynafleet Online desktop version analyses and works all the information provided by the trucks. Therefore, secondly, a mobile data connection is necessary to continuously send information from the truck to Dynafleet Online, which on its turn transfers it to the mobile application. Thus, it is important to make sure that the mobile device is connected with the Internet in order to use the mobile app (cfr. supra).

In addition, to use Dynafleet to its full capacity, certain modules (cfr. supra) need to be part of the trucking firm's portfolio. Regarding the generation of vehicle stats and fuel efficiency scores within the Dynafleet app, purchasing the 'Fuel & Environment' module is essential. Next, it is compulsory to get the 'Positioning' module in order to display the exact position of a vehicle. When a firm wants to access the driver times the module 'Driver Times' has to be purchased. The last module, namely 'Messaging', is particularly important to send messages from Dynafleet Online to the cabin of a truck. Though this module is not captured in the Dynafleet mobile application.

9. *Which employees have access to the Dynafleet mobile application?*

Firms that want to make use of the Dynafleet mobile application need to be registered within the Volvo Trucks system as a general Dynafleet user. This implies the monthly payment of a certain amount of money, dependent on the number of acquired modules (cfr. supra).

Current users of Dynafleet can log in the mobile app using the same login name and password as for Dynafleet Online. Consequently, this login provides them access to the complete packet of information offered by the Dynafleet application (cfr. supra).

Truck drivers on the other hand can only gain access to the tool when they submit a request on the start page of Dynafleet. In order to be accepted, the Dynafleet user within the firm must enter the driver's email address in the Dynafleet Online database. When accepted, the truck driver in question automatically receives his/her personal login name and password by mail. The data available to them is limited to their own personal driving information. Figures about other drivers or the fleet in general are hereby excluded (cfr. supra).

CHAPTER 5:
CASE STUDY FINDINGS

1. Utilization of mobile technology devices within the trucking sector

When prompting the question which of the mobile devices, choosing between smartphones, laptops and tablets, is chiefly utilized among truck drivers, Volvo Trucks, Scania, FTO and De Rese all declare it is the smartphone and more particularly the Android operating system. Truck drivers less frequently possess solely a tablet. Nevertheless, all four companies indicate the tablet is getting increasingly popular and expect this trend to continue in the future. This is mainly due to its larger screen size and the corresponding additional advantages. Though, this does not mean it will replace the smartphone over time. According to all four sources the tablet will be used as an additional device that has its place next to the widely spread smartphone. This is congruent with the previously mentioned findings regarding the global mobile technology market.

In addition, these companies also estimate that the amount of smartphone users within a company will further increase in the near future. First, this is due to the fact that the oldest employees, who are less frequent smartphone users, are retiring and leave the company. They are replaced by a fresh young workforce more familiar with this technology. Second, the data within Dynafleet is currently only available for truck drivers through a mobile app. It is expected that the first step to this source of information will be by the means of smartphones. This is due to its versatility of functions, its smaller and handier size and the presence of basic capabilities such as calling or sending offline text messages. It is the main device truck drivers use to remain in contact with the home front.

Volvo Trucks, Scania, FTO and De Rese all declare that the largest part of truck drivers is currently in the possession of a smartphone. Though, in the case of De Rese, only 30% of all truck drivers are using the Dynafleet mobile app. According to the driver trainer of FTO, the reason to this is twofold. First, the fact that part of his drivers do not have a mobile device in their possession simply means they cannot use this app. Second, some drivers have no idea how to use the mobile app, even though it is designed as user-friendly as possible. Volvo Trucks indeed provides no additional training sessions explaining how to use the Dynafleet mobile app.

Though, De Rese expects his number of users to go up. As already mentioned, this is because of the growing popularity regarding the use of mobile devices and their applications. Additionally, Volvo Trucks is considering providing training sessions to clarify the app's functionalities and how to access them.

CONCLUSION

The evolution regarding the use of mobile technology devices in the trucking business matches the previously mentioned findings concerning the global mobile market. It is expected that both smartphone and tablet markets will continue to enlarge their current user base in the near future. The high popularity of Android mobiles is also forecasted to proceed.

2. *The effect of internal competition*

"Anyone who imagines they can work alone winds up surrounded by nothing but rivals, without companions. The fact is, no one ascends alone."

Lance Armstrong – Former professional cyclist

Because Volvo Trucks encloses the use of scores and rankings in their mobile app, it can be stated that they aim to stimulate the internal competition level of the customer's firm. Neither the FleetBoard application of Mercedes-Benz nor the Fleet Management app of Scania has integrated such a ranking system. It seems that Dynafleet is one of the few mobile apps -maybe even the only one- that has embraced this concept at this particular moment. Because of the nature of this research as well as the abundance and variety of other fleet management applications on the market it is practically very difficult to provide an unambiguous decisive conclusion regarding this statement.

Consequently, an additional research question emerges whether this elevated internal competition level is rather beneficial or unproductive within a trucking firm.

Emerging research question:

Does an increased internal competition level, induced by the Dynafleet mobile application, has rather beneficial or unproductive consequences for a trucking firm?

In order to investigate this topic, a literature research provides an initial overview of the scientific findings regarding this form of competition. Next, the practical experiences originating from the four conducted interviews are added. This part ends with an objective conclusion concerning internal competition.

2.1 Literature research

In his book '*The Role of Internal Competition in Knowledge Creation: An Empirical Study in Japanese Firms'*, Makoto Matsuo (2005) defines 'internal competition' as "*the situation in which two or more people compete for tangible or intangible rewards that cannot be shared equally by all*". In other words, it is outlined as "*the situation in which rewards are distributed according to the members' relative performance*".

Although competition can be found in all kind of situations in everyday life, this section focuses solely on the internal competition taking place in the workplace. Matsuo

(2005) declares that employees continuously compete for various rewards such as a bonus, a higher position, a fascinating job or an elevated internal reputation within the firm.

2.1.1 A double-edged sword

Matsuo (2005) represents internal competition as a double-edged sword. On the one hand, various studies show that internal competition motivates people, encourages them to set higher goals, creates flexibility and questions the status quo. The latter is seen as an important contributor to the resistance to change (cfr. supra). On the other hand, research clarifies that internal competition is causing a decreased productivity level due to less knowledge sharing. Having more knowledge about a certain topic converts to a higher influence and power level for the individual or business unit in question. This is an asset they are often not willing to give up easily. Unfriendly relationships with colleagues, lower psychological health in the form of depression and feelings of failure can also be the result of this form of competition. As a consequence, the management of a firm has to decide whether encouraging internal competition will enhance or dwindle the company's performance.

2.1.2 Performance-based appraisal systems

If a firm opts for raising its internal competition level, performance-based appraisal systems seem the way to go. In their book '*Human Resource Management: gaining a competitive advantage'*, Noe, Hollenbeck, Gerhart and Wright (2012) define 'performance appraisal' as "*the process through which an organization gets information on how well an employee is doing his or her job*". Performance is here seen as the way employees' activities and outputs are congruent with the organization's goals.

There are five different approaches a manager can apply to measure its employees' performance. In the *comparative approach*, the overall performance of an individual is compared with the one of others within the same work group. This is based on ranking techniques. Next, the *attribute approach* verifies whether an individual possesses certain characteristics considered essential for the company's success. Further, the *behavioural approach* defines a certain behaviour an employee must exhibit to be effective in the job. Fourth, the *results approach* measures the degree to which certain company related objectives are accomplished. Finally, in contrast with the previously mentioned -rather traditional- performance measurement systems, the *quality approach* includes a customer orientation as well as the degree in which errors are prevented and continuous improvement is emphasized. The necessary data in order to apply these approaches can be generated by the

implementation of various information technologies or extracted from colleagues, subordinates, customers and the individual himself. (Noe, Hollenbeck, Gerhart & Wright, 2012, p. 350-369, 371-378)

When employees do their best to offer a high-level work performance, their behaviour has to be recognized and rewarded. This is done to increase the chances that this enhanced employee performance is repeated in the future. If the desired behaviour is not replied by a suitable reward of any kind, it is less likely that this effort will occur again. Further, it ensures that the interests and goals of the firm and its employees keep overlapping on the short- and long term. Finally, according to the *service profit chain* (cfr. supra), keeping the employees satisfied will increase their productivity and will ultimately lead to higher revenues and profitability. (Noe, Hollenbeck, Gerhart & Wright, 2012, p. 522-524)

The performance appraisal system of choice must meet essential criteria in order to instigate the desired results. This is stated by Noe, Hollenbeck, Gerhart and Wright (2012). First, the system must comply with the organization's strategy, goals and culture. This is called '*strategic congruence*'. The second important criterion is '*validity'*. Here, the appraisal system must focus on all relevant aspects of job performance, without emphasizing several factors and neglecting others. Third, a '*reliable'* performance measuring system means that it is free from random errors and is consistent. The fourth criterion implies the performance measurement system to be fair. This condition is denominated as '*acceptability'*. Finally, '*specificity'* investigates whether the appraisal system provides detailed guidance to employees about what is expected from them and how they can meet these expectations. (Noe, Hollenbeck, Gerhart & Wright, 2012, p. 346-350)

Management has the choice between two types of performance-based reward systems. First, they can opt for a monetary reward. These can occur in the form of bonuses, profit sharing programs, etc. A variety of research conclude that solely utilizing monetary ways to reward the workforce has still substantial effects on productivity. Second, non-monetary rewards are another feasible possibility. This concept can be exemplified by an employee of the month election. Recognition for the performed efforts is very appreciated by the employee or business unit in question. According to the former CEO of IKEA, Anders Dahlvig, "*recognition is the greatest motivator of them all*" (Dahlvig, 2011). Furthermore, a research study on organizational commitment in the restaurant industry (Upchurch, DiPietro, Curtis & Hahm, 2010) clarifies that "*some of the most effective methods of rewarding*

outstanding performance involve little or no money". Factors that impact the operational performance in this case are the feeling of being involved in the organization, having job security, working in good conditions and being proud to be part of the organization. Therefore, it is in the firm's best interest to support and enhance these motivational factors. In addition, studies show that employees prefer a number of non-pay factors over monetary rewards, especially the desire for influence and enhanced involvement in certain decision-making processes. Finally, other research clarifies that the addition of non-financial rewards can possibly raise the performance level even higher than the one stand-alone monetary bonuses would be able to achieve. (Noe, Hollenbeck, Gerhart & Wright, 2012, p. 526-539, 545)

2.2 Practical findings

If a firm opts for using the Dynafleet mobile application to evaluate its chauffeurs driving performance, the so-called *comparative approach* is applied (cfr. supra). Within the app, the generated fuel efficiency score of a truck driver is compared to the ones of his/her fellow colleagues within the same trucking firm. This score provides him/her a certain position within the ranking list. To avoid drivers targeting a particular chauffeur that is performing better or worse, they have no access to the complete ranking but only to their personal relative position (cfr. supra). This complete access is only granted to fleet users such as managers and dispatchers. It is up to the management to decide to which extent the complete ranking system is utilized within the trucking firm and how far the associated internal competition level has to be brought.

From the conversation with the non-Dynafleet user FTO nv, it appeared that this ranking system could possibly have a devastating impact on the friendship between colleagues. The firm also considers the performance measurement system to be unfair, taking the example of chauffeurs driving through the flat countryside of Holland who would have a significant lower fuel consumption level than someone who would need to cross the Alps. The latter's higher fuel consumption level is indeed inevitable and does not necessarily refer to eccentric driving behaviour.

In addition, Bergiers (Logistics Coordinator of FTO) thinks that the maximum period over which the scores are generated, namely 30 days (cfr. supra), is way too short. According to him, certain unexpected situations have then a too large impact on the average fuel consumption level. At FTO, the latter is measured after a time period of three months.

Bergiers considers this interval to be more acceptable. Therefore, he is of the opinion that Dynafleet's ranking system possibly lacks reliability and acceptability, two of the performance measurement criteria discussed earlier (cfr. supra).

Though, both arguments result from a complete misunderstanding of the app's functionality. As mentioned earlier, the fuel efficiency score is related to the driving behaviour of a truck driver, whereby his/her fuel consumption is left out of the analysis. Initially, Johan Coopman also encountered issues regarding this matter. "*When I first used Dynafleet and its mobile application, I could not understand why truck drivers with a relatively high fuel consumption were sometimes ranked near the top of the list. I thought I did something wrong. Or that Dynafleet was doing something wrong. Over time it became clear that the fuel efficiency score is based on other parameters that are specifically measuring one's driving behaviour, not his/her fuel consumption level. This makes it fair for those chauffeurs that have more difficult routes, such as crossing the Alps*", Coopman states.

Transport companies are generally aware of the different fleet management systems available on the market, though it seems that there can exist some crucial misunderstandings regarding their functionalities. The latter was clearly the case for FTO. This can possibly indicate that not enough technical information is offered by the several providers of these systems. Coopman also mentions that Volvo Trucks does not provide certain training in order to learn to work with Dynafleet although this could be a possible solution in order to tackle this essential problem. Additionally, trainings can induce a feeling of trust between provider and customer and can therefore contribute to their lucrative relationship (cfr. infra).

Although encountering certain difficulties, Coopman is certainly convinced that the fuel efficiency scores and the corresponding ranking system have improved its chauffeurs driving behaviour. Moreover, he declares that truck drivers that possess and use the Dynafleet app are actively adjusting their driving behaviour on their own and only ask for advice when they cannot figure out certain problems themselves. He also indicates that Dynafleet clearly generates bottom-up proactive improvements rather than top-down management interferences.

Though, it is not the fuel efficiency score but the fuel consumption level of each driver which is openly publicised within the company. De Rese chooses thus to raise the competition level in a healthy way, though not utilizing the ranking as provided by Dynafleet. An argumentation to decline access to the fuel efficiency list is that an optimized behaviour

behind the wheel, that Dynafleet helps to achieve, will ultimately translate in a lower fuel consumption level. And it is this final objective that is the most important to them. Coopman is certainly convinced that some form of internal competition eventually benefits the company.

From the incentives point of view, De Rese does not use financial rewards to stimulate drivers to perform well on the list of fuel consumption, nor on the ranking within Dynafleet. Though, it plays a role when conducting performance reviews (cfr. infra). Alternatively, De Rese opts for utilizing non-financial rewards such as recognition when one is on top of the list. This can range from just a small pat on the back to a special mentioning. As shown in the literature, this method can be -when implemented good- very effective. According to Coopman "*such non-financial rewards keep the internal competition healthy. Money could possibly put a temper on the friendly atmosphere*". Though, he also declares that certain other firms are settin the bar for internal competition even higher by developing elaborated rankings and relating financial rewards to the driver's position on the scoreboard. In his opinion, the effectiveness of internal competition depends from company to company and is thus related to the way companies and their truck drivers handle this corporate culture.

CONCLUSION

Based on the literature, it is uncertain whether internal competition -and consequently Dynafleet's ranking system- positively or negatively impacts the operational performance of a transport firm. According to Volvo Trucks, De Rese and FTO, it depends on the way each company implements it and how internal competition is experienced by its drivers that determines whether the final effect is beneficial or rather unproductive. Though, it is clear that Volvo Trucks did a great job developing the ranking system in such a way that it tries to avoid the possible negative effects that can come along with enhancing the internal competition level.

3. *Dynafleet's possible revenues and costs*

"Quality in a product or service is not what the supplier puts in.
It is what the customer gets out and is willing to pay for.
A product is not quality because it is hard to make and costs a lot of money,
as manufacturers typically believe. This is incompetence.
Customers pay only for what is of use to them and gives them value.
Nothing else constitutes quality."

Peter F. Drucker (1909-2005) – American management consultant, writer and teacher

It should be clear by now that the combination of Dynafleet's desktop and mobile version, when implemented and used correctly and intensively, offers the customer a lethal weapon to tackle abundant fuel consumption. This condition is an essential condition that definitely has to be emphasized.

But what mean all these advantages in financial terms? What kind of cost-savings can a firm typically expect? And from which fuel savings level is Dynafleet starting to be profitable? This section clarifies and addresses these matters according to the data of a current non-user and user of Dynafleet. Additionally, a sensitivity analysis is conducted to assess the impact of various parameters on the profitability of Dynafleet. The following analysis assumes the customer purchased the complete Dynafleet package. This means all four modules without Fuel Advice.

Afterwards, it is investigated whether or not Dynafleet contributes to dynamic routing, communications, driving time regulations and the environment. The first three factors also influence the operational costs of a trucking firm while the environmental impact is related to the level of fuel consumption.

3.1 Financial value of Dynafleet

3.1.1 Dynafleet: lucrative or unnecessary?

In general, five parameters are shoved forward that impact Dynafleet's profitability for a trucking firm. These are: the number of trucks, the average distance driven per truck per year (in km), the average fuel consumption of the fleet (in litre per 100km), the diesel price (in euro per litre) and finally the fuel savings level (as a percentage). The latter is defined as the percentage of fuel reduction Dynafleet is able to realize.

An interesting example regarding the possible costs and revenues of Dynafleet was given during the interview with Emry Tack. Although being striking and making use of realistic figures, it lacked authentic data from a real-life case. Therefore, this particular section is making an analysis based on the data of an existing medium-sized Belgian transport company, namely FTO nv. located in Lochristi (cfr. supra). The firm was founded in 1989. They profile themselves as an innovative company utilizing a modern fleet and are working exclusively with truck drivers with a Belgian nationality.

Tim Bergiers (FTO's Logistics Coordinator) is rather sceptical about the use of Dynafleet and its possible fuel savings. According to him, Dynafleet asks too much effort in order to continuously monitor the driving behaviour of his chauffeurs. Perhaps, this would mean hiring an extra person in order to do this job properly. The latter obviously would ask a new investment of the firm, namely in human capital. Moreover, he states that a wide array of alternative techniques is at his disposal when trying to lower the fuel consumption. He offers a variety of examples that can impact the fuel efficiency such as making the trucks more aerodynamic by covering the fuel tank and by taking off unnecessary equipment of the roof, changing the tires, remove superfluous lights within the cabin and at the front of the truck, use better fuel quality, etc. Additionally, he declares that "*driving 87km/h rather than 90km/h will generate a fuel consumption decrease of 3 litres per 100km*". Although the latter is significant, this also means the transport is slowed down and certain destinations are not within reach anymore when taking into account the legal driving time regulations.

On the other hand, Johan Coopman (Fleet and Technics Advisor/Driver Trainer at transport firm De Rese) states that "*By implementing and correctly utilizing Dynafleet accompanied with other services such as Fuel Advice, a firm having an average fuel consumption level of 33 litres per 100km can reduce its consumption under 30 litres*". This comes down to a fuel savings level of 9,09%. De Rese, possessing a fleet of 100 trucks, is a

loyal customer and extensive user of Dynafleet, already utilizing the complete package for over a decade.

The website of Volvo Trucks provides a Truck Efficiency Calculator that offers an indication of what the fuel savings cost for a firm can be, based on the type of Volvo Trucks service one selects. This relies completely on the parameters impacting the fuel consumption of the firm in question. These are the fleet size, average fuel consumption, fuel price and average distance driven per year.

For Dynafleet, a fuel savings level of 2% is proposed by this Truck Efficiency Calculator. Though, according to the Volvo Trucks general website, Dynafleet is able to realize a fuel savings level up to 7%. As previously mentioned, the latter depends on the way and intensity firms use the information provided by Dynafleet. In addition, the Truck Efficiency Calculator declares that, a combination of Dynafleet, Fuel Advice and appropriate driver training would realize fuel savings of roughly 7% on average. According to the Volvo Trucks website, this can mount up to even 10%. The 9,09% estimated by Coopman thus lies within this interval.

As already mentioned, this thesis only discusses the pure impact of the four modules of Dynafleet. Other fuel savings services are kept out of the analysis. Coopman indicates that Dynafleet alone is also able to realize significant reductions in the average fuel consumption department. In the specific case of De Rese, this fleet management system is able to realize a net cost reduction up to €211.824[a] per year. These are already significant figures.

As for every investment, an assessment has to be made whether the advantages outweigh the negative implications. Therefore, based on the necessary data FTO provided, the following case study examines the possible revenues and costs Dynafleet can offer to the firm. Next, it has to be emphasized that the Truck Efficiency Calculator of Volvo Trucks only focuses on the possible cost savings of Dynafleet, not taking into account its cost price of €60 per month per truck (cfr. supra). Because the latter is essential for the investment decision of a firm, it is chosen to certainly include this missing part of information in the calculations of this study. Ultimately, the goal of this section is to investigate whether Bergier's doubt is legitimate and if Dynafleet is able to realize more value than initially expected by FTO.

[a] This is based on table 12 in the Appendix. The way these numbers are generated is analogue to the analysis performed for FTO (cfr. infra).

3.1.2 Analysis

FTO possesses 17 trucks with a GVW of 44 ton, each driving on average 118.000km per year. This comes down to roughly 9850km per month. The average fuel consumption is currently 31,5 litres per 100km. The actual diesel price is around €1,08 per litre. This figure is based on the market conditions at the moment of writing this thesis. For a fleet of 17 trucks, the complete Dynafleet pack would cost this transportation firm yearly €12.240 in total. The latter is based on the following formula.

Yearly cost of Dynafleet

= (total cost for one module * number of purchased modules) * fleet size * 12 months

In order to perform the necessary calculations to overview the benefit or loss of using Dynafleet, three figures are essential, namely the *yearly fuel cost without utilizing Dynafleet*, the *yearly fuel cost with Dynafleet* and the *yearly cost savings when Dynafleet is applied*. The corresponding formulas are provided below.

Yearly fuel cost without Dynafleet

= fleet size * (average distance driven per year per truck/100) * average fuel price * average fuel consumption without Dynafleet

Yearly fuel cost with Dynafleet

= fleet size * (average distance driven per year per truck/100) * average fuel price * [(1-fuel savings level) * average fuel consumption without Dynafleet]

Yearly cost savings with Dynafleet

= Yearly fuel cost without Dynafleet – Yearly fuel cost with Dynafleet

Based on these findings, the table below is created. It clarifies the possible profit and loss of Dynafleet for FTO according to different fuel saving levels Dynafleet is possibly able to realize.

Fuel costs and -savings, net profit and ROI for different fuel savings levels (case FTO nv.)

Fuel savings level (in %)	1	2	3	4	5	6	7
Fuel consumption without Dynafleet (in litre/100km)	31,50	31,50	31,50	31,50	31,50	31,50	31,50
Fuel consumption with Dynafleet (in litre/100km)	31,19	30,87	30,56	30,24	29,93	29,61	29,3
Yearly fuel cost without Dynafleet	€ 682 441	€ 682 441	€ 682 441	€ 682 441	€ 682 441	€ 682 441	€ 682 441
Yearly fuel cost with Dynafleet	€ 675 725	€ 668 792	€ 662 076	€ 655 144	€ 648 427	€ 641 495	€ 634 779
Yearly cost savings with Dynafleet	**€ 6 716**	**€ 13 649**	**€ 20 365**	**€ 27 298**	**€ 34 014**	**€ 40 946**	**€ 47 663**
Yearly cost of Dynafleet	€ 12 240	€ 12 240	€ 12 240	€ 12 240	€ 12 240	€ 12 240	€ 12 240
Net profit	**-€ 5 524**	**€ 1 409**	**€ 8 125**	**€ 15 058**	**€ 21 774**	**€ 28 706**	**€ 35 423**
ROI	**0,55**	**1,12**	**1,66**	**2,23**	**2,78**	**3,35**	**3,89**

Table 10: Fuel costs and -savings, net profit and ROI for different fuel savings levels (case FTO nv.)

This table clearly shows that the Dynafleet package can offer a net profit up to €35.423 per year. Note that a limited fuel savings level is not lucrative for this company. Based on the subsequent formulas, the *minimum required fuel savings level* FTO should achieve for Dynafleet to be lucrative is 1,7936%. This is equal to a fuel consumption level of 30,935 litres per 100km or a saving of roughly 0,56 litres. This obviously results in a ROI equal to one.

Minimum required fuel savings level

$$= 1 - \frac{\text{yearly fuel cost with Dynafleet} + \text{yearly cost savings with Dynafleet} - \text{yearly cost of Dynafleet}}{\text{fleet size} * \text{fuel price} * \text{fuel consumption without Dynafleet} * \frac{\text{average distance per year per truck}}{100}}$$

Minimum required fuel savings

= minimum required fuel savings level * average fuel consumption without Dynafleet

3.1.3 Results and conclusion

It is clear that the yearly savings by utilizing Dynafleet can mount up to significant amounts for a transport firm of this dimension. Moreover, it appears that net profits can already be realised when small fuel savings occur, namely 0,56 litres per 100km in the of FTO.

Though, using Dynafleet implies that companies need to actively follow up and analyse the generated data, point out problematic driving behaviour, provide specific training, etc. These measures can cost effort or money, expressed in terms of adjusted driving behaviour of the truck drivers, investments in human capital and so on. On a yearly basis, these additional costs can possibly mount up and overtake the savings Dynafleet is able to realize. This is also stated in the interview with Tim Bergiers (cfr. supra). Moreover, the firm's complete fleet management system has to be replaced, which can lead to feelings of dissatisfaction for certain people within the company in question. This is due to the fact that people generally tend to be resistant to change (cfr. supra).

CONCLUSION

Depending on the necessary provisions that have to be taken due to the Dynafleet implementation, this fleet management system can ultimately provide a valuable or unprofitable service to the customer. The latter depends on their individual fleet parameters and the way and intensity Dynafleet's is used. Firms need to assess themselves whether Dynafleet is worth the effort or if other adjustments are considered more efficient and lucrative for the same investment.

3.2 Sensitivity analysis

A suited method to investigate the impact of changing circumstances on the net profit of Dynafleet is by conducting a *sensitivity analysis*, as proposed by Hillier and Lieberman (2009). Particularly, it implies the examination of how adjustments in one of FTO's fleet parameters affect this net profit. These parameters are respectively the fleet size, average driving distance, average fuel consumption and fuel price (cfr. supra).

The results are divided into three possible options namely the *worst-*, *normal-* and *best case scenario*. In the worst case scenario, the minimum fuel savings level is searched when Dynafleet is considered a break-even investment. The normal case is the situation in which the parameters are set on an average level. In the best case scenario, the thesis takes a closer look to what the highest realistic net yield of Dynafleet can bring when changing one of the corresponding parameters.

In this research, the intervals for each parameter are not based on a fixed deviation valid for all parameters, but are adjusted to realistic intervals for each factor specifically. Also, a fuel savings level of 2% is chosen because this percentage is applied in the Truck Efficiency Calculator of Volvo Trucks. Moreover, this is often just above the minimum fuel savings level when Dynafleet seems to be a profitable investment. Therefore, it offers roughly the minimum result a firm can expect when using this fleet management system. Again, the next calculations are based on the figures of FTO but can also be extrapolated for a wide array of transport firms.

3.2.1 Changes in the fleet size

First, the fleet size is the only parameter that does not cause changes in the minimum fuel savings level in order to realize a ROI equal to one for the Dynafleet investment. Looking at the formula of the minimum fuel savings level (cfr. supra), changes in the fleet size linearly affects all three factors in the numerator of the equation. Therefore, the global outcome remains the same. As calculated in the previous section, the fuel savings level has to be at least 1,7936% in order to assess Dynafleet as a profitable investment. This equals a required fuel consumption reduction of minimum 0,56 litres per 100km.

Next, the impact of the fleet size on the net profit of Dynafleet is investigated. The following graph provides the necessary information. The maximum fleet size is here set to

100 in order to limit the number of data but still capture the lion's share of transport firms on the market.

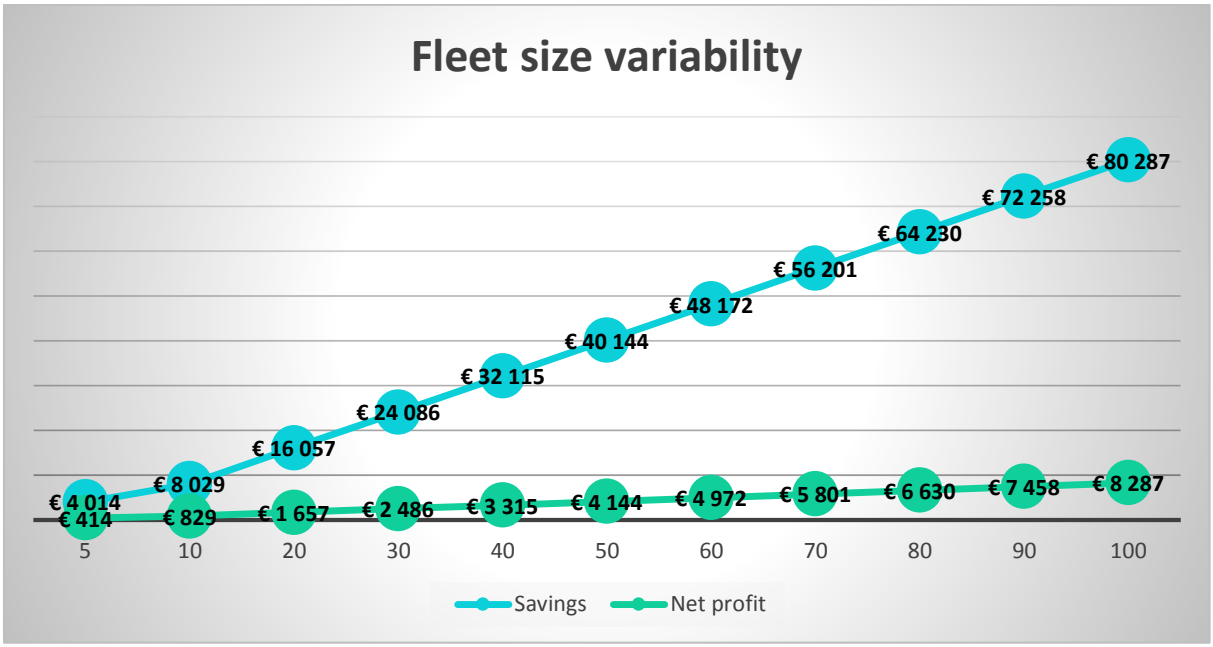


Figure 10: Fleet size variability

It is clear that the net profit increases linearly with the fleet size. Therefore, the larger the number of trucks a firm possesses, the more beneficial Dynafleet can be even though a higher purchase price will be the result. Nonetheless, this effect is not significant. When the fleet size enlarges by 10 trucks, based on the parameters of FTO, the net benefit of Dynafleet increases with only €829 per year. Finally, the ROI remains constant and is equal to 1,115.

3.2.2 Changes in the yearly average driving distance per truck

The yearly average driving distance impacts the minimum fuel savings level for which Dynafleet is considered lucrative for a company. Like fleet size, driving distance also affects the numerator of the previously mentioned equation. Though, it does not impact all factors above the equation line. It influences the *yearly fuel cost with Dynafleet* and the *yearly cost savings with Dynafleet*, though not the *yearly cost of Dynafleet* which is subtracted from the previous two.

Consequently, a yearly driving distance of more than 118.000km results in a larger equation and thus a lower minimum required fuel efficiency level than the 0,56 litres mentioned before. Considering a yearly driving distance interval between 50.000km and 150.000km, this minimum fuel savings level varies between 4,23% and 1,41% respectively. This comes down to a required fuel consumption reduction of 1,33 litres and 0,44 litres per

100km respectively in order to realize a break-even situation. There exists thus a negative linear relation between driving distance and the minimum fuel savings level.

Furthermore, the net profit of Dynafleet reacts linearly and positively to the driving distance, as showed on the following graph. If FTO's fleet drives yearly on average 5.000km further, the net gain of Dynafleet increases with €578 per year. For an increase of 2.000km, the yield is 2,5 times lower, thus €231 per year. These are thus rather small increases in the net profit of Dynafleet.

At last, the ROI in this example increases in a stable way from 0,85 to 1,32 within the previously mentioned yearly driving distance interval. As a result, the minimum yearly driving distance in this situation has to be 105.818km for Dynafleet to be a break-even investment. As mentioned before, this number is generated under the condition of a 2% fuel efficiency level. Trying to realize higher fuel efficiencies can be a viable solution for certain companies that are performing lower yearly driving distances.

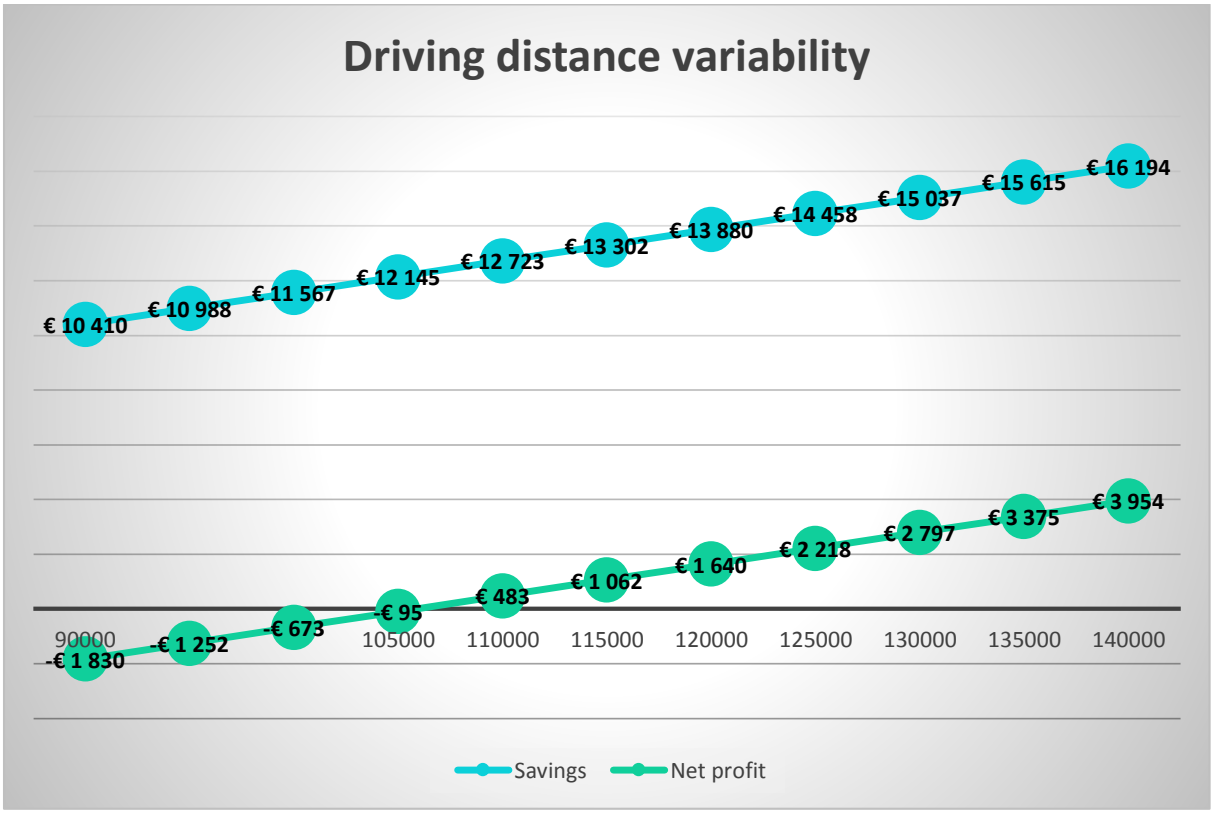


Figure 11: Driving distance variability

3.2.3 Changes in the average fuel consumption

The average fuel consumption of a company also influences the minimum fuel savings level. Just as the driving distance, it only impacts the *yearly fuel cost with Dynafleet* and the *yearly cost savings with Dynafleet* above the equation line. Therefore, a higher fuel consumption leads to a lower required fuel efficiency level. Applying an interval between 29 and 34 litres per 100km, the former level varies between roughly 1,95% and 1,66% respectively. Because these percentages are applied to a respectively lower and higher overall average fuel consumption, the minimum required fuel consumption reduction remains the same, namely just over 0,56 litres per 100km.

Its impact on the net profit is illustrated by the following graph. A positive linear relation between the diesel price and the possible return of Dynafleet is noticeable. When a company's average fuel consumption level is 0,5 litres higher than the one of FTO -which is 31,5 litres (cfr. supra)- Dynafleet offers an additional yield of €216. For 2 litres more -which comes down to an average consumption of 33,5 litres- the additional benefit of Dynafleet mounts up to €867 per year.

Finally, the ROI ranges between 1,03 and 1,20 for the considered fuel consumption interval (cfr. supra). Only when a firm with approximately the same parameters as FTO has a fuel consumption of 28,25 litres per 100km or less, then Dynafleet is not considered lucrative. This when considering a minimum fuel savings level of 2%. Nonetheless, such a particularly low average fuel consumption level is considered rather unrealistic for a trucking company in the first place.

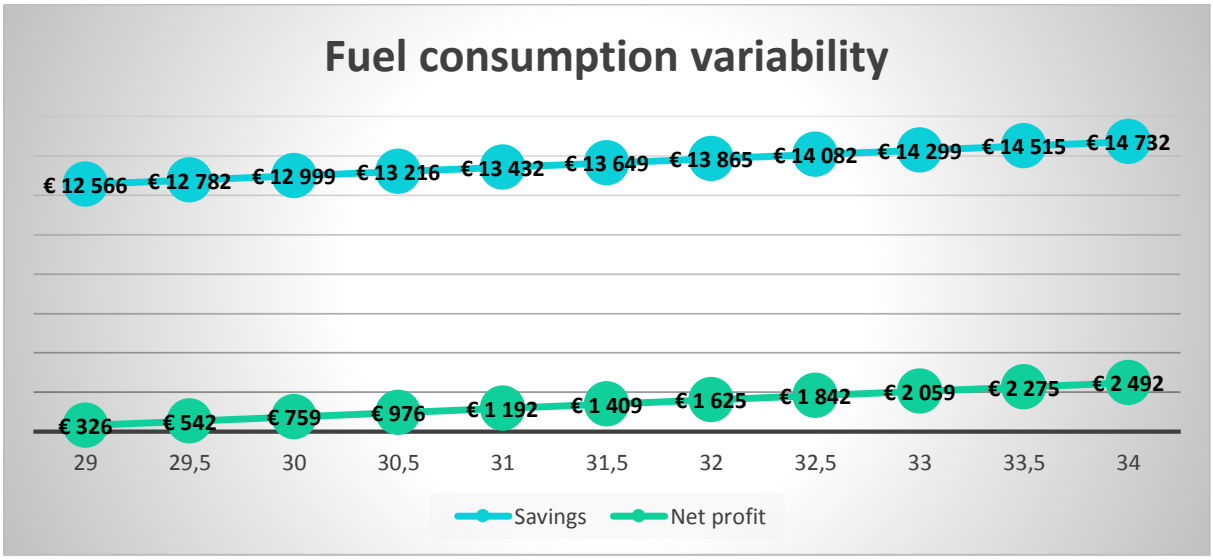


Figure 12: Fuel consumption variability

3.2.4 Changes in the fuel price

At last, modifications in the fuel price also change the minimum required fuel savings level. This is completely similar to the reasoning discussed in the previously two subsections. The minimum fuel savings level at a price of €1,08 per litre has to be 1,7936%. Nonetheless, when varying the fuel price from €0,98 up to €1,18 per litre this level decreases from 1.97% to 1,64% respectively. This results in a minimum required fuel consumption reduction of 0,62 litres down to nearly 0,52 litres per 100km. The minimum fuel savings level decreases in a roughly linear way when fuel prices increase.

