BI Norwegian Business School - campus Oslo

GRA 19502

Master Thesis

Component of continuous assessment: Forprosjekt, Thesis MSc

How can an urban consolidation center in Oslo ensure a more sustainable freight transportation?

Start:	01.12.2016 09.00
Finish:	16.01.2017 12.00

Preliminary thesis report

BI Norwegian Business School

"How can an urban consolidation center in Oslo ensure a more sustainable freight transportation?"

Supervisor:
Stein Erik Grønland

Master of Science in Business - Logistics, Operations and Supply Chain Management

Table of Content

Summary

This paper is a preliminary report for our master thesis. The topic is in collaboration with Statens Vegvesen to develop a more efficient and environmentally friendly method for freight transportation of goods in the center of Oslo. Focusing on sustainability and environmental friendly solutions has become of high interest both for public and private companies. The population in Oslo is steadily increasing and it is expected that the transportation of goods will follow this development. New solutions that emphasis greener strategies and environmental concern must therefore be considered to reduce the number of freight vehicles in circulation and reduce the greenhouse gas emissions.

Sustainable urban transportation aims to reduce the number of trucks operating empty or below capacity in highly populated areas. In relation to this, logistic service companies are expected to take initiatives to reduce their pollution and implement greener strategies in their business objectives when it comes to delivering goods. However, due to globalization and supply chain pressure, customers are expecting just-in-time deliveries, forcing logistics service providers to increase their number of trucks on the road to be able to satisfy this demand.

Literature reviewed shows that city logistic can be improved by utilizing and better operate the distribution activities. Coordination of the distribution of goods to best fill up trucks and limit the driving distance, can lead to higher efficiency. By using consolidation centers to allocate goods from different freight transporters and then distribute to the respective areas using a limited number of trucks, has shown to be more environmentally friendly. Our thesis will look into studies where urban consolidation centers has been utilized to improve urban freight sustainability.

1. Introduction

1.1 Background information

The focus on sustainable behavior has experienced a steady increase over the years and has become an important issue within many areas, in particular within transportation. The Brundtland Commission has since 1987 brought global interest to the concept of sustainable development and its application to urban and metropolitan areas (Goldman & Gorham, 2006). Sustainable development is a combination of the growing concern in regards to environmental issues, together with social and economic issues (Hopwood et al., 2005). Public sectors and private companies are working towards greener business strategies, and within some areas, sustainability can be considered a competitive advantage. This is due to the cost savings a business can experience, through better utilizing their resources and becoming more environmental friendly. However, the global increase and emergence of large and complex supply chains have lead to high customer requests of shorter lead times and more frequent delivery of goods. Urban areas, where population is relatively high, face a comprehensive emission issue due to the number of freight vehicles in circulation to meet this demand. Incentives to lower the emissions in these areas have thus become of governmental concern and different actions are being considered.

In Oslo the total amount of green gas emissions has increased by 25 percent since 1991 (oslo.kommune.no). Emissions per person have decreased from 2.5 tons to 2.3 tons and the largest part of green gas emissions comes from transportation. In 2013, transportation accounted for 63 percent of the total emissions in Oslo. The goal of the municipality of Oslo is to reduce green gas emissions by 50 percent compared to the level of 1.43 million tons CO2 equivalents in 1991. In accordance with the European Unions ambitions of an emission free city distribution within 2030, the municipality in Oslo has decided to implement immediate measures on days when the air pollution is shown to be very high (GBO2015). One measure that has already been initiated is closing some of the parking facilities in the center of Oslo (oslo.kommune.no). Others, like prohibit diesel vehicles from entering the city and increasing the road fee, are still to be

elaborated and approved. The city of Oslo expects an increase in the population of 30 percent within 2030, and that the following increase in freight transport will be 50 percent (GBO2015).

