LUND
UNIVERSITY

Approaches to sustainable urban freight transport and the impacts on CO_2 emission and ecosystems services – From the perspective of public and private sectors

SMM20: Master's Thesis, 30ECTS
M.Sc. Service Management, Logistics

Author: Korrawan Chaiyakan
Tutor: Torleif Bramryd

24-05-2016

Acknowledgements

First I would like to thank my greatest supervisor Torleif Bramryd who provided me not only supports and motivation to complete the thesis, but also share some personal experiences and so many interesting and inspiring attitudes in life. I have learned to be more patient and resistant to failures, many times when I felt I wanted to give up, he always motivate me and provide some suggestions and alternative ways to achieve the goal. He is one of the most marvelous professors I have ever known.

Second I would like to express my deepest gratitude to all respondents from private companies and public authorities who sacrifice their time for the interviews. Without them, this thesis would not have been accomplished successfully.

Also, I would like to thank all the supports from my dear cousin, Olof Willix who assist me in contacting respondent for the interview, friends and family who always be by my side.

Last but not least, I would like to express the highest appreciation to my dearest parents who are the main sponsor of my Master's study and provide me this precious opportunity to experience life abroad. I would not have come to this point without their kindness and endorsement.

(Korrawan Chaiyakan)

Abstract

With the growing of urban population, local and national economic prosperity expand rapidly. Consequently, demands of urban freight transport have been perpetually increasing leading to series of freight-induced problems such as congestion, air pollution, noise, environmental impacts, etc., which required some reactions from relevant stakeholders. Public authorities and private companies are the two main actors influencing sustainable urban freight transport. Thus, the research aim is to yield insight into how these two sectors react towards sustainable urban freight transport question and their consequences on environmental sustainability. The author collected ten semi-structure interviews regarding to their approaches to the sustainable urban freight transport, then analyze the impacts of their reactions on CO_2 emissions and ecosystem services based on the sustainable urban transport planning model (SUTP-freight). The findings show most approaches reflect positive impacts on freight-induce CO_2 emissions and ecosystems services. Some significant approaches, however, reflect negative impacts due to the conflicts of perceptions and interests between these two sectors, which require more involvement and attention from the public authorities regarding to urban freight transport.

Keywords: Urban freight transport, Ecosystems service, CO_2 emission, Public-Private Collaboration, Environmental Sustainability

List of Tables

List of Figures

Table of Contents

1. Introduction

1.1 Research Background

Transport and mobility is one of the most vital activities in our social lives. It draws us from one point to another, brings various goods and services worldwide closer to our communities and residences, and facilitates the flow of materials and resources in social and economic aspect.

"Transport is a crucial driver of economic and social development, bringing opportunities for the poor and enabling economies to be more competitive. Transport infrastructure connects people to jobs, education, and health services; it enables the supply of goods and services around the world; and allows people to interact and generate the knowledge and solutions that foster long-term growth" (World Bank, 2014).

Urban logistics, also known as "city logistics" defined by European Commission (2013) as "the movement of goods, equipment and waste into, out, from, within or through an urban area." Although it shares small contribution of the total urban transport, it is the key driver of economic competency. As a part of urban logistics, efficient freight transport increasingly plays an important role, particularly in urban livability and economic prosperity (Cui et al., 2015).

On the other hand, freight transport is the key driver of the increasing emissions from the transport sector, due to the size of vehicles and sources of fuel (Cui et al., 2015). Furthermore, with the continuous growing of cities worldwide, specifically in Europe, 73% of the population live in cities in which generate 85% of European GDP and the amount of urban population is predicted to increase to 82% (European Commission, 2013). In Sweden, it is expected to rise more than 90% by 2050 (European Commission, 2013). This number implies an increasing of demand of goods and services, eventually result to the higher demand and significance of freight transport. According to a report from Miljödepartementet (2009), distance travelled in both passenger transport sector and freight transport sector has increased, resulting in more energy consumption in transport sector, typically in freight transport, which is the main user of diesel energy and thus become the main driver of greenhouse gas emission.

Additionally, more populations are expected to reside in the city, more limited resources such as the land is typically required for several purposes (e.g. habitats, recreation, education, industry, transportation, and etc.). Furthermore, there is an increasing demand in automobile to facilitate their mobility, which eventually leads to more emissions from the transport sector. Thus, efficient land-use planning can mitigate these impacts by reducing demand of vehicle usage in cities. Numerous researches and studies such as (Banister, 2011; Bart, 2010; Beatley, 2000;

Brownstone & Golob, 2009; Cidell, 2015; Cui et al., 2015; Mindali, Raveh, & Salomon, 2004; Muñiz & Galindo, 2005) are mainly interested in the urban form and passenger transport by supporting the compact urban form in order to reduce automobile dependency through more public transportation usage such as bus, train, and tram or other alternative modes like cycling and walking to vicinity areas. These studies reflect relationship between land-use planning and environmental sustainability where an efficient use of land can potentially decrease environmental impacts from passenger transport sector. Regarding to freight transport sector, recent research from (Allen et al., 2012; Cherrett et al., 2012; Hesse, 2013; Woudsma et al., 2008) also supported the relationship between urban land-use planning and the efficiency of freight transport that an effective urban freight planning and policy can improve economic performance while reducing the environmental impacts. Aronsson & Brodin (2006) concluded that resource efficient could lead to effective transport in long run, and thus also support environmental sustainability in the long-term.