The following graph represents the situation if the diesel price would rise or drop. Like in the two former examples, the cost of Dynafleet remains fixed on €12.240. The net benefit of Dynafleet grows linearly when a higher fuel price is taking place. An increase in the diesel price of €0,02 means an additional yield for using Dynafleet of €253 per year. Dynafleet would only become unprofitable for a 2% fuel savings level when the diesel price would drop under an average of €0,9685 per litre. Though, this situation is rather unrealistic on the short term. Finally, within the considered interval, the ROI ranges between 1,01 and 1,22.

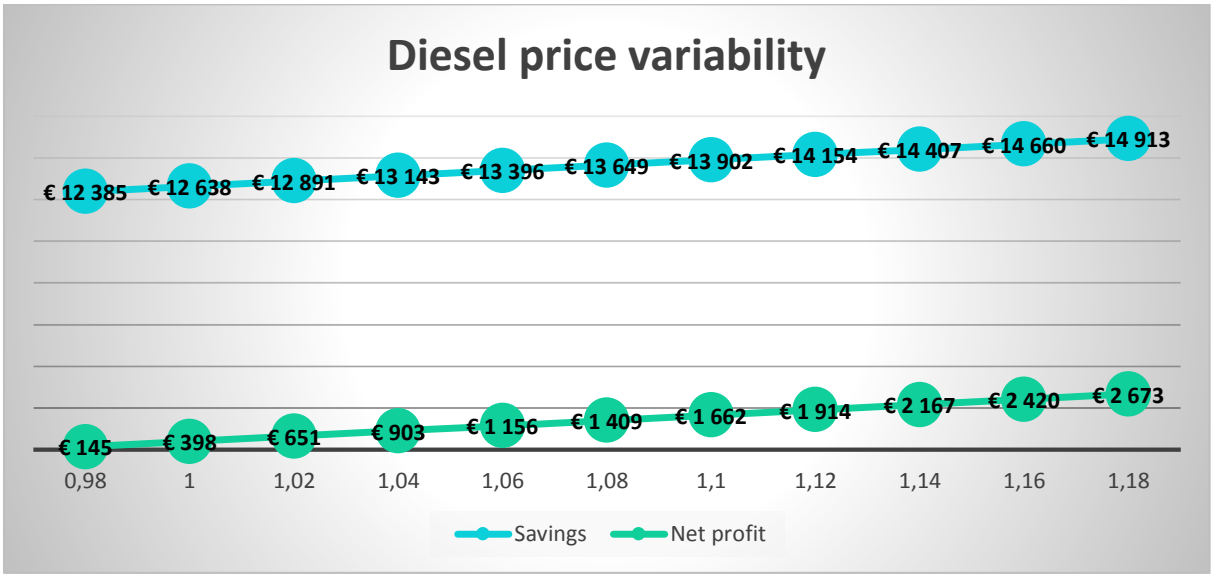


Figure 13: Diesel price variability

CONCLUSION

It is clear that the use of Dynafleet is often already profitable when a firm can realize just a limited improvement in its fuel consumption level. Generally speaking, this is already the case when a company is able to bring about a fuel consumption reduction of around 0,5 to 0,6 litres per 100km. This could be achieved rather easily when making small adjustments to the driving behaviour of the truck drivers.

Moreover, this sensitivity analysis shows that the larger the fleet size, the higher the fuel price, the further each truck is driving on average and the higher the fuel consumption level of a certain firm, the higher the profitability of Dynafleet can be. Nonetheless, these changes have generally no significant impact on the net yield of Dynafleet.

3.3 Dynamic vehicle routing problem

Cheung, Chy, Li, Shy and Tang (2008) as well as Zeimpekis, Tarantilis, Giaglis and Minis (2007) indicate the importance of mobile technologies such as RFID, GPS and GIS when performing *dynamic routing* (cfr. supra). The information captured by these technologies is gathered in the computer of the truck and subsequently sent to Dynafleet Online in real-time by using a mobile data connection. Afterwards, employees within a trucking firm can analyse the data and are able to take the necessary decisions. More particularly, a dispatcher, a fleet manager or a truck driver can apply the received data to optimize routing schedules, verify driving times, adjust deliveries based on unexpected situations like car accidents, etc.

Being able to avoid traffic jams while serving as many clients as possible can result in a higher general performance of the fleet while maintaining the same dimension. The fact that the situation is continuously monitored also increases the firm's flexibility to adapt to unexpected changes and can possibly enhance the customer service level, as stated by Zeimpekis, Tarantilis, Giaglis and Minis (2007). Furthermore, a trucking company is able to make more detailed prospections of the estimated time of arrival for a particular truck at a customer's firm. Providing this information to their clients offers them the opportunity to exactly know the arrival time of their product. Ultimately, this can also lead to a higher customer service level.

The core data processing and analysis is here generally performed within Dynafleet Online. Nonetheless, the exact way dynamic vehicle routing practically occurs within Dynafleet Online is not described in this thesis as this would disperse the subject too far from its initial focus. In order to have more specific knowledge about this topic, further research is advised.

CONCLUSION

Especially Dynafleet Online enables users to continuously monitor the position of each truck as well as the current traffic situation in order to act accordingly. This can allow the company to achieve higher fleet efficiency levels and can also improve the customer service level.

3.4 Driving time regulations

The previously conducted financial analysis does not take into account certain other costs that can rise to significant amounts, which Dynafleet proactively tries to avoid. An example is the fines when violating the driving time regulations. These start from €20 and mount up to €2000, depending on the type and severity of the violation (cfr. supra). Such fines can thus be avoided as dispatchers have continuously access to the precise driving- and rest times of each driver. When a possible violation can occur, warning signs are hereby displayed on the computer screen of the fleet administrator.

Dynafleet has also the ability to send automatic messages to a screen in the truck's cabin when possible violations would occur. The latter is only possible when possessing the necessary corresponding modules of Dynafleet, namely 'Driver Times' and 'Messaging'. The truck drivers themselves have, because of the Dynafleet mobile application, direct and immediate access to all the specific parameters and details of their tachograph (cfr. supra). While normally these tachograph data need to be manually retrieved every month, 'Driver Times' imports them automatically into the Dynafleet system in which they are stored. Both Volvo Trucks and Scania confirm that this takes otherwise on average 20 minutes per month per truck. On a fleet of 100 trucks, such as the one of De Rese, this can save more than 33 hours per month. Thus, on a yearly basis, 400 hours can be yield and are able to be deployed in a much more lucrative way.

Knowing the minimum fines are between €20 and €40 per truck and the complete Dynafleet package costs €60 per month per truck, it can possibly be valuable for firms to acquire this fleet management system.

When questioning Johan Coopman about the possible issues of De Rese with violating the regulations regarding driving times, this was his answer: "*Driving time regulations? What is that? Our truck drivers as well as the dispatchers can anywhere and anytime check when a break needs to take place. In addition, automatic messages warn the driver when he/she is about to exceed the legal driving time. Since we started to use Dynafleet no violation of these regulations took place*". His statement is clear.

CONCLUSION

The Dynafleet mobile app as well as Dynafleet Online are certainly able to avoid possible future driving time violations.

3.5 Communication

Depending on the screen type the trucks are equipped with, different kinds of messages can be displayed. Automatic notes regarding legal driving times, traffic conjunctions, optional routes and further assignments can therefore make the life of a chauffeur definitely less stressful.

While mobile phones are bound to the driver, the 'Messaging' module of Dynafleet is bound to a truck. It enables a firm to communicate essential information regardless of the chauffeur's number or type of phone. This communication flow ensures decisions can be taken quickly and precisely.

In addition, when the freight is delivered to its corresponding customer, the required invoices and confirmations can be immediately sent from the truck to Dynafleet Online. This ensures that the employees at the office can follow the situation in real-time while having the ability to take the necessary administrative steps right after the shipment is delivered.

But is the 'Messaging' module worth the investment? Imagine a firm's trucks are driving through different countries or even continents. In that case, maintaining communication through the use of mobile phone conversations is a very costly affair for a transportation firm. By using the 'Messaging' module, only a single payment of €15 per month per truck has to be made in exchange for unlimited communication, regardless of the position of the truck. The one downside is that truck drivers can only send messages while being stationary because these messages need to be created using a wireless keyboard.

A possible solution can be provided by also integrating the messaging component in the Dynafleet mobile app. This way, truck drivers can consult essential messages or communicate with the necessary people from wherever they are. This idea is among others implemented by Scania within their Fleet Management app. Though, when questioning Bert Leenaerts of Volvo Trucks about this subject, he states that this way of communication requires the truck driver to turn on the mobile data connection of his/her mobile device continuously. This could possibly lead to high roaming costs when being abroad. Those costs are not always reimbursed by the transport firm they are working for. Therefore, Volvo Trucks made the conscious decision to leave the Messaging module out of the Dynafleet app. Nonetheless, it can still be a valuable option to implement this in the Dynafleet app, giving the truck driver at least the opportunity to consult certain messages wherever and whenever he/she wants.

CONCLUSION

The ‘Messaging’ module of Dynafleet is certainly able to facilitate the way information is exchanged between a firm and a truck driver and performs this in a cost-efficient way. Because the ‘Messaging’ module is currently underrepresented within the Dynafleet mobile app, it is mainly Dynafleet Online that provides the previously mentioned advantages. It seems interesting to also implement this module in the mobile counterpart of Dynafleet.

3.6 Environment

Transport companies are huge polluters of noxious gasses and particulate matter (cfr. supra). The level of pollution generally depends on the fuel consumption of the fleet, but also on the type of trucks employed. Dynafleet is able to reduce this air pollution when implemented well. In order to know how significant this average reduction can be, the Truck Efficiency Calculator on the Volvo Trucks website provides a rough estimation of the level of CO_2-emission Dynafleet can help to avoid on a yearly basis. In the case of FTO, Dynafleet should be able to reduce its CO_2-emission by nearly 33 ton (figure 21 in the Appendix). These figures are overwhelming.

Though, according to David Desmet of Scania, Bert Leenaerts of Volvo Trucks, as well as Tim Bergiers and Johan Coopman, the main driver for companies to use sophisticated fleet management systems such as Dynafleet are cost considerations. Exhaust fumes -to which the transport sector is greatly contributing to- are harming the environmental climate, causing global warming, increasing the pressure on all ecosystems, deteriorating buildings and materials and affecting human health. Nonetheless, the reduction of air pollution is in the eyes of these enterprises seen as a nice by-product.

Take for example FTO. Bergiers declares that, although the competition in the transport sector is fierce, companies like FTO choose explicitly to work with domestic Belgian workers. According to Bergiers, this would improve among others the communication with the client as well as the way they treat the transported products. Nonetheless, foreign truck drivers are often significantly less expensive workers. Outsourcing transportation solutions to foreign countries can therefore lead to a major reduction in a main category of costs (cfr. supra), namely wages and salaries. If FTO decides to stay in Belgium, they are forced to reduce their largest pool of costs -namely fuel consumption (cfr. supra)- in order to keep up with the prices of the competition. This should be accompanied by a very strong focus on customer service. Increasing FTO's fuel efficiency in this situation would be simply seen as a matter of remaining competitive rather than differentiating with a green image.

CONCLUSION

The protection of the environment is generally not part of the main drivers to buy and use Dynafleet.

4. *Dynafleet as a service to the customer*

Dynafleet is a prime example of the growing servitization of the economy (cfr. supra). Although the first Volvo truck was built in 1928, it took Volvo Trucks until the 1990's to develop Dynafleet, a clear-cut fleet management service tool. An important reason explaining this delay is that it took track-and-trace systems and GPS technologies until the end of the 20th century to make their first introduction in the business world. These technological developments are essential for any fleet management system. As previously mentioned, innovations are necessary to create certain services. This is also the case for Dynafleet.

Regarding the definition of services provided by Gemmel, Van Dierendonk and Van Looy (2003) (cfr. supra), a service should be intangible and must imply interaction between a service provider and the consumer. Although Volvo Trucks clearly positions Dynafleet as a service to the customer, this tool does not comply with the interactive condition of this definition. Namely, the software application is sold independently to the customer, without any further interaction with the seller has to take place. The client has thus self-control over the use and the corresponding benefits of this tool (cfr. supra).

Dynafleet can also be seen as an enabler of intangible service provision. For example, managers can confront drivers with possible eccentric driving behaviour and can help them to improve this. Therefore, certain professional people can be hired to teach chauffeurs the secrets of eco-driving. This suggested training is a clear-cut service example. In addition, the mobile app can be valuable to a manager in the form of having security and the ability to consult all data about the fleet anytime and anywhere due to its mobility. Dispatchers are also able to manage their fleet more efficiently. In addition, part of the administration can be performed automatically, resulting in huge time- and effort savings. From these perspectives, a more suitable definition of services, established by Gagnon and Quinn (1986), can be offered: "*Services are actually all those economic activities in which the primary output is neither a product nor a construction*".

But why did Volvo Trucks develop Dynafleet? "*We want to earn more from our customers than only by selling trucks. Namely, we want to create a constant source of income that fills the gap between consecutive truck sales. Therefore we offer valuable services such as Dynafleet,*" declared Emry Tack of Volvo Trucks Belgium. Every time a non-Dynafleet user purchases a Volvo truck, they get the option to buy Dynafleet as well. If that firm

decides to acquire Dynafleet, a monthly fee per truck has to be paid in order to get access to its functionalities (cfr. supra).

In order to provide a financial incentive to buy Dynafleet, this program satisfies those customer needs that are seen as very actual. These days, all transport firms are intensively occupied with managing and reducing the so-called *life-cycle costs* of their fleet (cfr. supra). As Dynafleet tackles the largest source of these costs, namely fuel consumption, it is clear that this can offer a valuable service to those firms wrestling with this issue. Dynafleet can provide them the opportunity to make their operations as efficient as possible.

In addition to the fuel efficiency scores Dynafleet offers, face-to-face pieces of advice can be supplied to each individual trucking firm in order to raise the fleet's and drivers' efficiency. These are based on each one's specific situation. This is realised thanks to the Fuel Advice service, considered as an additional fifth module of the Dynafleet package (cfr. supra). The degree of customization goes thus very far. So far that personal pieces of advice for each chauffeur's driving behaviour are rendered. Therefore, the valuable personal information Fuel Advice is able to offer can possibly reinforce the buyer-seller relationship.

Additionally, Dynafleet is not only able to provide interesting information to the customer but also to Volvo Trucks. The latter can use Dynafleet as an important tool to investigate the reason behind extensive fuel consumption of trucks. According to Emry Tack, this was in the past mostly seen as a result of a technical malfunction. As a result, every component of the truck was inspected searching for a defect. This is a time-consuming assignment. Though, using measuring systems such as Dynafleet, the driver behaviour aspect can now also be examined. If here an abnormality takes place, Volvo Trucks can investigate whether or not this human interference is the main reason for extensive fuel consumption. As a consequence, the complete technical state of the truck has no longer to be inspected which results in important time and effort savings for Volvo Trucks. Moreover, the emphasis can then lay on the true cause of fuel inefficiency, which is on its turn beneficial for the client. If technical malfunctions do occur, Volvo Trucks then uses this information to further improve the quality of its trucks. It can thus clearly be confirmed that Dynafleet contributes to the concept of *value fusion* (cfr. supra). Though, it is not considered a *benevolent mobile application* (cfr. supra).

Consequently, according to the service profit chain (cfr. supra), services such as Dynafleet that target the customers' individual needs will contribute to their satisfaction.

These services will make clients more loyal, which is these days the goal of many companies. Bert Leenaerts of Volvo Trucks stated during a conversation that, "*when a trucking firm opts for changing its fleet management system, these people are the first ones that will complain*". He declares this while pointing to the dispatchers currently working with Dynafleet on the other side of the room. When changing from service provider, employees consequently have to learn to work with another program they are not familiar with. People are generally speaking change averse. Change can induce negative feelings and irritation in the workplace. These are feelings managers rather want to avoid. Therefore, this can negatively influence the management's decision regarding the willingness to change.

On the other hand, Emry Tack also provided a clear example of the contribution of services to customer retention. "*Services are important tools to ensure customer loyalty. For example, clients having a maintenance contract at Volvo Trucks will choose in 80% of the cases for a Volvo truck when they need to replace their old fleet by new trucks*". This also accounts for Dynafleet, though an unambiguous percentage is unable to be provided.

Despite this emphasis on services, Volvo Trucks and Scania declare that the main competition between truck manufacturers is still taking place based on the vehicles they sell. The increasing importance of fleet management systems recently accompanied by their mobile counterparts can only offer an extra competitive advantage to these produced goods.

CONCLUSION

The main reasons for Volvo Trucks to develop Dynafleet and its mobile application are the increased attention trucking firms give to the so-called life-cycle costs, the elevated use of GPS and ICT technologies in fleet management accompanied by the increased customer loyalty and the constant flow of revenues Dynafleet is able to generate.

Customer loyalty is in the case of Dynafleet certainly realized. This is mainly done by satisfying the individual needs of the customers and due to their resistance to change. Price advantages and intensive direct communication are here rather neglected. The latter is mainly the task of Fuel Advice. Dynafleet is also not considered a benevolent mobile application. Nonetheless, it realises value fusion between the customer and Volvo Trucks.

Finally, it is clear that from a differentiation point of view, fleet management systems such as Dynafleet play a less significant role.

5. *Value of the Dynafleet mobile application*

As already mentioned, Dynafleet consists of a desktop portal and a mobile application. Although it is declared by Emry Tack that the mobile application only counts for 10% of the complete Dynafleet offering, this app holds some unique features. This section explains specifically why the mobile application is of such value to Volvo Trucks as well as to the client.

5.1 User-friendliness

"*The greatest value of the mobile application is the fact that it makes a black box of all technical data and only prompts conclusions and results to the user. Therefore, a quick look at the situation can be offered in a user-friendly way to whoever needs it, ranging from fleet managers to the truck drivers*", declares Tack. And user-friendly it is indeed. People who have less or no initial experience with fleet management can easily find the cause of certain issues -without going through loads of data material- thanks to this mobile app. With just one finger touch, the user can scroll through different areas of information within the app. On a tablet, these figures are even displayed on a single screen. Additionally, clear colour codes - green, yellow and red - provide a quick overview of where the major problems are located and what is done correctly.

Nonetheless, these colour codes are not implemented in FleetBoard and the Scania Fleet Management app, mentioned by Volvo Trucks themselves as their closest competitors regarding mobile fleet applications (cfr. supra). Moreover, these apps have a rather greyish and unattractive looking interface. In addition, FleetBoard presents all information in rather long and unpleasant looking lists. Based on the layout and design of the app, Dynafleet definitely shoots this one out of the park. Particularly when compared with the two other applications.

Furthermore, according to Volvo Trucks and De Rese, it is especially the managers and truck drivers that use the mobile app the most. Both generally tend to neglect the underlying data and are only interested in the outcomes. Dispatchers and administration on the other hand rather prefer the extended desktop version because they need all the possible data to perform their job correctly. As a consequence, the complete Dynafleet package, containing the portal as well as the mobile application, is valuable for everyone within the client's transport firm (cfr. supra).

According to Johan Coopman of De Rese, the employees -and especially the truck drivers- are eager to use the Dynafleet mobile app because it is good-looking and extremely user-friendly. They can consequently access the essential information they need in a very fast way at the moment they want. For example, they do not need to wait until they arrive back at the company or until their next performance review in order to get feedback on their driving behaviour. They can consult their fuel efficiency score on every moment they desire. Coopman also mentions that this certainly impacts the efficiency of their driving behaviour and consequently their overall fuel consumption. This is very similar to the findings and statements of Lee and Park (2008) regarding their *technology satisfaction model*. The perceived ease of use of the Dynafleet mobile app is thus ultimately generating a better market performance.

Finally, because it is an app, it can be installed on any mobile device running the Android or iOS operating system. Users can consequently take the app wherever they want. Therefore, managers for example do not need to make several calls to their dispatchers or need to access a computer. They can make critical decisions immediately and efficiently, without losing important time and based on the data they have literally in their own hands. Truck drivers on the other hand can for example consult their fuel efficiency score when taking a break in a wayside restaurant.

5.2 Facilitation of continuous monitoring, control and improvement

Because managers and especially truck drivers have otherwise no immediate access to important figures such as fuel efficiency scores and fuel efficiency parameters, this mobile application provides them the opportunity to continuously monitor and proactively adjust their driving behaviour. Of course, each user decides on how he/she interprets 'continuously'. Though, the literature shows that these continuous improvements are extremely important in the way business is conducted nowadays and can have a significant impact on costs (cfr. supra). The latter is also researched in practice in a previous section of this thesis.

During the interview, Tack provided a graph that clarifies the importance of continuous monitoring and improvements. The same chart is provided below. He declared that truck drivers generally reduce their fuel consumption level significantly just after receiving training, advice or new tools. Nonetheless, after some time, a phenomenon he identifies as 'unwanted behaviour' takes place in which the chauffeur gradually forgets or neglects what he learned. Consequently his/her fuel consumption level elevates. According to

him, the Dynafleet mobile application is able to avoid this negative phenomenon and moreover, can reduce the drivers' fuel consumption level even further. Consequently, it can be stated that the mobile application significantly contributes to the practical implementation of the concept 'continuous improvement'.

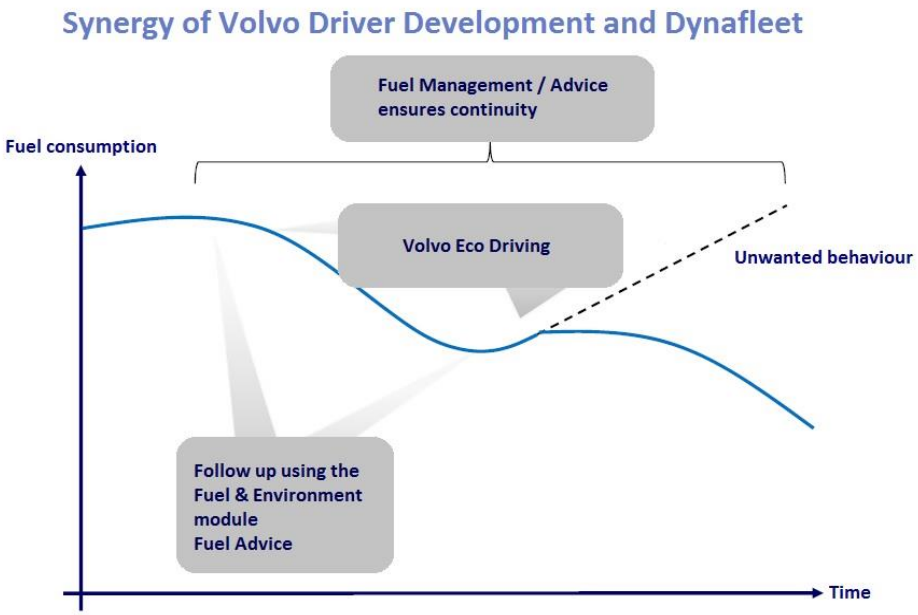


Figure 14: Synergy of Volvo Driver Development and Dynafleet (source: interview Volvo Trucks)

Furthermore, Johan Coopman of De Rese declares that it is mainly the truck drivers who proactively change their driving behaviour and not the management that stimulates them to do it. A clear bottom-up approach is here noticeable. In general, De Rese utilizes continuous improvements together with investments in better trucks to fight excessive fuel consumption.

In general, both authorities, here the fleet manager and the truck drivers, can reduce the overall fuel consumption of the fleet. Three factors can induce this effect. First, no one wants to be at the bottom list. Although other drivers cannot see the complete ranking, knowing one is near the bottom of the ranking will motivate him/her to make a greater fuel saving effort. Second, the management can also point out to the individual he/she is in a problematic situation and provide him/her with the necessary training. This enables the manager to coach the individual before his/her behaviour is starting to be very problematic. This proactive attitude can possibly avoid later unnecessary costs. Because the mobile app enables the user to access information from the past, the former can verify whether the

parameters are starting to change in a positive way. Third, drivers who are near the top of the list notice their efforts are paying off. This is essential in a society striving for feedback and recognition. The latter can be achieved when the management for example decides to establish a performance-based (monetary) reward system, based on a trucker's ranking (cfr. supra).

5.3 Employee involvement

Johan Coopman remarks that "*My truck drivers love this mobile app. It is new and it looks good. They are using it all the time. Given that we earlier made clear that additional fuel savings significantly impact the costs of the firm, they are prepared to contribute to this matter. They feel involved, they feel like they can make here a difference to help the company being much more profitable. In the end, this is also beneficial for them. It even goes so far that drivers who are currently not having a smartphone and consequently cannot use the app, come to me and ask me how their fuel efficiency score is and what they did good or wrong. As the driver trainer of De Rese, this is very satisfying to witness*".

This is a prime example of how employee involvement contributes to a more efficient way of working and ultimately leads to a higher profitability of the firm. According to Noe, Hollenbeck, Gerhart and Wright (2012) "*employees who are engaged in their work and committed to the company they work for give companies a competitive advantage including higher productivity, better customer service, and lower turnover*". These are important matters that can also be identified on the left side of the *service profit chain* (cfr. supra). Although not expected at first, this mobile application impacts thus both sides of this model.

Another advantage of this increased employee involvement, as cited by Johan Coopman and Volvo Trucks, is the fact that providing these truck drivers continuous access to their personal statistics facilitates the way performance interviews take place. Those are no longer a sudden confrontation every number of weeks or months, with charts and figures the truck driver does not know the origin of. According to Johan Coopman, his employees are more understanding and accept criticism more easily because they can consult those numbers themselves whenever and wherever they want. He declares that "*performance interviews are becoming continuous events, rather than big important meetings after each period of time*".

Nonetheless, he adds that this transition in mentality initially asked a lot of efforts from his employees. "*Suddenly stimulate someone who is driving his truck for already 30 years to change his driving behaviour was not always an easy task. Nevertheless, when they*

realized what a slight change could mean for the company, it was easier for them to make the transition and to implement what people like me are trying to teach them. Of course, there are people who are stubborn and refuse to adapt, though these are rather exceptions. We are talking about just a few persons on our fleet of 100 trucks. These are mostly of the older generation and sometimes do not even have a smartphone. In that case, we rather accept their loyalty and knowledge within the firm and other sacrifices they do for the company instead of brutally forcing them to change". The negative implications of mobile technology are discussed in a further section of this thesis.

5.4 Providing persuasiveness in sales

The mobile app's user-friendliness also contributes to a completely other subject than operational performance, namely sales. It indeed forms an important weapon for Volvo Trucks to convince the client of its main functions and capabilities. Tack states that a manager has generally speaking no knowledge how to work profoundly with a fleet management program. Operating the latter is often solely the task of a dispatcher or the administration. Though, the manager is in charge of taking the final distance and consequently decides whether or not he/she purchases the service. Nonetheless, the reason the latter chooses for Volvo Truck's Dynafleet is especially based on the advice he/she receives from his/her dispatcher and the relative price difference compared with other similar fleet management programs. This amount of information is limited, especially if the order winner is in this case the system's capabilities and the possible ROI a client is able to realize. Putting the Dynafleet mobile app in the hands of this manager will immediately clarify some things. Without having the necessary background knowledge about the program, he/she gets an instantaneous idea of what this service is capable of. The latter can be translated in a much better view of the possible ROI and consequently elevates the chances the manager buys this fleet program. Tack adds: "*I am sure that, if we would not have this mobile application, only 50% of all our current users would be willing to purchase Dynafleet*". These are significant numbers that cannot be ignored.

CONCLUSION

The mobile application is an indispensable asset within the Dynafleet package. Its user-friendliness and portability increase its chances of adoption and make it an ideal tool to continuously monitor one's fleet. Additionally, it is an essential asset in performance reviews and the realisation of sales contracts. Moreover, it can be utilized to give employees the feeling they have an important influence on the profitability of a company and to ensure continuous improvements.

6. *Conditions for firms to use Dynafleet*

As already mentioned, the main incentive for companies to use Dynafleet is to realize cost reductions. If a firm thinks that with the help of Dynafleet it is able to realize this goal and considers itself ready to make the technical and emotional transition, it can choose to purchase this fleet management system. On the other hand, a company is generally also interested in the investment cost. When an organisation is of the opinion that Dynafleet can offer them significant benefits taking into account its price, the chances are real that one will buy this system.

For its part, FTO is not convinced Dynafleet can offer significant advantages to their company. From this point of view, they have decided to not acquire the program. Consequently, they have opted for an alternative less sophisticated fleet management system, namely Transics. It is thus clear that FTO falls in the upper-left section of the *fit-viability model* (cfr. supra).

CONCLUSION

It seems that all five parameters of the *fit-viability model* (cfr. supra) are generally important for a firm's investment decision regarding Dynafleet or any other fleet management system. Though, the IT infrastructure component plays most of the time a less significant role.

7. *Implications of mobile technology regarding the Dynafleet mobile application*

This section refers regularly back to the by Jarvenpaa and Lang (2005) formulated paradoxes and their related user behaviour (cfr. supra). More specifically, it clarifies those paradoxes which are particularly applicable for the Dynafleet fleet management application.

First, Bergiers states that all of FTO's truck drivers possess and continuously use a mobile phone. These people are generally a long time away from home and a mobile phone is one of the devices that enables them to remain in contact with the home front. From this perspective, the previously mentioned *Empowerment/Enslavement* and *Independence/Dependence* paradoxes certainly play an important role.

In addition, messages from the dispatching are exchanged by phone or displayed on a screen within the truck's cabin. Though, it is prohibited by law to make phone calls behind the wheel without utilizing a hands-free car kit. The latter consequently has to be purchased and installed in the cabin. Besides this, the mobile device of a Dynafleet user must also possess a mobile internet connection in order to run the Dynafleet mobile app. It is necessary to load all data from Dynafleet Online to the mobile app. When going even further, each truck has to contain a smart computer and data emitter in order to generate the information and transfer it from the truck to Dynafleet Online. Bergiers of FTO also states that the use of Dynafleet probably implies hiring an extra person to monitor and adjust the driving behaviour of the truck drivers. Furthermore, Johan Coopman indicates that Volvo Trucks does not provide any training or formation when selling Dynafleet. Even for the mobile phone application -although developed as user-friendly as possible- there is a clearly defined need regarding this issue. Coopman indeed declares that it initially took him a lot of time to discover the way certain aspects of Dynafleet are working. He gives the example of the fuel efficiency score and the fact that he could not understand why drivers with a higher fuel consumption were sometimes having a very good fuel efficiency score (cfr. supra). Therefore, he asked Volvo Trucks if it would be possible to provide a clarification to its truck drivers concerning the functions of the app and where the presented data is originating from. This could also positively influence the adoption of the app within the firm. On the part of Volvo Trucks, this requires the creation of a new service to the customer, which demands time and effort. These requirements are thus prime and clear examples of the *Fulfils/Creates Needs* paradox.

Though, Bergiers also emphasizes that the possession of mobile phones is not typically equal to the possession of smartphones. He referred to one of its recently retired employees who was present at the moment the interview took place. The former truck driver owned a straightforward older type of mobile phone. Nonetheless, his grandchildren bought him a new smartphone as a present. Though, he could not handle this major transition and decided to go back to his old phone. When showing him the Dynafleet mobile application, how user-friendly and easy it may be possibly designed, this was clearly still a large obstacle for that particular person. It can be concluded that the *Competence/Incompetence* paradox and the inherent feelings of stress, anxiety and avoidance definitely play a role in this example.

Another illustration of the latter paradox is the fact that Dynafleet's mobile application possibly makes certain complex matters look too abstract. Bergiers indicates for example the term 'Vehicle Utilization' that can be found on the 'Dashboard' tab within the Dynafleet mobile app (cfr. supra). He questions whether this component is referring to the percentage of trucks currently on the road and whether it includes the trucks which are having a break or loading or dropping off their cargo. The answer is unclear, even when questioning an experienced person within Volvo Trucks about this matter. Further information regarding this particular subject needed to be asked to the development team in Sweden, who created the Dynafleet mobile application. This issue consequently also contributes to the *Illusion/Disillusion* paradox.

Next, referring to the *Planning/Improvisation* paradox, Bergiers recognizes the value of Dynafleet in dynamic routing. The main decisions regarding this subject are taken by the dispatcher of the firm. Though, this person is generally using Dynafleet Online for this matter. He/she decides what needs to happen when certain unforeseen situations take place. Alternative routes have to be suggested and delays need to be estimated. From this perspective, Dynafleet Online is an important planning and improvisation tool. Though, its mobile counterpart does not play a significant role in this story. Chauffeurs will employ their GPS when certain accidents take place instead of using the app. The former device generally shows the major tailbacks, something which is not displayed on the Dynafleet app. It can thus be concluded that the Dynafleet mobile application specifically has an insignificant impact on planning or improvisation.

As mentioned before, the use of mobile devices when driving elevates significantly the chances of having an accident. When consulting the Dynafleet app when driving, this will negatively affect the cognitive, physical and visual driver's attention towards the road and the traffic (cfr. supra). Nonetheless, as the Dynafleet mobile app does not emit any sound the truck driver will still be able to remain focused on an auditory basis. Whether or not these disadvantages match the positive capability of being reachable wherever a driver is located is most of the time dependent on each truck driver's specific behaviour. Nonetheless, it can be concluded that this is a striking example of the *Engaging/Disengaging* paradox and that the latter definitely impacts Dynafleet's mobile application.

During the interview with Volvo Trucks, Emry Tack points out that, compared with the past, truck drivers generally tend to stay in their cabin when taking a break. According to him, one of the reasons to this phenomenon is the use of mobile technology and the fact that all the necessary equipment and necessities are installed in the truck, ranging from smartphones and tablets to televisions and even small microwaves. Because they generally have all the requisites to consult the Dynafleet mobile application within their truck, possible public hindrance is reduced. As mentioned before, the mobile app emits no sound, which makes information transfers more confidential and less bothersome for bystanders. Thus, from this perspective, it is clear that the Dynafleet mobile app emphasizes the private effect and does not fall victim to the *Private/Public* paradox.

CONCLUSION

It seems that 6 out of 8 mobile technology paradoxes take place when using the Dynafleet application. The findings regarding the corresponding emotions and feelings are completely parallel with the conclusions of Chae and Yeum (2005) (cfr. supra). Especially the paradoxes of *Competence/Incompetence* and *Empowerment/Enslavement* induce feelings of anxiety, stress and avoiding behaviour towards the use of the Dynafleet mobile application. Also, according to the conclusions of Chae and Yeum (2005), the *Private/Public* paradox is rather seen as positive to the Dynafleet mobile user. Finally, the *Planning/Improvisation* paradox is considered inexistent.

CHAPTER 6:
GENERAL CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

1. *Research results and conclusion*

Based on the conducted research, it clearly appears that smartphones and tablets have completely changed the business-to-business landscape and will certainly continue to do this in the near future. More specifically for the trucking sector, the past five years brought along the adoption of mobile fleet management systems running on these devices. One of the most prominent ones in Europe is considered Dynafleet. Developed by Volvo Trucks, this mobile application offers fleet information and fuel efficiency scores of truck drivers to the corresponding people within a trucking company. Interviews with Volvo Trucks, Scania and two transportations firms, whether or not user of Dynafleet, were the main drivers behind the conducted research.

Dynafleet is a very elaborated user-friendly mobile application, whose published data are initially generated by Dynafleet Online, its more sophisticated desktop counterpart. It was first launched on iOS in 2012 and later also on Android. The way information is presented within the mobile app depends on the fact whether one is logged in as a fleet user or as a truck driver. The mobile app consists among others of figures regarding the fleet, drivers and trucks accompanied by a performance ranking. Hereby, search costs and ranking effects play a significant role on smartphones and less on tablets. Though, both devices are expected to gain on popularity within the trucking business in the near future.

The performance ranking within the mobile app enables firms to raise their internal competition level. Whether this effect is helpful or unproductive depends mainly on the way companies implement and stimulate this phenomenon and how it is accepted and experienced by their truck drivers.

Though, it seems that the way Dynafleet builds up the drivers' fuel efficiency scores generally incites them to continuously improve their driving behaviour and helps them to shy away from unwanted negligent behaviour. In addition, more specific training can be provided by the management of the company. This can ultimately be translated into a lower fuel consumption level and reduced fuel costs for the organisation in question. This is thus also good news from an environmental point of view, though this aspect is generally not the

primary goal of a trucking firm. Volvo Trucks declares that a correct implementation of Dynafleet allows a firm to save up to 7% of their current fuel level. This can bring a trucking firm of 17 vehicles a yearly net profit of about €35.423. Generally speaking, Dynafleet is already considered a profitable investment when a company is able to realize a fuel consumption reduction of barely 0,5 to 0,6 litres per 100km.

The Dynafleet mobile app is also able to enhance employee involvement, is an important convincing tool in sales and helps drivers to avoid violating the different driving time regulations. Dynamic routing and improved communications are rather under-represented features of the mobile app, though captured by Dynafleet Online. Enhanced customer retention is realized by both the mobile app and Dynafleet Online.

Despite their advantages, it seems that Dynafleet and the mobile devices on which it is running can be a source of distraction for the chauffeurs while driving or can create additional needs. Furthermore, certain aspects of the application can sometimes be considered too abstract by the user. People experiencing feelings of incompetence or enslavement when using the Dynafleet mobile app rather shy away from it due to invoked sentiments of stress and anxiety.

It also seems that all five parameters of the fit-viability model have to be satisfied before a firm decides to purchase a sophisticated (mobile) fleet management system such as Dynafleet.

Finally, despite the fact that mobile devices such as smartphones and tablets are currently widely adopted by the majority of the employees within a trucking firm, the utilization of promising mobile fleet management applications like Dynafleet is still in its infancy. Though, it is expected that these valuable apps will increasingly grow on importance in the near future.

2. *Limitations and further research*

The possibilities of further researching certain topics are explicitly mentioned all along this thesis when considered applicable.

The performed research is done by means of a case study of Dynafleet. Therefore, a broad overview of the different capabilities and characteristics of all the mobile fleet management applications on the market is not provided. This can provide a further research opportunity. In addition, other mobile applications possibly offer other functionalities or present them in a completely different way so that certain previously mentioned conclusions are no longer valid.

When performing the sensitivity analysis to examine the possible net profit Dynafleet is able to deliver to a company under different circumstances, a fuel savings level of 2% is presumed. It could be valuable to perform this analysis with different data and discuss the corresponding results. Also the case in which multiple fleet parameters are changed simultaneously can be a valuable addition to this work.

Finally, because of the realization of in-depth interviews with a limited amount of key sources, the point of view of other relevant companies or users could not be captured. These could indeed offer new point of views or reveal unexplored focus areas that could be further investigated.