Statens Vegvesen is a Norwegian government agency with responsibility of planning, building, operating and maintaining interstate roads and regional roads in Norway (vegvesen.no). The national goal within transportation is to provide an effective, available, secure and sustainable transportation system. Statens Vegvesen work towards reaching this goal, which can be divided into four main parts: navigability and regional development, road safety, environment, and universal configuration. In order for Statens Vegvesen to reach their goals, they have chosen three core values to represent their visions: professional, future oriented and including. Professional includes using their academic strength to act with quality and to be solution oriented. Future oriented creates the foundation to develop innovative and sustainable solutions for the future, within transportation and the services they provide. To be including involves being accommodating to the surroundings, and to communicate in a clear and understandable way. Our contribution is this paper is within the environmental aspect, to help limit greenhouse gas emission and reduce the environmental impact from freight transportation within the city of Oslo.

1.2 Problem statement

In collaboration with Statens Vegvesen we will look into environmental effects of reducing or better utilizing the freight transport within a restricted area in Oslo. More precisely we will look into the effect of establishing a urban distribution center, and see how this could affect emissions in comparison with today's situation. We will see how utilizing a joint urban consolidation center can help reduce the environmental impact and reduce the number of vehicles used for freight transportation. More precisely, we will look into possible alternatives for transportation from an urban distribution center to retailers, and evaluate how this will lead to more sustainable freight transportation in Oslo.

Our chosen thesis question is as follows:

"How can an urban consolidation center in Oslo ensure a more sustainable freight transportation?"

To help answer our thesis question we have developed some sub questions we want to answer:

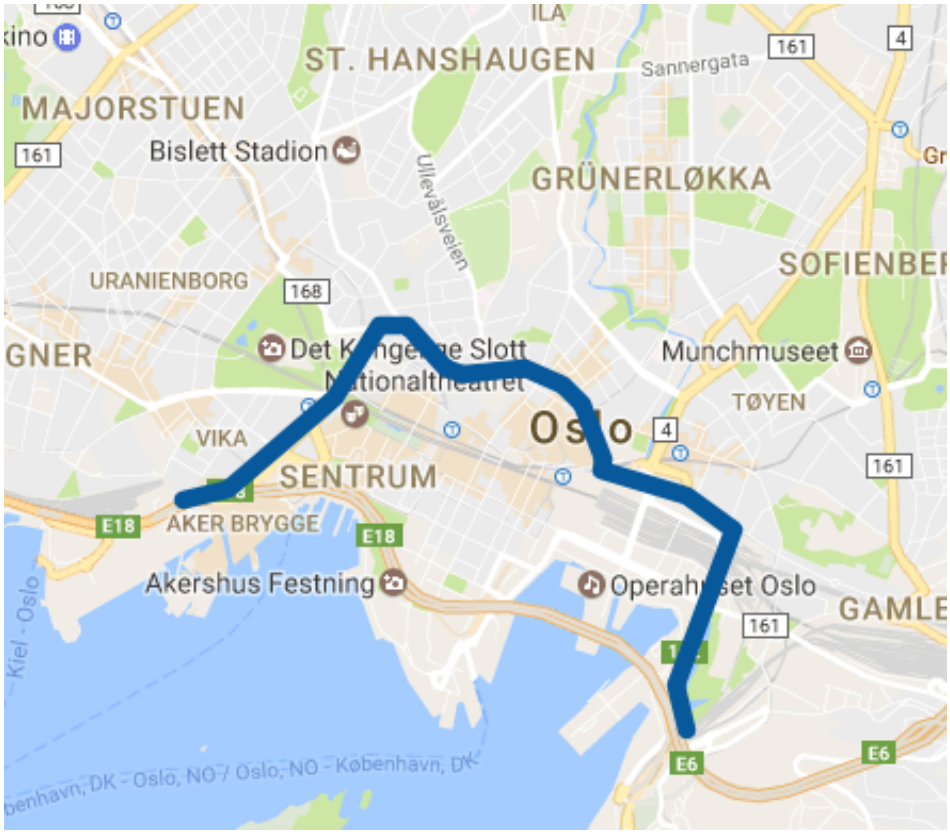
- Will the use of a consolidation center reduce the number of trucks in circulation?
- Will the utilization of the vehicle capacity increase?
- Will this lead to a reduction of greenhouse gas emissions?