REFERENCES

Books

Bell, S. (2005). *Lean enterprise systems: using IT for continuous improvement* (Vol. 33). John Wiley & Sons.

Buttle, F. (2009). *Customer relationship management: concepts and technologies*. Routledge.

Cummings, D., & Krajci, I. (2014). *Android on x86: An Introduction to Optimizing for Intel® Architecture* (p. 380). Apress.

Dahlvig, A. (2011). *The IKEA edge: Building global growth and social good at the world's most iconic home store* (p. 208). New York: McGraw-Hill Education - Europe.

Davis, A. (2014). A brief history of Customer Relationships. In *Human to human selling: How to sell real and lasting value in an increasingly digital and fast-paced world* (p. 104). New York: Morgan James Publishing.

De Pelsmacker, P., & Van Kenhove, P. (2010). Gegevensverzameling. *Marktonderzoek: Methoden en toepassingen* (3rd ed., p. 568). Amsterdam: Pearson Education.

Gemmel, P., Van Dierendonk, R., & Van Looy, B. (2003). *Services Management: An Integrated Approach* (2nd ed., p. 529). Pearson.

Hillier, F., & Lieberman, G. (2009). Assumptions of linear programming. In *Introduction to operations research* (9th ed., p. 1088). San Francisco: McGraw-Hill Education - Europe.

Hutt, M., & Speh, T. (1998). *Business Marketing Management: A Strategic View of Industrial and Organizational Markets* (p. 777). Dryden Press.

Levin, J. (2012). *Mac OS X and iOS Internals: To the Apple's Core* (p. 864). Wrox.

Matsuo, M. (2005). Why is internal competition important? In *The Role of Internal Competition in Knowledge Creation: An Empirical Study in Japanese Firms* (Vol. 11, p. 208). Peter Lang.

Noe, R. A., Hollenbeck, J. R., Gerhart, B. A., & Wright, P. M. (2012). Human Resource Management: Gaining a Competitive Advantage. In *Human resource management: Gaining a competitive advantage.* (8th ed., p. 830). Irwin McGraw-Hill.

Noe, R. A., Hollenbeck, J. R., Gerhart, B. A., & Wright, P. M. (2012). Performance management. In *Human resource management: Gaining a competitive advantage.* (8th ed., p. 830). Irwin McGraw-Hill.

Noe, R. A., Hollenbeck, J. R., Gerhart, B. A., & Wright, P. M. (2012). Recognizing employee contribution with pay. In *Human resource management: Gaining a competitive advantage.* (8th ed., p. 830). Irwin McGraw-Hill

Thompson, A. A., Strickland, A. J., Peteraf, M. A., Janes, A., Gamble, J. E., & Sutton, C. (2013). Analysing an organisation's external environment. *Crafting and executing strategy: The quest for competitive advantage: Concepts and cases: European Edition* (1st ed., p. 648). Boston: McGraw-Hill/Irwin.

Zeimpekis V., Tarantilis, C. D., Giaglis, G. M., & Minis, I. (2007). *Dynamic fleet management*. Springer Science+ Business Media, LLC.

Educational material

Chalmet L. (2012). *Productiebeleid.*

De Rijcke J., adjusted by Van den Poel D. (2012). *Inleiding tot Marketing*.

De Witte B., Sercu B., Van Langenhove H. & Walgraeve C. (2014). *Milieutechnologie* (p. 93).

Raa B. (2013). *Advanced Production Management.*

Interviews

Bergiers T. (2014, November 19). Logistics Coordinator at FTO nv in Lochristi, Belgium. *Dynafleet review by a current non-user*. Personal interview.

Coopman J. (2014, December 11). Fleet and Technics Advisor/Driver Trainer at De Rese in Bruges, Belgium. *Dynafleet review by a current user*. Personal interview.

Desmet D. (2014, November 14). Product Manager regarding Fleet Management Services Benelux at Scania Belgium. *Scania Fleet Management App*. Personal interview.

Tack, E. (2014, October 29). Key Account Manager regarding Transport Solutions at Volvo Trucks Belgium. *Volvo Trucks - Dynafleet.* Personal interview.

Legislation

European Regulation (EC) 561/2006

KB van 27/04/2014

Magazines

Aamoth, D. (2014, August 18). First Smartphone Turns 20: Fun facts about Simon. *Time*.

Urban G. L., & Sultan F. (2014, December 4). The Case for 'Benevolent' Mobile Apps. *MITSloan Management Review*.

Manuals

US War Department. (1945). *Technical Manual TM11-242 Radio Set SCR-300-A*.

Newspapers

Arthur, C. (2012, January 24). The history of smartphones: Timeline. *The Guardian*.

Austen, I. (2014, January 10). BlackBerry Chief Drops 'Interim' Label. *The New York Times*.

Little, K. (2014, September 19). IPhone 6 wait smashes record in Manhattan. *CNBC*. Retrieved September 20, 2014, from http://www.cnbc.com/id/102017018#

Vara, V. (2013, August 12). How BlackBerry Fell. *The New Yorker*. Retrieved September 23, 2014, from http://www.newyorker.com/tech/elements/how-blackberry-fell

Presentations

Cook, T. (2014, June 2). *Apple - WWDC 2014* [Video file]. Retrieved from http://www.youtube.com/watch?v=w87fOAG8fjk

Jobs, S. (2010, March 5). *Steve Jobs introduces Original iPad - Apple Special Event (2010)* [Video file]. Retrieved from http://www.youtube.com/watch?v=_KN-5zmvjAo

Jobs, S. (2010, June 1). *Steve Jobs in 2010, at D8* [Video file]. Retrieved from https://www.youtube.com/watch?v=KaQLtoBBDVQ

Myerson T. (2014, September 30). *Windows 10: Enterprise Features & Core Experience for Businesses*. [Video file]. Retrieved from https://www.youtube.com/watch?v=NfveyXCsiA8

Reports

American Transportation Research Institute. (2013). An Analysis of the Operational Costs of Trucking: 2013 Update.

EEA. (2014). Air quality in Europe – 2014 report.

Steunpunt Milieu en Gezondheid & VITO. (n.d.). Fact sheet: t,t'-muconzuur.

Scientific articles

Adamson, I., & Shine, J. (2003). Extending the new technology acceptance model to measure the end user information systems satisfaction in a mandatory environment: A bank's treasury. *Technology Analysis and strategic management*, *15*(4), 441-455.

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological bulletin*, *84*(5), 888.

Benoit, D. F., & Van den Poel, D. (2012). Improving customer retention in financial services using kinship network information. *Expert Systems with Applications*, *39*(13), 11435-11442.

Bessant, J., Caffyn, S., Gilbert, J., Harding, R., & Webb, S. (1994). Rediscovering continuous improvement. *Technovation*, *14*(1), 17-29.

Bhuiyan, N., & Baghel, A. (2005). An overview of continuous improvement: from the past to the present. *Management Decision*, *43*(5), 761-771.

Bi, Q., Zysman, G., & Menkes, H. (2001). Wireless mobile communications at the start of the 21st century. *Communications Magazine, IEEE*, *39*(1), 110-116.

Bowden, S., Dorr, A., Thorpe, T., & Anumba, C. (2006). Mobile ICT support for construction process improvement. *Automation in Construction*, *15*(5), 664-676.

Chae, M., & Yeum, D. (2010). The Impact of Mobile Technology Paradox Perception and Personal Risk-Taking Behaviors on Mobile Technology Adoption. *Management Science and Financial Engineering*, *16*(2), 115-138.

Cheung, B. K. S., Choy, K. L., Li, C. L., Shi, W., & Tang, J. (2008). Dynamic routing model and solution methods for fleet management with mobile technologies. *International Journal of Production Economics*, *113*(2), 694-705.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, *35*(8), 982-1003.

Ford, J., Ford, L. W., & D'Amelio, A. 2008. Resistance to change: The rest of the story. *Academy of Management Review*, 33: 362-377.

Gagnon, C. E. and Quinn, J. B. (1986). Will services follow manufacturing into decline? *Harvard Business Review*, 95-103.

Ghose, A., Goldfarb, A., & Han, S. P. (2012). How is the mobile Internet different? Search costs and local activities. *Information Systems Research*, *24*(3), 613-631.

Giannopoulos, G. A. (2004). The application of information and communication technologies in transport. *European Journal of Operational Research*, *152*(2), 302-320.

Gounaris, S. P. (2005). Trust and commitment influences on customer retention: insights from business-to-business services. *Journal of Business research*, *58*(2), 126-140.

Grover, V., & Malhotra, M. K. (1997). Business process reengineering: a tutorial on the concept, evolution, method, technology and application. *Journal of operations management*, *15*(3), 193-213.

Hammer, M., & Mangurian, G. E. (1987). The changing value of communication technology. *Sloan Management Review*, 28(2), 65−71.

Heskett et al. (1997); Heskett, J. L., Jones, T. O., Loveman, G. W., Sasser, W. E. and Schlesinger, L. (1994) 'Putting the service profit chain to work', *Harvard Business Review*, 164-74

Hon, A. H., Bloom, M., & Crant, J. M. (2014). Overcoming resistance to change and enhancing creative performance. *Journal of Management*, *40*(3), 919-920

Jarvenpaa, S. L., & Lang, K. R. (2005). Managing the paradoxes of mobile technology. *Information Systems Management*, *22*(4), 7-23.

Jermier, J. M., Knights, D., & Nord, W. R. (Eds.). 1994. *Resistance and power in organizations*. London: Routledge.

Jones, G. R. 2001. *Organizational theory: Text and cases*. New York: Addison-Wesley.

Kossoff, L. (1993). 'Total quality or total chaos?'. *HR Magazine*. Vol. 38 No. 4, pp. 131-4.

Larivière, B., Joosten, H., Malthouse, E. C., Van Birgelen, M., Aksoy, P., Kunz, W. H., & Huang, M. H. (2013). Value fusion: the blending of consumer and firm value in the distinct context of mobile technologies and social media. *Journal of Service Management*, *24*(3), 268-293.

Lee, T. M., & Park, C. (2008). Mobile technology usage and B2B market performance under mandatory adoption. *Industrial Marketing Management*,*37*(7), 833-840.

Leung, K., & Antypas, J. (2001). Improving returns on m-commerce investments. *Journal of Business Strategy*, 22(5), 12−13.

Liang, T. P., & Wei, C. P. (2004). Introduction to the special issue: mobile commerce applications. *International Journal of Electronic Commerce*, *8*(3), 7-17.

Liang, T. P., Huang, C. W., Yeh, Y. H., & Lin, B. (2007). Adoption of mobile technology in business: a fit-viability model. *Industrial management & data systems*, *107*(8), 1154-1169.

Oreg, S. (2003). Resistance to change: Developing an individual differences measure. Journal of Apllied Psychology, 88: 680-693.

Porter, M. E. (2008). The five competitive forces that shape strategy. *Harvard Business Review*, 86(1): 80-6.

Reinartz, W., Thomas, J. S., & Kumar. (2005). Balancing acquisition and retention resources to maximize customer profitability. *Journal of Marketing*, *69*(1), 63-79.

Sanders, N. R. (2007). The benefits of using e-business technology: the supplier perspective. *Journal of Business Logistics*, 28(2), 177−206.

Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business logistics*,*22*(1), 29-48.

Perego, A., Perotti, S., & Mangiaracina, R. (2011). ICT for logistics and freight transportation: a literature review and research agenda. *International Journal of Physical Distribution & Logistics Management*, *41*(5), 457-483.

Upchurch, R. S., DiPietro, R. B., Curtis, C., & Hahm, J. (2010). Research note: Organizational commitment in the restaurant industry. Journal of Foodservice Business Research, 13(2), 127-143.

Van den Poel, D., & Lariviere, B. (2004). Customer attrition analysis for financial services using proportional hazard models. European journal of operational research, 157(1), 196-217.

Varshney, U., Mallow, A., Jain, R., & Ahluwalia, P. (2002). Wireless in the enterprise: requirements and possible solutions. In J. R. Beer, R. C. Nickerson, & S. Veran (Eds.), *Proceedings of the Workshop on Wireless Strategy in the Enterprise: An International Research Perspective*. Berkley: University of California.

Varshney, U., & Vetter, R. (2002). Mobile commerce: framework, applications and networking support. *Mobile Networks and Applications*, 7(3), 185−198.

Varshney, U., Malloy, A., Ahluwalia, P., & Jain, R. (2004). Wireless in the enterprise: requirements, solutions and research directions. *International Journal of Mobile Communications, 2*(4), 354-367.

Websites

4GAmericas.org. (n.d.). Understanding 1G vs. 2G vs. 3G vs. 4G. Retrieved October 9, 2014, from http://www.4gamericas.org/index.cfm?fuseaction=page&sectionid=361

Ames, B. – IDC News Service (2007, May 7). Samsung launches Q1 Ultra ultramobile. Retrieved October 18, 2014, from http://www.computerworld.com/article/2544959/mobile-wireless/samsung-launches-q1-ultra-ultramobile.html

Apple. (2008, March 8). Apple Announces iPhone 2.0 Software Beta. Retrieved October 24, 2014, from https://www.apple.com/pr/library/2008/03/06Apple-Announces-iPhone-2-0-Software-Beta.html

Apple. (2010, March 5). Persinformatie van Apple - iPad verkrijgbaar in de Verenigde Staten vanaf 3 april. Retrieved October 10, 2014, from http://www.apple.com/benl/pr/library/2010/03/05iPad-Available-in-US-on-April-3.html

Apple. (2014). IPhone 6. Retrieved October 7, 2014, from http://store.apple.com/us/buy-iphone/iphone6

Apple. (2014). The world's most advanced mobile OS. In its most advanced form. Retrieved October 10, 2014, from https://www.apple.com/ios/what-is/

Apple. (2014, September 9). Apple Unveils Apple Watch-Apple's Most Personal Device Ever. Retrieved October 25, 2014, from http://www.apple.com/pr/library/2014/09/09Apple-Unveils-Apple-Watch-Apples-Most-Personal-Device-Ever.html

Apple. (2014, September 22). First Weekend iPhone Sales Top 10 Million, Set New Record. Retrieved October 11, 2014, from https://www.apple.com/pr/library/2014/09/22First-Weekend-iPhone-Sales-Top-10-Million-Set-New-Record.html

Apple. (2014, October 16). Apple - Press Info - Apple Pay Set to Transform Mobile Payments Starting October 20. Retrieved October 24, 2014, from http://www.apple.com/pr/library/2014/10/16Apple-Pay-Set-to-Transform-Mobile-Payments-Starting-October-20.html

Artman, J. (n.d.). Why is the iPhone so popular? Retrieved September 20, 2014, from http://smallbusiness.chron.com/iphone-popular-27294.html

Beal, V. (n.d.). WAP - Wireless Application Protocol. Retrieved September 23, 2014, from http://www.webopedia.com/TERM/W/WAP.html

BIVV. (2014, July 29). BIVV lanceert campagne tegen gsm'en achter het stuur. Retrieved December 9, 2014, from http://bivv.be/frontend/files/press_releases/bivv-lanceert-campagne-tegen-gsm'en-achter-het-stuur.pdf

BlackBerry. (2013, November 4). BlackBerry Executive Team. Retrieved October 2, 2014, from http://us.blackberry.com/company/newsroom/executive-team.html

BlackBerry. (2014, September 24). BlackBerry Passport. Retrieved September 25, 2014, from http://global.blackberry.com/en/smartphones/blackberry-passport/overview.html

Block, R. (2007, January 9). Live from Macworld 2007: Steve Jobs keynote. Retrieved October 1, 2014, from http://www.engadget.com/2007/01/09/live-from-macworld-2007-steve-jobs-keynote/

Bott, E. (2014, July 8). High-end ultramobile devices carve a bigger share of the PC market as Chromebooks struggle. Retrieved October 17, 2014, from http://www.zdnet.com/high-end-ultramobile-devices-carve-a-bigger-share-of-the-pc-market-as-chromebooks-struggle-7000031363/

Bucki, J. (n.d.). Definition of Mobile Device. Retrieved September 11, 2014, from http://operationstech.about.com/od/glossary/g/Definition-Of-Mobile-Device.htm

Bughin, J., Doogan, J., & Vetvik, O. J. (2010, April). A new way to measure word-of-mouth marketing. Retrieved December 1, 2014, from http://www.mckinsey.com/insights/marketing_sales/a_new_way_to_measure_word-of-mouth_marketing

BusinessDictionary.com. (n.d.). What is cell phone? Definition and meaning. Retrieved October 1, 2014, from http://www.businessdictionary.com/definition/cell-phone.html

Canalys. (2013, February 22). Mobile device market to reach 2.6 billion units by 2016. Retrieved October 8, 2014, from http://www.canalys.com/newsroom/mobile-device-market-reach-26-billion-units-2016

Cearley D. (2014, November 5). Top 10 Strategic Technology Trends for 2013. Retrieved September 24, 2014, from http://www.smama.ch/wp-content/uploads/2012/05/12_mOutlook_Top_10_Strategic_Technology_Trends_for_2013_Gartner_e.pdf

Chel, M. (2012, June 29). Wat is het verschil tussen Windows 8 en Windows RT? Retrieved October 25, 2014, from http://www.tabletsmagazine.nl/2012/06/wat-is-het-verschil-tussen-windows-8-en-windows-rt/

Domingo, J. (2014, February 20). SSD vs. HDD: What's the Difference? Retrieved October 20, 2014, from http://www.pcmag.com/article2/0,2817,2404258,00.asp

eMarketer.com. (2014, June 14). Worldwide smartphone usage to grow 25% in 2014. Retrieved September 20, 2014, from http://www.emarketer.com/Article/Worldwide-Smartphone-Usage-Grow-25-2014/1010920

Entner, R. (2011, June 23). International comparisons: The handset replacement cycle. Retrieved October 3, 2014, from http://mobilefuture.org/wp-content/uploads/2013/02/mobile-future.publications.handset-replacement-cycle.pdf

EPA. (n.d.). Ground Level Ozone. Retrieved November 27, 2014, from http://www.epa.gov/groundlevelozone/

European Commission. (2013, October). A recovery on the horizon? An annual report on European SMEs 2012/2013. Retrieved December 29, 2014, from http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/supporting-documents/2013/annual-report-smes-2013_en.pdf

Fitch Ratings. (2014, August 12). Samsung and Apple to Lose Global Smartphone Market Share. Retrieved October 7, 2014.

Flowers, M. (2004). World War II Marine Equipment-SCR-300 Field Radio. Retrieved September 12, 2014, from http://www.ww2gyrene.org/equipment_SCR_300.htm

Fried, I. (2010, September 9). Microsoft exec Elop named Nokia CEO. Retrieved October 2, 2014, from http://www.cnet.com/news/microsoft-exec-elop-named-nokia-ceo/

Gartner. (2008, June 6). Gartner Says Worldwide Smartphone Sales Grew 29 Percent in First Quarter of 2008. Retrieved October 2, 2014, from http://www.gartner.com/newsroom/id/688116

Gartner (2009, March 11). Gartner Says Worldwide Smartphone Sales Reached Its Lowest Growth Rate With 3.7 Per Cent Increase in Fourth Quarter of 2008. Retrieved October 2, 2014, from http://www.gartner.com/newsroom/id/910112

Gartner. (2010, February 23). Gartner Says Worldwide Mobile Phone Sales to End Users Grew 8 Per Cent in Fourth Quarter 2009; Market Remained Flat in 2009. Retrieved October 5, 2014, from http://www.gartner.com/newsroom/id/1306513

Gartner (2011, February 9). Gartner Says Worldwide Mobile Device Sales to End Users Reached 1.6 Billion Units in 2010; Smartphone Sales Grew 72 Percent in 2010. Retrieved October 2, 2014, from http://www.gartner.com/newsroom/id/1543014

Gartner. (2011, May 19). Gartner Says 428 Million Mobile Communication Devices Sold Worldwide in First Quarter 2011, a 19 Percent Increase Year-on-Year. Retrieved October 6, 2014, from http://www.gartner.com/newsroom/id/1689814

Gartner. (2011, August 11). Gartner Says Sales of Mobile Devices in Second Quarter of 2011 Grew 16.5 Percent Year-on-Year; Smartphone Sales Grew 74 Percent. Retrieved October 6, 2014, from http://www.gartner.com/newsroom/id/1764714

Gartner. (2011, November 15). Gartner Says Sales of Mobile Devices Grew 5.6 Percent in Third Quarter of 2011; Smartphone Sales Increased 42 Percent. Retrieved October 6, 2014 from http://www.gartner.com/newsroom/id/1848514

Gartner (2012, February 15). Gartner Says Worldwide Smartphone Sales Soared in Fourth Quarter of 2011 With 47 Percent Growth. Retrieved October 2, 2014, from http://www.gartner.com/newsroom/id/1924314

Gartner. (2013, June 24). Gartner Says Worldwide PC, Tablet and Mobile Phone Shipments to Grow 5.9 Percent in 2013 as Anytime-Anywhere-Computing Drives Buyer Behavior. Retrieved October 3, 2014, from http://www.gartner.com/newsroom/id/2525515

Gartner. (2014, January 7). Gartner Says Worldwide Traditional PC, Tablet, Ultramobile and Mobile Phone Shipments On Pace to Grow 7.6 Percent in 2014. Retrieved October 11, 2014, from http://www.gartner.com/newsroom/id/2645115

Gartner (2014, February 13). Gartner Says Annual Smartphone Sales Surpassed Sales of Feature Phones for the First Time in 2013. Retrieved October 2, 2014, from http://www.gartner.com/newsroom/id/2665715

Gartner (2014, July 7). Gartner Says Worldwide Traditional PC, Tablet, Ultramobile and Mobile Phone Shipments to Grow 4.2 Percent in 2014. Retrieved October 2, 2014, from http://www.gartner.com/newsroom/id/2791017

Golson, J. (2014, March 27). Selling its 500 millionth iPhone, Apple has time to create next big thing. Retrieved September 26, 2014, from http://www.techrepublic.com/article/selling-its-500-millionth-iphone-apple-has-time-to-create-next-big-thing/

Gralla, P. (2011, November 10). Microsoft released its first tablet 10 years ago. So why did Apple win with the iPad? Retrieved October 10, 2014, from http://www.computerworld.com/article/2471642/mobile-apps/microsoft-released-its-first-tablet-10-years-ago--so-why-did-apple-win-with-the-ipad-.html

Honan, M. (2014, January 9). Apple unveils iPhone. Retrieved September 23, 2014, from http://www.macworld.com/article/1054769/iphone.html

Hwang, D. (2013, July 29). Lines between tablets, notebooks and ultra-mobile PCs blur. Retrieved October 20, 2014, from http://searchenterprisedesktop.techtarget.com/news/2240202674/Lines-between-tablets-notebooks-and-ultra-mobile-PCs-blur

IDC. (2010, October 28). Apple Joins Top Five Mobile Phone Vendors as Worldwide Market Grows Nearly 15% in Third Quarter. Retrieved October 8, 2014, from http://www.idc.com/about/viewpressrelease.jsp?containerId=prUS22550010

IDC. (2013, September 11). Tablet Shipments Forecast to Top Total PC Shipments in the Fourth Quarter of 2013 and Annually by 2015. Retrieved October 21, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS24314413

IDC. (2014, February 26). Despite a Strong 2013, Worldwide Smartphone Growth Expected to Slow to Single Digits by 2017. Retrieved October 7, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS24701614

IDC. (2014, March 6). Worldwide Tablet Growth Forecast to Slow as New and Replacement Purchases in Mature Markets Begin to Level Off, According to IDC. Retrieved December 17, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS24716914

IDC. (2014, May 29). IDC Lowers Tablet Projections for 2014 as Phablet Shipments and Slower Refresh Rates Impact Shipment Growth. Retrieved October 22, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS24890514

IDC. (2014, July 24). Worldwide Tablet Market Grows 11% in Second Quarter on Shipments from a Wide Range of Vendors. Retrieved October 22, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25008314

IDC. (2014, July 29). Chinese Vendors Outpace the Market as Smartphone Shipments Grow 23.1% Year over Year in the Second Quarter. Retrieved October 7, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25015114

IDC. (2014, August 14). Worldwide Smartphone Shipments Edge Past 300 Million Units in the Second Quarter; Android and iOS Devices Account for 96% of the Global Market. Retrieved October 25, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25037214

IDC. (2014, August 29). IDC Lowers Tablet Projections for 2014 as Demand in Mature Markets Levels Off. Retrieved October 21, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25065614

IDC. (2014, September 3). A Future Fuelled by Phablets - “Worldwide Phablet Shipments to Surpass Portable PCs in 2014 and Tablets by 2015. Retrieved October 21, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25077914

IDC. (2014, November 25). Worldwide Tablet Growth Expected to Slow to 7.2% in 2014 Along With First Year of iPad Decline. Retrieved December 24, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25267314

IDC. (2014, December 1). Worldwide Smartphone Growth Forecast to Slow from a Boil to a Simmer as Prices Drop and Markets Mature. Retrieved December 24, 2014, from http://www.idc.com/getdoc.jsp?containerId=prUS25282214

Intel. (n.d.). Intel 2 in 1s: Razor-Thin Laptop Meets Ultra-Fast Tablet. Retrieved October 21, 2014, from http://www.intel.com/content/www/us/en/2-in-1/laptop-tablet.html

Mawston N. (2014, July 31). Xiaomi Becomes World's 5th Largest Smartphone Vendor in Q2 2014. Retrieved September 21, 2014, from http://blogs.strategyanalytics.com/WSS/post/2014/07/31/Xiaomi-Becomes-Worlds-5th-Largest-Smartphone-Vendor-in-Q2-2014.aspx

Microsoft News Center. (2013, September 23). Microsoft unveils Surface 2, Surface Pro 2 and new accessories. Retrieved October 25, 2014, from http://news.microsoft.com/2013/09/23/microsoft-unveils-surface-2-surface-pro-2-and-new-accessories/

Microsoft Store. (n.d.). Buy the Microsoft Surface 2 Tablet and Surface2 4G LTE. Retrieved October 25, 2014, from http://www.microsoftstore.com/store/msusa/en_US/pdp/Surface-2/productID.286867200

Miller, H. (2013, January 30). RIM Changes Company Name to BlackBerry. Retrieved October 2, 2014, from http://www.bloomberg.com/news/2013-01-30/rim-changes-company-name-to-blackberry.html

Miller, P. (2007, July 25). Apple sold 270,000 iPhones in the first 30 hours. Retrieved September 26, 2014, from http://www.engadget.com/2007/07/25/apple-sold-270-000-iphones-in-the-first-30-hours/

MobileInfo.com. (n.d.). What is WAP? Retrieved October 2, 2014, from http://www.mobileinfo.com/WAP/what_is.htm

Molen, B. (2014, April 25). What you need to know about Microsoft's acquisition of Nokia. Retrieved September 24, 2014, from http://www.engadget.com/2014/04/25/microsoft-nokia-merger-details/

Nokia. (2005, September 21). Nokia Introduces Nokia 2652, fold design for new growth markets, Major milestone reached - one billionth Nokia mobile phone sold this summer. Retrieved October 9, 2014, from http://company.nokia.com/en/news/press-releases/2005/09/21/nokia-introduces-nokia-2652-fold-design-for-new-growth-markets-major-milestone-reached-one-billionth-nokia-mobile-phone-sold-this-summer

Nokia. (2014, April 29). Nokia appoints Rajeev Suri as President and CEO and announces new strategy, program to optimize capital structure, and leadership team. Retrieved October 2, 2014, from http://company.nokia.com/en/news/press-releases/2014/04/29/nokia-appoints-rajeev-suri-as-president-and-ceo-and-announces-new-strategy-program-to-optimize-capital-structure-and-leadership-team

O'Reilly, D. – PC World (2006, May 11). First Look: Ultra Mobile PCs--Small Package, Big Price. Retrieved October 18, 2014, from http://www.techhive.com/article/125675/article.html

Oxford University Press. (n.d.). Definition of mobile. Retrieved September 11, 2014, from http://www.oxforddictionaries.com/definition/english/mobile

Oxford University Press. (n.d.). Definition of technology. Retrieved September 11, 2014, from http://www.oxforddictionaries.com/definition/english/technology

Regas, T. (2002, June 3). Defining mobile technology for legal professionals. Retrieved September 11, 2014, from http://www.llrx.com/columns/mobiletech.htm

Rocha, E., & Selyukh, A. (2014, September 11). BlackBerry buys UK mobile technology start-up Movirtu. Retrieved September 11, 2014, from http://www.reuters.com/article/2014/09/11/us-blackberry-m-a-idUSKBN0H61GC20140911

Rouse, M. (n.d.). Smartphone. Retrieved September 25, 2014, from http://searchmobilecomputing.techtarget.com/definition/smartphone

Rouse, M. (n.d.). Tablet (tablet PC). Retrieved September 24, 2014, from http://searchmobilecomputing.techtarget.com/definition/tablet-PC

Scott, K. (2012, December 6). B2B Mobile Use (Infographic). Retrieved September 24, 2014, from https://www.hotdesign.com/marketing/b2b-mobile-use-infographic-2/

Shah, A. from IDC News Service (2011, November 3). Tablets vs. Laptops vs. Smartphones. Retrieved October 10, 2014, from http://www.pcworld.com/article/243132/tablets_vs_laptops_vs_smartphones.html

Shah, A. (2014, September 15). Why buy Intel's Broadwell chip, with Skylake waiting in the wings? Retrieved October 20, 2014, from http://www.pcworld.com/article/2683392/pc-confusion-to-linger-on-intels-quick-jump-to-skylake.html

Statista. (2013). Statistics and facts about smartphones. Retrieved September 13, 2014, from http://www.statista.com/topics/840/smartphones/

Statista. (2014). Global smartphone shipments forecast 2010-2018. Retrieved October 3, 2014, from http://www.statista.com/statistics/263441/global-smartphone-shipments-forecast/

Statista. (2014). Tablets vendors: Market share 2011-2014. Retrieved October 22, 2014, from http://www.statista.com/statistics/276635/market-share-held-by-tablet-vendors/

Stofer, J. (n.d.). Mobile technology. Retrieved September 12, 2014, from http://technology-use-and-abuse.wikispaces.com/3. Mobile Technology

United States Department of Labor. (2013, December). Industry employment and output projections to 2022 : Monthly Labor Review. Retrieved December 29, 2014, from http://www.bls.gov/opub/mlr/2013/article/industry-employment-and-output-projections-to-2022-1.htm

Usablenet.com. (2013). Infographic - Tablet growth: What to expect. Retrieved September 24, 2014, from http://knowledgecenter.usablenet.com/infographic-tablet-growth:-what-to-expect

Usablenet.com. (2014). Five Best Practices for B2B Mobile Commerce - Infographic. Retrieved September 24, 2014, from http://knowledgecenter.usablenet.com/infographic-five-best-practices-for-b2b-mobile-commerce

Viken, A. (2009, April 9). The history of Personal Digital Assistants 1980 – 2000. Retrieved September 25, 2014, from http://agilemobility.net/2009/04/the-history-of-personal-digital-assistants1/

Volvo Group. (2014). Volvo Group Presentation 2014. Retrieved November 6, 2014, from http://www.volvogroup.com/SiteCollectionDocuments/VGHQ/Volvo Group/Volvo Group/Presentations/Volvo Group presentation 2014 English.pdf

Volvo Penta. (n.d.). De organisatie. Retrieved November 6, 2014, from http://www.volvopenta.com/volvopenta/benelux/nl-nl/our_company/Pages/our_company.aspx

Volvo Trucks. (n.d.). Home - startpagina: VOLVO TRUCKS. Retrieved November 6, 2014, from http://www.volvotrucks.com/trucks/belgium-market/nl-be/Pages/Home.aspx

Volvo Trucks. (n.d.). Houd de winstgevendheid in de gaten met een Dynafleet-app. Retrieved November 13, 2014, from http://www.volvotrucks.com/trucks/belgium-market/nl-be/aboutus/every-drop-counts/Pages/dynafleet.aspx

Volvo Trucks Belgium. (n.d.). Dynafleet. Winstmogelijkheden tonen. Retrieved November 15, 2014, from http://www.volvotrucks.com/trucks/belgium-market/nl-be/services/dynafleet/Pages/Default.aspx

Willans, J. (2014, July 25). The incredible history of Nokia camera phones in pictures. Retrieved October 25, 2014, from http://conversations.nokia.com/2013/07/25/the-incredible-history-of-nokia-camera-phones-in-pictures/

WindowsPhone.com. (n.d.). Overstappen op Windows Phone. Retrieved October 2, 2014, from http://www.windowsphone.com/nl-BE/how-to/wp8/moving-to-windows-phone

Zeitler, N. - SAP News Center (2013, July 4). What are Ultra Mobiles? Retrieved October 11, 2014, from http://www.news-sap.com/what-are-ultra-mobiles/

APPENDIX

1. *Extensive mobile technology timeline*

Although the mobile technology revolution is considered novel, its origin dates back decades ago. The first industrialized portable device that could be -rather easily- carried by man and used microwaves to transmit information is considered the Walkie-Talkie. Produced in 1940 by Motorola, the first Walkie-Talkie was used by infantry units during the Second World War. Known under the technical name 'SCR-300', this battery powered voice radio transmitter/receiver could transmit information between divisions and from the frontlines to the headquarters. This 285x135x240mm device was strapped on the back of a soldier and weighted slightly more than 17 kilograms. It had a reach of almost five kilometres and the massive battery produced sufficient energy for eight to twelve hours. Although being large and heavy, this device created the opportunity for soldier to pass through information while being on the move. Therefore the characteristic nickname 'Walkie-Talkie' was chosen. (Flowers, 2004; US War Department, 1945)

The most sophisticated mobile device to date that corresponds to at least the characteristics of the SCR-300 is the so-called smartphone. The smartphone is "*a mobile phone that includes software that a user is able to modify and update. The user controlled software must be able to transfer information to and from external systems*" (Töyssy & Helenius, 2006). Margaret Rouse (2007), manager of the awarded IT encyclopedia website WhatIs.com, outlines a smartphone as "*a cellular telephone with an integrated computer and other features not originally associated with telephones, such as an operating system* (cfr. infra), *Web browsing and the ability to run software applications* (cfr. infra)". The latter three characteristics define the difference between a smartphone and a regular cell phone.

Compared to the current average smartphone, the SCR-300 lacks far behind. First of all, a smartphone is way lighter and more compact. Furthermore, the smartphone's much smaller battery has almost the same duration as the one of the SCR-300. In addition, you can make use of the wide spectrum of opportunities which define the smartphone of today. This small device combines the functionalities of a radio, telephone, GPS, camera, alarm clock, flashlight, video player, calculator, and much more. Thanks to the evolution of mobile internet, multiple technical advancements and the development of numerous applications, its functionalities are expected to expand even more in the future.

Frequently, the smartphone of today is seen as a combination of a cell phone and a Personal Digital Assistant, or PDA. The former is also called a mobile phone and can be outlined as "*a small wireless device that has at least the same functions of a standard wired telephone but is smaller and more mobile*" (BusinessDictionary.com, n.d.). It requires the user to subscribe to a service provider and pay here for a prepaid or monthly fee. In addition, it has more functions than a traditional land line but needs to be charged after a period of time. It was Motorola that, on the 3rd of April 1973, was able to manufacture the first handheld mobile phone and to make the first phone call from a mobile device. The prototype was 25cm long and weighted over 1kg. It offered 30 minutes of talk time before the battery needed to recharge for a whopping 10 hours (redOrbit, n.d). Since then, these devices became smaller and lighter, with increased performance and capabilities.

Besides this, the other ancestor of the smartphone is the PDA. Being a very small and compact pocket pc, it was initially used to store different kinds of personal, business or contact information. The Organizer was officially the first PDA. Released by Psion in 1984, this device had a 6x6 alphabetically ordered keyboard. Major breakthroughs were caused by the flipped open PDA's of HP's Jaguar and Psion's Series 3 released in 1991. In addition, Apple launched the MessagePad in 1993. This was considered the first device using a touchscreen and stylus and had the ability to recognize handwritings. These capabilities increased the user friendliness of the PDA. Though, since the development of the smartphone, the use of the PDA deteriorated. (Viken, 2009).

In 1994 the first smartphone was developed by IBM, the so-called Simon Personal Communicator. Equipped with a touchscreen, email capability, calculator, address book and a calendar, it was on the market for $1100. Due to its high price, relatively limited capabilities and its weak battery, it lasted only one hour, the Simon was not a cheer success. Only 50.000 units were sold. (Aamoth, 2014; Cummings & Krajci, 2014, p. 12)

Despite the efforts of IBM, it was the launch of Apple's revolutionary iPhone 2G in June 2007 that caused an extreme growth in the smartphone user base. "*We want to reinvent the phone*" declared the legendary Steve Jobs, former CEO and co-founder of Apple (Block R., 2007). The iPhone was a sheer success. Apple sold 270.000 iPhones in the first 30 hours of its launch, which is amazing for a radically brand-new device (Miller, 2007). Even to date, the launch of the latest - and controversial - iPhone 6 (Plus) caused some people camping for days in front of Apple shops, waiting to be the first to get their hands on such a device (Little,

2014). Over 10 million of the 6 series were sold in 72 hours after launch (Apple, 2014b). This is extraordinary, taking into account it was initially only available in a very select number of countries. Over the last seven years, sales of the iPhone series increased exponentially and reached the 500 million mark in March 2014 (Golson, 2014).

In order to get one of these in 2007, your wallet was $499 lighter for the 4GB and $599 for the 8GB version (Block, 2007). Although the initial price for the iPhone 2G was very comparable with the competitors' devices at the time, Apple's success was unstoppable. So what was it that made this device so extraordinary?

First, the physical design was ground-breaking in comparison with other smartphones like BlackBerry which were already on the market at the time. The iPhone 2G had just one large button on the front and four on the side. The major part of the device was an interactive 8.9-cm touch screen that allowed the user to easily access the iPhone's functions. The ability to display a lot of data on one screen will reduce search costs and consequently reduce the effort of the user to browse for information (cfr. infra). Not only this device looked very futuristic, also its internal specifications in terms of processing speed and graphics stunned the consumers. Three different sensors integrated in the screen controlled the behaviour of the display in terms of brightness and orientation. In addition, Apple took into account that its widely spread iPod users could easily make the transition from iPod to iPhone. So could all data stored on an iPod and in the iTunes library seamlessly be synchronised with the iPhone. This was mainly achieved by Apple's solely control of its soft- and hardware, which made the company able to streamline and align the user-friendliness over its complete product assortment. Steve Jobs also provided the iPhone with a Safari web browser, so that information could be sought on standard web pages instead of the WAP version of a page. The latter provides a standard format for the delivery of wireless information and Internet transfers to mobile phones. As a consequence, Internet pages do not need to be adjusted for the particular display of every mobile phone or personal organizer. Therefore a very basic representation of a webpage, with little possibilities for editing colour, font or images, was used (MobileInfo.com, n.d.). On top of the Safari web browser, the iPhone was viable to run applications which extended the functionalities of the device even more. Compared with its competitors, Apple offered many free apps, particularly in contrast to BlackBerry, and these were far easier to install and to use. (Honan, 2007; Artman, n.d.)