1.3 Limitations

The concept of freight transportation in Oslo with the objective of reducing environmental impacts is extremely broad, and needs to be limited in terms of geographical area. Reducing the area from the entire city of Oslo to a smaller scope, such as "Ring 3", "Ring 1" or "Majorstua", does this. We have decided that Ring 1 is the best alternative so far, both because it is a quite limited area and also since this could be of interest for the future, with reference to Oslo municipality´s decision of limiting the area for traffic. However, we realize that the area is still quite big so we might need to narrow it even further before we start to collect our data.

We will assume than an Urban Consolidation Center has been established and look at how this facility can reduce freight transportation with Ring 1. This will be a facility located close to the city access or ring highways. The exact location of the center will be decided in relation to the geographical area we decide to study.

Below is an illustration of our chosen geographical area:



Source: Google Maps 2017

We will probably also narrow down the scope of the goods transported and delivered. This can be done by choosing goods to retail stores, goods to the food industry or small packages below a set target weight. As we probably need to narrow down our geographical area, and the fact that we have limited knowledge of the current transportation situation in the designated area, this will be limited further at a later time.

1.4 Relevance of the paper

This paper is of high relevance, due to the concern of greenhouse gas emission in Oslo produced by freight transportation. The paper will try to examine how to reduce the environmental impact by using the concept of an urban consolidation center. Shifting to more sustainable transportation system is of high interest for the municipality in Oslo, in order to free up area capacity and reduces the number of freight vehicles. The main goal is to have emission free freight transportation in the city centers throughout Norway within 2030 (Nasjonal Transportplan, 2016).

The prerequisites for delivering goods in the center of Oslo are changing, and restrictions that favor public transportation services and security is under implementation. Accessing delivery points will thereby become more difficult in light of these changes. Due to the high number of both public and private vehicles travelling in Oslo every day, leading to extensive queues, more efficient and environmentally friendly solutions must be considered.

2. Relevant theory and literature

2.1 Sustainable logistics

"Logistics is the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organisation and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfillment of orders" (Christopher, 2016).

The most widely accepted definition of sustainable development is "development that meets the needs of the present without compromising the needs of future generations to meet their own needs" (World Commission on Environment and Development, 1987) (Anderson et al., 2005). Abukhader and Jönson (2004) states that the concept of sustainable logistics can be divided into three themes:

1. Reverse logistics
2. Greening supply chains (assessing the impact of environment on logistics)
3. Emissions assessment

When implementing an achievable sustainable strategy for logistics, with the limitation of emissions in mind, parameters of measurement must be the determined. This includes factors such as the scale of geography, impact on the environment and social impacts, all of which are important in order to achieve more sustainable cities and urban freight transportation systems (Anderson et al.,

2005). To determine these measurements and their following actions, can be very difficult. Anderson et al. (2005) states that two groups has the possibility to change the urban freight system and make it more sustainable, and they both have different rationales for doing so. The first group is changes implemented by governing bodies, which includes introducing policies and measures that will force companies to change their actions with the result of becoming more environmental friendly (Ogden, 1992; Anderson et al., 2005). The other group is changes driven by companies. This entails that companies will implement measures to reduce their effects from freight transportation only if it gives them some sort of benefit. This could be economic advantage resulting from improved economic efficiency or increased market shares. The measures implemented could be consolidating urban freight to increase the vehicle load factor, develop improved systems of collection and delivery, and to implement the use of routing software.

2.2 City logistics

Witkowski and Kiba-Janiak (2014) states that city logistics can be defined as "planning, implementation and monitoring of economic efficiency and effectiveness of people, cargo and relevant information flows in urban areas in order to improve the citizens quality of life". Literature shows that City Logistics can be improved by making the distribution activities more effective and utilizing the freight transport operations (Crainic et. al., 2009). City Logistics aim to reduce freight transportation in highly populated areas, while supporting the social and economic development in the cities (Crainic et al., 2009). The incentive includes reducing the emissions as well as traffic in general, and to free up capacity in areas used to deliver goods. One way to reduce freight transportation and reduce the level of emissions in the cities is to make it more efficient and thereby decrease the number of vehicles.

Economic continuity is an important aspect of city logistics. This entails that the project has to last over time, a requirement that can be measured by the systems logistics performance of two dimensions (Gonzalez-Feliu and Morana, 2010). The enterprise vision is related to the last mile of the supply chain in the urban part, e.g. supply chain management and quality performance. Collective vision in a

system-city point of view is not as relevant in terms of economy but is important to evaluate the economic sustainability of city logistics, both for the system development and to ensure the system's operability. The social aspect of city logistics regards different groups of people that are affected in terms of restrictions and comfort levels. Transportation carriers, commercial activities and citizens are important stakeholders that are necessary to take into account when planning and ensuring sustainable freight transportation. The environmental aspect of city logistics is divided into issues relating to emissions of greenhouse gasses and noise, as well as local pollution. This also has two dimensions, which are environmental performance of city logistics in a Supply Chain Management approach and environmental gains of the city logistics system (Morana and Gonzalez-Feliu, 2010; Gonzalez-Feliu and Morana, 2010). According to the Kyoto Protocol, decreasing greenhouse gas emissions is an objective of city logistics, as these are one of the main reasons for global warming. In terms of freight transportation, CO2 is the main greenhouse gas emission from fuel consumption, but other pollution gasses such as CO, NOX and SOX are also important contributors to global warming. The total emissions from a vehicle can be calculated based on the total distance travelled, number of stops, average speed and conversion tables (Routhier et al., 2009; Gonzalez-Feliu and Morana, 2010).

2.3 Urban freight transportation

According to Plowden and Buchan (1995) “Freight transport is essential to the modern economy. An efficient system must provide the customer with a good service at a reasonable cost.” (Anderson et al., 2005). However, the continuously increasing level of contamination in urban areas today has lead to the uncertainty of whether levels of efficiency are high enough. The Freight Transport Association states, “While industry has achieved significant success in improving vehicle productivity and utilisation, urban congestion imposes major constraints on further improvements” (Freight Transport Association, 1996; Anderson et al., 2005). The overall objective is therefore to reduce the impact freight transportation and the following emission has on the cities living conditions, without compromising the city's social and economic activities (Crainic et al. 2009).

The urban freight and passenger transportation has economic impacts such as congestion, inefficiency and resource waste (Anderson et al., 2005). The environmental impacts are pollutant emissions, production of waste products and loss of wildlife habitats and threat to wild species. In addition there are social impacts such as physical consequences on public health, injuries and death due to traffic accidents, noise and visual intrusion. Vehicles used for freight transportation that operate in an urban environment emits more pollutants per travelled kilometer than other motor vehicles, due to higher fuel consumption per unit of distance travelled and the use of diesel as fuel (Anderson et al., 2005). However, the use of such transport is important due to factors such as sustaining our existing lifestyle, and the sector's efficiency contribution to the competitiveness of industry (Meyburg & Stopher, 1974; Hasell et al., 1978; Ogden, 1992; Anderson et al., 2005).

Freight transport is closely tied to the nature and flow of goods, so to be able to make such transportation more sustainable, it is important to be aware of these flows and the driving forces behind it. Examples of these are activities' geographical location, demand of customers and cost of activities related to the goods, such as transportation (Anderson et al., 2005). This implies that in order to affect the patterns and reduce the influence of the freight transport, the attention should be on changing some of the factors in addition to paying attention to the movement of vehicles. An example of this can be the use of urban consolidation centres, which through their strategic location can reduce the needed number of vehicles, as well as reduce transportation costs.

2.4 Urban Consolidation Centers

Urban Consolidation Centers (UCCs) are distribution centers that are located on the edge of urban areas (Study on Urban Freight Transport). These centers receive goods that are to be delivered to customers from several different transporters, and then consolidate the freight into loads that are subject to last mile delivery. Coordinating the distribution of goods among logistic service providers, can lead to lower turnover/circulation of freight transportation. Implementing joint venture in goods distribution collaboration through consolidation centers, can be

economically profitable, increase the logistic efficiency and be environmental friendly (Eriksson & Svensson, 2008).