Large former prevailing companies like Research In Motion, known as RIM, and also Nokia were already developing and manufacturing smartphones before the moment of launch. The latter launched their first smartphone, which is to some extent comparable to the ones on the market to date, yet in 2002 (Willans, 2014). On the other hand, BlackBerry introduced already early versions of smartphones back in 2003 (Cummings & Krajci, 2014, p. 11). BlackBerry is the subsequent name of RIM, after changing the company name in January 2013 to its best-know product 'BlackBerry' (Miller, 2013).

Still the iPhone managed to shrink both companies' market share significantly over time (cfr. infra). Apple's competitors saw no harm in the advanced product that Steve Jobs had released. The iPhone was so radically different that even the former CEO of Microsoft, Steve Ballmer, laughed when the iPhone was launched and postulated that "*the iPhone is the most expensive phone in the world*" and that it "*does not appeal to business customers because it does not have a keyboard*" (Arthur, 2012; Vara, 2013). On that moment, the distinctive aspect of the BlackBerry series was not accidentally its QWERTY physical keypad. Microsoft, offering an operating systems for smartphones at the time, knew a huge fall back in market share up till now because it neglected that severe threat of Apple (cfr. infra).

Even though the smartphones of RIM and Nokia, both prevailing companies at the time, possessed the latest specifications like Wi-Fi access, push e-mail and a 2 megapixel camera, it would be still Apple's iPhone that would dominate the phone market. Examples of the competing products at that moment were the BlackBerry Curve 8300 and the Nokia 7500 Prism. In the first quarter of 2007, so before the iPhone launched, the Finish colossus Nokia possessed an overwhelming 46.7% of the global smartphone market. This corresponds with a total shipment of more than 11.6 million smartphones. Second, with barely 8.3%, was RIM (cfr. supra) followed by Sharp with 7%. Apple did not sell any kind of smartphone at the moment. In the last quarter of 2007, Apple jumped from nowhere to place three of the companies with the largest market share. Its 5.2% was scant compared with the 50.9% of Nokia, which reached its last peak to date. Sharp was no longer part of the top three and the market share of RIM grew with 31.3%. By the end of 2008, Apple's market share more than doubled, while RIM increased to nearly a fifth of the global market and became the main direct competitor of Apple. In the US, RIM was the biggest with 42% under its command, Apple became number two with 20%. Nokia had difficulties with adjusting to the new environment and was stuck into a global descending trend (Gartner; 2008, 2009).

Global market share smartphone market (2007-2008)				
	1Q07	4Q07	1Q08	4Q08
Nokia	46,7%	50,9%	45,2%	40,8%
RIM	8,3%	10,9%	13,4%	19,5%
Apple	0,0%	5,2%	5,3%	10,7%

Table 1: Global market share smartphone market (2007-2008)

After recognizing the threat of Apple, implementing radical changes and adapting their devices according the design and specifications of the iPhone, companies like BlackBerry and eventually Nokia succeeded to survive. Both companies also made changes in the board and even the CEO to raise innovativeness and differentiation. For Nokia, Stephen Elop took the wheel over from Olli-Pekka Kallasvuo in September 2010. He was a former manager at Microsoft. In May 2014, Elop was followed by Nokia's current CEO Rajeev Suri (Fried, 2010; Nokia, 2014). BlackBerry on its turn appointed John Chen as Interim CEO in November 2013. Two months later he could drop the 'Interim' label. (Austen, 2014; BlackBerry, 2013)

BlackBerry decided to keep its characteristic keypad over the years but also created touch screen devices. Recently, in September 2014, the company bought the UK mobile technology start-up Movirtu in order to offer functionalities that can further differentiate them from the competition. In particular, the know-how of Movirtu can help to facilitate the alternation between work and personal files without requiring the user to carry multiple devices or change SIM cards (Rocha & Selyuki, 2014). Designed to meet the current user's need of a good-looking smartphone that is user-friendly and can display a large amount of information at once (cfr. infra), BlackBerry launched recently the BlackBerry Passport. Released the 24th September 2014, this device is equipped with a large 11,4cm touch screen which is squared instead of the usually rectangular screen used by most other smartphone manufacturers. Although this innovative thinking, the Passport maintains it physical distinctive keypad (BlackBerry, 2014). BlackBerry states this offers the device two advantages. First, it enables the smartphone to display a lot of information, without losing space to the keypad. Second, BlackBerry declares typing is easier on a physical keypad. In comparison with 2007 (cfr. supra), we can conclude that BlackBerry is at the moment by all means up-to-date of the users current needs and expectations.

According to Melissa Chau (IDC, 2014), a senior research manager at IDC, "*large screen smartphones become the new norm*". Phablets, which are smartphones with a massive

screen between 5,5 and 7 inches are becoming very popular, expected to take over 32,2% of the smartphone market in 2018. This is a significant increase compared with 14% in 2014.

In the case of Nokia, the firm decided to enter a cooperation with computer manufacturer Microsoft in order to use its know-how and innovativeness for the development of Windows smartphones. Here, the former cell phone giant collides with the current computer colossus. The collaboration may enable both companies to refine devices to run applications smoothly and to develop the smartphone in such a way that the transition between smartphone and computer is simplified, something Apple already did in 2007 (cfr. infra). The interface of the Windows Phone is developed in such a way that it almost looks the same as Microsoft's latest windows 8 operating system. This is widely spread out over the Windows Phone website (Windowsphone.com, n.d.). Additionally, a complete description is stated how to make the transition from competing operating systems (cfr. infra). Recently, in April 2014, Microsoft not only decided to take the collaboration a step further by acquiring Nokia's Devices and Services division for seven billion dollar. This deal includes both Smart and Mobile devices. The reason of this acquisition is to reduce inefficiencies between the two companies. (Molen, 2014)

We can conclude that Steve Jobs had set the tone in 2007, not only for the smartphone world, but for mobile technology as a whole. With his extraordinary device, he developed a new spectrum of fresh user needs to which former leading companies were forced to adapt.

2. *Factors that make mobile technology possible*

This section will offer an overview the technical evolutions that enabled the existence of mobile technology devices we know today. The goal is to provide essential general information, without getting into complex technical details.

Mobile technology exploded in the beginning of the 21st century (Bi, Zysman & Menkes, 2001). An information and technology revolution provided manufacturers the ability to produce the ancestors of the devices we know to date. In order to give context to this period and the devices of that time, we can refer to the world-famous and one the best-selling mobile phone ever namely the Nokia 3310. This device was launched in the fourth quarter of 2000 (Nokia, 2005).

Before the 1980s, phones were the size of a briefcase and most of them were installed in cars. However, developments in semiconductor technologies in the late 1980's caused 'mobile' phones to shrink in size. This had a major impact on the cellular mobile industry. No longer did people need to look up their cars to make a phone call, but were able to execute their call from wherever they wanted. Also the consumer base expanded from the number of vehicles to the number of people (Bi, Zysman & Menkes, 2001; p. 110).

Second, the introduction of the second-generation (2G) digital technology standards improved significantly the voice quality and decreased handset- and infrastructure costs. This replaced the analogue 1G networks from '80s. In 2001, 3G systems are launched which enable faster data transmission. This is made possible by moving from small band to wideband. Here, data packets are sent parallel over a wider range of frequencies. Using these parallel systems expand the network capacity and services. Multimedia capabilities skyrocket. Another advantage is the further reduction of the system's cost because its efficiency is increased. Where 2G formed the bridge between cars and persons, 3G is the link between persons to machines and machines mutually. As a consequence, a further increase in the customer base took place. In addition, the user penetration rate also rose due to the enlargement of the mobile phone's functions being built-in. (4GAmericas.org, n.d.; Bi, Zysman & Menkes, 2001 p. 110-111).

Furthermore, the development of the Global Positioning System, or GPS, in the late 20th century made it possible to determine the geographical location, or geolocation, of the mobile phone user. This was considered an enabling technology because it opened the door

for a variety of applications. The mobility- and e-commerce sector are one of the many examples. (Bi, Zysman & Menkes, 2001 p. 114).

Subsequently, the accession of superconductors in the mobile technology world made a significant difference. The coverage radius of a handset is limited by its maximum transmit power and noise figure. The transit power will have an impact on the battery life. Consequently, it is desirable to minimize both parameters. Using superconductor technology, the impact is twofold. On the one hand, the noise figure is reduced by a few decibel. This leads to a larger coverage radius. On the other hand, less transmit power is necessary to cover the same radius, resulting in smaller batteries and smaller devices (Bi, Zysman & Menkes, 2001 p. 114-115).

With the introduction and rise of wireless internet, mobile phones needed to be adapted in order to get access to this massive amount of information. In short, the circuit-switched systems, which transmit only voices, needed to be replaced by packet-switched channels which made both data and voice transmission possible. Packet-switched channels are integrated in 3G systems (cfr. supra). Furthermore, the integration of voice and data results in lower networks costs (Bi, Zysman & Menkes, 2001 p. 115).

The recently launched successor of 3G, namely 4G, will further increase the amount of data to be transmitted per period of time. In addition, the network resources are used more efficiently by increasingly simultaneously occurring actions (4GAmericas.org, n.d.).

Finally, it cannot be forgotten to also mention the development of for example interactive screens and LED lights. Though, this explanation would be too technical and is therefore chosen to be neglected in this thesis.

All these innovations have changed the way people communicate with each other but also the capabilities and the way mobile phones are used in our everyday life. It is expected that further technical developments in the future will continue to increase the functionalities of mobile devices.

3. *Past, current and future smartphone market*

3.1 Introduction

Over the period 1Q07-1Q08, worldwide smartphone sales rose with 29%. At the time, being in the middle of one of the largest economic crisis in history, this expansion was very remarkable. The sales increase, more particularly in the US market, was driven by heavy advertising, severe marketing promotions and the strong support of mobile operators (Gartner, 2008).

It was in 2011, only four years after the smartphone's turning point (cfr. supra) and just one year after the increased popularity of the tablet computer (cfr. infra), that for the first time in history, smart device sales had overtaken the personal computer (Cummings & Krajci, 2014, p. XXV). According to Cummings and Krajci, this changing of the guard is caused by three main factors. First, people strive for constant and open communication in their professional and social life. Next, smartphones and tablets can be obtained at a lower price while possessing new interesting features. Finally, the increased availability and user friendliness of mobile applications increase the demand for these easy-to-use good-looking mobile devices.

In 2014, according to a report published by IDC (2014), the combination of smartphones and phablets (cfr. supra) represents 70% of the smart connected device market. It is therefore the appliance of choice worldwide. By 2018, this figure is expected to rise even further to a staggering 75,6%. The drop of the average selling price of the phablet and the smartphone, respectively from €447 and €252 in 2013 to €312 and €229 in 2014, certainly contributes to this trend. At the moment, selling more than five times the amount of phablet shipments, the smartphone forms a crucial device in the smart connected market and will deserve the necessary attention in this thesis accordingly.

The next sections provide an overview of evolution in smartphone sales worldwide from a macro- and meso point of view. In addition, the handset replacement cycle and the use of multiple smartphones is discussed. Next, a section is dedicated to the evolution in market share of different smartphones manufacturers.

3.2 Worldwide absolute number of sales

To start, this section will provide a macro overview of the smartphone market. Hereby the global worldwide market trend will be clarified. Next, the latest changes in particular

regions will be discussed. This can be found under the meso level part. Finally, a section is dedicated to the current developments of the handset replacement cycle and the roughly constant proportion smartphone users to sales. This is based on data provided by different sources.

3.2.1 Macro level

A clear sketch of the situation can be given combining quarterly and yearly data published by Gartner, a worldwide leading company in IT research, and IDC, a global provider of market intelligence regarding the IT, telecommunications and consumer technology markets. (Gartner, 2009, 2011, 2012, 2014a, 2014b; IDC, 2014). This produces the following table.

Yearly worldwide smartphone sales to end users (thousands of units) (2007-2014)								
	2007	2008	2009	2010	2011	2012	2013	2014 (expected)
Absolute units shipped	122.316	139.288	172.376	296.647	472.891	680.108	967.776	1.200.000
Relative increase		13,88%	23,76%	72,09%	59,41%	43,82%	42,30%	24,00%

Table 2: Yearly worldwide smartphone sales to end users (thousands of units) (2007-2014)

Moreover, according to a study of eMarketer (2014), expectations are that at the end of 2014 almost one out of four people worldwide will have at least one smartphone in their possession. In 2017, this number will further expand to one on three persons. In the second quarter of 2014, worldwide smartphone sales moved past the 300 million shipments in one quarter for the first time in history. A vast 301,3 million smartphones were shipped, an increase of more than 25% in comparison with the same quarter the year before. (IDC, 2014)

Although there is a clear increase in worldwide smartphone shipments, according to IDC (2014), 2014 will be the year the smartphone expansion will be radically lower than the ones during previous years. Referring to the 24% expected increase in 2014, this increase will decline in the future from 8,3% in 2017 to 6,2% in 2018 (IDC, 2014). Statista (2014) forecasts a slightly higher growth of roughly 10% for the period 2017-2018. The table in the part ‘smartphone replacement cycle and possessing multiple smartphones’ offers the data for this reasoning. This is still significantly lower than the current 24%.

Overall, it can be stated that the decrease in growth is clear. The reason behind this is the upcoming saturation of large mature markets and the rising demand of emerging and Asian markets (cfr. infra).

Nonetheless Gartner (2014b) declares that, considering the decrease in growth, the smartphone market will continue to do well in the future. The sector is still growing and the sales figures are massive. By 2018, smartphone sales will represent 88% of the total mobile phone market, compared with the 66% in 2014 and only 31% in 2011. It is important to take into account that the total mobile phone market keeps on growing too, from 1.21 billion in 2009 to 1.86 billion in 2014, reaching 2 billion in 2016 (Canalys, 2013; Gartner, 2014b). This is an increase of roughly 50% over the five year time period '09-'14 (Gartner, 2014b). According to Gartner's research director Ranjit Atwal (Gartner, 2014a): "*Mobile phones are a must have and will continue to grow, but at a slower pace, with opportunities moving away from the top-end premium devices to med-end basic products*".

A last remark refers to the large increase of 72% in 2010. As the smartphone was getting more and more embedded in the everyday life, the requests for these device was unseen. Kevin Restivo, at the time senior research analyst of IDC Worldwide Mobile Phone Tracker, declared that "*mobile phone makers that are delivering popular smartphone models are among the fastest growing firms*". Demand was so enormous that "*vendors that are not developing a strong portfolio of smartphones will be challenged to maintain and growth market share in the future*" (IDC, 2010). So was Nokia losing market share at the time while Apple, which focussed only on smartphones and not on cell phones, presented an 87,2% growth (Gartner, 2011a).

3.2.2 Meso level

eMarketer (2014) indicates that in 2015, 50% of the inhabitants in the US, Canada, most countries in Western Europe and big parts of the Asia-Pacific region will own at least one smartphone. They also state that the Asia-Pacific region is currently responsible for more than half the global demand, roughly satisfying 951 million users. This is a major difference with the situation in 2010 where Western Europe and North America accounted for 52,3% of the market (Gartner, 2011a).

A report of Gartner (2014a) shows that in the last quarter of 2013, India knew the highest sales growth among all countries observed, with 166,8% compared to the last quarter of 2012. Latin America possessed the strongest growth over all considered regions with 96.1%. On the other hand, mature markets like North America and Europe will only increase by single digit percentages in 2014 (IDC, 2014).

To conclude, the increase in global smartphone sales nowadays is fed by the emerging and Asia-Pacific markets (Gartner, 2014a) (cfr. infra).

3.2.3 Handset replacement cycle and possessing multiple smartphones

The perceptive reader has certainly noticed that eMarketer rather focusses on the number of users, while Gartner and IDC define their data in terms of sales. It is important to make a distinction between these types of information because deviations can be large. Therefore, the following table is generated based on the corresponding data. Be aware that for this comparison sales figures are used provided by Statista (2014). This leading statistics company offers information even further in the future and the figures and forecasts are comparable with the ones of Gartner and IDC.

Comparison between smartphone users and -sales (in millions of units)							
	2012	2013	2014	2015	2016	2017	2018
Smartphone users	1060	1400	1760	2040	2290	2520	2730
Smartphone sales	725	1009	1204	1284	1435	1579	1739
Ratio sales/users	68,40%	72,07%	68,41%	62,94%	62,66%	62,66%	63,70%

Table 3: Comparison between smartphone users and -sales (in millions of units)

The table provides on the one hand the yearly accumulated number of smartphone users, followed by the quantity of smartphones shipped per year. In addition, it clarifies that the number of smartphone users is currently larger than the yearly number of sales. The same situation appeared in the past and will also be the case in the near future. At last, a rather constant proportion of smartphone sales to -users is expected to occur in the near future.

Multiple possible explanations for these trends can be offered. First, a handset replacement cycle of nearly two years (Entner, 2011) can cause the discussed relatively lower level of sales. The former can be triggered by the current trend of longer smartphone lifecycles (Gartner, 2013) and the corresponding limited willingness of a user to switch over buying a new, possibly more advanced smartphone. Second, relatively lower sales levels can occur due to the decreasing trend of possessing multiple smartphones. In certain occasions, people have several smartphones in order to perform different tasks. For example, one smartphone is purchased and exclusively used for private intentions while another performs business assignments. At the moment, companies like BlackBerry are putting their hands on the development of a smartphone that facilitates the transition between work and personal files on a single device (cfr. supra). This technical revolution will further reduce the amount of double smartphone owners. Third, the rather constant ration of sales on users can be

caused by the growing importance of cheaper smartphones and tablet computers. As these devices are offered at a lower price, more people living in emerging markets will adopt them. This will increase the number of users. In addition, the number of sales will increase accordingly due to the fact that cheaper devices will accelerate the upgrade cycle (IDC, 2013).

Though, these statements are not comprised by the subject of this thesis and are consequently not further investigated. Therefore, further reading on this topic is strongly advised.

3.3 Market share of multiple smartphone manufacturers

The smartphone segment is not only supplied by products of Apple, BlackBerry or Nokia (cfr. supra). Obviously other companies all over the world try to take over a piece of this lucrative market. According to Mawston (2014), the six smartphone manufacturers with the most smartphone sales at the moment are, from largest to smaller; Samsung, Apple, Huawei, Lenovo, Xiaomi and LG. Second place holder Apple is the sole American founded company of this sequence. The others have a Chinese or South-Korean origin.

This hierarchy is largely confirmed by older data provided by Gartner (2009, 2014a). Adding the very recent findings of Mawston's report (2014), the following combined table is drawn. Hereby, some overall and recent evolutions are deducted. These figures are also confirmed by several reports published by IDC.

Average market share of the top 5 smartphone manufacturers for 2007-2Q14 (in thousands of units)

Top 5 in 2007		2008	Growth '07-'08	Top 5 in 2013		Growth '12-'13	Top 5 in 2Q14		Growth 2Q14-'13
Nokia	49,9%	43,7%	-12,4%	**Samsung**	31,0%	2,3%	**Samsung**	25,0%	-19,4%
RIM	9,6%	16,6%	72,9%	**Apple**	15,6%	-18,3%	**Apple**	12,0%	-23,1%
Sharp	5,6%	3,8%	-32,1%	**Huawei**	4,8%	20,0%	**Huawei**	7,0%	45,8%
HTC	3,0%	4,2%	40,0%	**LG Electronics**	4,8%	26,3%	**Lenovo**	5,0%	11,1%
Apple	2,7%	8,2%	203,7%	**Lenovo**	4,5%	40,6%	**Xiaomi**	5,0%	177,78%
Others	29,6%	23,5%	-20,6%	Others	39,3%	-0,8%	Others	46,0%	17,0%

Table 4: Average market share of the top 5 smartphone manufacturers for 2007-2Q14 (source: Gartner, Mawston, 2014)

Comparing 2007 with 2Q14, the top five of smartphone manufacturers is completely shifted. Apple, which closed the top five back in 2007 with barely 2.7%, is the only one that has stood the test of time. At the moment, this Cupertino based giant holds second place with a dominant 12% of the market. Its market share more than quadrupled over the last seven years, but is currently decreasing. Also in 2007, the five leading smartphone manufacturers

held more than 70% of the market. To date, the top five only accounts for 54%. Even compared with 2013, this is a decrease of 11%. Therefore, a conclusion is drawn that the current smartphone market is more and more scattered and consists of multiple smaller manufacturers which are able to exceed most design and technical requirements at a lower price? (Fitch Ratings, 2014) (cfr. infra).

Multiple recent trends are unmasked when comparing the numbers of 2013 with those of 2Q14. To start, the first as well as second place smartphone manufacturers are losing ground. Samsung and Apple, collectively holding 46,6% of the market in 2013, are seeing their market share to drop resp. 19,4% and 23,1% in the second quarter of 2014. LG Electronics barely falls out the top six with 4,9% (Mawton, 2014). The latter forms together with Huawei, Lenovo and Xiaomi an Asian front of new and rather smaller low-price (cfr. infra) smartphone manufacturers. Together, this quartet is holding 21,9% of the market. All of them are seeing their market share to increase with double to triple digit percentages in comparison with 2013 and the years before.

Their advance is fed by the growing demand for a cheaper smartphone, mostly in emerging and Asian markets (cfr. supra) like India and China (Fitch Ratings, 2014). These two countries are expected to be responsible for the over 60% of the growth in smartphone shipment volumes. According to a report of IDC (2013), from the €488,4 billion smart connected device market in 2013, two thirds is coming from smartphone and tablet sales under €275 or $350 per piece. Thereby Megha Saini, research analyst at IDC, states that "*at the time when the smartphone and tablet markets are showing early signs of saturation, the emergence of lower-priced devices will be a game-changer*".

Melissa Chau, a senior research manager at the same company, said in an important statement that: "*As the death of the feature phone approaches more rapidly than before, it is the Chinese vendors that are ready to usher emerging market consumers into smartphones*" (IDC, 2014). Because in these markets the focus is on cost rather than brand strength or cutting-edge technology, the low-price manufacturers can offer competing products at a price between $100 and $300. As exemplified below, the price difference between these companies and the current number one and two on the global smartphone market is enormous. Apple's latest iPhone 6 (Plus) carries a price tag of at least $649 (resp. $749) (Apple, 2014). When writing this thesis in the last months of 2014, Samsung's current smartphone flagship, the Galaxy S5, can be found online for a sloppy $599,99.

The fact that this revolution is already started can no longer be neglected. During the second quarter of 2014, Xiaomi took the lead in the Chinese smartphone market with 15%. It is followed by Samsung that has 3% less. In comparison with seven years ago, only Sharp and HTC, which are respectively from Japanese and Taiwanese origin, were the only Asian smartphone manufacturers in the top five. Now, the overwhelming majority has oriental roots.

3.4 Conclusion

To finish this section of the thesis, it can be stated that the smartphone's popularity will be still increasing in the near future, but at a decreased pace. Emerging and Asian markets are key to this increase and will determine the growing popularity of low-price smartphone manufacturers. These two evolutions will have a striking impact on the smartphone market we know to date. As mature markets become saturated and worldwide growth slows, the premium smartphone suppliers, which are the key players in today's market, will have a hard time selling their products. They will seek opportunities to move them to wherever and whoever they can (IDC, 2014).

The B2B market segment can offer therefore a solution to these premium smartphone -and tablet- manufacturers. Companies have the intention to pay for well-functioning customized services based on cutting-edge technology. This phenomenon and trend is exemplified by the partnership of Apple and IBM to provide business applications.

4. *Past, current and future tablet market*

Although an extensive description of the smartphone evolution is given, this is not the final destination of mobile technology we know to date. The following sections explain the other device which drastically changed the mobile technology world, namely the tablet computer. An overview is provided regarding its origin, its market and the outstanding characteristics when compared to other mobile devices and its predecessors. In addition, a short description of the currently very sought-after ultramobile is displayed.

4.1 The outstanding characteristics of the tablet computer

Steve Jobs mentioned in his presentation in 2007 already some of the critical parameters in which the tablet, and more particular his iPad, excels (cfr. supra). Furthermore, Ezra Gottheil, senior analyst at Technology Business Research, confirms these statements and additionally adds that tablets offer a wider digital keyboard that simplifies typing (Shah, 2011). Moreover, Ghose, Goldfarb and Pil Han (2013) state that "*smaller screen sizes on mobile phones increase the cost of browsing for information to the user*". The time and effort needed to look up data is stipulated as those particular (search) costs. Furthermore, their research shows that data appearing at the top of a list is more likely to be observed than those at the bottom. Therefore, it is not surprisingly that larger screen tablets increase in popularity (cfr. infra)

In a B2B context, where multiple parameters and different data often need to be shown simultaneously on the screen, smaller displays can form an important obstacle. As a consequence, tablets are increasingly imbedded in a commercial environment (cfr. infra). On top of that, their interactive high-quality screens enable the user to easily and quickly perform the required actions just by swiping your finger over the display. No stylus or any other physical accessory is necessary. In addition, strong processors make sure that all these actions are, as the term indicates, fluently processed. Holding the tablet in another orientation, landscape or portrait, will adjust the way data is displayed. Hereby, other types of information can appear on the screen. Finally, this thin and light weighted device can be easily moved and handled from one place to another. Thereby, its long battery life increases its usability. In order to illustrate these parameters, the first iPad in the series has the following dimensions. It was 13,4mm thick, weighted 680 grams and its battery lasted for 10 hours (Apple, 2010; Jobs, 2010a).

Taking all these characteristics into consideration, it is not surprising that tablets are so sought-after. Their capabilities make it an indispensable versatile mobile technology device, as well for consumers as in the business world.

4.2 What did the iPad's predecessors do wrong?

This part of the thesis are based on the statements in an article of Preston Gralla, an IT expert and author of more than 45 books (Gralla, 2011).

He declares that Apple was not the first one that saw the opportunity of a large screen easy movable and user-friendly device. In 2001 at the COMDEX Fall computer show in Las Vegas, Bill Gates, former CEO of Microsoft, introduced a prototype of the so-called Tablet PC. It was described as having "*the size of a legal notepad and half the weight of most today's laptop PCs, the Tablet PC is a full-powered, full-featured PC that runs Windows XP and combines the power of desktop computing with the flexibility and portability of a pen and paper notepad*". On top of that Gates predicted that "*within five years it will be the most popular form of PC sold in America*".

This otherwise very talented computer company made some critical mistakes. According to Gralla (2011), Microsoft saw the Tablet PC as a full-fledged computer and was designed accordingly. Therefore the price tag mounted up to $2000 or more. In comparison, the first iPad was on the market already for $499 (Jobs, 2010a). Next, in order to operate the Tablet PC it required the use of a small pen looking device, a stylus. Compared with the 2010's iPad which could be operated using different finger movements only, this was a dramatic misstep. It made the user-friendliness level drop significantly. Finally, Microsoft implemented the device initially with an operating system compared with the ones that ran on traditional computers. In order to build a fast and responsive device that could live up to its expectations, Jobs correctly saw the need to implement an operating system which was different than the one used by its computer line (cfr. infra).

Apple produced a device which was far superior to the old Tablet PC, exceeded its capabilities and priced it a quarter of the price. Therefore this product was, as stated by Jobs in the first minute of its presentation (2010a), revolutionary.

4.3 Is the traditional computer market doomed?

The tablet computer increasingly gains popularity in both B2B and B2C practices. According to Usablenet.com (2013), it is expected that by 2015 more tablets will be shipped than desktop computers and laptops combined. This is confirmed by Ranjit Atwal (Gartner, 2014c), research director at Gartner (cfr. supra). The corresponding data can be found in the table below, which combines two reports published by the latter research firm (Gartner; 2013, 2014c). Hereby it is necessary to clarify that the figures published by another large provider of market intelligence, namely the International Data Corporation (IDC), offer the same general insights as its counterpart Gartner.

Worldwide device shipments over the period 2012-2015 (in thousands of units)							
Device type	2012	2013	Growth '12-'13	2014	Growth '13-'14	2015	Growth '14-'15
Traditional PCSs (Desktop and Notebook)	341.273	296.131	-13,2%	276.221	-6,7%	261.657	-5,3%
Premium ultramobiles	9.787	21.517	119,9%	32.251	49,9%	55.032	70,6%
Total PC Market	**351.060**	**317.648**	**-9,5%**	**308.472**	**-2,9%**	**316.689**	**2,7%**
Tablets	120.203	206.807	72,0%	256.308	23,9%	320.964	25,2%
Mobile phones	1.746.177	1.806.964	3,5%	1.862.766	3,1%	1.946.456	4,5%
Other ultramobiles (hybrid and clamshell)	N.A.	2.981	N.A.	5.381	80,5%	7.645	42,1%
Total	**2.217.440**	**2.334.400**	**5,3%**	**2.432.927**	**4,2%**	**2.591.753**	**6,5%**

Table 4: Worldwide device shipments over the period 2012-2015 (in thousands of units)

Prognoses for the tablet sales in 2014 mount up to 256.308.000 units. In comparison, the combination of desktop computers, notebooks and premium ultramobiles comprise 308.472.000 units. Thus in 2014, the PC market remains its dominance. However in 2015, due to the decreased popularity of traditional PCs (cfr. infra) and the much higher increase in the sales of tablets, the situation will be reversed. Tablets will then have overtaken the PC market for a first time since its foundation. Remember that the smart device market as a whole already surpassed the personal computer in 2011 (cfr. supra).

Prospections of the smart connected device's market share (sales in millions of units)						
Device type	2013 sales	2013 market share	2017 sales	2017 market share	Growth in sales '13-'17	Growth in market share '13-'17
Desktop PC	134,4	8,6%	123,11	5,0%	-8,4%	-41,9%
Portable PC	180,9	11,6%	196,6	8,0%	8,7%	-31,0%
Traditional PC market	**315,3**	**20,2%**	**319,71**	**13,0%**	**1,4%**	**-35,6%**
Tablet	227,3	14,6%	406,8	16,5%	78,9%	13,0%
Smartphone	1.013,2	65,1%	1.733,9	70,5%	71,1%	8,3%
Total	**1556**	**100%**	**2460**	**100%**	**58,1%**	**N.A.**

Table 5: Prospections of the smart connected device's market share (sales in millions of units) (source: IDC, September 2013)

The table above offers insight how the fixed and mobile smart connected device market will look like on a relatively longer term. Taking into account this is a massively evolving and changing information technology segment, prognoses beyond 2017 are very complex to create. Tom Mainelli of IDC Devices and Displays (IDC, 2014) states that "*what works well today could very well shift tomorrow*". Therefore, as prospects of several sources can differ, this thesis is more concerned about the global insights of future trends rather than exact numbers. In this case, this is particularly the increasing dominance of the smartphone, tablet and ultramobile market while the traditional computer market lacks behind.

By 2017, according to research by Usablenet (2013), the global accumulated sales of tablets will continue to skyrocket to far over 1 billion units shipped. Considering data of both IDC (2013) and Gartner (2013, 2014c), it is expected that this magical number will be already attained in 2016. This is impressive, knowing the tablet revolution mainly started in 2010 (cfr. supra).

Table 5 as well as table 6 render a clear decreasing trend of the traditional computer market, which includes desktop- and even notebook computers. Although the decline is stabilizing, especially the traditional market continues to shrink, hereby talking about a decrease of more than 35% of its market share.

Nevertheless, a marginal growth in global computer sales is foreseen, mainly due to portable market segment (cfr. infra). Combined, the portable and desktop computer market will hold 13% of the market in 2017, while tablets and smartphones account for respectively 16,5% and 70,5%. Smartphones will thus still be the clear captain of the smart connected device market, shipping over 1,7 billion units that year (IDC, 2013). Nonetheless, according to figures of Statista (cfr. supra), the latter situation is expected to take place in 2018. Over the period 2012-2015, the total number of traditional computer sales fell with more than 23%. In contrary, the ultramobile market is shooting up and will be in 2015 more than 2,5 times larger compared with 2013.

Therefore, Mr. Atwal declares that "*2014 will be marked by a relative revival of the global PC market*" (Gartner, 2014c). According to him this is firstly due to the business upgrades from Windows XP to Windows 7 and the business replacement cycle in general, especially in Western Europe. On the other hand, the launch of Microsoft's new operating system 'Windows 10' in late 2015 will definitely have an additional beneficial impact on the computer market (Myerson, 2014). As a footnote, Windows 10 is the successor of 'Windows

8’ and consequently Microsoft decided to skip version 9. The latter was considered not being in line with Microsoft’s release of different ‘1-series’ devices.

Second, the sales of premium ultramobiles compensate the drop in sales of traditional computers. Consequently, a small rebirth of the overall market in 2015 is the outcome of these two trends. Hereby it is obvious that premium ultramobiles are taking over a larger share of the global computer market. This is illustrated by the graph below.

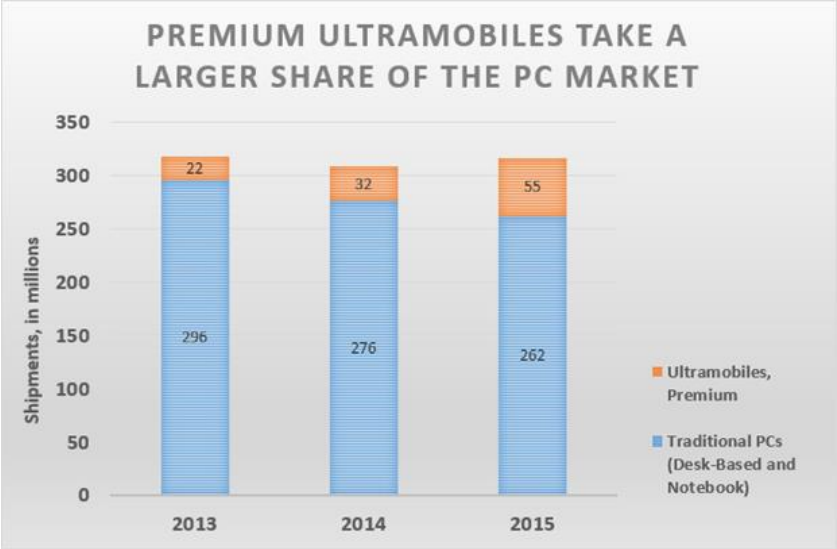


Figure 1: Premium ultramobiles take a larger share of the pc market (source: zdnet.com)

At that moment, premium ultramobiles will possess 17,4% of the once so blooming PC market in comparison with not even 7% just two years earlier. By 2015, Gartner expects to premium ultramobile sales will mount up to a staggering 55 million units worldwide. These numbers indicate the ultramobile to be a true competitor of the traditional computer market. According to a consumer survey of Gartner, “*less than 8% of the users would replace their laptop by a tablet, but the transfer to an ultramobile is almost twice this figure*” (Gartner, 2014a). This is a remarkable trend and therefore will be the reason for the further investigation of the conception and capabilities of ultramobiles in this thesis (cfr. infra). Although the main focus will be still on the currently dominant smartphones and tablet computers.

The decrease of the computer market and the takeover by mobile devices like the tablet was already predicted by Steve Jobs in June 2010. At that moment he was interviewed on a D8 conference, some months after the initial release of the first iPad earlier that year. Hereby Jobs (2010b) declared that:

"We were an agrarian nation, all cars were trucks because that is what you needed on the farm. But as vehicles started to be used in the urban centres and America started to move into those urban and suburban centres, cars got more popular. PCs are going to be like trucks. They are still going to be around. They are still going to have a lot of value, but they are going to be used by one out of X people."

Another very mobile device, the mobile phone, knows a marginal but increasing trend. Currently, this market is closing in to the 2 billion mark (cfr. supra).

The reason for the mobile revolution is described by several of Gartner's reports. Namely according to Carolina Milanesi (Gartner, 2013), Gartner's research vice president: "*Consumers want anytime-anywhere computing that allows them to consume and create content with ease, but also share and access that content from a different portfolio of products. Mobility is paramount in both mature and emerging markets*". Nonetheless, a more recent report of Gartner (2014a) indicates that mature market do like mobility, but prefer larger screen tablets (cfr. supra). In addition, Ranjit Atwal states that the reason for the decrease in popularity of the traditional PC lies in the fact that tablets, hybrids and lighter notebooks offer a greater flexibility and can address users' increasingly different demands (Gartner, 2014a). The user preferences regarding tablet computers are described in the next section.

4.4 User preferences according to the tablet screen size

Within the tablet market, the current trend comprises users to prefer more and more basic tablets instead of premium, more expensive ones (Gartner, 2013). The latter have extended functionalities and are mostly larger. In 2013, two thirds of the smart device market was coming from smartphone and tablet sales under €275 (cfr. supra). Therefore, the shift from the traditional computer market to more reasonably priced tablets and smartphones lowered the overall average selling price (ASP) from €363 in 2012 to €254 in 2017. (IDC, 2013)

Furthermore, sales of basic tablets are growing faster than anticipated. This is confirmed by the number of shipments of the iPad Mini, already representing 60% of Apple's tablet sales in 1Q13. According to IDC (2014), unit growth is particularly fuelled by emerging markets looking especially for the cheap, less than eight inch tablets. Ranjit Atwal of Gartner (2013) declares that the cause of this trend is threefold. First, the range of different basic tablets is extended while containing a relatively lower price. Second, value add is

increasingly shifting from hardware to software, resulting in longer lifetimes of premium tablets. In other words, premium tablet users hold on longer to their device and upgrade much less frequently. Software evolutions will be therefore more easily dispersed and adopted by basic tablets as it is less expensive to replace them, compared to their premium counterparts. Third, an important asset of smaller basic tablets is their added mobility (Gartner, 2014a).

Nevertheless, referring to a later report in 2014, Atwal announced the increasing favourability in mature markets of larger screen tablets to the credit of smaller screens (Gartner, 2014c). This trend is confirmed by IDC (2014). The latter is the outcome for, among others, the increased search costs on smaller screen devices (cfr. supra). Moreover, cellular-enabled tablets are sought-after in mature markets. In other words, these tablets make it possible for the user to make phone calls.

Mature markets like North America and Western Europe are considered to be wealthy countries capable of buying large premium devices. As a result, mature markets' ASP is expected to stabilize around €293 in 2014. In comparison, the ASP of the rest of the world decreased over the past years to €273. Although saturated, mature markets will continue to produce significant revenues due to sales of expensive premium medium- to large-sized devices. Besides this, the majority of shipments is at the account of the rest of the world, primarily driven by sales of smaller devices. (IDC, 2014)

In addition, because the ASP of smartphones is significantly lower, that is €229 (cfr. supra), than tablet computers, people are more likely to upgrade their smartphone to a newer version than the tablet variants.

Finally, the difference in preferences between mature and emerging markets and the cannibalization of less than 8 inch tablets by smartphones provide the corresponding figures published by IDC in May 2014.

Tablet market share by screen size for 2013-2018			
Year	7 - 8 inch	8 - 11 inch	>11 inch
2013 actual	55,0%	44,1%	0,9%
2014 forecast	50,8%	47,3%	1,9%
2018 forecast	44,5%	48,9%	6,6%

Table 6: Tablet market share by screen size for 2013-2018 (source: IDC, May 2014)

This table provides a clear overview of the future shift from smaller to much larger screen tablets. The <8 inch tablets know a significant decrease in market share, while the 11+ inch devices are growing sharply. Possible reasons are the lower search costs and the

decrease in ASP of phablets and larger screen tablets. The former are part of the smartphone family. (IDC, 2014)

4.5 Top 4 tablet manufacturers

An overview of the most dominant smartphone manufacturers is provided by Statista (2014). Their results are found in the graph below. They are solely based on quarterly reports of IDC over the period 2Q11-2Q14. This section of the thesis will consequently elucidate the major trends in terms of market share of tablet manufacturers.

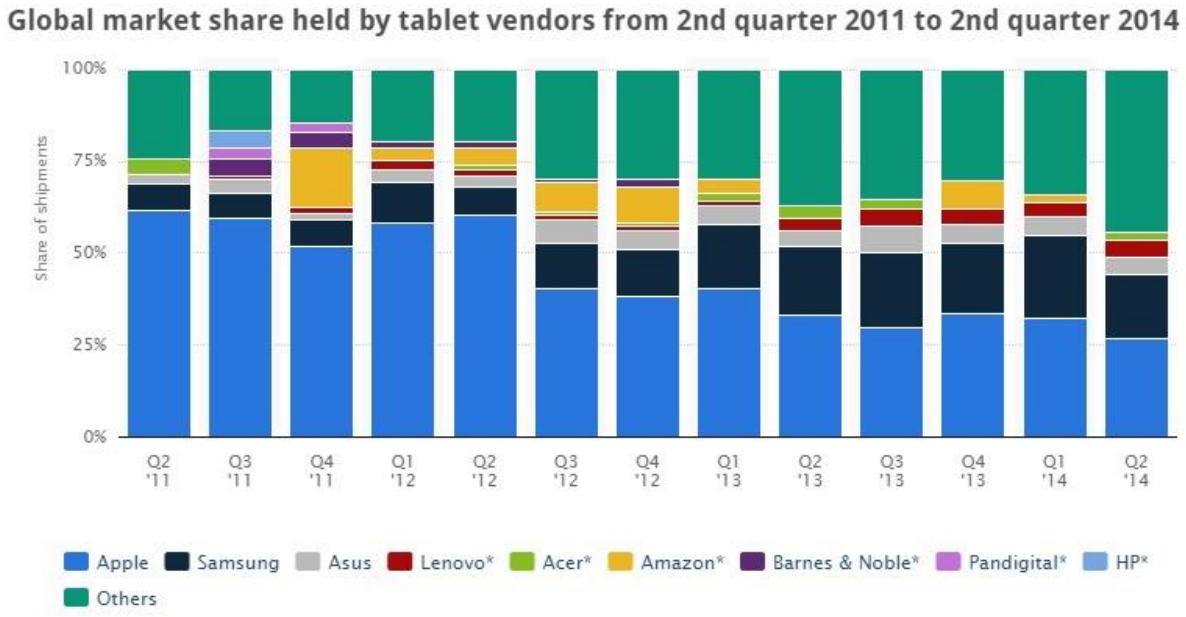


Figure 2: Global market share by tablet vendors from 2nd quarter 2011 to 2nd quarter 2014 (source: IDC & Statista, 2014)

Starting from 3Q11 until 1Q14, the top four of tablet manufacturers has not changed. The largest piece of the market has always been in hands by Apple, followed respectively by Samsung, ASUS and Lenovo. Over this period of time, Apple lost ground while Samsung, Asus and Lenovo took over a larger part of the market. Apple had 61,5% of all sales in hand in 2Q11, while at the moment in 2Q14 this is sharply dropped to almost 27%. Thereby, Samsung's and Lenovo's market share respectively tripled and quadrupled over the last three years, while ASUS knows a smaller increase. This is why the second quarter of 2014 shows Lenovo jumping to the third place selling 2,4 million units (IDC, 2014), thereby overtaking ASUS. Moreover, the share of other smaller companies increased in time, indicating the presence of multiple new players on the market.

5. Ultramobiles

5.1 Introduction

Researching the mobile market, premium ultramobiles and their massive increase in sales deserves a closer look. This section will talk about ultramobiles in particular, what makes them different and where they are used.

According to Nicolas Zeitler (2013), the first ultramobiles were presented by Microsoft and Intel at CeBIT 2006, one of the world's most important computer expo. The first devices were the Q1 manufactured by Samsung and TabletKiosk's EO series (O'Reilly, 2006). Zeitler, an experienced IT specialist who already published works for IT magazines, SAP News Center and the IDG News Service, indicates that these device at the time possessed the dimensions of a tablet PC. Equipped with a touchscreen, it was physically very similar to a tablet. But it was the presence of larger number of buttons on the edges that really made a significant difference. Although the EO was cheaper than the Q1, both devices were characterized by similar high prices, ranging from $899 up to $2000 depending on the configuration the user preferred (Ames, 2006; O'Reilly, 2007).

In an article about high-end ultramobile devices written by Ed Bott (2014) and based on reports of Gartner, a clear and extensive definition of these appliances is given. The former blogger is an award-winning technology writer and author of more than 25 books on Microsoft Windows and Office. Hereby it is said that:

"Premium ultramobiles extend the notebook usage model toward the tablet by refinement of physical characteristics, such as less weight, smaller size and smaller screen size (to enable easier portable usage), and instant-on. Premium ultramobiles typically weigh 1.6 kilograms (kg) and less. They are user-interface-optimized for media consumption, while retaining capabilities for full-scale data processing. Such a device will provide a good productivity and content creation capability compared with basic ultramobiles. It will, therefore, be an alternative to a notebook, dependent on the trade-offs that a user wishes to make between the characteristics of devices and their expected usage pattern. This category includes Microsoft's Windows 8 Intel x86 products and Apple's MacBook Air."

The most important aspects of an ultramobile is thus the combination of the portability and mobility of a tablet while preserving the most important capabilities of a normal notebook. Ultramobiles fill therefore the gap between a tablet and a PC or netbook

based on their physical characteristics and functionalities (Zeitler, 2013). Nonetheless, ultramobiles are usually not equipped with a CD/DVD drive, just like a tablet.

Increasing the currently so sought-after mobility of these devices (cfr. supra) while maintaining a large spectrum of functionalities make the ultramobile a very popular appliance and a true contender of the notebook in particular (cfr. supra). Besides this, the influence on tablet sales is insignificant, knowing the latter segment is massively growing (cfr. supra) and very popular.

5.2 A very blurry situation

Finding it difficult to remain a clear distinction between all these devices? Do not worry. Diana Hwang (2013), specialist in mobile technologies and former research analyst for IDC, declares that it is increasingly difficult to determine when a mobile device is a tablet, a notebook or an ultramobile. According to her, multiple evolutions leading to this situation consist of technical revolutions and the competition's strive for differentiation. These aspect are clarified below. In addition, extensive definitions are provided further in this section mainly focussing on the physical characteristics of these mobile devices.

To start, new technologies enabling portability comprise among others the development of new chips and the introduction of SSD (Hwang, 2013). Intel, a company specialised in delivering state-of-the-art computer software and hardware, announced to launch their brand-new chips on the market in the near future. More specifically, the new Broadwell and Skylake chips will be expected in respectively the first quarter and the second half of 2015. Intel states the latter are the biggest PC innovations in the last decade. According to Kirk Skaugen, general manager of Intel's PC Client Group, the Skylake chips will offer "*a significant increase in performance, battery life and power efficiency*" (Shah, 2014). This is excellent news for an environment currently striving for mobility. Prime examples are given on Intel's website. There it is stated that their current 2-in-1 products, which combine the functionalities of a tablet and notebook computer, offer a "*higher performance and greater speed with twice the battery life and half the weight*". This company among others offers devices that can lie flat, are able to be folded or even detached from the physical keyboard. (Intel, n.d.)

In addition, SSDs, or solid-state drives, continue to optimize the way data is stored. First, SSD enables devices to boot in a matter of seconds, decrease the time necessary to launch apps and increase the overall performance. Moreover, SSDs do not use moving parts

to operate and are therefore less sensitive to breakdowns or dysfunctions. Using these parts in very turbulent and harsh conditions will therefore not decrease their lifespan. This can be very interesting while operating in rough situations or when storing sensitive important information. Furthermore, as SSDs in comparison with hard disk drives, do not rely on spinning platters, the former are not limited in size reduction. As technology goes on, these SSDs will become increasingly smaller, resulting in smaller devices. This on its turn improves the portability. Finally, because SSDs are non-mechanical parts, the noise emission is virtually non-existent. (Domingo, 2014)

These factors are decisive from a private as well as business point of view, but even more crucial for the mobile environment as a whole. Additionally, they are responsible for closing the gap between tablet and non-tablet systems in terms of mobility, battery life and performance (Hwang, 2013).

Besides these incremental and radical technologies, it are the manufacturers that want to diversify their product offerings and try to fill every customer need. As an example, Microsoft, a company that stepped relatively late in the tablet market, decided to launch tablets with screen sizes up to 17 inches. This corresponds to a tremendous 43,2cm. This can be useful in the graphics market. Furthermore, disagreement exists in how large a tablet's screen maximally can be. In addition, notebooks are increasingly equipped with touch screen technology. This makes it possible to operate them using the computer mouse and keyboard or by simply sweeping fingers over the display, considerably decreasing operating times and enhancing user friendliness. Besides this, technical revolutions make notebooks lighter and better (cfr. supra). In addition, ultramobiles are on the market which fold into a tablet and are able to lie flat and detach (cfr. supra) (Hwang, 2013).

No need to say that this effort to diversify contributes significantly to the blurred line that separates these devices from one another.

At last, in order to give a certain guidance to the reader, it is worth mentioning the major directives that, according to Hwang (2013), split the mobile devices into their corresponding categories. Compared to the definitions described throughout previous sections in this thesis, these statements mainly focus on weight and size characteristics. Moreover, some striking examples are mentioned.

First, tablet computers are: "*Touchscreen, lightweight products that offer mobility, such as Apple's iPad. The devices' diagonal screen size is about 7 inches -- bigger than the 'phablet',*

a combination smartphone and tablet device -- to about a 12-inch screen diagonal. Tablets used to be distinguished not only by their size and touch, but also by their operating systems, which were different from those on full-fledged PCs. Microsoft's entry into this space with a full version of the Windows OS has changed the definition." (Hwang, 2013)

Second, the term ultramobiles comprises "*devices that are compact and light and offer the portability of a tablet, but function like a full PC. This category may include small-screen clamshell devices like a Chromebook or Surface Pro, or hybrid devices that also offer a detachable keyboard. Devices in this category may be termed 'ultra-light' or 'ultra-slim' notebooks as well, based on the product's size and weight. These devices generally weigh under 4 lbs.*" (Hwang, 2013). Hereby, 4 lbs. corresponds with 1,81 kg.

Finally, a notebook computer (or laptop) is seen as "*a full-fledged PC that is heavier than the ultra-slim notebooks, weighing 5 lbs. and above. These devices often replace the traditional desktop PC. Even though the notebook PC is mobile, it is still heavier than the ultra-mobiles like a Chromebook or even a 3-lb. MacBook Air.*" (Hwang, 2013). Converted, 3 and 5 lbs. match respectively 1,36 and 2,27 kg.

Although noticing this overlap of mobile devices' characteristics, it is decided to mainly focus this thesis on the currently most widespread and highly mobile appliances namely the smartphone and tablet computer (cfr. supra).

6. *Servitization of the economy*

6.1 The importance of services in the current economy

Where once the farming, forestry, fishing and industrial sector flourished, it is said that at the moment the service sector is the largest contributor to employment and GDP in most countries. This overtake started mid-twentieth century in certain countries and only gained importance since then. By 1999, the service sector of all developed countries contributed on average 71% to their GDP. In 1970, this share only amounted up to 53%. In addition, in 1999, two on three employees working in Europa are active in the service sector. In the US this sector even account for 75% of the overall employment. More recent figures can be found below. The focus here are the data regarding Europe as this is the major area of distribution of Dynafleet. Here, a clear growing trend occurs over the last years from about 71,8% to 74,4%. Also on a global scale a slight increase is noticeable. The service's share in the world's least developed countries fluctuates marginally around 46% of the GDP. Expectations are that this servitization trend will gradually spread over the entire world with each region adopting on its own pace. (Gemmel, Van Dierendonk & Van Looy, 2003, p.4-8)

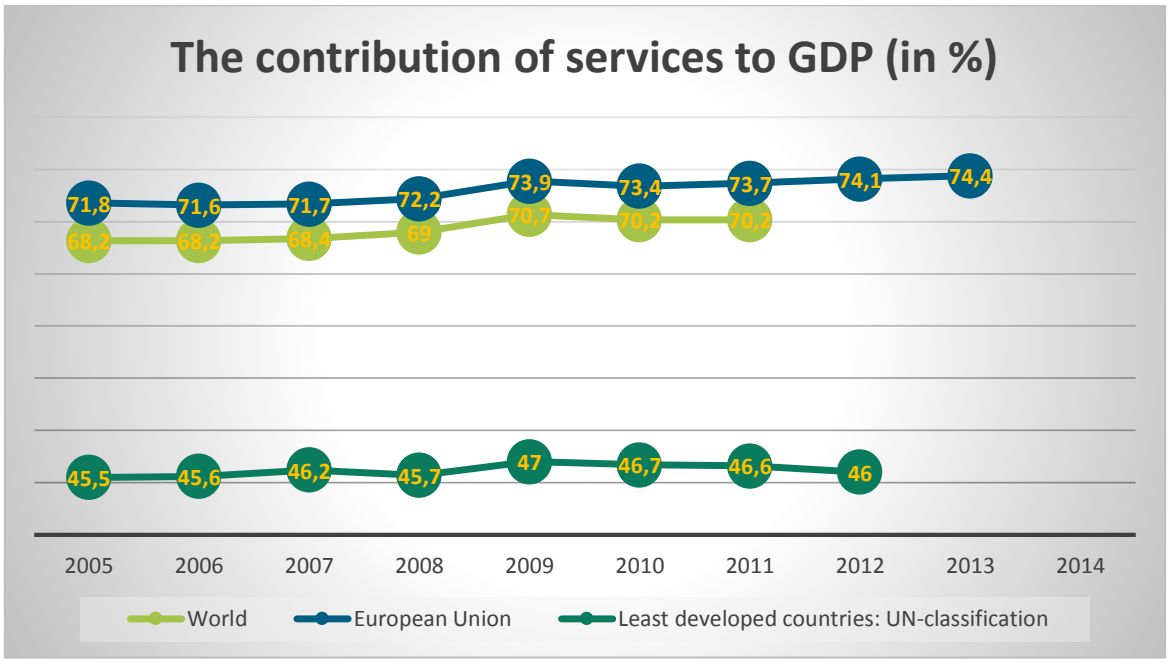


Figure 3: The contribution of services to GDP as a percentage (source: The World Bank)

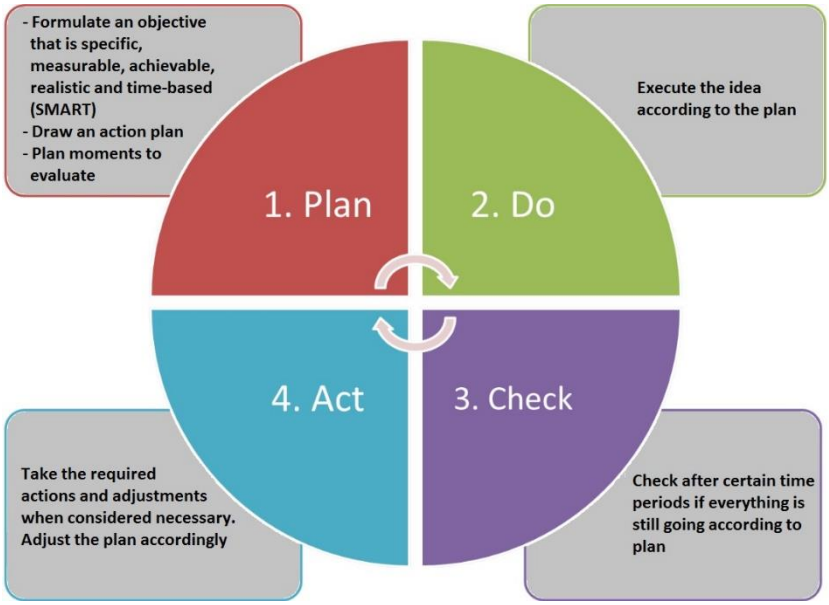
6.2 Factors contributing to relationship marketing

Three factors lay on the basis of this relationship based transition. First, technological developments facilitate the collection, research, derivation and storage of individual preferences or demand patters. Second, today's customers increasingly expect their individual preferences and needs will get recognized and satisfied. Finally, over the last decades, an explosion found place of the number of firms, entrepreneurs, businesses, etc. This increased the level of competition significantly. Consequently, gaining market share can be a challenging task. Therefore, it is up to these companies to retain their customers as best as they possibly can.

7. *Continuous improvements*

According to Raa (2013), the concept of continuous improvement is based on five principles. In order to successfully step into the 'kaizen' way of working, these principles have to be accomplished. First, all employees within the company must create a mind-set for improvement. Here it is important that they question every detail of the current way of working, especially those processes which seem so obvious and robust. Having the opinion of externals can help. Second, when something is causing problems, find the main source of this problem. This can be done using the '*5 why technique*' in which an employee successively asks himself why something is caused, until the moment he cannot find any more answers. The last possible answer is then the main cause of a particular problem. Third, try to reach your goal by doing small improvements rather than immediate perfection. It is important to check for mistakes in the meantime. Fourth, when searching for a particular solution, use brainstorm techniques and get the opinions from different people. Ideas can be, initially without any comment of the other participants during the session, written on post-it's and be put on a wall. When everyone has given his/her proposals, the best suggestions can be picked. Finally, it is important to remember that improvement knows no limits. A company can strive for perfection, but will never realize this goal. (Chalmet, 2012; Raa, 2013)

Methodologies utilized to realise this are the PDCA-cycle and the DMAIC-method. The *PDCA-cycle* is characteristic for the continuous improvement concept. It gives the corresponding sequence of steps, namely '*Plan'*, '*Do'*, '*Check'* and '*Act'*, which must be utilized when something within the company has to be implemented or executed. In this way, no essential steps are neglected or skipped. An alternative is the *DMAIC-method*, short for '*Define'*, '*Measure'*, '*Analyse'*, '*Improve'* and '*Control*'. It is part of the Six Sigma philosophy which consists of decreasing the amount of variation and consequently reduce costs. A representation of both techniques can be found below. (Chalmet, 2012; Raa, 2013)



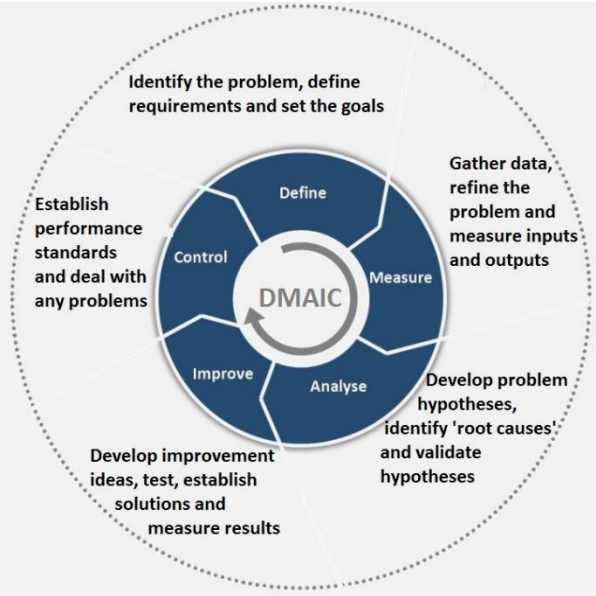


Figure 4: The PDCA-cycle (top) and DMAIC-method (bottom)
(source: Productiebeleid by Chalmet, 2012; Advanced Production Management by Raa, 2013)

8. *Driving time regulations*

The Regulation (EC) 561/2006 comprises among others that every 4,5 hours a break of at least 45 minutes should be taken. In total, the daily driving period is limited to 9 hours. Drivers are allowed to extend this up to 10 hours, but only twice a week. The total weekly driving time can only rise up to 56 hours and the total fortnightly driving time cannot exceed 90 hours. So, when for example a chauffeur wants to max out its daily driving capacity in a particular week and consequently drives in the first week six days, with four days of 9 hours driving and two days of 10 hours, then he totals 56 hours that week. This implies that in the following week he is only able to work 34 hours. Therefore, an extensive time planning is here certainly essential.

In addition, the driver is obliged to rest 11 uninterrupted hours on a daily basis. This can be reduced to 9 hours maximum three times a week. The daily resting time can also be split up in 3 hours followed by 9 hours of uninterrupted rest time instead of 11 hours in one time. Though, in the former case he/she rested in total one hour longer due to his/her rest was broken into two smaller parts. The weekly and fortnightly rest periods are also embedded in the 561/2006 regulation, though this would lead this topic to far from its intent. Therefore, it is advised to consult this regulation when additional information is desired.

Exceeding of the daily maximum driving time

		Longest uninterrupted resting time in the considered period of daily driving time				
		< 3 hours	3-5 hours	5-7 hours	7-9 hours	> 9 hours
Number of daily driving hours exceeding the authorized driving time a day (9 or 10 hours)	< 1 hour	€ 120	€ 100	€ 80	€ 60	€ 40
	1-2 hours	€ 180	€ 155	€ 130	€ 105	€ 80
	2-3 hours	€ 300	€ 260	€ 220	€ 180	€ 140
	3-5 hours	€ 450	€ 380	€ 310	€ 240	€ 170
	5-8 hours	€ 880	€ 750	€ 620	€ 500	€ 380
	8-12 hours	€ 1 320	€ 1 130	€ 940	€ 750	€ 560
	> 12 hours	€ 1 600	€ 1 360	€ 1 120	€ 910	€ 700

Table 8: Exceeding of the daily maximum driving time (source: KB 27/04/2007)

Hereby, it has to be mentioned that, if the driver did rest for a certain amount of time, but his/her break was interrupted, the fine is equal to €50 for every half an hour under the daily obliged resting time of 11 hours in normal circumstances (cfr. supra).

Exceeding of the maximum authorized uninterrupted driving time (4h30)

		Duration of the longest uninterrupted break time in the driving time period considered (breaks shorter than 15min are not considered)		
		No break of at least 15 minutes	Between 15 and 30 minutes of break	Between 30 and 45 minutes of break
Time of driving exceeding the authorized uninterrupted driving time (4h30)	< 15 minutes	€ 40	€ 30	€ 20
	15-30 minutes	€ 80	€ 60	€ 40
	30-60 minutes	€ 120	€ 90	€ 60
	1-2 hours	€ 240	€ 180	€ 120
	2-3 hours	€ 400	€ 300	€ 200
	3-5 hours	€ 600	€ 450	€ 300
	5-8 hours	€ 1 200	€ 880	€ 600
	> 8 hours	€ 2 000	€ 1 460	€ 1 000

Table 9: Exceeding of the maximum authorized uninterrupted driving time (4h30) (source: KB 27/04/2007)

9. Environment

Most information implemented in the following sections is based on an air quality report for Europe published in 2014. This document is draft by the EEA, short for 'European Environment Agency', and evaluates the status and trends of the European air quality based on figures from 2003 up to 2012. Further details about air pollution and quality can be found there.

9.1 Origin of different pollutants

9.1.1 Particulate matter (PM)

Particulate matter is emitted in the atmosphere by fuel combustion in vehicle engines ($PM_{2,5}$), but also coming from tyres-, brakes- and road wear (PM_{10}). PM is subdivided into different categories based on the particles' aerodynamic diameter. Is this smaller than 10µm or 2,5µm then we talk about PM_{10}, resp. $PM_{2,5}$. The transportation sector the third largest provider of PM, preceded by household fuel combustion and industry. In transportation, $PM_{2,5}$'s share within PM_{10} is around 78%. This share is slightly lower in comparison with household fuel combustion, but significantly higher than industrial generated $PM_{2,5}$. Non-exhaust emissions are mainly considered PM_{10}. This quantity mounts up to roughly 50% of the exhaust emitted PM_{10}. The share of $PM_{2,5}$ compared with exhaust originated emissions of $PM_{2,5}$ is not even one fourth.

Figure 5 in the Appendix shows that the emission of PM_{10} and $PM_{2,5}$ resulting from the transportation sector is slightly decreasing.

9.1.2 Non-methane volatile organic compounds (NMVOC)

NMVOC is discharged into the atmosphere due to fuel combustion. The collective term NMVOC is part of the VOC (Volatile organic compound) family and specifically excludes methane containing compounds. The reason is the much higher reactivity of products when being methane free. This higher reactivity with other matter can result in the deterioration of human health and nature, a subject that receives a closer look in the next section.

A particular example of NMVOC is benzene (C_6H_6). The EEA declares that: "*80 to 85% of C_6H_6 emissions are attributable to vehicle traffic in Europe*". Though, this pollutant is seen as a subcomponent of NMVOC and therefore not independently recorded. Benzene is

added to petrol and reaches the atmosphere -again- due to incomplete fuel combustion. Other important pollution sources are oil refineries and the handling, distribution and storage of petrol. These are important foregoing processes necessary to run the transport sector. Exposure to benzene can lead to anaemia, deterioration of the immune system, cancer and reproduction problems.

The amounts of NMVOC emitted by the transport sector fell considerably over the last decade (cfr. figure 5 in Appendix). In 2003 this sector held a sad second place within EU-28, discharging 2.500.000 tonnes of NMVOC that year. In 2012 it dropped under the commercial, institutional and household fuel combustion, decreasing its emission by 63% compared with 2003. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.47; EEA, 2014, p. 23-25; Steunpunt Milieu en Gezondheid & VITO)

9.1.3 Nitrogen oxides (NO_x)

Fuel combustion in car and truck engines create NO and NO_2, collectively described as NO_x. Normally engines emit 5% to 10% of NO_2, the remaining part is NO. The latter will form NO_2 when oxidation takes place (cfr. infra). Diesel engines are an exception. Up to 70% of their NO_x is NO_2. Due to the increased share of diesel vehicles in traffic, NO_2 limit values are often exceeded in traffic hotspots.

From figure 5 in the Appendix it is clear that transport is by far the largest supplier of NO_x. Though, its value is significantly decreasing over time due to the rise of strict regulations in the transport sector. The latter also accords as a reason for the lower NMVOC emission. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.45-47 & 51-52; EEA, 2014, p.13 & 25; EPA, n.d.)

9.1.4 Benzo(a)pyrene (BaP)

BaP is part of the polycyclic aromatic hydrocarbon (PAH) family. It is also found in fine PM. Road traffic is among the main sources of BaP in Europe. Both the combustion of fuel as well as rubber-tyre wear contribute to this matter.

Exposure to BaP and PAH in general, due to skin contact, inhalation or eating contaminated food, elevates the chances of dying from cancer. PAH on its own contributes only for a small fraction to carcinogenic effects. Though, in combination with other PAHs, vulnerability for cancer increases in an exponential way. This can be certainly the case as PAHs in general are very difficult to decompose and consequently have a considerably long

retention time. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.60-61; EEA, 2014, p.25)

Figure 5 in the Appendix shows that the emission level of BaP by transport is similar to almost all other main sources of air pollution. An exception is the commercial, institutional and household fuel combustion. This is by far the main supplier of BaP. Moreover, the BAP level emitted by transport did not change much in the period 2003-2012. (Figure 6 Appendix)

9.1.5 Sulphur dioxide (SO_2)

This gas is emitted into the atmosphere when sulphur-containing fossil fuels and biofuels are burned, such as in a vehicle's combustion engine. Though, the vehicle transportation sector is one of the less significant sources of SO_x, a collective term to refer to SO_2 and SO_3. (EEA, 2014, p.27)

As already mentioned, SO_2 contributes to the phenomenon of acidification of the soil, lake-, river-, and rainwater (cfr. supra). As a consequence, this pollutant has a disastrous effect on the environment as well as materials and buildings.

Over the period 2003-2012 the overall SOx-level in EU-28 dropped by 54%. This is mainly due to massive reductions of the latter pollutant in the energy sector. (Figure 5 Appendix)

9.1.6 Carbon oxide (CO_x)

CO_x is a collective term for CO and CO_2. This compounds originate from incomplete fuel combustion of fossil fuels and biofuels taking place in vehicle engines. Therefore CO_x-emission levels tent to fluctuate based on different traffic patterns occurring during the day. Urban areas and rush hours are hotspots when it comes to emitting this pollutant.

Due to the implementation of catalytic converters in vehicles, road transport is no longer the main emitter of CO_x. In 2003 road transport was by far the largest source of this pollutant. Though, stricter European and national emission regulations caused the CO_x-emission of this sector to plunge. In this case, the most prominent measure is the Euro standards (cfr. Appendix section 9.5). Currently the emission is around industry level, while commercial, institutional and household fuel combustion takes the first place. (cfr. figure 5 Appendix) (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.39-41; EEA, 2014, p.27)

9.1.7 Toxic metals

The amount of toxic metals emitted by the transport sector is, relatively to other pollution sources, low. Though, a wide variety of hazardous metals come free when fuel combustion takes place. Arsenic (As), cadmium (Cd), mercury (Hg), copper (Cu), nickel (Ni), zinc (Zn) and lead (Pb) are emitted. Hereby, the latter is on a relatively base for the transport sector the most significant one. From 2003 to 2012, the amounts of each metal discharged by this sector are rather constant.

All these metals are toxic to very toxic for human beings. Dependent of the type of metal and the amount and time of exposure, they can be deadly. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.9; EEA, 2014, p.27-28)

Additionally to these pollutants, non-toxic nuisance occur prompt by the transport sector. Hereby, odour and noise hindrance are evident examples.

9.2 Impact of different pollutants

9.2.1 Human health

Therefore, the higher sickness level and consequently the increased medical costs and decreased productivity of the economy have a considerable economic impact. The European Commission estimates that the impact on human health caused by air pollution in 2010 had an overall price tag between the 330 and 940 billion euro whereby lost workdays and healthcare costs amounted to respectively 15 and 4 billion euros. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.47, 60-63; EEA, 2014, p.13, 20-25, Steunpunt Milieu en Gezondheid & VITO)

9.2.2 Ecosystems

Consequences are that, among others, the growth rate of agricultural crops can be affected. For 2010, unsatisfied crop growth due to air pollution cost the European farmers 3 billion euro. Furthermore, this phenomenon contributes to the biological impoverishment of Scandinavian lakes and forest dieback in Central-Europe. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.45-47, 51-52; EEA, 2014, p.13, 25; EPA, n.d.)

9.2.3 Climate

CO_2, accompanied by methane (CH_4) and nitrous oxide (N_2O), are the prominent sources of a phenomenon called the *greenhouse effect*. The previously mentioned gasses,

which are located in the atmosphere, are named greenhouse gasses. Analogue to the corresponding garden construction, their function is generally the same. Part of the incoming sunlight can pass these gasses, but the following emitted heath of the Earth is retained. As a result, the temperature of the Earth rises. This leads to the well-known problem of global warming and all of its consequences. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.39-41; EEA, 2014, p.27)

9.2.4 Effects of ozone depletion and photochemical smog

Furthermore, NO reacts with O_3 (ozone) to form NO_2 and O_2. In other words, NO is causing ozone depletion. Because O_3 is an instable chemical matter with a strong oxidizing capacity, this reaction takes place. 90% of all ozone in the atmosphere is located in the stratosphere, peaking in Europe around an altitude of 21 to 24km. These amounts of O_3-concentrations is called the *ozone layer*. (De Witte, Sercu, Van Langenhove & Walgraeve, 2014, p.45-47, 51-52; EEA, 2014, p.25; EPA, n.d.)

9.3 Are we on track?

Due to regulations, policies and standards, Europe's air quality is noticeably improved over the last 20 years. An extensive overview regarding this subject is provided in the Appendix (table 10). Though, we are still a long way for achieving acceptable pollution levels from an environmental as well as health point of view. The EEA mentions that a study was performed investigating whether the TSAP objectives for 2020 would be met. The result showed that, without updated or additional policies, this would not be the case. Therefore, the European Commission proposed in late 2013 the Clean Air Policy Package, introducing stricter national emission reduction commitments on a longer term, namely for 2030 and thereafter. (EEA, 2014, p. 16-18)

In comparison with certain other continents such as Asia and South-America, Europe is doing relatively well. Due to an increased economic activity during the last decades, certain countries in the former regions implement older technologies, have lower environmental standards and more polluting fuels are used in comparison with Europe. So from a relatively global point of view, Europe's efforts are paying off, though being far from achieving its ultimate goals. (EEA, 2014, p. 13)

9.4 Figures and graphs

Policies \ Pollutants		PM	O_3	NO_2 NO_X NH_3	SO_2 SO_X	CO	Heavy metals	BaP PAHs	VOC
Directives regulating ambient air quality	2008/50/EC	PM	O_3	NO_2	SO_2	CO	Pb		Benzene
	2004/107/EC						As, Cd, Hg, Ni	BaP	
Directives regulating emissions of air pollutants	2001/81/EC	(a)	(b)	NO_X, NH_3	SO_2				NMVOC
	2010/75/EU	PM	(b)	NO_X, NH_3	SO_2	CO	Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V		VOC
	Euro standards on road vehicle emissions	PM	(b)	NO_X		CO			VOC, NMVOC
	94/63/EC	(a)	(b)						VOC
	2009/126/EC	(a)	(b)						VOC
	1999/13/EC	(a)	(b)						VOC
	91/676/EEC			NH_3					
Directives regulating fuel quality	1999/32/EC	(a)			S				
	2003/17/EC	(a)	(b)		S		Pb	PAHs	Benzene, VOC
International conventions	MARPOL 73/78	PM	(b)	NO_X	SO_X				VOC
	LRTAP	PM (a)	(b)	NO_2, NH_3	SO_2	CO	Cd, Hg, Pb	BaP	NMVOC

Note: (a) Directives and conventions limiting emissions of PM precursors, such as SO_2, NO_X, NH_3 and VOC, indirectly aim to reduce particulate matter ambient air concentrations.

(b) Directives and conventions limiting emissions of O_3 precursors, such as NO_X, VOC and CO, indirectly aim to reduce troposphere O_3 concentrations.

Table 10: Legislation in Europe regulating emissions and ambient concentrations of air pollutants (source: Air quality report 2014 - EEA)

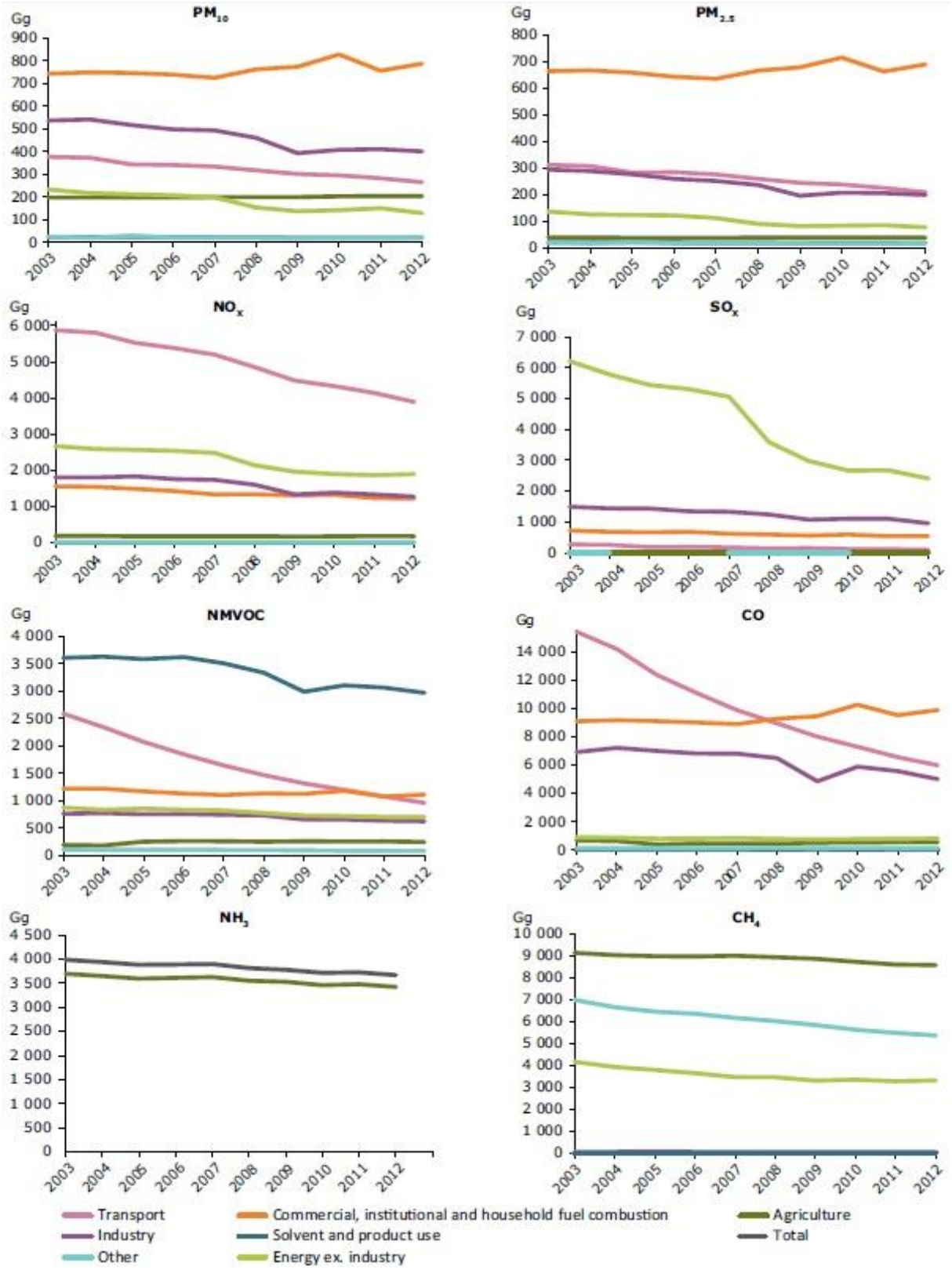


Figure 5: EU-28 emissions by source (source: EEA)
***Gg = 1000 tonnes**

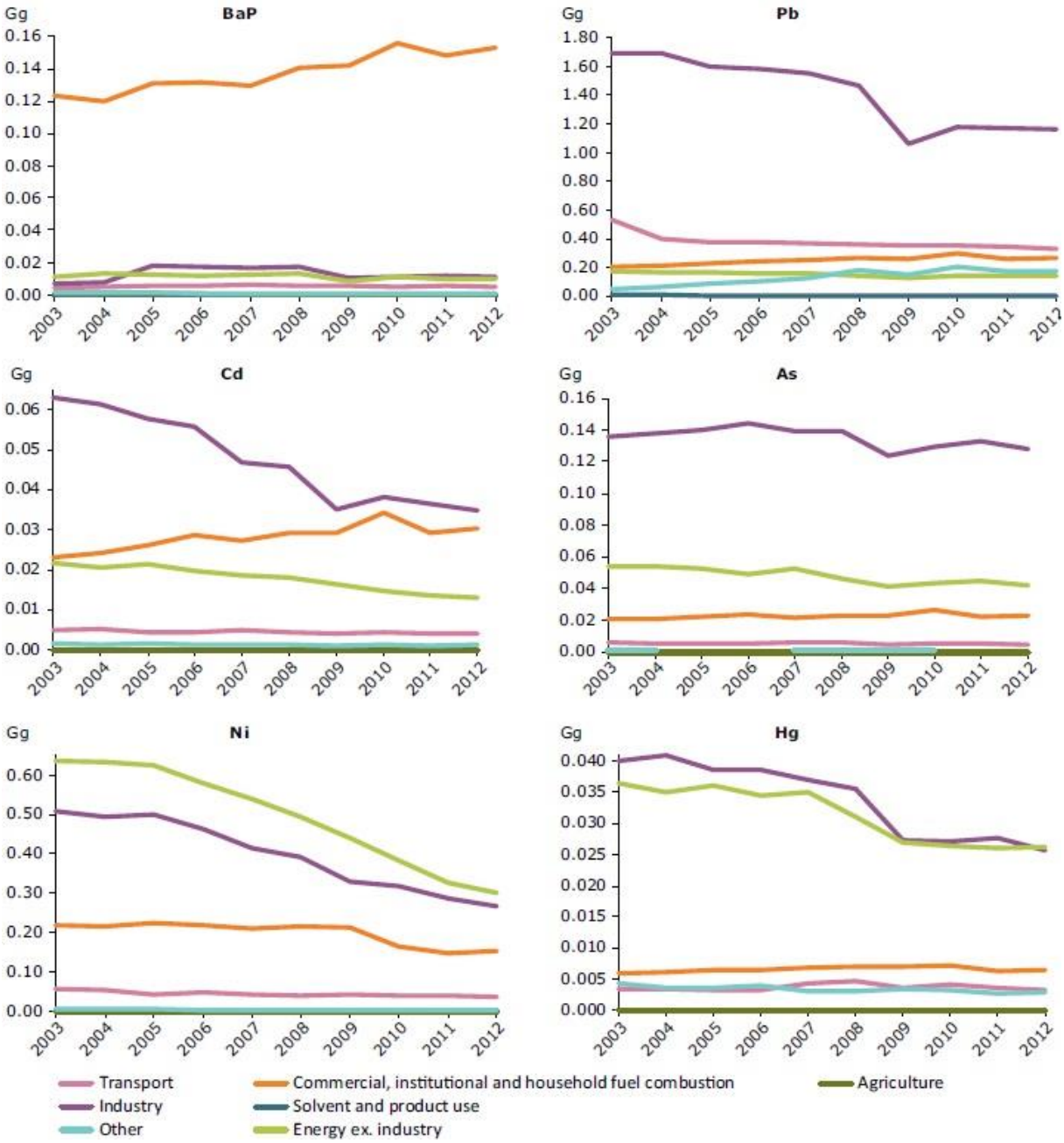


Figure 6: EU-28 emissions by source (cont.) (source: EEA)
***Gg = 1000 tonnes**

9.5 How does Europe battles air pollution?

According to the EEA, an investigation of 12 cities across Europe showed that, in order to reduce PM and NO_2 concentrations to acceptable levels, most measures to tackle air pollution were taken on the part of traffic and transportation. As already mentioned, the transportation sector has an important influence on the air quality. Dynafleet reduces fuel consumption and consequently fuel combustion, an important enabler of air quality deterioration. In other words, less fuel consumption and combustion would mean better air quality. Dynafleet realizes this mainly by better planning, increased monitoring and providing valuable feedback to the employees. Though it is important to have also insight in other ways air pollution is dealt with. The next section overviews especially those regulations regarding road transport and traffic that aim to restore the air quality. (EEA, 2014, p. 19)

The European air pollution problem is combated utilizing well-established policies, directives and regulations, implementing air quality standards and controlling emissions. Concrete air quality objectives are enclosed by the Thematic Strategy on Air Pollution (TSAP). Hereby, the situation in 2020 must be significantly improved compared with the one in 2000.