Consolidation centers can be divided into two different main types, the first is centers for consolidation of retail deliveries in city centers, while the other is centers for consolidation of construction materials for development sites in urban areas (Study on Urban Freight Transport). UCCs for retail deliveries have the main objective of reducing the number of needed vehicles in the city through maximizing the loading factor. A direct effect of this will be the reduction of emissions and road congestion, and due to this the government often subsidizes consolidation centers. Research shows that the environmental effects of urban consolidation centers are larger in areas where there is a fragmentation in the retail markets or where there is a good mixture of number of small and medium stores alongside larger chain stores.

2.5.1 Route optimization

A tool that perfectly address efficiency and is considered a crucial factor within transportation of services and goods is route optimization. The main aim of route optimization is to reduce costs, through reducing the level of fuel used, filling up trucks, limiting the distance between each stopover, reduce time spent at each stop, and evaluate modes of transportation used (Cachon et al. 2013, p. 409). In city logistics important factors will also be the density of the area, the dimension of the sector, the traffic of other public and private vehicles, and restrict city limitation.

Traditionally, the optimal route is driven by economic incentives, but when considering in accordance with sustainable logistics, the objective becomes wider and operational constraints can occur (Lin et. al., 2014). A fundamental idea when optimizing route planning in accordance to sustainability and urban areas, is not to consider each shipment, firm and vehicle individually. One should rather consider them as components of an integrated logistics system (Crainic et. al., 2009). By using an urban consolidation center, freight transportation routes could be better utilized and become more efficient. It would require cooperation between Logistic

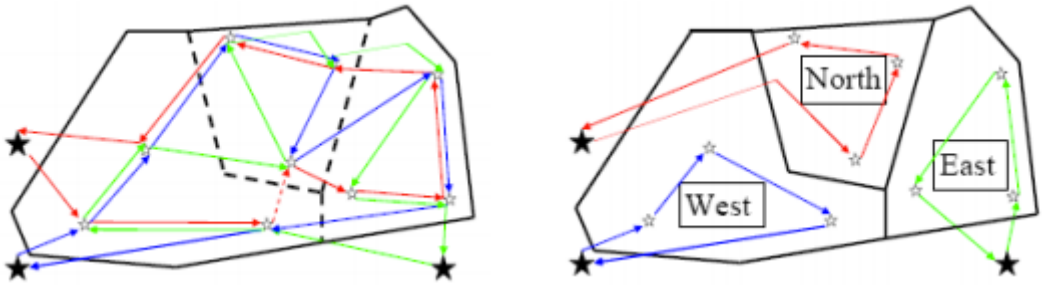
Service Providers (LSP), and retail shops must also be collaborative in forms of time of the delivery and the frequency of the delivery.

2.6 Previous studies

Previous studies on how consolidation centers has had an impact on sustainability in urban areas has shown good effects and will function as inspiration for our thesis.

2.6.1 Linköping

In 2004 a pilot trial of coordinated retail distribution was conducted in Linköping City, to measure the effects on transportation of having a consolidation center (Eriksson & Svensson, 2008). Three big freight forwarders was involved (DHL, Posten and Schenker), where the aim was to create an economically and efficient system for delivering goods, that was also environmentally friendly. The figure below shows how the city was divided into three different distribution patterns, each color representing a distributor. The left figure shows the distribution without coordination, and the right figure with coordinated distribution.



Transport pattern without and with coordinated distribution. Source: Eriksson & Svensson, 2008.

Without coordination all three distributors delivered goods to the whole city, but with coordination each was assigned one zone of about a third of the city. In the coordinated pilot project the goods was sorted out in accordance to the receipt zone at the consolidation center.

In order to evaluate the effects of coordinated distribution, following parameters were used (Eriksson & Svensson, 2008):

- total driving-time
- total distance covered
- total number of stops (for unloading)
- total stop-time
- total amount of transported goods (weight)
- average loading factor

The results from the trial showed that the number of trucks needed decreases by a third, as the filling per pallet was increased by fifty percent (Eriksson & Svensson, 2014). Total time for distribution decreased by a fifth and the total driving kilometers and driving time in the city was reduced by fifty percent. These numbers gives both economic and environmental incentives to develop a consolidation center and coordinate the operation of goods between the freight transporters. Additionally, including the extra cost for unloading and loading at the consolidation center and the cost for an administration system, the total net saving for the freight forwarder was about 20 percent (Eriksson & Svensson, 2008).

2.6.2 Rome

A study made by Tor Vergata University of Rome assessed the potential impact of developing an urban consolidation center close to the city center. This would function as a consolidation center for the retail sector (Study on Urban Freight Transport). This sector is characterized as a quite fragmented retail market in the historic center, where there is a mix of both small and medium shops. In this study they used electric vehicles for the last mile distribution, and results showed that this reduced emissions from freight transportation in Rome with a significant amount. CO2 was reduced by 24 percent and NOX by 27 percent.

2.6.3 Kassel

In 1994 an urban consolidation center in Kassel, Germany was set up. This was an initiative between private transportation companies, where ten companies decided to cooperate (Köhler, 2004; van Duin et al., 2010). An incentive for this was the difficulty of the companies to improve their image of being environmentally friendly. Another was the government's decision to restrict an area in the city center for pedestrians only. The consolidation center started with subsidies from the municipality before the cooperating companies started paying for it some time during the beginning of the 21th century. The cargo from the transport companies was delivered at the consolidation center where it was consolidated and further delivered to customers through a neutral carrier. Utilization of the urban consolidation center has resulted in a reduction in the number of vehicles per retailer of 13 percent per year. The number of kilometers driven within the city was reduced by 60 percent and the utilization of vehicle capacity increased by 100 percent in terms of volume and 140 percent in terms of weight (Browne et al, 2005).

3. Research Methodology

3.1 Research strategy

A research strategy is a general orientation to the conduct of social research (Bryman and Bell, 2015, p. 728). Research strategies can in general be distinguished into two types; quantitative and qualitative research. Qualitative research emphasizes words rather than quantification in the collection and analysis of data (Bryman and Bell, 2015, p. 38). It has an inductive approach in relation to theory and research, where generation of theory has a predominant role. Quantitative research emphasize quantification when collecting and analyzing data through a deductive approach, this entails testing of theory using numerical data (Bryman & Bell, 2015, p. 38).

Our study will mainly have a deductive approach with quantitative research, but will also include qualitative data through participant observation and unstructured interviews (Bryman & Bell). We therefore believe to use a mixed method strategy

in our study, combining both quantitative and qualitative data, to obtain a detailed examination of the case. The quantitative data will have a structured approach, with a structured questionnaire and gathering of official statistics.

3.2 Research design

Research design is used to provide a framework for collection and analysis of data, and gives an indication on the priority given to the different dimensions within the research process (Bryman and Bell, 2015, p. 49). Bryman and Bell (2015) mention five prominent research designs: cross-sectional design, case study design, experimental design, longitudinal design and comparative design.

We believe a case study is best suited for our research study, as we are writing the thesis in collaboration with Statens Vegvesen and due to our limited geographical area. A case study entails a detailed and intensive analysis of a single case, and is often limited to a single organization, location, person or event (Bryman & Bell, 2015). By using a case study to answer our research question, it will enable us to narrow down the scope and go further in-depth within our research field.

Furthermore, in the level of analysis, it is common to distinguish between which units that are to be primarily measured or analyzed (Bryman & Bell, 2015). The different levels are often referred to as the SOGI model, where the units are represented as societies, organizations, groups and individuals. In our thesis, we will use a combination of data from different levels in order to conduct our analysis, but will have the main focus on the society within the environmental context.

3.3 Data collection

In this section we will discuss how we are going to collect data and why we choose the selected data sources. To obtain our main output variable, environmental impact, we have to define and collect the input variables we find to be most important when achieving sustainable freight transportation. In order to obtain this we will collect both secondary and primary data.

We will need to calculate and approximate emissions based on number of vehicles, time of transportation and emissions per kilometer. To do this we will need both our collected secondary and primary data.