Source-specific legislations target among others all types of vehicle emissions and fuel quality standards. Hereby, limitations or target values are set to national emissions of harmful pollutants such as SO_2, NO_x, CO (carbon monoxide), C_6H_6 (benzene), NMVOC and NH_3. Examples of such European directives regarding air pollution levels are 2008/50/EC, 2004/107/EC, the NEC Directive and the Gothenburg Protocol. (EEA, 2014, p. 15)

In addition to the more general vehicle directives, more specific conventions are developed focussing specifically on trucks and cars. Hereby, the Euro Regulations are well-known standards on the topic of road vehicle emissions. The latest norms are the Euro 5 and 6. In order to achieve a certain standard, the vehicle must suffice certain emission parameters. The higher the standard number, the lower the amount of pollutants in exhaust fumes may be. Hereby, the particular parts are CO, HC, NO_x and PM. The following table provides an overview of the different Euro standards and the corresponding limitations for pollutants. Here, EEV stands for Enhanced Environmentally friendly Vehicle. (EEA, 2014, p. 16)

European standards regarding emission of trucks (in g/kWh)							
Standards	Directives	Commencing date (new types)	Commencing date (new registrations)	CO	HC	NO_X	PM_{10}
Euro-0	88/77	July 1, 1988	October 1, 1990	11,2	2,40	14,40	-
Euro-1	91/542	July 1, 1992	October 1, 1993	4,5	1,10	8,0	0,36
Euro-2	91/542	October 1, 1995	October 1, 1996	4,5	1,10	7,0	0,15
Euro-3	1999/96	October 1, 2000	October 1, 2001	2,1	0,66	5,0	0,10
Euro-4	1999/97	October 1, 2005	October 1, 2006	1,5	0,46	3,5	0,02
Euro-5	1999/98	October 1, 2008	October 1, 2009	1,5	0,46	2,0	0,02
EEV		-	-	1,5	0,25	2,0	0,02
Euro-6	595/2009	January 1, 2013	January 1, 2014	1,5	0,13	0,4	0,01

Table 11: European standards regarding emission of trucks (source: Instituut voor duurzame mobiliteit)

Next, Directive 2009/126/EC encloses guidelines regarding the amount of petrol vapour that needs to be recovered during the refuelling of motor vehicles at service stations. Furthermore, Directive 2003/17/EC provides norms for the quality of petrol and diesel fuels. Finally, according to the Directive 2003/59/EG chauffeurs holding a driving license C and C+E necessary to drive a truck, must attain every five years a training of 35 hours regarding among others eco-driving. That a particular Directive addresses the air pollution problem with this type of solution means that changing the behaviour of truck drivers does impact the air quality to a certain degree. This is good news for driving style monitoring tools such as Dynafleet. Though, as seen in previous and following examples, air pollution in the transportation sector is tackled in a much wider variety of ways than Dynafleet is capable to.

For more interesting details and examples regarding European directives and international conventions regulating air pollutant emissions, table 11 in the Appendix provides an overview of this subject.

Certain policies are implemented across Europe in order to be in line with the air quality regulations. Specifically for the transport sector prioritisation took place of rapid urban transit, low-emissions vehicles and less sulphur containing fuels are used, speed limits, road pricing, low emission zones and retrofitting are introduced. The latter occurs when new technologies are fitted to older technical systems. An example is a diesel particulate filter to significantly lower diesel particulate matter from the exhaust gasses of a diesel engine.

The ultimate goal of these directives, standards and conventions is to bring air pollution levels down in areas where limits are crossed. If exceedances occur, air quality management plans must be (sub-) nationally developed in order to tackle the specific problems and to be in line with the European legislation. Of course, local authorities have to option to implement additional, more severe measures.

10.Dynafleet explained

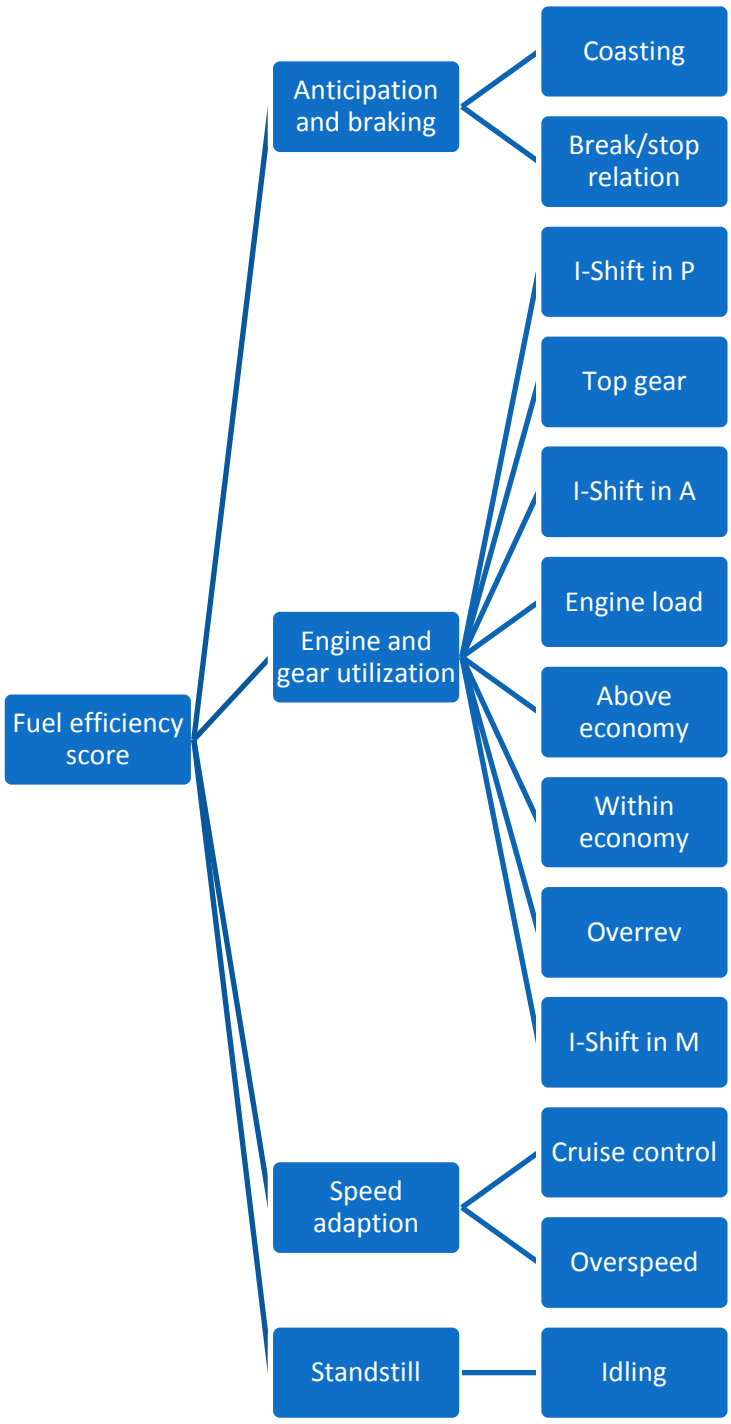


Figure 7: Categories and parameters of Dynafleet's fuel efficiency score

11.Dynafleet mobile application for those who have complete access (fleet users)

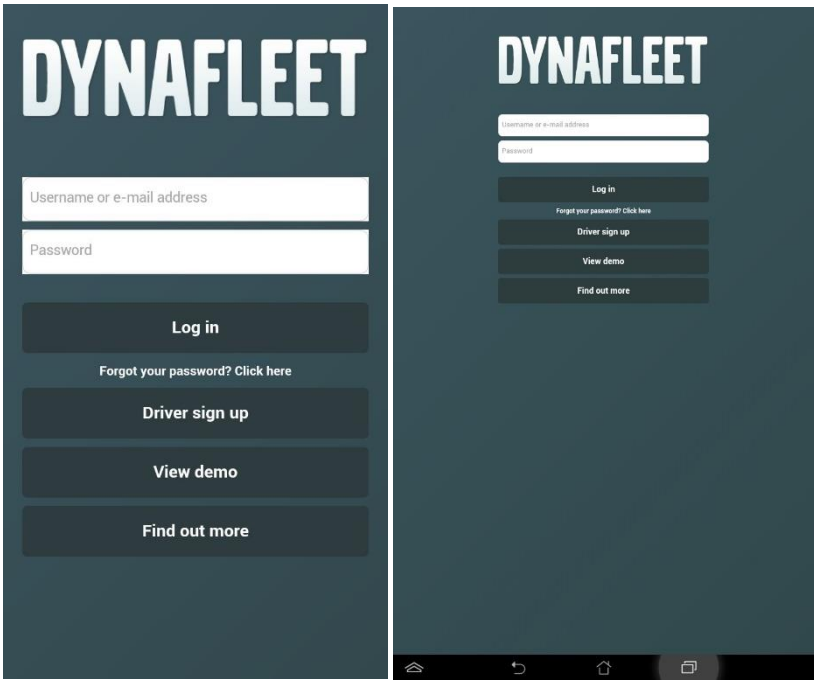


Figure 8: Home screen of Dynafleet's mobile application on smartphone (left) and tablet (right)

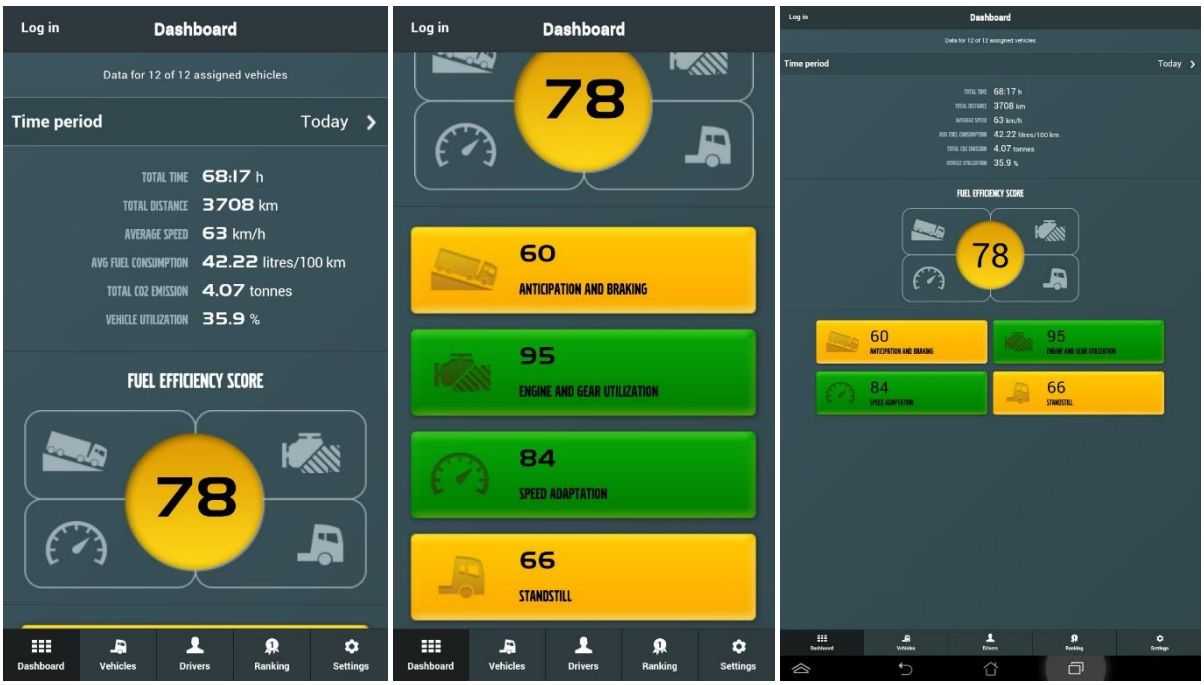


Figure 9: Dashboard screen of Dynafleet's mobile application on smartphone (left and center) and tablet (right)

Figure 10: Parameters regarding fuel efficiency score of Dynafleet's mobile application on smartphone (left and center) and tablet (right)

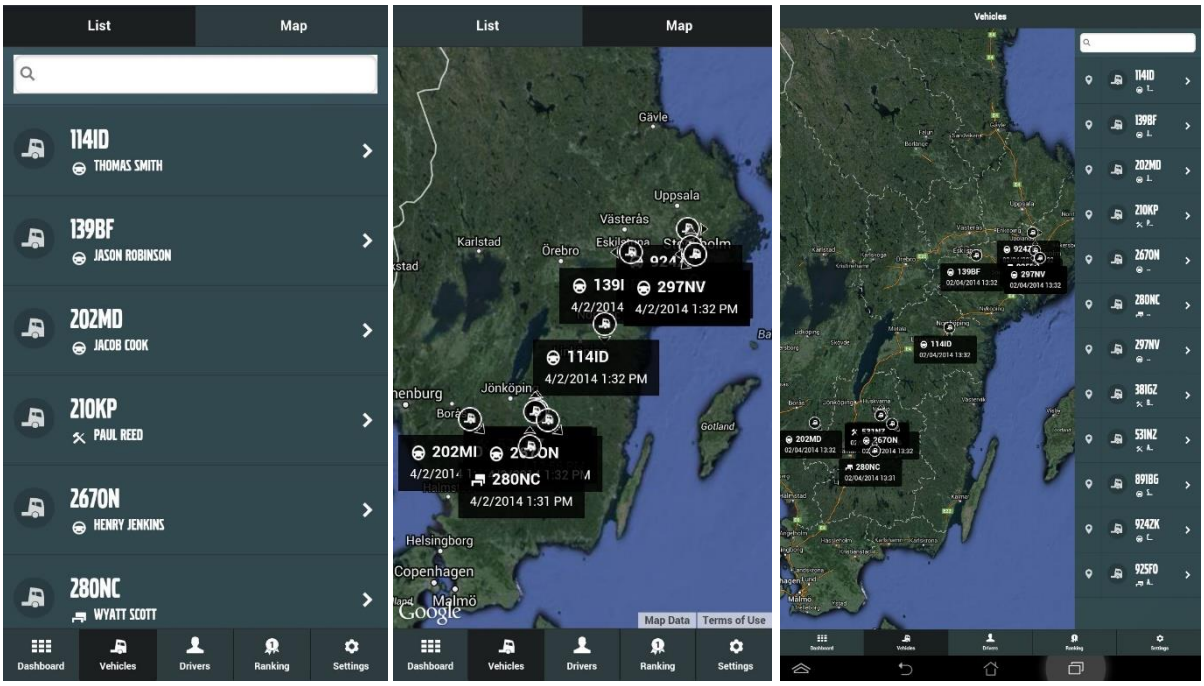


Figure 11: Vehicles screen of Dynafleet's mobile application on smartphone (left and center) and tablet (right)

Figure 12: Driver details within the Vehicles screen of Dynafleet's mobile application on smartphone

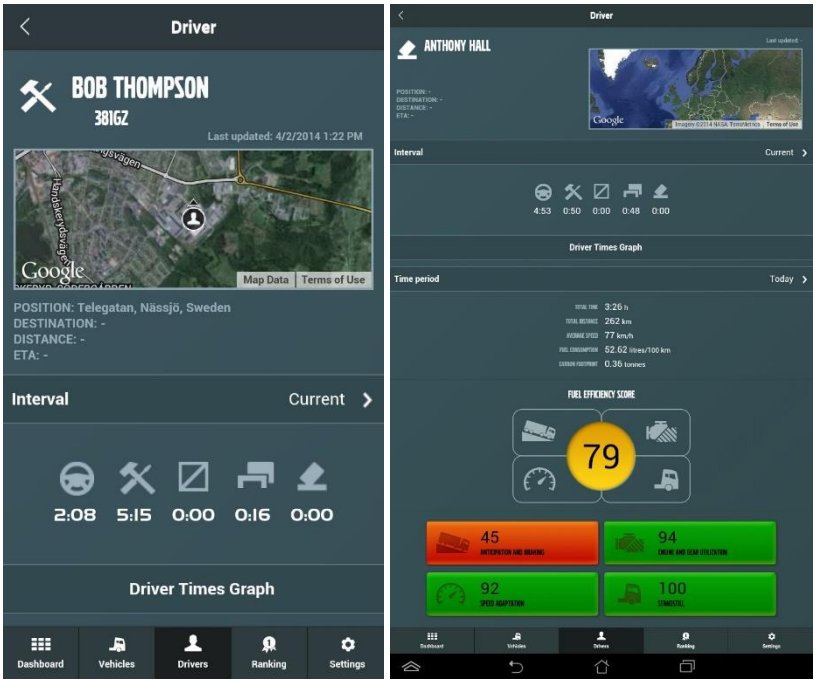


Figure 13: Part of the driver details within the Drivers screen of Dynafleet's mobile application on smartphone (left) and tablet (right)

Figure 14: 'More parameters' screen within the driver details of Dynafleet's mobile application on smartphone (left) and tablet (right)

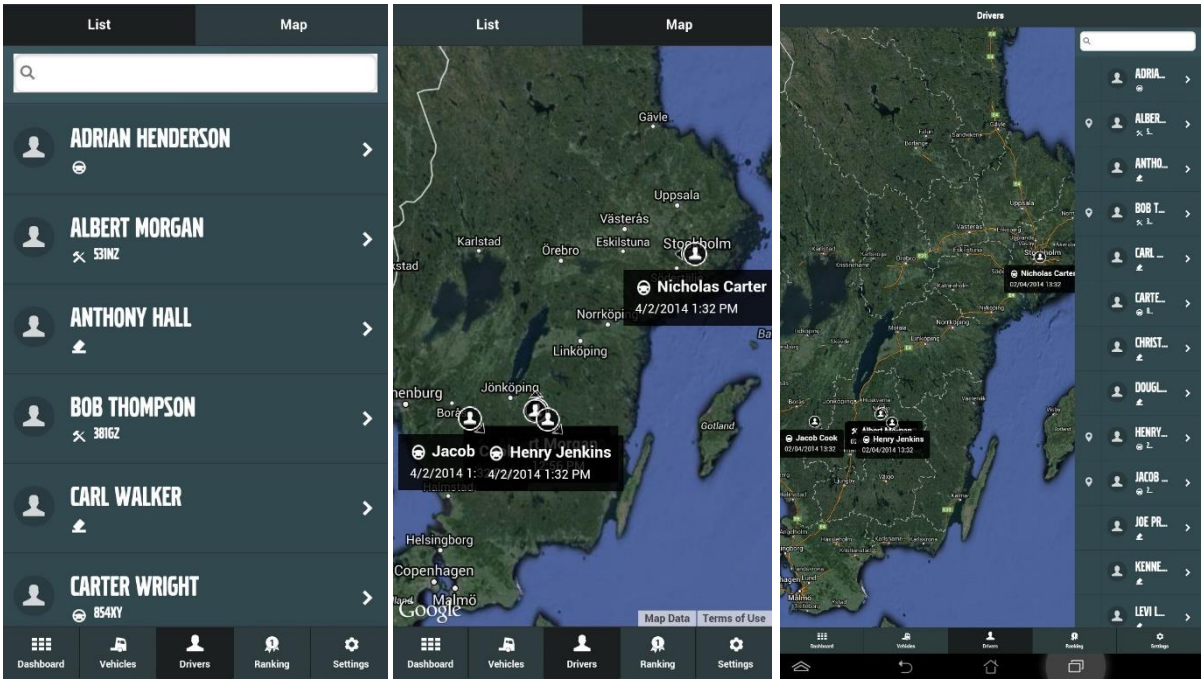


Figure 15: Drivers screen of Dynafleet's mobile application on smartphone (left and center) and tablet (right)

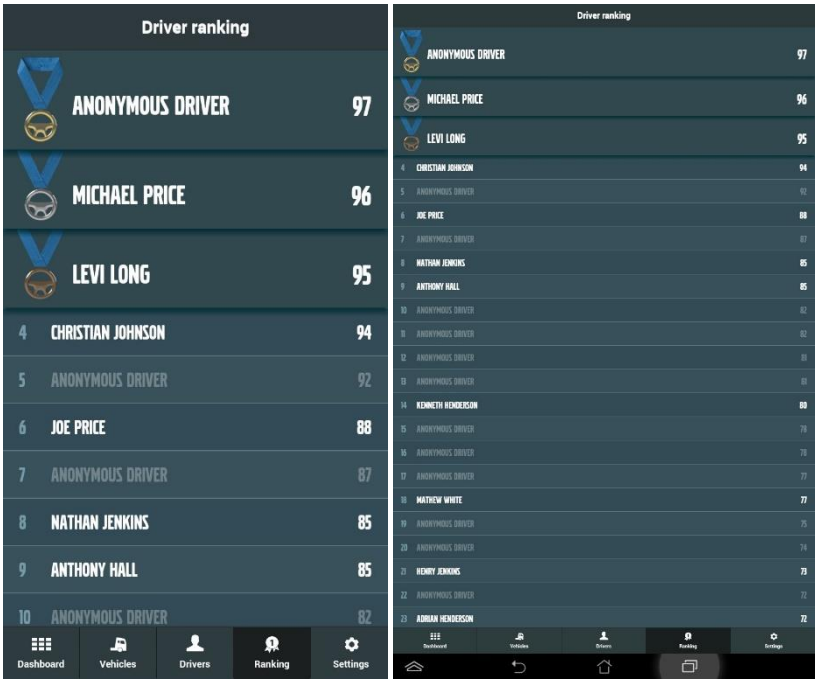


Figure 16: Ranking screen of Dynafleet's mobile application on smartphone (left) and tablet (right)

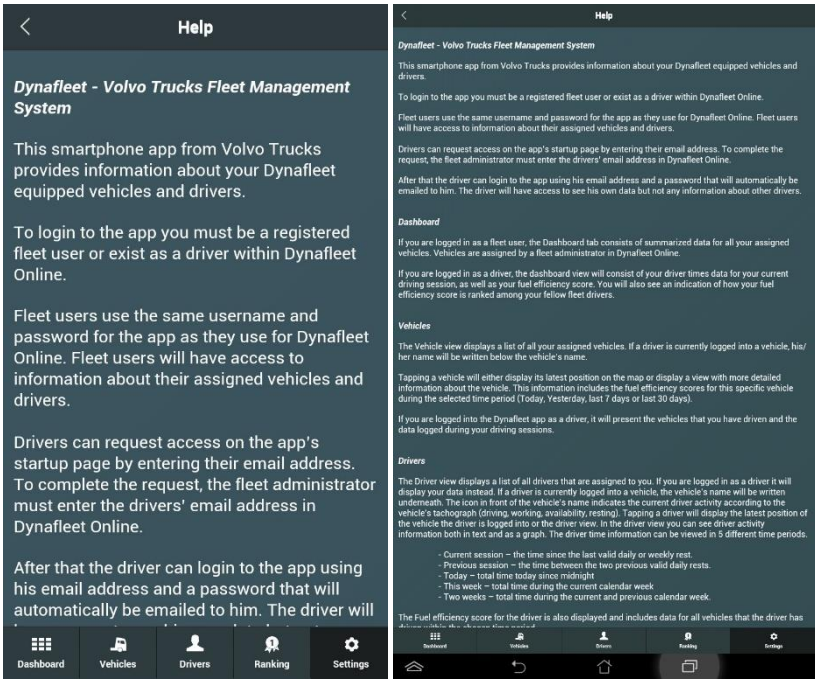


Figure 17: Help screen within Settings menu of Dynafleet's mobile application on smartphone (left and center) and tablet (right)

12.Dynafleet mobile application for those who have limited access (truck drivers)

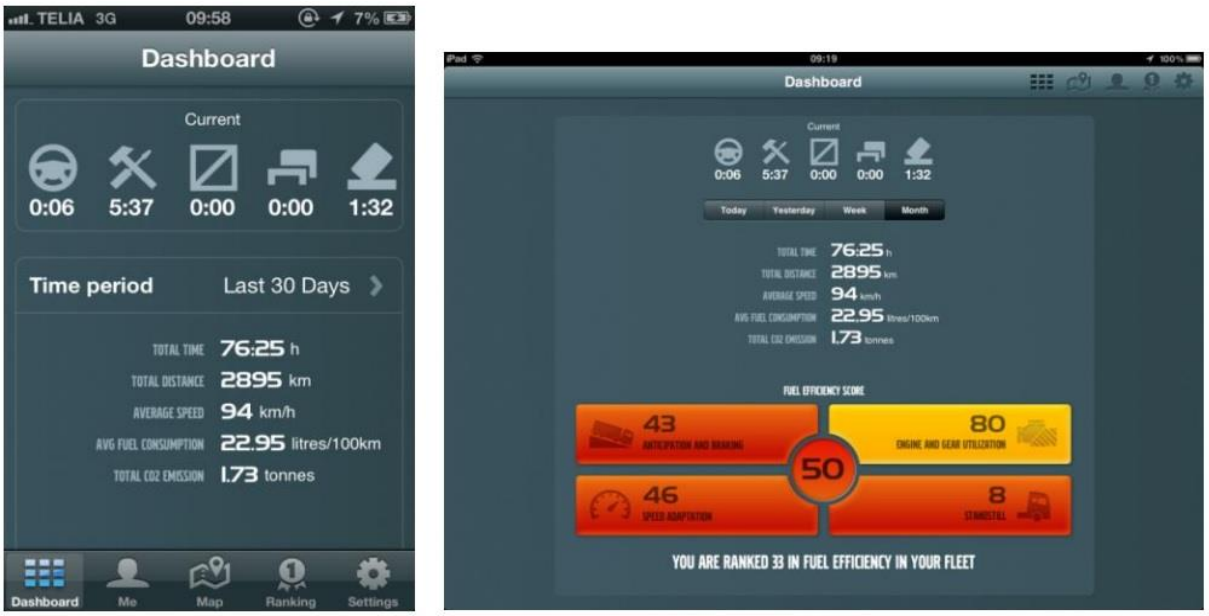


Figure 18: Dashboard menu for truck drivers on smartphone (left) and tablet (right) (source: Dynafleet release notes)

Figure 19: Me menu for truck drivers on smartphone (source: Dynafleet release notes)

13.Dynafleet's possible revenues and costs

13.1 De Rese's possible annual revenues and costs

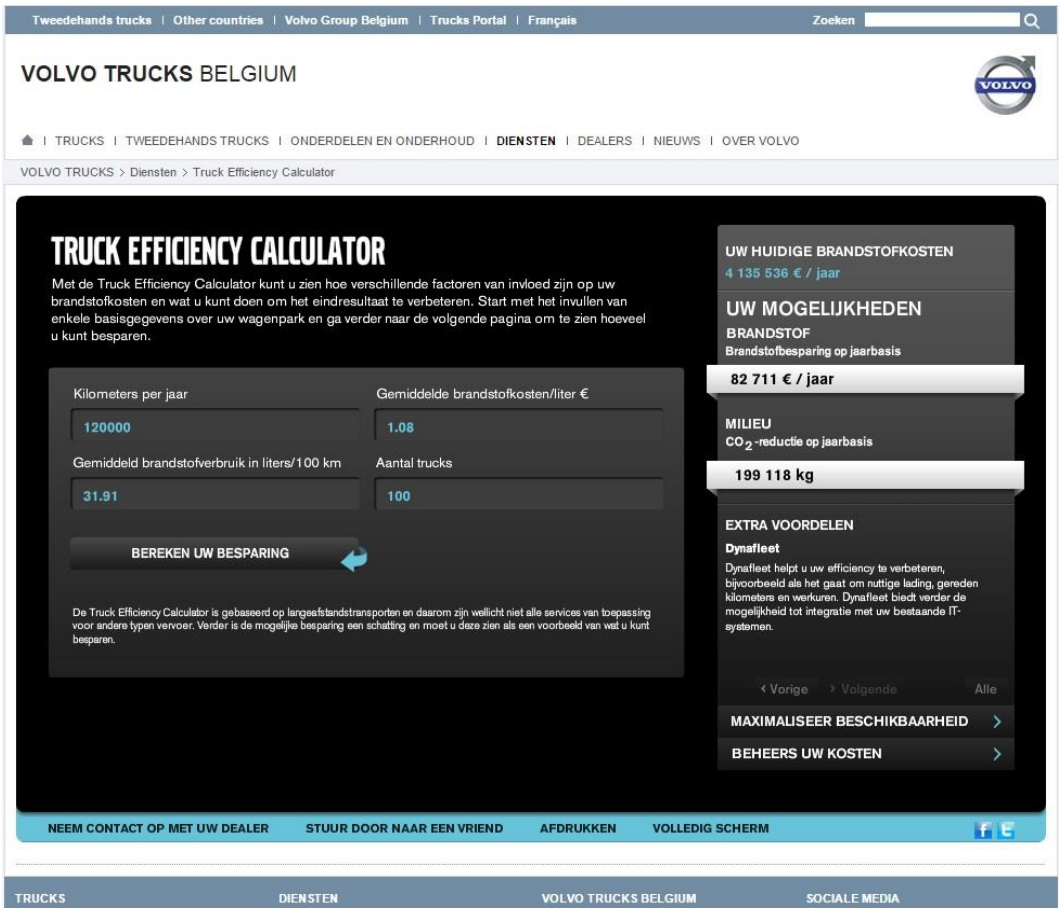


Figure 2015: Fuel Efficiency Calculator (source: Volvo Trucks)

Fuel costs and -savings, net profit and ROI for different fuel savings levels (case De Rese)

Fuel savings level (in %)	1	2	3	4	5	6	7
Fuel consumption with Dynafleet (in litre/100km)	31,28	31,28	31,28	31,28	31,28	31,28	31,28
Fuel consumption without Dynafleet (in litre/100km)	31,59	31,91	32,22	32,53	32,84	33,16	33,47
Yearly fuel cost with Dynafleet	€ 4 053 888	€ 4 053 888	€ 4 053 888	€ 4 053 888	€ 4 053 888	€ 4 053 888	€ 4 053 888
Yearly fuel cost without Dynafleet	€ 4 094 064	€ 4 135 536	€ 4 175 712	€ 4 215 888	€ 4 256 064	€ 4 297 536	€ 4 337 712
Cost savings with Dynafleet	**€ 40 176**	**€ 81 648**	**€ 121 824**	**€ 162 000**	**€ 202 176**	**€ 243 648**	**€ 283 824**
Yearly cost of Dynafleet	€ 72 000	€ 72 000	€ 72 000	€ 72 000	€ 72 000	€ 72 000	€ 72 000
Net profit	**-€ 31 824**	**€ 9 648**	**€ 49 824**	**€ 90 000**	**€ 130 176**	**€ 171 648**	**€ 211 824**
ROI	**0,56**	**1,13**	**1,69**	**2,25**	**2,81**	**3,38**	**3,94**

Table 12: Fuel costs and -savings, net profit and ROI for different fuel savings levels (case De Rese)

13.2 FTO's yearly CO_2 emission

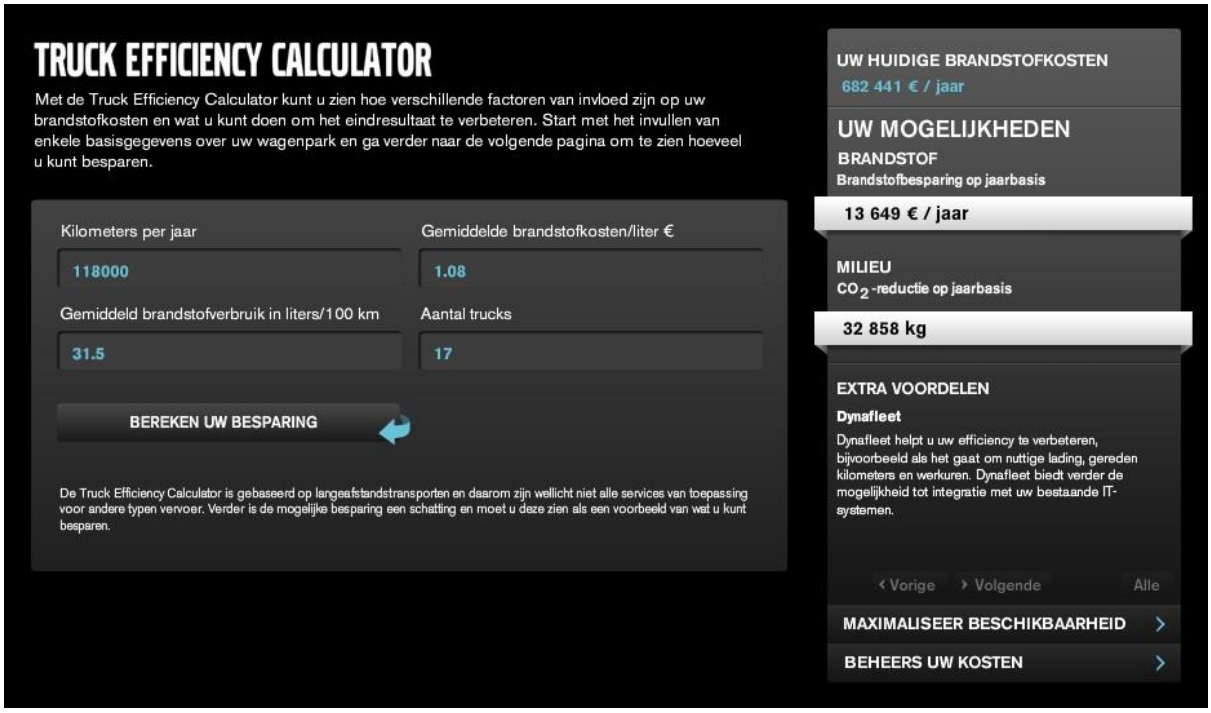


Figure 2116: FTO's yearly CO2 emission (source: Volvo Trucks)

14.Research design

14.1 Questions interview 1: Emry Tack – Transport Solutions Manager of Volvo Trucks

Vragen mbt Volvo Trucks

1. Hoe is **Volvo Trucks** verschillend van Volvo? Waar houden ze zich mee bezig? Bouwen of verkopen ze enkel trucks? Beetje meer info hierover is genoeg. Dient voor introductie
2. Vragen + uitleggen wat **mobiele technologie** is:
   Hoe belangrijk is mobiele technologie voor Volvo Trucks? Is er een bepaald departement die instaat voor mobiele technologie? Hoeveel budget wordt hiervoor uitgetrokken? Hoeveel budget wordt voorzien voor de ontwikkeling van applicaties?
3. Worden er veel **mobiele applicaties** uitgebracht door Volvo Trucks? Hoe belangrijk is Dynafleet binnen dit gamma?
4. Worden deze apps voornamelijk **in-house gemaakt of geoutsourcet**?
5. Hoe evolueert volgens u het **gebruik van mobiele apparaten in een B2B omgeving**? Gaat dit toenemen/dalen? Welke apparaten worden het meest belangrijk: tablets, smartphones, ultramobiles?

Vragen mbt tot de app zelf

6. Hoe is **Dynafleet** tot stand gekomen? Wanneer? Vanwaar kwam het idee?
7. Heeft de **concurrentie** ook zo een applicatie? Bv. IVECO, MAN
8. Is er een vorm van **marktonderzoek** gebeurd bij de ontwikkeling? Werden de behoeften van de klanten onderzocht of is het product geëvolueerd na verloop van tijd?
9. Werd Dynafleet volledig en alleen **ontwikkeld** door Volvo Trucks of in samenwerking met een ander bedrijf?
10. Voor welk **besturingssysteem** was Dynafleet initieel ontwikkeld?
11. Hoeveel **kost** het voor de klant? Werkt men met een abonnementsdienst? Is er sprake van **klantenbinding**?
12. Hoeveel schat Volvo Trucks dat bedrijven met deze applicatie kunnen **besparen**? In termen van tijd, kostenreductie, hoger service level naar de klant toe (omwille van stiptere leveringen),… Kan dit verwoord worden in concrete cijfers en/of percentages?

13. Wat zijn de **functionaliteiten** van Dynafleet? En welke vindt Volvo Trucks de belangrijkste? Welke levert de meeste waarde op?
    - Brandstofbesparing
    - Signaal wanneer rijtijden van chauffeurs overschreden worden
    - Administratief werk- en tijdbesparend
    - Andere?
14. Kan er enkel via het gebruik Dynafleet aan **routeoptimalisatie** worden gedaan? Of dient Dynafleet gekoppeld te worden **aan andere programma's** (Enterprise Resource Planning systemen)?
15. Hoe wordt de **positie** van een vrachtwagen opgenomen in de app? Is dit door de GPS van de truck, de ingebouwde navigatie in mobiele apparaten,…?
16. Is er volgens uw mening sprake van **Value fusion**, met andere woorden, levert het product waarde op voor Volvo Trucks als voor de klant die Dynafleet gebruikt?
17. Heeft Volvo Trucks **toegang tot de data die door de klant wordt gecreëerd**? Slaat Volvo Trucks deze data op in database en wordt deze gebruikt voor analyses of standaarden te maken ivm het optimaal rijgedrag? Indien niet, is dit een mogelijkheid om te implementeren op lange termijn? En hoe zit het dan met de privacy van de klant?
18. Worden **klachten** van klanten gebruikt om het product te verbeteren en verder te optimaliseren?
19. De applicatie maakt het mogelijk chauffeurs de toegang te verlenen naar deze app zodanig dat ze hun status en de relatieve efficiëntie tov andere chauffeurs kunnen analyseren. Gebruiken transport bedrijven **reward systems** voor chauffeurs die het tov anderen heel goed doen, maw, diegenen die hoog scoren op het Dynafleet leaderboard.

<u>Vragen mbt mobiliteit van de applicatie</u>

20. **Op welke producten draait Dynafleet** het meest? Desktop computers, tablets, smartphones, ultra-lichte laptops (ultramobiles)? Was het de bedoeling om de mobiele producten meteen op te nemen in het gamma?
21. Hoe belangrijk vindt u het **mobiele aspect van Dynafleet**? Hoeveel draagt het bij tot zijn totale waarde (aandeel in %)

22. In welke mate is de **mobiliteit** van deze app belangrijk voor deze gebruikers? Wordt hiervoor **extra betaald**? En wat zijn de verwachting naar de toekomst? Wordt dit een betalende functie?
23. Is de **smartphone** versie verschillend van de **tablet** versie? Wordt er bv meer informatie getoond op een tablet met een groter scherm?
24. Is er **mobiel internet** nodig om de applicatie te draaien?

<u>Andere</u>

25. Hoe belangrijk is **milieubewustheid** in de transportsector? Eventueel data hiervan?
26. Hoeveel kost een boete wanneer een truck chauffeur de wettelijke **rijtijdrichtlijnen** overschrijdt? Kan Dynafleet helpen om dergelijke overtredingen te vermijden?

14.2 Questions interview 2: David Desmet – Product Manager Fleet Management Services Benelux (department Premium Services) at Scania

Vragen mbt Scania

1. Kan u een beetje meer uitleg geven over de **activiteiten van Scania**? Houden ze zich enkel bezig met trucks of ook met andere rij- of werktuigen te verkopen? Hoe groot is het aandeel hiervan? In welke landen is Scania actief? Is hiervan een presentatie of powerpoint? Dient voor introductie
2. Positioneert Scania zich als een **innovatief bedrijf**? En hoe zit dit tov de concurrentie? Gelijk niveau, hoger, iets lager?
3. Vragen + uitleggen wat **mobiele technologie** is:
   Hoeveel **budget** wordt voorzien voor de ontwikkeling van applicaties?

Ontwikkeling van de app

4. Hoe is de app **tot stand gekomen**? Was er eerst de desktopversie en dan pas de app? Wanneer? Vanwaar kwam het idee? Hoeveel heeft ze gekost?
5. Hoe **belangrijk** vindt u het mobiele aspect van de **app tov de desktopversie**? Hoeveel draagt het bij tot zijn totale waarde (aandeel in %)
6. Worden er **andere mobiele applicaties** uitgebracht door Scania? **Hoe belangrijk is de Fleet** Management App binnen dit gamma?
7. Worden deze apps voornamelijk **in-house** gemaakt of **geoutsourcet**?
8. **Wanneer** is de Scania Fleet Management App gemaakt?
9. Werd de app ontwikkeld **als reactie op concurrerende apps**?
10. Is er een vorm van **marktonderzoek** gebeurd bij de ontwikkeling? Werden de behoeften van de klanten onderzocht of is het product geëvolueerd na verloop van tijd?
11. Hoe lang was de **ontwikkelingstijd**?
12. Op welk **besturingssysteem** draaide Scania aanvankelijk? Was dit bijvoorbeeld meteen iOS en Android of eerst één van beide? En waarom deze keuze?
13. De **concurrent** Volvo Trucks heeft ook een dergelijke applicatie nl **Dynafleet**. Wat weet u van hun app en wat heeft de Scania Fleet Management App meer te bieden? Weet u nog andere concurrenten met gelijkaardige applicaties?

Functionaliteiten van de app

14. **Wat kan de app**? Is het mogelijk eens door de app te lopen? Eventueel log in krijgen? (bij Volvo Trucks: fuel & environment, driver times, messaging, positioning)
15. Scania Fleet Management app wordt verkocht als een service dienst aan andere transporteurs. **Hoeveel moeten zij hiervoor betalen**? Wordt er betaald per module? En is de app gratis of ook betalend?
16. Is de app enkel beschikbaar **voor managers of ook truckchauffeurs**? Wat is er verschillend tussen beide versies.
17. Hoeveel schat Volvo Trucks dat **bedrijven met deze applicatie kunnen besparen**? In termen van tijd, kostenreductie, hoger service level naar de klant toe (omwille van stiptere leveringen),… Kan dit verwoord worden in concrete cijfers en/of percentages?
18. Kan er enkel via het gebruik van het programma aan **routeoptimalisatie** worden gedaan? Of dient deze **gekoppeld te worden aan andere programma's** (Enterprise Resource Planning systemen)?
19. **Hoe wordt de data van de vrachtwagen gekoppeld aan de app**? Is dit door een centrale computer geïnstalleerd in de truck?
20. Is er in de app een systeem aanwezig zodat **chauffeurs onderling een vergelijking** kunnen maken? Zijn hier **bij de klant reward systems** aan gebonden?
21. Wordt de app enkel door klanten gebruikt om hun trucks te monitoren, of zijn er ook bij die bijvoorbeeld hun **bestelwagens** ermee controleren.
22. Hoe belangrijk is **milieubewustheid** in de transportsector? Eventueel data hiervan?
23. Hoeveel kost een **boete** wanneer een truck chauffeur de wettelijke rijtijdrichtlijnen overschrijdt?

Ivm klanten van Scania

24. **Wie zijn de klanten van Scania** die deze applicatie hebben aangeschaft? Zijn dit enkel transporteurs? Of wordt Scania Fleet Management ook gebruikt door hun klanten?
25. Is er volgens uw mening sprake van **Value fusion**, met andere woorden, levert het product waarde op voor de klant van Scania en die hun klant?
26. **Heeft Scania toegang tot de data die door de klant wordt gecreëerd**? Slaat Volvo Trucks deze data op in database en wordt deze gebruikt voor analyses of standaarden

te maken ivm het optimaal rijgedrag? Indien niet, is dit een mogelijkheid om te implementeren op lange termijn? En hoe zit het dan met de privacy van de klant?

27. Worden **klachten van klanten gebruikt om het product te verbeteren** en verder te optimaliseren?

Ivm tablets en smartphones

28. **Op welke producten draait Scania app het meest**? Tablets, smartphones, ultra-lichte laptops (ultramobiles)? Was het de bedoeling om de mobiele producten meteen op te nemen in het gamma?
29. Op welk **besturingssysteem** draait de Scania app momenteel het meest? iOS of Android?
30. Is de **smartphone versie verschillend van de tablet versie**? Wordt er bv meer informatie getoond op een tablet met een groter scherm?
31. Is er **mobiel internet nodig** om de applicatie te draaien?
32. **Hoe evolueert volgens u het gebruik van mobiele apparaten in een B2B omgeving**? Gaat dit toenemen/dalen? Welke apparaten worden het meest belangrijk: tablets, smartphones, ultramobiles?

14.3 Questions interview 3: Tim Bergiers – Logistics Coordinator at FTO

Vragen ivm FTO zelf

1. Positioneren jullie zich als een **klein, middel of groot transportbedrijf**?
2. In **welke landen** zijn jullie voornamelijk actief?
3. Wordt er gewerkt met **Belgische chauffeurs** of met bijvoorbeeld chauffeurs uit **Oostbloklanden**? Is dit een specifieke keuze van jullie en waarom?

Huidig fleet management systeem

4. Welk **fleet management systeem** gebruiken jullie?
5. Wordt deze ontwikkeld door een truck producent, software ontwikkelaar of nog een andere **aanbieder**? Indien door een truck producent, worden de trucks die FTO gebruikt eveneens bij diezelfde producent aangekocht? Heeft de één een effect op de aankoopbeslissing van de ander?
6. Heeft het gebruikt fleet management systeem ook een **mobiele app**?
   - Indien ja, op **welke apparaten** draait deze app het meest? Zijn dit **smartphones/tablets**? Worden deze mobiele apparaten gegeven door het bedrijf zelf of is dit vnl. eigendom van de werknemers zelf? Indien door het bedrijf: is dit vnl. **Apple** of smartphones/ tablets die **Android** draaien?
   - Welke **voordelen/nadelen** ondervinden zij om met deze app te werken? Is dit soms te moeilijk? Vinden ze dat ze te veel gecontroleerd worden?
   - Wat zijn de **voornaamste troeven** van deze mobiele app?
   - Wat vinden jullie **slecht** aan deze mobiele app?
   - **Voldoet deze mobiele app aan jullie eisen**? Zijn er dingen die **ontbreken**?
   - Hoeveel **punten op 10** zou je dit systeem geven?
   - Hoe belangrijk is volgens u het **mobiele aspect tov de desktopversie**?
7. Wat gaf de **aanleiding** tot het gebruiken van het huidige fleet management systeem boven een ander fleet management systeem?

Vragen ivm Dynafleet

8. Kent u **Dynafleet**? (Dynafleet uitleggen en de mobiele applicatie kort demonstreren)
9. Wat zijn de **voornaamste troeven** van deze mobiele app?
10. Wat vinden jullie **slecht** aan deze mobiele app?
11. Zijn er dingen die **ontbreken**?
12. Hoeveel **punten op 10** zou je dit systeem geven?

13. Hoe belangrijk is volgens u het **mobiele aspect tov de desktopversie**?
14. Heeft u het gevoel dat Dynafleet meespeelt om voor Volvo Trucks te blijven kiezen? Maw, reduceert dit de neiging om bijvoorbeeld over te stappen binnen een paar jaar naar een Scania of MAN truck? (**customer retention**)
15. Wat vindt u van de **prijs** van Dynafleet?

Ivm hun brandstofverbruik

16. - Over **hoeveel trucks** beschikken jullie?
    - wat is de **gemiddelde afstand** per truck per jaar?
    - wat is jullie **gemiddelde brandstofverbruik** (in liter per 100km)?
    - wat is de **dieselprijs**?
17. Is hierdoor jullie **brandstofverbruik evenredig met de concurrentie** volgens jullie schattingen? Beter/hetzelfde/iets slechter dan de concurrentie?
18. Worden er **financiële of non-financiële rewards (erkenning)** gegeven aan uw truckchauffeurs die een heel laag brandstofverbruik hebben?
19. De Dynafleet app beschikt over een **ranking**, waarbij managers en truckchauffeurs hun relatieve positie kunnen zien tov de rest van de werknemers. Draagt dit in jullie mening **positief** of eerder **negatief** bij tot het reduceren van bepaalde kosten of tot efficiënter werk?
20. Hebben jullie een idee wat het gebruik van **Dynafleet financieel zou kunnen opleveren**?
21. Hoe belangrijk is de bescherming van het **milieu** in het opzicht van brandstofbesparing. Wordt dit gezien als een echt streefdoel of is het toch voornamelijk de **kostenreductie** die het belangrijkste is?
22. Hoe vaak worden jullie geconfronteerd met **overtredingen ivm rijtijden reguleringen**? Hoeveel bedraagt zo'n boete? Helpt Dynafleet naar uw mening bij het al dan niet naleven van de rijtijdenwetgeving? Zouden bijvoorbeeld het aantal boetes hierdoor dalen?

Algemeen

23. **Hoe evolueert volgens u het gebruik van mobiele apparaten in een B2B omgeving**? Gaat dit toenemen/dalen? Welke apparaten worden het meest belangrijk: tablets, smartphones, ultramobiles?

24. Denkt u dat een goed fleet management systeem en een sterke focus op brandstofverbruik ervoor kan zorgen dat transportbedrijven **geen goedkopere buitenlandse arbeidskrachten moeten aanwerven**?

14.4 Questions interview 4: Johan Coopman – Fleet and Technics Advisor/Driver Trainer at De Rese

Vragen ivm De Rese zelf

1. Positioneren jullie zich als een **klein, middel of groot transportbedrijf**?
2. In **welke landen** zijn jullie voornamelijk actief?
3. Wordt er gewerkt met **Belgische chauffeurs** of met bijvoorbeeld chauffeurs uit **Oostbloklanden**? Is dit een specifieke keuze van jullie en waarom?
4. Zijn **de trucks die jullie gebruiken van Volvo** of van een ander bedrijf? Waarom die keuze? In welke mate speelt het feit dat **Dynafleet** ontwikkeld is door Volvo Trucks mee in deze keuze?

Vragen ivm Dynafleet

5. **Sinds wanneer** gebruiken jullie Dynafleet?
6. Gebruiken jullie **alle 4 de modules van Dynafleet** (Fuel & Environment, Driver Times, Positioning en Messaging) of enkel bepaalde modules?
7. Wat is volgens u het **meest interessant aspect** van Dynafleet Online (dus desktopversie)?
8. Gebruiken uw **werknemers** ook de Dynafleet mobile app? Wie dan in het bijzonder? Zijn dit de **managers/truckchauffeurs/dispatchers/…**?
9. Welke **voordelen/nadelen** ondervinden zij om met deze app te werken? Is dit soms te moeilijk? Vinden ze dat ze te veel gecontroleerd worden?
10. Op **welke apparaten** draait deze app het meest? Zijn dit **smartphones/tablets**? Worden deze mobiele apparaten gegeven door het bedrijf zelf of is dit vnl. eigendom van de werknemers zelf? Indien door het bedrijf: is dit vnl. **Apple** of smartphones/ tablets die **Android** draaien?
11. Wat zijn de **voornaamste troeven** van deze mobiele app?
12. Wat vinden jullie **slecht** aan deze mobiele app?
13. **Voldoet deze mobiele app aan jullie eisen**? Zijn er dingen die **ontbreken**?
14. Hoeveel **punten op 10** zou je dit systeem geven?
15. Hoe belangrijk is volgens u het **mobiele aspect tov de desktopversie**?
16. Heeft u het gevoel dat Dynafleet meespeelt om voor Volvo Trucks te blijven kiezen? Maw, reduceert dit de neiging om bijvoorbeeld over te stappen binnen een paar jaar naar een Scania of MAN truck? (**customer retention**)

17. Wat gaf de **aanleiding** tot het gebruik Dynafleet boven een ander fleet management systeem? Was dit de noodzaak om bepaalde kosten aan te pakken?
18. Wat vindt u van de **prijs** van Dynafleet?

Ivm hun brandstofverbruik

19. De Dynafleet app beschikt over een **ranking**, waarbij managers en truckchauffeurs hun relatieve positie kunnen zien tov de rest van de werknemers. Draagt dit in jullie mening **positief** of eerder **negatief** bij tot het reduceren van bepaalde kosten of tot efficiënter werk?
20. Worden er **financiële of non-financiële rewards (erkenning)** gegeven aan die mensen die bovenaan de lijst staan?
21. Hebben jullie een idee wat het gebruik van **Dynafleet jullie financieel oplevert**? Is door het gebruik van Dynafleet (en deze internet competitie) jullie **brandstofverbruik gedaald**? **Hoeveel (als een %)**?
22. **Hoe** wordt dit brandstof besparend karakter **gerealiseerd**? Door betere **routeplanning**? Door coaching? Is er volgens u eerder sprake van een **top-down approach** waarbij managers wijzen op eventueel vreemd rijgedrag van truck chauffeurs of een **bottom-up approach** waarbij chauffeurs proactief al hun rijgedrag aanpassen wanneer dit nodig blijkt te zijn? Hoe belangrijk speelt hierbij het aspect dat er **continu** kan worden **gemonitord**?
23. Is hierdoor jullie **brandstofverbruik evenredig met de concurrentie** volgens jullie schattingen? Beter/hetzelfde/iets slechter dan de concurrentie?
24. - Over **hoeveel trucks** beschikken jullie?
    - wat is de **gemiddelde afstand** per truck per jaar?
    - wat is jullie **gemiddelde brandstofverbruik** (in liter per 100km)?
    - wat is de **dieselprijs**?

    Deze gegevens worden enkel en alleen maar gebruikt om de kostenbesparingen die Dynafleet teweegbrengt te dimensioneren. Deze gegevens kunnen vertrouwelijk worden meegedeeld, ook eventueel na het gesprek als bepaalde zaken moeten worden opgezocht.
25. Hoe belangrijk is de bescherming van het **milieu** in het opzicht van brandstofbesparing. Wordt dit gezien als een echt streefdoel of is het toch voornamelijk de **kostenreductie** die het belangrijkste is?

26. Hoe vaak worden jullie geconfronteerd met **overtredingen ivm rijtijden reguleringen**? Hoeveel bedraagt zo'n boete? Helpt Dynafleet ook bij het al dan niet naleven van de rijtijdenwetgeving? Zijn bijvoorbeeld het aantal boetes hierdoor gedaald?

Algemeen

27. **Hoe evolueert volgens u het gebruik van mobiele apparaten in een B2B omgeving**? Gaat dit toenemen/dalen? Welke apparaten worden het meest belangrijk: tablets, smartphones, ultramobiles?
28. Denkt u dat een goed fleet management systeem en een sterke focus op brandstofverbruik ervoor kan zorgen dat transportbedrijven **geen goedkopere buitenlandse arbeidskrachten moeten aanwerven**?

14.5 Questions addressed to the Swedish development team of Dynafleet

General questions

1. **When** was Dynafleet's mobile application firstly available for its customers?
2. **How long** was the development time for the mobile application?
3. What was the **motive** to develop a mobile application?
4. How much **people and budget** is currently used in order to further develop the Dynafleet app? (rough number is sufficient) In other words, do you have any idea of the overall (development) cost to make Dynafleet's mobile application?
5. Dynafleet's mobile application was firstly developed for the **iOS mobile operating system**? Why this choice? Is there any research done to support this choice? If yes, it is possible to get access to this research?
6. A. How many times overall is the Dynafleet mobile application been downloaded when making a **distinction between Android and iOS**? This should be around 5000 times on Android, is this correct? Figures for iOS are currently not made public in the iOS app Store. Therefore this question.

   B. **Which operating system is currently the most popular** to run Dynafleet's mobile application? Is this changed in comparison with the past/when the app was first launched? Are there any figures which can be provided to confirm this statement?
7. Which of the 4 **modules** (Fuel & Environment, Positioning, Messaging and Driver Times) is currently **bought the most**? Or does buyers rather buy all modules at once? Are there any figures which can be provided to confirm this statement?
8. Is the Dynafleet Online desktop version provided as a **portal or** as a **software** that needs to be downloaded on a certain computer?

Questions regarding specific aspects inside Dynafleet's mobile application

9. Can an **overview** be provided about those **options** which were developed and implemented in the application in the **past** and which are currently **in the pipeline** and being worked on to be implemented in the future? In this questions, the future changes are the most interesting to know.
10. Currently there is no tool in the Dynafleet application that provides easy **messaging** between for example truck drivers and the dispatcher. Will this option be developed in

the future? And is the Messaging module therefore not slightly neglected in the Dynafleet app?

11. When selecting a particular driver in the Dynafleet mobile app, **5 icons** appear referring to the state of this truck driver. What is their meaning? Certain pictograms are rather unclear.
12. On the Dashboard tab on Dynafleet's mobile application, a '**Vehicle utilization**' figure is provided as a percentage? What does this number refer to? Is it the percentage of the fleet that is currently on the way? Does it includes trucks which are currently in break or unloading their shipment? After what time are these data being updated?
13. In 'Engine and gear utilization', what does **I-Shift in P, A or M** mean?
14. The **Ranking** tab that provides a general overview of the current ranking of the different drivers is a very interesting tool. But based on what period of time are these numbers referring to? And after what time is this updated?
15. The demo version of the app provides a general overview of the functionalities of the app. Is it also possible to have a log in of a **truck driver**, as the information displayed in this case is rather limited?

15.Interview with Emry Tack

This part provides a transcription of the interview conducted on the 29th of October 2014 in collaboration with Emry Tack, key account manager regarding transport solutions for Volvo Trucks Belgium. The interview was held in Dutch, the mother tongue of Mr. Tack and me. Therefore, it is chosen to perform the transcription in the same language.

The following section contains the major part of what is said during the interview. Although, some parts are neglected or rather summarized because they comprise information which is not considered relevant to the subject. The text of the interviewer is indicated in italic.

The interview started with a small introduction to the thesis and the topic to be investigated.

Transcription:

Wat doet Volvo Trucks en in welke mate is Volvo Trucks verschillend van Volvo in het algemeen. Worden de trucks bijvoorbeeld enkel verkocht of ook hier gebouwd? Waar wordt het onderscheid gemaakt?

Volvo Trucks maakt deel uit van de Volvo Group. Deze laatste is een overkoepelend geheel bestaande uit verschillende entiteiten waarvan Volvo Trucks er één van is. We zijn anders dan het Volvo Cars gedeelte. In 1999 is dit verkocht geweest. Nadien is Volvo Trucks eerder bezig zich toe te leggen op investeringsgoederen. Dit zijn goederen die voornamelijk worden gebruikt om business te doen, zonder er weinig emotionaliteit erbij te betrekken. Er zijn verschillende entiteiten die in Europa en Noord-Amerika gevestigd zijn, en ook wordt er gebruik gemaakt van joint ventures om de Aziatische markt te penetreren. Dit omdat het moeilijk is om met uw eigen merk deze markt aan te boren. Naast trucks produceert Volvo ook graafmachines zoals er beneden in de showroom staan.

En hoe zit het dan specifiek voor Volvo Trucks?

Volvo Trucks houdt zich eigenlijk bezig met het produceren en commercialiseren van Volvo trucks en transportoplossingen. Wij zijn een ‘customer driven’ bedrijf die produceert en verkoopt op basis van de noden en de vraag van de klant. We beseffen dat we één van de duurdere spelers zijn op de markt, maar voor een ‘premium customized’ product hoort natuurlijk ook een ‘premium’ prijs. Andere vrachtwagenproducenten hebben bijvoorbeeld een andere strategie, daarom niet noodzakelijker slechter, waarbij ze 10 dezelfde trucks

produceren en dan pas kijken of er vraag naar is. Eventueel laten ze op termijn hun prijs zelfs zakken omdat de vraag naar die trucks beperkter wordt. Dit doet Volvo Trucks niet.

Ik zal ook meteen de brug maken met uw werk. Onze core values zijn environment, quality en safety. En binnen quality is onze leuze eigenlijk 'Volvo Trucks, driving progress'. Dus als uit uw onderzoek zou blijken dat wij achterop hinken in de industrie dan zou dat een heel slecht teken voor ons zijn. Wij willen eigenlijk de eerste zijn en zeer innovatief zijn in al onze applicaties die wij ontwikkelen, maar ook product technisch. (enkele voorbeelden worden gegeven)

Ook in marketing toestanden zoals op YouTube willen wij zeer sterk zijn. Dus het zijn zowel de services en de applicaties, maar ook de hardware en dus de truck zelf die voor ons van hoge kwaliteit en zeer vooruitstrevend moeten zijn. Dit geldt ook voor de financiering als verzekering van de truck, maar ook bijvoorbeeld voor service contracten.

Dynafleet is dus eigenlijk ook een service die wij aanbieden. We zijn al reeds met Dynafleet begonnen in de jaren '90, wanneer 'track-and-trace' enorm populair werd. Toen was Dynafleet niet de versie die we nu kennen, maar veel primitiever. Het was dan een soort van extra computer ingebouwd in de vrachtwagen zelf die niets anders deed dan bepaalde taken waarvoor nu Dynafleet verantwoordelijk is, uit te voeren en op te slaan. Regelmatig werd dan een link gelegd tussen die computer en het Dynafleet systeem. Vanaf 2012 hebben de trucks deze computer standaard aan boord, omdat deze computer nu voor veel meer wordt gebruikt dan alleen maar Dynafleet. Technici doen met deze computer veel meer dan alleen maar gebruiksopvolging of chauffeurs analyses. Zo kunnen ze een aantal componenten van de vrachtwagen volgen, om bijvoorbeeld te kijken wat de staat momenteel is van de koppeling. Alles loopt eigenlijk continu via mobiel dataverkeer naar onze servers wanneer dit in het verleden na een bepaalde periode werd uitgelezen. Vervolgens controleren we één keer per week deze data om te kijken wat de toestand is van verschillende componenten. Vanuit het opzicht van Dynafleet is wel constante monitoring vereist en mogelijk.

Wordt dit dan door Volvo Trucks gedaan vanop het kantoor?

Dit wordt voornamelijk gedaan door de dealers die Volvo Trucks verkopen aan de eindconsument en waarmee de klant een onderhoudscontract of dergelijke heeft. Dit laatste is in 80% van de klanten het geval.

De dealer moet dan enkel het chassisnummer ingeven en de technische details van een bepaalde truck verschijnen dan meteen op het scherm. Zo kan de dealer eigenlijk zien vanop afstand wanneer er bijvoorbeeld een achterlicht kapot is. Bijgevolg kan de dealer ook met de klant bespreken op welk moment deze laatste de truck het best binnenbrengt om een reparatie uit te voeren, dit naargelang het soort van defect natuurlijk. Indien er bepaalde lampjes op het dashboard beginnen branden kan de dealer ook heel snel uitleg verschaffen aan de klant zonder dat hij daarvoor ter plaatse moet komen.

Wordt dit uitgevoerd via mobiele applicaties?

Dit is een uitbreiding van een bestaande applicatie die wij VOSP noemen. VOSP staat voor Volvo Optimized Service Planning. En in dat dealer software pakket is een kleine extensie bijgemaakt waarbij ze deze componenten kunnen lezen. Zeker naar de toekomst toe is er een nieuw systeem ontwikkeld, Features Online, en zal op de werkplaats herprogrammaties kunnen doen aan die vrachtwagens. Bijvoorbeeld zo kan men het aantal toeren aanpassen van een truck wanneer hij stationair draait. Dit kan dan volledig vanop afstand gedaan worden.

Kunnen truckchauffeurs dan zelf inloggen op dit systeem?

Neen, het is volledig een dealer systeem. Het is een bewuste keuze van Volvo Trucks om dit niet bij de klant te leggen. Niet omdat we die informatie niet willen delen met de klant zelf, maar omdat we de klant vrij van zorgen willen stellen. Bijvoorbeeld als jij in een auto stapt en je start en er komt een foutcode op je dashboard, dan ga je waarschijnlijk de handleiding van de wagen lezen en kijken waarom dat lichtje aanspringt. Vervolgens ga je nagaan hoe erg dit defect is en of je eventueel nog zo met je auto kan verder rijden. Andere mensen kunnen ook gewoon hun telefoon nemen en naar hun dealer bellen. Het zou veel beter zijn dat de dealer u als proactief opbelt en zegt: “dat lampje brandt in die truck, maar het probleem is niet zo erg. Je kan best nog verder rijden met die vrachtwagen. Toch is het aan te raden om na de rit, of op een ander moment, eens bij ons (de dealer) binnen te springen en wij zullen dan het probleem oplossen”. Zo is de klant vrij van zorgen en gaat Volvo Trucks meteen meedelen wat er mis is met de truck en hoe erg het defect is en wanneer het probleem kan opgelost worden. Het laatste kan perfect worden ingepland in het tijdsschema van de klant en bespaart hem of haar heel wat kopzorgen. Daarnaast wordt de klant ook niet bij het bellen naar zijn dealer doorgeschakeld naar verschillende mensen tot wanneer hij de verantwoordelijke persoon daarbij beet heeft die zegt dat het geen probleem is om met de

truck verder te rijden. Tijdsverliezen, zorgen en frustraties worden hierdoor sterk gereduceerd.

Is het omwille van dit aspect dan dat Dynafleet niet over deze functie beschikt? Meer bepaald omdat truckchauffeurs en de klanten zelf dan op dit systeem zouden kunnen inloggen?

Dynafleet excludeert het technische gedeelte van het voertuig. We gebruiken wel dezelfde boordcomputer in de truck. Toch moet het technische gedeelte gescheiden worden van wat klanteninformatie is. Dit voornamelijk omwille van de reeds aangehaalde redenen.

Met betrekking op de concurrentie, zoals bijvoorbeeld een IVECO of MAN, heeft u weet van een dergelijk vergelijkbaar systeem? Ik stel deze vraag omdat u Volvo Trucks positioneert als een enorm innovatief bedrijf.

Ik denk dat het bedrijf die daar het verst in staat, is Mercedes. Die hebben namelijk een dergelijk systeem, Fleetboard. Ook produceren zij brandstofefficiënte trucks, maar ik kan u vertellen dat Volvo Trucks hier veel verder in staat. Dit blijkt zelfs uit objectieve pers testen. Ja, de pers kan soms ook objectief zijn (*lacht*). Er is ook een Duitstalige transporteur die van elk merk een nieuwe vrachtwagen koopt en die de verbruiksresultaten op internet zet. Ook daaruit blijkt dat vrachtwagens van Volvo Trucks het laagste brandstofverbruik hebben.

Het grote algemene voordeel van Dynafleet is dat Dynafleet door de constructeur zelf ontwikkeld is. Er zijn veel softwareleveranciers op deze kar gesprongen bij de transportboom van 2007 en door de crisis zijn deze geconfronteerd met een inkrimpende markt. Veel meer spelers op een kleinere markt zorgde ervoor dat veel van die softwareleveranciers failliet zijn gegaan, of zich op een ander segment hebben gefocust. Klanten die dergelijk systeem hebben gekocht, zijn in de kou blijven staan. Het grote voordeel is dat je met Dynafleet in zee gaat, dat die continuïteit verzekerd wordt. Volvo Trucks gaat namelijk niet van vandaag op morgen stoppen met Dynafleet. We zijn daarmee begonnen in de ’90, en doorheen de tijd en ook naar de toekomst toe, gaat dit programma blijven ontwikkeld worden. Sommige klanten zijn bijgevolg al 7 tot zelfs 10 jaar een gelukkige Dynafleet klant en hebben heel deze evolutie meegemaakt. Volvo Trucks gaat dan ook altijd voor deze klanten zorgen. De investering die bijvoorbeeld 5 jaar geleden is gebeurd, waarbij een bepaald type computer werd geïnstalleerd in de truck, zal na 10 jaar nog steeds renderen omdat Volvo Trucks nooit met Dynafleet zal stoppen. Terwijl andere kleinere softwarebedrijven, die beurtelings wouden meeproeven van dit lucratief transportsegment en eigen types van investeringen vereisten met betrekking tot de trucks, gingen failliet. Het eindproduct die de klant in handen had was na verloop van tijd

niet meer bruikbaar omdat het niet meer verder werd ontwikkeld of omdat de computers in de trucks die de gegevens genereerden moest worden vervangen. Bijgevolg was de investering niet rendabel en bleef de klant over met een op termijn waardeloos product. Nogmaals, dit is niet het gevolg met Dynafleet en Volvo Trucks, waarbij de continuïteit wordt verzekerd.

Transics is bijvoorbeeld een merkonafhankelijk systeem, maar dit bedrijf is zeer groot en hebben een heel groot stuk van de market. Daarom kunnen nieuwe spelers moeilijk nog de markt penetreren, voornamelijk omdat de markt al zo beperkt is en door de hoge ontwikkelingskosten zijn de winstmarges bijzonder klein.

Om op de vraag terug te komen, Mercedes met FleetBoard is de grootste concurrent. Deze laatste staat er ver of even ver in met betrekking tot de ontwikkeling vergeleken met Dynafleet. Ik weet wel niet of ze een mobiele applicatie hebben, dat zal waarschijnlijk wel. Toch geloof ik wel dat Volvo Trucks over de best applicatie beschikt en er het verste in staan.

Het grote verschil binnen Dynafleet, met betrekking tot de desktopversie en de mobiele app, is dat de applicatie dient om zeer snel te zeggen waar er een bepaalde truck of chauffeur is en waar er verbetering vereist is. Het is niet genoeg in onze business om te zeggen ‘meten is weten’. Het is niet omdat ik een rapport naar u stuur met gegevens, dat het iets van waarde oplevert voor u. Het is pas als er wordt gezegd ‘dit zijn de gegevens en als je deze maatregelen neemt, kunnen de parameters bijvoorbeeld zoveel percent afnemen’, dat het enigszins waardevolle informatie kan zijn.

Wat betekent mobiele technologie voor u?

Wanneer ik denk aan mobiele technologie dan denk ik meteen aan het fenomeen dat zich afspeelt gedurende de laatste jaren, namelijk dat iedereen 24 uur op 24 en 7 dagen op 7 bereikbaar is. Je zit op kantoor, in de wagen, thuis, op vakantie, iedereen kan je waar dan ook bereiken. Dit komt voornamelijk omdat heel veel mensen tegenwoordig over een smartphone beschikken. Ook denk ik aan wat wij noemen ‘connectivity’, waarbij draadloos gegevens van trucks kunnen doorgestuurd worden naar ons (Volvo Trucks). Alles gebeurt tegenwoordig draadloos. Dit is voor mij mobiele technologie.

In welke mate draagt Dynafleet toe tot dit innovatief karakter van Volvo Trucks?

Dynafleet is zeer belangrijk in dit opzicht. Vanuit het standpunt om innovatief en vooruitstrevend gepositioneerd te blijven is dan ook deze app ontwikkeld.

Is er bij de ontwikkeling van Dynafleet onderzoek gebeurd naar een eventuele behoefte van de klant inzake mobiliteit?

Ja, bij de ontwikkeling van Dynafleet is onderzoek gedaan naar wat het mobiele landschap is. Op termijn is deze mobiele wereld wel sterk veranderd, met momenteel een sterke penetratie van de Aziatische fabrikanten. Initieel werd er door Volvo Trucks besloten om Dynafleet te laten werken op het iOS platform en hebben we ons niet meteen gefocust op een platform onafhankelijke ontwikkeling. In het begin werd er geen app gecreëerd die werkte op toestellen met een Android besturingssysteem. Oorspronkelijk kwam Volvo Trucks dus op de proppen met een app die enkel werkte op iOS-toestellen. Wij hebben het gevoel dat pas sinds 2 à 3 jaar Samsung enorm populair is geworden, maar misschien kan jij daar een beter antwoord op geven vanuit je onderzoek.

Dit klopt inderdaad. De evolutie in mobiele toestellen en mobiele besturingssystemen vormt dan ook een belangrijk onderdeel van mijn thesis.

Ook hebben wij het gevoel dat de betaalbaarheid hierdoor is gestegen, wat de populariteit enkel en alleen maar kan tegoed komen. De grote transporteurs die hebben allemaal een iPhone, dat is daar de trend. Alles wat zich daaronder bevindt, in het bijzonder de kleinere transporteurs en chauffeurs, die maken meer gebruik van de Galaxy's (van Samsung) en de andere goedkopere smartphones die draaien op het Android platform. Die personen of bedrijven konden wij in het begin niet bereiken. Eind 2012, begin 2013 pas hebben wij een platform afhankelijk systeem en is onze applicatie ook bereikbaar op Google Play. Zo kunnen wij Dynafleet ook aanbieden op bijvoorbeeld Smartphone toestellen.

Hoe komt het dat initieel de keuze is gemaakt om te kiezen voor een platform afhankelijk besturingssysteem als dat van iOS?

Er is een onderzoek gebeurd binnen Volvo Trucks, geleid door het hoofdkantoor in Zweden, die naging voor welk mobiel platform er initieel moest worden gekozen. Daaruit bleek dat het voornamelijk naar de toekomst toe het voordeligst leek om binnen Volvo Trucks voor iOS toestellen te kiezen. Iedereen die over een smartphone moest beschikken, kreeg een iPhone. Nog eens, dit omdat een toekomst met voornamelijk Apple toestellen het meest voor de hand lag en er het meest rooskleurig uitzag, in vergelijking met andere smartphone aanbieders. Natuurlijk als dit onderzoek nu zou gebeuren, dan is het mobiele landschap enorm veranderd. Nu zou eventueel een andere keuze gemaakt worden en gekozen worden voor Samsung en het Android besturingssysteem. Indertijd was het ook zo dat wanneer je een app ontwikkelt

voor Android, dat die er anders uitzag dan voor iOS. Plus, Apple heeft een veel strenger protocol.

Dat klopt inderdaad. Voor Apple applicaties is er een licentie nodig en ook de controle bij het aanbieden van applicaties op iOS is strikter.

Voila. De oorzaak was dus tweeledig, voor ons was Apple de toekomst en heerste bij hun het strengste protocol. Nadien is er natuurlijk de ontwikkeling gebeurd om in Google Play te komen en op Android toestellen te draaien.

Heeft u een idee op welk besturingssysteem Dynafleet momenteel het meest wordt gedraaid? Is dit nog steeds iOS of heeft Android zijn schade reeds ingehaald?

De hoofdbrok is nog steeds voor iOS. Dit is vooral te wijten aan het feit, zoals eerder aangehaald, dat initieel met iOS is begonnen en pas later, begin 2013, met Android. Elke klant die wij bezochten voor 2013 vroeg uitsluitend naar iOS. Kwamen we toch een klant tegen wiens mobiele toestellen op Android, of een ander besturingssysteem, draaiden, boden we Dynafleet niet aan. Anders zou ik onder mijn eigen duiven schieten. We vermeldden wel op dat moment dat de Android versie van Dynafleet in ontwikkeling zat en weldra ging uitgebracht worden.