3.3.1 Secondary data

Secondary data is data collected by other researchers, businesses or organizations in previous studies, and thereby used for analysis by researchers who did not participate in collecting the data (Bryman & Bell, 2015, p. 321). The advantages of using secondary data is the cost and time savings it will provide, and that the data employed can be of high quality. Previous studies conducted by other researchers can also be of help in terms of reviewing the literature conducted of similar research studies.

We will use a data system provided by Statens Vegvesen called reisetider.no to collect data on driving time on designated distances. This system provides data down to five minutes intervals, which makes it easy to collect traffic information such as delays in traffic due to queues. In the thesis we will also use secondary data collected by Norwegian logistics service providers to analyse where changes can be made to limit the emission. Some of the secondary data we believe to gather are:

- Traffic information
- Information about the vehicle's (emission levels, capacity, driving distance)
- Number of deliveries per day
- Current greenhouse gas emission in Oslo (per day/month)

3.3.2 Primary data

Primary data is when the researcher who conducted the data, also analyze the data (Bryman & Bell, 2015, p. 13). This data is therefore first-hand and will be compared to the secondary data we collect, and strengthen our research study.

To get a more complete picture of how the freight transportation system within our chosen area looks like today, it is of interest to investigate how many logistics

service providers are represented. We think it is necessary to use several days to observe the amount of freight transport in the area to get an overview of this, as well as looking at the amount delivered. When we observe there are several inputs that will be interesting for our further analysis:

- Number of trucks that deliver goods
- Total distance covered
- Number of delivery points/unloading areas
- Driving time
- Stop-time for loading/unloading

We also aim at collecting data of the time spent on the transportation routes by joining and observing one or several trucks on their freight delivery trips. By doing so we will be able to see how the route is conducted and develop an idea on how the freight transportation can become more sustainable in the specific area. These data can help us find any bottlenecks that may be present.

3.4 Quality of the research

In order to ensure that the quality of the research is of high standard, some measures can be taken. Reliability regards whether the results of the study are repeatable and consistent, while validity is concerned with the integrity of the study and looks at what has been concluded through the research (Bryman and Bell, 2015, p. 50). For quantitative studies reliability is more important, but it is also applicable to qualitative studies. In terms of the validity criteria, this applies to both methods. A third quality measurement is replicability, which entails that the study can be reproduced by other researchers.

3.4.1 Reliability

Reliability can be divided into different categories in terms of the structure of the study. For quantitative studies this includes stability, internal reliability and inter-rater reliability while for qualitative studies these are external and internal reliability (Bryman and Bell, 2015). Stability and external reliability focuses on the replicability of a study, and this can be measured through a test-retest method

where a measure is administered on two different occasions. We will gather data from advanced data systems and through logistics service providers, and thus we believe the study will be reliable.

3.4.2 Validity

Validity can be divided into several categories such as measurement validity, internal validity, external validity and ecological validity (Bryman and Bell, 2015). In our thesis we will gather both quantitative research and qualitative data, which will affect the validity of the study. For the data collected from Statens Vegvesen and the logistics service providers as well as rutetider.no, we assume them to be valid. We believe that the possible inconsistencies in regards of validity will be the primary data we collect through unstructured interviews.

5.0 Project plan

We have had one initial meeting with Statens Vegvesen, and have through e-mail communication decided on a proposal for a thesis question. Shortly after delivering the preliminary we will contact Toril Presttun in Statens Vegvesen and schedule a meeting to further discuss our thesis. In this meeting we hope to get more information on what data already exists that we can receive and use, and what data we will need to collect ourselves. We will also try to narrow down our thesis question even further and ensure that we have decided on a topic that is both doable and appreciated by Statens Vegvesen. After this meeting we will probably need to review a lot more literature, so we will spend some more time on this in the following month. At the same time we will start to collect the secondary data we need for our thesis, and this will probably lead us to further narrow down our scope of research. Further we will collect our primary data before we start analyzing and processing both the primary and secondary data. While we are analyzing the data we will start writing a proposal for our final thesis followed by reviewing it and finally handing it in, hopefully by July. We look forward to further collaboration with Statens Vegvesen and our supervisor.