Naar de toekomst verwacht ik wel dat Dynafleet lopend op Android zijn iOS tegenhanger zal voorbijsteken, vooral omdat Android meer en meer populair wordt, wijder verspreid is en momenteel al dominanter is dan iOS.

Volgens u mening, indien er bij de ontwikkeling van de Dynafleet app zou gebleken zijn dat Android in de toekomst veel groter zou zijn dan Apple, zou er dan een andere beslissing gemaakt zijn met betrekking tot het iOS platform? Met andere woorden, verwacht u dat de voorkeur zou uitgaan voor Android of zou iOS nog steeds blijven stand houden?

Naar mijn bescheiden mening zou er zeker en vast wat sterker over nagedacht worden of de keuze voor Apple wel echt zo voordelig is. Langs de andere kant mag je niet vergeten dat, wanneer je naar de wereldmarkt kijkt, de Dynafleet applicatie niet draait in China en niet in Japan. Deze wordt voornamelijk gebruikt in de EMEA landen.

Wat betekent EMEA?

EMEA staat voor ‘Europe Middle East en Africa’. Maar het aandeel in Afrika is zeer beperkt omdat de mobiele data dekking daar nog niet zo sterk is ontwikkeld. Dynafleet zit nog in de

kinderschoenen wat betreft EPAC zoals Oceanië en gans Azië. EPAC staat hierbij voor 'East Pacific'. Die regio wordt beschouwd als een volledige Samsung markt. Dus wij moeten niet zo veel rekening houden met die markt met betrekking tot mobiele applicaties en het Android platform waarop ze draaien. Ik denk dat, mocht je hetzelfde onderzoek doen naar Europa en Amerika, dan ga je waarschijnlijk wel meer Apple terugvinden. Indertijd was deze verhouding nog zwaarder, daarom dat de keuze initieel voor Apple zo werd gemaakt. Stel dat het wereldaandeel van Samsung 64% is, ik geef maar een voorbeeld, en het overgrote gedeelte hiervan zijn Aziaten die nog geen Dynafleet hebben, dan moeten we hier niet naar kijken in het opzicht van het soort besturingssysteem we gaan gebruiken. Dus voornamelijk omwille van die reden is de keuze naar iOS gemaakt.

Als ik persoonlijk bij een klant ga en ik stel Dynafleet voor, dan heb ik een enorme troef aan die app. Zeker bijvoorbeeld 2 jaar geleden, dan was dit concept revolutionair. Als die dan een Samsung bovenhaalden en ik kon zeggen dat het geen probleem was om die app ook op dat apparaat te gebruiken, dan kan ik niet ontkennen dat de stap om toch Android te gebruiken zeer positief is geweest.

Ook zie ik dat de laatste jaren, in het bijzonder vanaf eind 2012 en begin 2013, bijna iedereen een smartphone of tablet heeft, of beide. Dit gaande van managers tot aan de truckchauffeurs. Het is daarom denk ik heel interessant een applicatie te ontwikkelen zoals Dynafleet die op al deze toestellen kan draaien en beschikbaar is voor iedereen.

Ja dat klopt. Verscheidene studies verwachten namelijk dat tegen 2017 ongeveer 2,5 biljoen mensen over een smartphone zullen beschikken. Dit is ongeveer een derde van de huidige wereldbevolking.

Ter conclusie, een zeer groot aandeel hiervan zijn Aziaten. Maar aangezien onze app Dynafleet daar niet loopt, hoeven wij ook geen aangepaste versie te maken specifiek voor de toestellen die daar worden gebruikt.

Hoe zit het met het budget die dient voor de ontwikkeling van de app? Kan u daarop een cijfer plakken? Heeft u daarnaast een idee wanneer de ontwikkelingen van de app van start zijn gegaan?

De laatste 18 maanden is er sterk geïnvesteerd geweest in de mobiele app van Dynafleet en R&D in het algemeen. Onze slogan luidt 'Driving Progress' waarbij innovatie enorm belangrijk is. Daarom zijn de uitgetrokken budgetten hiervoor toch wel groot. Toch mag er

niet vergeten worden dat Volvo Trucks geen IBM is en dat er uiteraard een grote portie ook gaat naar de hardware, namelijk de truck zelf en allerhande tools. Volvo Trucks zorgt wel voor geïntegreerde transportoplossingen, maar dit is een randactiviteit. Toch is er zwaar in Dynafleet geïnvesteerd.

Het is eigenlijk vanaf 2006, onder het bewind van Leif Johansson, dat Volvo Trucks sterk is beginnen inzetten op services, dit naast de hardwarecomponenten. We willen niet enkel rekenen op verkopen van trucks, we willen continu iets aan de klant verdienen en zo de leegte tussen twee verkopen opvullen. Daarom bieden wij services zoals Dynafleet aan. Naast een belangrijke continue bron van inkomsten zorgen services ook voor een sterkere klantenbinding. Om maar een voorbeeld te geven, 80% van de klanten die bij ons een onderhoudscontract hebben afgesloten op hun truck zullen in de toekomst weer een Volvo truck kopen. Dit is nog een verklaring waarom het budget voor Dynafleet, wat zeker en vast kan gerekend worden als een innovatieve service voor de klant, zo hoog is.

Is Dynafleet dan wel lucratief? En hoe belangrijk is het mobiele aspect van Dynafleet?

De app bedraagt eigenlijk maar 10% van wat het gehele Dynafleet pakket kan. Maar toch is deze mobiele app cruciaal. De grote waarde van de app is dat deze een black box maakt van heel wat technische gegevens en enkel de conclusies en resultaten toont aangevuld met informatie over de domeinen die beter kunnen. Dit wordt heel gebruiksvriendelijk voorgeschoteld aan de klant die deze rijke bron aan informatie heel snel kan raadplegen. Heel snel betekent, met enkele drukken op het scherm van een smartphone of tablet. Hierbij wordt een zeer duidelijk overzicht gegeven van de belangrijkste parameters en ook waar eventuele moeilijkheden zich voordoen. De kleurcodes maken dat in één oogopslag meteen de oorzaak van het probleem eenvoudig kan worden weergegeven, zelfs voor iemand die nog nooit met Dynafleet heeft gewerkt of die geen ervaring heeft in de transportsector.

Daarnaast is de desktopversie veel vollediger dan de mobiele applicatie. Ze beschikt over meer functionaliteiten en men kan actief verschillende gegevens over verschillende periodes opvragen, zelfs voorgesteld in verscheidene grafieken. Dit terwijl in de app enkel op een passieve manier gegevens worden weergegeven.

De achterliggende data, gebruikt voor de resultaten weer te geven in de mobiele app, wordt verwerkt door de desktopversie van Dynafleet. Die analyseert de gegevens afkomstig van de boordcomputer van de trucks, laat er complexe algoritmes op los, en geeft vervolgens een

score op 100 aan de hand van de berekende. Dit kan worden teruggevonden op het leaderboard, maar ook per deeldomein, bijvoorbeeld bij het remmen.

Ook kan de desktopversie gelinkt worden met andere softwaresystemen van de klant. (of met de klant zijn klant, naar het voorbeeld van ArcelorMittal dat verder in het interview wordt besproken). Zo kan Dynafleet gekoppeld worden met ERP systemen om de meest optimale route te berekenen. Enerzijds levert Dynafleet de gegevens die door het ERP systeem worden opgenomen en deze laatste berekent dan de meest optimale weg. Dit kan niet gedaan worden met louter de mobiele app. Deze laatste geeft enkel zeer snel en overzichtelijk de resultaten weer gecreëerd door de desktopversie.

De mobiele app is vooral handig voor (transport)managers en chauffeurs, die een snelle blik op de zaken moeten hebben, zonder de achterliggende data eerst te bestuderen. Het zijn dus voornamelijk de hoogste en laagste werknemers laag binnen een bepaald bedrijf. Daartussen zitten dan bijvoorbeeld dispatchers of mensen die instaan voor de administratie of loonuitkering waarbij het volledig spectrum van data van belang is. Die zullen dan eerder gebruik maken van de Dynafleet desktopversie in plaats van de app. Deze laatste bevat veel meer opties en gegevens tov zijn mobiele tegenhanger. Toch is ervoor gekozen om deze zaken niet op te nemen in de app omdat dit het gebruiksgemak en de overzichtelijkheid van de informatie niet ten goede zou komen. Nu is er eigenlijk een mobiele versie en desktopversie die de behoeften kan vervullen van elke persoon binnen het bedrijf van de klant. Anders zou dit niet het geval geweest zijn.

Maar niet alleen qua functionaliteiten, ook in de verkoop van het programma Dynafleet speelt de mobiele app een zeer grote rol. Zelfs al heeft deze laatste slechts 10% van de functionaliteiten van de desktopversie. Als bij een verkoopgesprek de manager van een bepaalde klant van ons aanwezig is, die niet over de kennis beschikt om met de uitgebreide desktopversie te werken, maar wel op basis van de app snel kan zien waar Dynafleet allemaal toe in staat is, dan is de stap tot de werkelijke aankoop van het programma veel kleiner. Dit is een aspect dat vaak over het hoofd wordt gezien, maar is o zo cruciaal in het aan de man brengen van Dynafleet. Het is dus niet belangrijk om de dispatcher te overtuigen, die verstand heeft hoe Dynafleet werkt, maar wel zijn manager, die nog altijd zal beslissen of hij Dynafleet al dan niet koopt. Het is namelijk zeer belangrijk dat klanten, en in het bijzonder de beslissing nemers binnen dat bedrijf, een duidelijk beeld hebben van de waarde die Dynafleet kan opleveren. Ik ben er zeker van dat, mochten we de mobiele app niet hebben, dat 50% van

die ‘key users’ zich niet zouden aangesproken voelen om Dynafleet te kopen. Met andere woorden, de verkopen van Dynafleet zouden in dat geval met de helft afnemen.

Is het mogelijk om een overzicht te geven van wat de desktopversie dan allemaal (meer) kan tov mobiele versie?

Ja, ik zal u een handleiding doorsturen en ook een login bezorgen zodat je kan inloggen in ons systeem en zo vertrouwd kan geraken met de functionaliteiten van Dynafleet.

- Mr. Tack besloot op dit moment me zelf de volledige versie te laten zien en het verschil te tonen met de mobiele applicatie –

Tegen welke prijs kan de klant Dynafleet kopen? Moet hij/zij extra betalen voor de mobiele versie?

Dynafleet bestaat uit 4 modules. Eerst en vooral bieden we Fuel & Environment aan. Dit gaat voornamelijk over verbruiks- en chauffeursopvolging. Ten tweede heb je Driver Times. Dit is alles wat rijtijden omvat. Vervolgens Messaging, wat de berichtencommunicatie tussen de vrachtwagens en de dispatch of het kantoor inhoudt. De laatste module is Positioning. Dit gaat vooral over waar de trucks zich bevinden, hoe zijn ze naar die locatie gereden, en dergelijke. Hier kan ook geo-messaging worden gebruikt waarbij je een bepaalde regio onderverdeeld in sectoren. Wanneer een truck dan van de ene naar de andere sector rijdt, wordt er automatisch een bericht gegenereerd die deze actie weergeeft op de display van de desktopversie.

Dankzij Positioning kan een dispatcher een chauffeur een andere route toewijzen waar er bijvoorbeeld geen file is. Hiervoor zal de dispatcher zeer waarschijnlijk gebruik maken van de desktopversie in plaats van de mobiele app, omdat deze eerste veel meer informatie kan weergeven of waarbij bepaalde selecties kunnen worden gemaakt. Bovendien kan hij de chauffeur hierbij contacteren via de Messaging module. Daarnaast maakt de administratie van het transportbedrijf vaak gebruik van de Driver Times module om zo de loonkosten van de verschillende chauffeurs te berekenen. Chauffeurs kunnen hierbij ook zien of ze nog steeds binnen de wettelijke maxima zitten of anderzijds dringend een pauze moeten nemen. Fuel & Environment heeft weerslag op het kostenpakket wat van belang is voor het management. Ze kunnen maatregelen treffen om de efficiëntie te verhogen. Ook is deze module interessant voor de chauffeurs zelf zodat ze individueel snel kunnen opvolgen welke aspecten beter kunnen.

De chauffeurs en het management gebruiken dus vooral de mobiele app, terwijl de lagen daartussen, zoals dispatchers en administratieve bedienden vaker teruggrijpen naar de complete desktopversie van Dynafleet.

Eigenlijk, naast de 4 modules die Dynafleet omvat beschikt Volvo Trucks over nog een vijfde module namelijk 'Fuel Advice'. Deze staat in theorie los van Dynafleet maar gebruikt wel de data gegenereerd door de module 'Fuel & Environment' van Dynafleet om zo rapporten te creëren en tips in verband met het rijgedrag aan te bieden aan de klant. Zo moet de klant zelf niet langer een weg banen door al dat datamateriaal, maar wordt dit door Volvo Trucks gedaan en krijgt de klant uiteindelijk een overzichtelijk rapport, aangevuld met praktische gedetailleerde tips om zijn rijefficiëntie te verhogen. Deze tips zijn verschillend voor elke chauffeur gebaseerd op hun persoonlijk rijgedrag.

Om terug te komen op de vraag, één module van het Dynafleet pakket kost per chassis €15 per maand. Wil je het complete pakket, namelijk de 4 modules, dan betaal je €60 per vrachtwagen per maand. De prijzen worden dus gerekend per chassis en niet per chauffeur. Zo kan het zijn dat twee chauffeurs rijden met slechts één vrachtwagen, dan is de maandelijkse kost voor een pakket Dynafleet voor die specifieke truck €60 en niet €120. Voor de mobiele applicatie moet bovendien niet extra worden bijbetaald.

Is de klant bereidt dit bedrag te betalen? Met andere woorden, brengt deze app hen ook financieel iets op?

Het fenomeen is dat veel transportbedrijven Dynafleet zien als een kost, soms dus €60 per truck per maand. Dit kan oplopen €720 per truck per jaar. Dit lijkt heel veel, zeker als de klant bijvoorbeeld beschikt over een vloot van 15 trucks. Toch vergeten ze vaak te kijken naar de ROI (return on investment), die o zo belangrijk is. Het is belangrijk dat wij als verkopers hen daarop toewijzen.

Beschikt Volvo Trucks over praktijk gegevens die kunnen aangewend worden om de klant te overtuigen, bijvoorbeeld kunnen jullie zeggen 'indien jullie het Dynafleet pakket implementeren zullen jullie sowieso 5% brandstof besparen, waarbij slechts 1 module voor een kostenreductie van ongeveer 1% zorgt '. Hebben jullie dergelijke richtgetallen?

Dynafleet is een tool die chauffeurs erop wijst wat ze verkeerd doen. Indien ze deze regels opvolgen kan er een significante kosten- en/of tijdsbesparing het resultaat zijn. Hoeveel elk transportbedrijf kan besparen varieert telkens en is afhankelijk van hoe goed ze het

momenteel doen en hoe groot de ruimte voor verbetering is. Op de Volvo Trucks website staat er een handige tool (http://www.volvotrucks.com/trucks/belgium-market/nl-be/trucks/volvo-fh-series/key-features/Pages/the-fuel-deal.aspx onderaan) die de jaarlijkse besparing voor de klant kan dimensioneren. Onderstaande business case wordt vaak gebruikt, naargelang de dimensies van het bedrijf van de klant.

Stel nu dat in ons voorbeeld het transportbedrijf beschikt over 15 trucks die jaarlijks 85.000km rijden en gemiddeld 33 liter per 100km verbruiken. De dieselprijs staat bijvoorbeeld ongeveer €1,20 per liter. Indien de transporteur de richtlijnen van Dynafleet volgt, dan kan hij bijvoorbeeld zijn verbruik terugdraaien per truck naar 32 liter per 100km. Dit is een daling van 3,03%, wat vrij klein lijkt. De tool geeft weer dat in dit geval het transportbedrijf jaarlijks toch een besparing realiseert van €16.063. Wetende dat een volledig pakket Dynafleet €60 kost per truck en per jaar, dan kost dit het bedrijf €10.800. We zien dus duidelijk dat de transporteur hier een netto winst maakt van €15.298-€10.800 = €4498. Verbruikt het bedrijf nog minder, laat ons zeggen 31 liter per 100km, dan is de gemaakte winst nog groter, namelijk €19.796. Dit is zeer impressionant. En wanneer deze berekening wordt voorgeschoteld, dan pas dringt het door tot de transporteur dat Dynafleet niet enkel een kostenpost is, maar werkelijk een significant bedrag kan opleveren voor het bedrijf.

Ook kunnen de modules apart al heel wat kosten besparen. Neem nu de Messaging module. Wanneer deze module ervoor kan zorgen dat maandelijks bijvoorbeeld 100 internationale telefoongesprekken per truck kunnen worden uitgespaard, dan heb je uw €15 misschien al terugverdiend. Daarnaast kan de module Driver Times verzekeren dat chauffeurs niet de wettelijke richtlijnen met betrekking tot rij- en rusttijden overschrijdt. Eén enkele boete kan zo al gauw oplopen tot €1250. De maandelijkse €15 die deze module kost is hiertegenover insignificant. Dezelfde module kan ook heel wat tijd besparen met betrekking tot administratie en loonberekening. Zo kunnen de nodige rijtijden rechtstreeks gedownload worden in het systeem en moeten deze niet meer manueel uitgelezen worden.

Toch is het zeer belangrijk om te vermelden dat Dynafleet echter een tool is. Start je dit systeem gewoon op, dan kost dit geld. Ga je dit systeem verder doorgronden, bekijken en implementeren, dan kan Dynafleet allerhande kosten reduceren en tijd besparen. Het is daarom gevaarlijk om te zeggen ‘met Dynafleet kan je zoveel met zoveel procent je kosten laten dalen’. Transporteurs gaan zich namelijk op die getallen vastpinnen. Nogmaals, wat de

klant met Dynafleet doet, in welke mate ze de richtlijnen gaat toepassen en hoeveel brandstof er wordt bespaard, ligt volledig in hun handen.

Ligt de grote brok van een lager brandstofgebruik dan eerder niet in het product technische domein dan bij Dynafleet?

Uiteraard gaat een goede basis, namelijk een goed uitgeruste truck die over een lichter aerodynamisch chassis beschikt, gebruik kan maken van technologische snufjes zoals de I-Shift en daarnaast ook nog een ecologische motor heeft, minder verbruiken dan een zware logge truck met een overdreven krachtige motor. Dit kan ertoe leiden dat een vrachtwagen niet meer 33 liter maar 32 of zelfs 31 liter verbruikt per 100km. Zoals eerder gezien, betekent dit een immens verschil op gebied van kosten.

Dynafleet's functie is dan tweeledig. Ten eerste werkt het controlerend. De transporteur kan monitoren of de vrachtwagen waarbij Volvo Trucks garandeerde dat deze 32 liter kon verbruiken, wel degelijk slechts 32 liter verbruikt. Indien dit cijfer niet wordt gehaald, kan men in Dynafleet gaan kijken wat de oorzaak kan zijn. Zo heeft een chauffeur bijvoorbeeld niet genoeg dezelfde snelheid aangehouden. Dit is een parameter die men kan terugvinden binnen Dynafleet. (Hierbij toont Mr. Tack dit op Dynafleet geïnstalleerd op zijn smartphone). Dit laatste kan ertoe wijzen dat de chauffeur niet genoeg op cruise control heeft gereden. Zo kan men via Dynafleet die chauffeur op de vingers tikken en uitleggen wat hij nu net verkeerd heeft gedaan. Ook speelt vaak het fenomeen dat vrachtwagenchauffeurs vooral in het begin letten op hun brandstofverbruik, wanneer ze net met hun nieuwe truck mogen rijden. Op termijn ziet men dat hun gedrag wat lakser wordt en hun brandstofverbruik stijgt. Ook hier is het mogelijk Dynafleet te gebruiken om die persoon op zijn gedrag te wijzen en aan te zetten om opnieuw de energiezuinige draad op te pikken. (This paragraph was explained based on a slide regarding 'fuel economy') Dit kan op zijn beurt voordelig zijn voor Volvo Trucks omdat wij trainingen, zoals Volvo Eco Driving, aanbieden voor chauffeurs zodanig dat zij nog efficiënter een Volvo truck kunnen besturen.

Anderzijds dient Dynafleet om het onderste uit de kan halen. Is het niet op basis van rijgedrag, dan kan er misschien bespaard worden door het gebruiken van andere routes of gebruik te maken van de Messaging component, die allemaal deel uitmaken van Dynafleet en al eerder werden besproken.

Zoals reeds aangehaald kunnen kleine bezuinigingen op een grote vloot enorme besparingen met zich meebrengen. Beschikt een transportbedrijf bijvoorbeeld niet over genoeg geld om

bepaalde investeringen te doen, dan kan het relatief goedkope Dynafleet nog steeds helpen om die laatste oneffenheden, die leiden tot inefficiënt rijgedrag, eruit te halen.

Men mag niet vergeten dat de transportsector een zeer competitieve markt is waarbij men zo lean mogelijk tracht te werken. Kan er ergens kosten bespaard worden, dan zal men niet twijfelen dit te doen. Het moeten dus niet altijd de werknemers, en de bijhorende ontslagen, zijn die hiervoor moeten opdraaien.

Denkt u dat het gebruik van mobiele applicaties en de besparingen die ze meebrengen voordeliger zijn dan bijvoorbeeld buitenlandse chauffeurs aan te trekken die werken tegen een lager loon?

Ik ben hiervan overtuigd. Ook wanneer je beseft dat loonkost behoort tot een groot deel van de totale kosten. Brandstofverbruik is de tweede grote kost voor de transporteur met 30%.

Je moet goed weten dat Dynafleet niet enkel kosten reduceert, maar de klant ook tijd bespaart. Dit is niet het geval wanneer het bedrijf een vrachtwagenchauffeur vervangt door een goedkopere buitenlandse bestuurder. Een vrachtwagen besturen is niet meer zoals dit een decennia geleden was. Trucks zijn smart geworden en bevatten allerhande tools die ervoor zorgen dat de truck minder verbruikt.

Zo heeft Volvo Trucks bijvoorbeeld een systeem ontwikkeld, genaamd I-Shift. Kostprijs is €2000 per truck. Dit systeem geeft de exacte positie weer wanneer een chauffeur de gas moet lossen wanneer hij over de top van een helling rijdt. Zo kan de truck, puur op basis van kinetische en voortschrijdende krachten, een helling over geraken zonder dat er nog gas moet worden gegeven, wat leidt tot een lager brandstofverbruik. Een chauffeur kan onmogelijk dit exacte punt weten en kan er enkel maar naar gissen. Soms kan dit leiden tot het verbruik van een hele liter diesel die er op een paar seconden door is. I-Shift vermijdt deze situatie. Maar het is dan ook de verantwoordelijkheid van de truckchauffeur om dit systeem, maar ook andere, toe te passen en zich daarop te vertrouwen. Andere hulpmiddelen werken bijvoorbeeld alleen wanneer de vrachtwagen in cruise control rijdt. Doet de bestuurder dit niet, dan schieten de hulpmiddelen niet in gang en wordt er steeds onnodige brandstof verkwanseld.

U kan zich voorstellen dat dit training en moeite vraagt vanwege de transporteur om zijn chauffeurs op te leiden. Moet dit telkens gebeuren in de moedertaal van een buitenlandse aangeworven bestuurder, bijvoorbeeld in het Pools of Russisch, dan kost dit tijd en soms ook

geld. Misschien wordt dan wel bespaard op de grootste kostenfactor, namelijk de loonkost, toch kan het de transporteur meer tijd gekost hebben of kan de rit tegen een hoger brandstofgebruik uitgevoerd zijn dan wanneer er werd gekozen voor een Belgische chauffeur. En zoals u reeds kon zien, reeds een besparing van één liter op 100km kan een wereld van verschil maken.

Binnen Dynafleet wordt ook gebruik gemaakt van een 'leaderboard' waarbij chauffeurs onderling zichzelf kunnen vergelijken en aflezen hoe brandstofefficiënt ze rijden ten opzichte van andere bestuurders. Heeft u enige weet dat transporteurs beloningen koppelen aan deze uitslag? Bijvoorbeeld dat de drie hoogst gerangschikte chauffeurs een bepaald bedrag ontvangen of erkenning krijgen voor hun prestaties?

Allereest moet worden opgemerkt dan Dynafleet eigenlijk een mobiele versie heeft uitsluitend voor chauffeurs en een andere uitsluitend voor het management. Bij de eerste kan de chauffeur zijn/haar gegevens uitvoerig bekijken en zich afvragen hoe hij efficiënter kan rijden, zonder dat andere medechauffeurs dit kunnen meevolgen of zijn gegevens kunnen inkijken. Daarnaast heeft het management wel toegang tot dit scorebord en kan het dus de chauffeurs onderling vergelijken.

Mocht deze individuele informatie intern publiekgemaakt worden of de werkgever dit uithangt, dan kunnen er inderdaad problemen optreden met betrekking tot de privacy. Er kan bijvoorbeeld wel onderling overeengekomen worden in een apart contract dat deze informatie intern toch publiek mag worden gemaakt en dat er bijgevolg beloningen aan kunnen vasthangen naarmate je beter scoort. Nu ben ik geen expert in de privacy wetgeving en kan ik u niet met 100% zekerheid vertellen of dit legaal is.

Toch is het wel perfect mogelijk om beloningen hieraan te koppelen. Dit gebeurt wel eerder wanneer de chauffeurs van een bepaalde transporteur opereren in een bepaalde regio, neem nu bijvoorbeeld de Benelux. De bestuurders worden dan allemaal geconfronteerd met praktisch hetzelfde landschap en dezelfde omstandigheden. Wanneer deze parameters gaan wijzigen, bijvoorbeeld wanneer één chauffeur enkel in het vlakke Nederland rijdt en een andere voortdurend de Alpen over moet steken, dan wordt een dergelijk beloningssysteem zeer moeilijk om uit te voeren.

In de Dynafleet mobiele app wordt de ranking opgemaakt op basis van het rijgedrag van een chauffeur over de laatste 40 uur. Dit kan uiteraard sterk variëren. Iemand die maar net bij een klant is vertrokken zal veel meer verbruiken dan iemand die gedurende de gehele periode in

cruise control stand op de autosnelweg rijdt. In de desktopversie daarentegen kan men bijvoorbeeld de gegevens oproepen over een gans jaar en hieruit het gemiddelde nemen. Beloningen zullen dus eerder gebaseerd worden op basis van gegevens uit de desktopversie.

Toch is het scorebord interessant voor een manager om continu het gedrag van zijn chauffeurs te volgen en daarnaast ook de algemene status van zijn fleet te bekijken.

Daarnaast is er trouwens ook een ranking op basis van de nummerplaten van de trucks, aangezien sommige vrachtwagens beschikken over twee chauffeurs. In dat geval is het soms niet mogelijk om het per chauffeur te doen, maar wel op nummerplaat.

Hebben de chauffeurs in het algemeen er dan niets op tegen dat hun volledige doen en laten kan gemonitord worden door het management?

Ik denk dat, in de mate dat ik de privacywet ken, de werkgever enkel de werknemer dient in te lichten dat dergelijk systeem op hun voertuig zit. Langs de andere kant heb ik nog nooit een bestuurder tegengekomen die hierover klaagt. Integendeel. Vaak vragen chauffeurs om advies om hun rijgedrag nog verder te verbeteren. Dit is iets wat meer en meer populair is omdat bestuurders meer en meer beseffen hoe hun rijgedrag een impact kan vormen op het kostenaspect van het bedrijf. En vaak zien we toch dat goed rijgedrag ook door de werkgever wordt beloond, vooral op het einde van het jaar.

Daarnaast is het ook voordeliger voor de chauffeur zelf om zijn best te doen. Indien de verbruikskosten, die 30% uitmaken van de totale kosten van het transport, verder doorgroeien, dan moet de werkgever bijvoorbeeld besparen op lonen. Hierdoor worden financiële beloningen minder waarschijnlijk en dreigen de bestuurders zelfs vervangen te worden door goedkopere werkkrachten, bijvoorbeeld uit Oost-Europa.

Zelfs wanneer dit systeem niet geïnstalleerd is op de vrachtwagen, heeft de transporteur nog steeds een goed zicht hoe goed of slecht zijn transporteurs het doen. Deel je de hoeveelheid diesel die hij nodig had door de afstand die hij heeft afgelegd, dan kom je uiteindelijk nog steeds op het gemiddeld verbruik. Ook kan het gemiddelde verbruik vaak worden afgelezen op het dashboard van de truckchauffeur. Het grote voordeel van Dynafleet is echter dat ze veel meer en preciezere data kan weergeven over verschillende periodes en de bestuurders effectief kan helpen om het nog beter te doen.

Als ik het goed begrijp gebruiken enkel klanten van jullie, die actief zijn in de transportsector, jullie applicatie. Nu heb ik uit goede bron vernomen dat ArcelorMittal, een

staalproducent, ook Dynafleet gebruikt om te zien waar de trucks zitten die aan ArcelorMittal leveren. Klopt dit? En kan u hieromtrent wat meer informatie geven?

Dit klopt maar half. Ze maken eigenlijk onrechtstreeks van Dynafleet gebruik.

Eerst en vooral moet worden gezegd dat ArcelorMittal zijn logistiek uitbesteedt. Dit wil zeggen dat ArcelorMittal zelf geen trucks bezit, maar dat het transport wordt gedaan door een extern transportbedrijf. Het is eigenlijk dit transportbedrijf, die weliswaar klant is van Volvo Trucks, dat ook gebruik maakt van Dynafleet. ArcelorMittal zelf beschikt niet zelf over dit programma, maar kan wel bepaalde informatie opvragen aan zijn transporteur waar bijvoorbeeld een bepaalde truck zit aangezien ze die bepaalde goederen nu of op korte termijn nodig hebben. Daarbij is het systeem van ArcelorMittal bijgevolg gekoppeld aan dat van Dynafleet, dat in handen is van de transporteur. Maar ArcelorMittal beschikt dus niet rechtstreeks over Dynafleet. Volvo Trucks is hier wel belangrijk omdat zij een koppeling van Dynafleet naar het systeem van ArcelorMittal kan ontwikkelen.

Bent u dan van mening dat er 'value fusion' optreedt bij Dynafleet? Bij dit fenomeen creëert het programma eigenlijk waarde voor beide partijen, hier de transporteur en zijn klant namelijk ArcelorMittal.

Dit wordt inderdaad gecreëerd door Volvo Trucks en Dynafleet. ArcelorMittal wil vooral controle hebben over de toelevering van goederen, terwijl de transporteur zijn vloot wil beheren. Nogmaals, de specialisten in het domein van Dynafleet die hier werken binnen Volvo Trucks kunnen de overbrugging verzorgen tussen beide systemen. Met name de transporteur van ArcelorMittal die Dynafleet gebruikt en het systeem van ArcelorMittal zelf. Volvo Trucks slaagt er dus in een product aan te bieden, zowel aan de transporteur als diens klant.

Waarom wordt dan Dynafleet ook niet aangeboden aan ArcelorMittal? Zou dit het proces niet eenvoudiger maken?

Neen, omdat Dynafleet heel wat functies heeft die voor ArcelorMittal niet van belang zijn. Ik denk dan aan brandstofbesparing, rijtijden, enz. ArcelorMittal wenst enkel dat zijn producten op tijd worden geleverd en heeft geen aandeel in het fleet management aspect, zeker wetende dat ArcelorMittal zijn transport uitbesteedt waardoor Dynafleet voor hen totaal overbodig is.

Dynafleet wordt gebruikt door verschillende transportbedrijven. Stroomt de data die zij genereren ook terug naar Volvo Trucks? Waardoor Volvo Trucks bijvoorbeeld technische

aanpassingen kan maken gebaseerd op waargenomen rijgedrag van enkele chauffeurs om zo de brandstofefficiëntie van trucks zo optimaal mogelijk te krijgen?

Er moet goed een onderscheid worden gemaakt tussen het technische aspect van trucks en Dynafleet. Uiteraard willen wij weten bijvoorbeeld op welke plaats er technische mankementen het meest plaatsvinden. Dit wordt voornamelijk geregistreerd door de computer aanwezig in de truck maar ook door de transporteurs die melden dat bepaalde onderdelen gevoeliger zijn aan pannes dan andere. Momenteel zijn de 4 grootste domeinen waarin er veel defecten gebeuren de remmen, koppeling, batterij en luchtdroger element. Niet toevallig wordt de staat van deze componenten wekelijks via connectiviteit uitgelezen. Uiteraard moet op termijn deze lijst uitgebreid worden. Hierbij speelt de factor van big data dus een grote rol.

Bij Dynafleet ligt dit anders. Trucks bestaan in verschillende maten en gewichten, gemaakt uit verschillende componenten en aangedreven door verschillende motoren. Volvo Trucks verkoopt aan verschillende bedrijven meestal nooit twee dezelfde vrachtwagens. Het type vrachtwagen kan bijvoorbeeld verschillen naargelang het gebied waarin het bedrijf zicht bevindt. Er is namelijk een groot verschil tussen vrachtwagens die door de polders rijden of die de Alpen moeten oversteken. Hierdoor gaat bijvoorbeeld het brandstofverbruik per truck sterk schommelen. Daarnaast is er nog een bijkomende niet onbelangrijke variabele, namelijk de vrachtwagenchauffeur zelf. Het is goed mogelijk dat de ene bestuurder 34 liter per 100 kilometer verbruikt terwijl iemand anders slechts 31 liter per 100 kilometer erdoor jaagt. Al deze varianties maakt het gebruik van big data gegenereerd door Dynafleet zeer moeilijk.

Dynafleet wordt daarnaast wel ingezet om chauffeurs erop te wijzen wat ze nu net verkeerd doen en hoe ze zo optimaal mogelijk de vrachtwagen kunnen besturen.

Hoe wordt de data gecreëerd die via Dynafleet wordt gebruikt? Wordt deze gekoppeld aan de boordcomputer? En wordt deze naar de transporteur verstuurd?

Wat er aan het voertuig fysisch verandert is een antenne op het dak. Via 2G/3G datacommunicatie worden de gegevens doorgestuurd. Daarnaast is er ook een FM antenne die voor de navigatie wordt gebruikt en in contact staat met satellieten. Op basis van GPS wordt dan de exacte locatie van de truck weergegeven. Deze twee antennes voeden de TGW unit, wat staat voor Telematics Gateway.

(kijk ook naar http://www.youtube.com/watch?v=FmOYiOIF7lY)

Dit laatste is een apparaat die zich boven de vooruit bevindt in het dak van de truck. Alle technologische informatie van de truck wordt naar deze computer gestuurd. Bijvoorbeeld de tachograaf die de rij- en rusttijden weergeeft, is hiermee verbonden. De TGW gaat dan die informatie verzamelen en via de antenne van de truck naar de transporteur sturen. De informatie die door de TGW unit wordt ontvangen is al vrij uitgebreid, maar naar de toekomst toe zouden we nog een aantal zaken graag toevoegen om te monitoren.

Het is ook zo dat de verschillende entiteiten die deel uitmaken van de Volvo Group steeds voorstellen mogen doen om bepaalde wijzigingen door te voeren of voor de ontwikkeling van nieuwe tools of producten. Deze worden dan in Zweden bekeken en geanalyseerd. Zo was er onlangs een voorstel vanuit België om ook het aantal keren dat ABS (antiblokkeersysteem) en ESP (Electronic Stability Program) heeft moeten ingrijpen, te registeren. ABS zorgt ervoor dat de wielen van de vrachtwagen niet blokkeren wanneer de bestuurder remt, maar eerder pompend remt. Anderzijds wordt ESP gebruikt om te vermijden dat een truck gaat kantelen. Dit voornamelijk door op een van de achterwielen stevig te remmen. Deze zaken gebeuren automatisch en alle Volvo Trucks zijn hiermee voorzien. ABS en ESP zijn eigenlijk ook maar computersystemen en de informatie wordt dus wel ergens opgeslaan. Het is nu de taak van Volvo Trucks om die informatie eruit te halen en te kunnen weergeven.

Deze nieuwe implementaties kunnen op termijn ook belangrijk zijn voor Dynafleet. Hoe meer parameters er geregistreerd en onderzocht kunnen worden, des te beter de richtlijnen zullen zijn naar de klant toe in verband met het rijgedrag van een bepaalde chauffeur.

Toch worden bepaalde voorstellen niet uitgevoerd, bijvoorbeeld omdat het hoofdkantoor in Zweden vindt dat andere zaken voorrang hebben of omdat er niet genoeg budget is om bepaalde voorstellen momenteel uit te voeren.

Dus het is enkel het hoofdkantoor in Zweden dat beslist wat er wanneer wordt uitgevoerd? De entiteiten hebben dus enkel een adviserende rol?

Ja, dat klopt. Ik maak een business case op die Volvo Trucks België vertegenwoordigt en schrijf daarin alle zaken die ik graag zou geïmplementeerd zien. Daarop beslist Zweden of deze zaken wel waardevol zijn en wanneer ze deze al dan niet zouden uitvoeren.

Mag ik dan aannemen dat mobiele technologie meer en meer belangrijker wordt binnen de transportsector?

Dat klopt. Bijna elke chauffeur bezit namelijk een smartphone of tablet. Ook zien we dat bestuurders nu veel individualistischer zijn dan vroeger. Waar men toen stopte aan een tankstation en uitstapte om een praatje te slaan met andere chauffeurs en iets te eten of te drinken, blijven ze nu gewoon in hun cabine. Soms zien we dan toestanden dat chauffeurs hun eten koken op een fornuis in hun cabine of er een microgolf toestel hebben staan om hun eten op te warmen. Volvo Trucks biedt zo ook bijvoorbeeld televisies en microgolf toestellen aan die kunnen worden geïnstalleerd in de cabine van de vrachtwagen. De chauffeurs leven meer en meer enkel in hun cabine. Dit kan soms aanleiding geven tot eerder marginale situaties.

Dit betekent niet dat chauffeurs geen sociaal contact willen hebben. Dit gebeurt wel, maar dan binnen hun cabine door het gebruik van mobiele technologie. Men gaat bijvoorbeeld op Facebook of ze voeren videogesprekken via Skype. Als resultaat groeit het aandeel van laptops en tablets, die aanwezig zijn in de cabine, significant.

Maakt Dynafleet ook een onderscheid tussen smartphones en tablets? Wordt er bijvoorbeeld meer informatie weergegeven op tablets, omwille van hun groter scherm, dan bij smartphones? Of wijzigt de soort van informatie die wordt getoond naarmate men het toestel gaat kantelen, met andere woorden, wanneer de oriëntatie van het apparaat wijzigt?

Neen, dit is niet het geval. De applicatie is wel overzichtelijker op een tablet omdat tezelfdertijd meer informatie kan worden weergegeven op dat grote scherm, in vergelijking met smartphones.