	2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Hand-in thesis registration									
Hand-in preliminary									
Literature review									
Data collection									
Data analysis									
Write thesis									
Finish first draft									
Revision									
Submission									

6.0 References

Abukhader, S. M., & Jönson, G. (2004). Logistics and the environment: Is it an established subject?. *International Journal of Logistics Research and Applications*, *7*(2), 137-149.

Anderson, S., Allen, J., & Browne, M. (2005). Urban logistics—how can it meet policy makers' sustainability objectives?. *Journal of transport geography*, *13*(1), 71-81.

Bjerkan K.Y., Sund A.B., Nordtømme M.E., Levin, T., Foss., T. and Andersen J. (2015). Løsninger for effektiv og miljøvennlig varedistribusjon i Oslo. Rapport A26833. *SINTEF Teknologi og samfunn.*

Browne, M., Sweet, M., Woodburn, A., & Allen, J. (2005). Urban freight consolidation centres final report. *Transport Studies Group, University of Westminster*, *10*.

Bryman, A. and Bell, E. (2015). "Business Research Methods" *Oxford University Press, 4th edition*

Cachon, G. and Terwiesch, C. (2013). Maching Supply with Demand: An introduction to operations management. *McGraw-Hill Education, 3rd edition*

Crainic, T.G., Ricciardi, N. and Storchi, G. (2009). Models for Evaluating and Planning City Logistics Systems. *Cirrelt.*

Christopher, M. (2016). *Logistics & supply chain management*. Pearson Higher Ed.

Eriksson, J.R. and Svensson, T. (2008). Efficiency in goods distribution collaboration in cities - SAMLIC. *VTI rapport 623A*

Gonzalez-Feliu, J., & Morana, J. (2010). Are city logistics solutions sustainable? The Cityporto case. *TeMA-Trimestrale del Laboratorio Territorio Mobilità Ambiente*, *3*(2), 55-64.

Goldman, T. and Gorham, R. (2006). Sustainable urban transport: Four innovative direction. *Technology in Society (28), p. 261-273*

Hopwood, B., Mellor, M. and O'Brien, G. (2005). Sustainable Development: Mapping Different Approaches. *Wiley InterSciences (13), p. 38-52.*

Van Duin, J. H. R., Quak, H., & Muñuzuri, J. (2010). New challenges for urban consolidation centres: A case study in The Hague. *Procedia-Social and Behavioral Sciences, 2(3), 6177-6188.*

Witkowski, J. and Kiba-Janiaka, M. (2014) The Role of Local Governments in the Development of City Logistics. *Procedia - Social and Behavioral Sciences, Vol 126, p. 373-385*

Oslo Kommune. Klima- og energistatistikk. Viewed 04.01.17. https://www.oslo.kommune.no/politikk-og-administrasjon/statistikk/miljostatus/klima-og-energistatistikk/

Oslo Kommune. Gate, transport og parkering. Dieselforbud og strakstiltak. Viewed 10.01.17. https://www.oslo.kommune.no/gate-transport-og-parkering/dieselforbud-og-strakstiltak/

Sintef. Grønn Bydistribusjon Oslo 2015. Viewed 10.01.17. http://www.sintef.no/contentassets/067ef756b7644281ad2514bef7955c53/gbo/gbo-2015_mai.pdf

Vegvesen. Om Statens Vegvesen. Viewed 11.01.17. http://www.vegvesen.no/om+statens+vegvesen/om+organisasjonen/Om+organisasjonen/V%C3%A5re+roller+og+oppgaver

Transportetatene. Grunnlagsdokument Nasjonal transportplan 2018-2029. Viewed 11.01.17.
http://www.ntp.dep.no/Nasjonale+transportplaner/2018-2029/Plangrunnlag/_attachment/1215451/binary/1108802?_ts=154a51c1a38

MDS Transmodal Limited. DG MOVE European Commission: Study on Urban Freight Transport. Viewed 13.01.17
http://ec.europa.eu/transport/sites/transport/files/themes/urban/studies/doc/2012-04-urban-freight-transport.pdf