With respect to sustainable urban development, urban freight transport is usually seen as a threat of urban sustainable development and a disturbance in passenger transport (Behrends, 2011; Lindholm & Behrends, 2012). Problems including traffics, health and environmental impacts such as noise, air pollution, and greenhouse gas emissions are usually seen as shadows of freight transport. Traffic congestion is one of the most common complaints in most cities, which not only generates noise and pollution to surrounding residences but also influence high level of fuel consumption with approximately 30% under heavy congestion (European Commission, 2011).

Moreover, approximately 15% of greenhouse gas emission is derived from the transport sector in which the major contributor of this emission is road transport sector accounting for 71.3% of total emissions from transport (World Bank, 2014). In addition, urban mobility contributes to 32% of energy consumption, and 40% of CO_2 emission of road transport (Russo & Comi, 2012). One of the main causes is the rapid growth of freight transport activity reported by (European Commission, 2011; Klimat & Sårbarhetsutredningen, 2007) that it would go up by 82% between 2005 and 2050 compared to the 51% increased in passenger transport activity.

This CO_2 emission, typically from freight transport sector, has been perpetually contributed to the climate change. Klimat & Sårbarhetsutredningen (2007) reported that global warming has been increasing by 0.7 degrees over the last century; the average global temperature will continuously rise by 1.8-4.0 degrees by the end of the century compared to 1990. Moreover, the report also stated that the average temperature in Sweden and Scandinavia will rise more than the global mean by 3-5 degrees by 2080, the sea levels are anticipated to rise up to 0.2 meters in seas connecting to Sweden (Klimat & Sårbarhetsutredningen, 2007). As a result of the climate change, several extreme incidents such as severe windstorm, heavy snowstorms, floods (Klimat & Sårbarhetsutredningen, 2007), several health problems such as chronic respiratory disease (Haines et al., 2006), or tick-borne encephalitis

(Lindgren, 1998) are reported due to the climate change. Thus it is necessary to have more attention and awareness of CO_2 emissions, which is one of the main factors contributing to the climate change, especially from freight transport sector, in order to improve the transport performance to be more cost efficiently while reducing its impacts to the environment.

With the interdependence relationship between freight transport and land-use, Hesse (2004) stated that it is vital to have an effective land-use planning that support the sustainable urban freight transport operations. The involvement of different stakeholders in urban freight transport planning can result in more effective implemented measures or restrictions that are accepted and agreed among them (Hesse, 2004). However, few studies regarding to freight transport and land-use planning have been found. While freight transport sector is usually seen as a major contributor of urban traffic problems (Hesse & Rodrigue, 2004), some recent researchers including (Allen et al., 2012; Aronsson & Brodin, 2006; Vieira et al., 2015) pointed that there is a lack of interest in the freight transport sector compared to the passenger transport sector. Additionally, some authors such as (Dablanc, 2007a; Lindholm, 2012) revealed that there are some knowledge and understanding gap between public and private sector towards sustainable urban freight transport, as well as Cui et al. (2015) has concluded in the study that

"It is important to fill the gaps between urban freight transport understanding, development and planning in the region, and to identify what lessons could be learned and what could be applied elsewhere".

Though it is true that freight vehicles share few contributions in urban transport compared to passenger vehicles, it should not be concluded that the emissions from freight transport sector is less than that of the latter. On the contrary, high emission from freight transport is usually reported and concerned as a threat of urban sustainability. Thus, the significance of urban freight transport and its potential affect on environmental sustainability has drawn the author's interest into this area.

The author wish to understand how do public and private sectors react towards sustainable urban freight transport, and how do these reaction influence environmental sustainability, in term of CO_2 emissions and ecosystem services resulted from urban freight transport. Several literatures relevant to urban logistics, land-use planning, public-private partnership, and ecosystem services are the main theoretical framework included in this study, the author interviewed some authorities such as politician, transport administration and municipality officers, researchers; as well as some managers from private enterprises that are operating urban distribution.

1.2 Research Aim and Question

The aim of this study is to yield insight into how public and private sector react towards sustainable urban freight transport and how that affect environmental sustainability. Thus, the research questions for the study are:

RQ1. How do public and private sectors approach sustainable urban freight transport?
RQ2: How do their reactions affect CO_2 emission and ecosystems services?

1.3 Delimitation

The study focuses on the reaction of public authorities and freight companies on sustainable urban freight transport and consequential influences on CO_2 emissions and ecosystems services in urban areas. Mainly overall situation and anticipated consequences from those reactions should be expected in this study. It does not include any calculation of CO_2 emission or numeric measurement of the abundance of urban ecosystem services resulted from those reactions.

1.4 Thesis Structure

1. ***Introduction*** – presents problem background and the significance of research areas to environmental sustainability, research aim, questions, as well as delimitations are also included in this section.
2. ***Theoretical Framework*** – proposes relevant theoretical framework and models that provides readers general knowledge and findings regarding to the field of research. It comprises of theories, concepts, scientific researches, as well as official reports that are corresponding with the research aim, assist in data analysis and answer the research questions.
3. ***Research Methodology*** – illustrates the author's philosophical standpoints, data collection methods, which provide research transparency, ensure research quality and ethics, limitations according to the chosen methods applied in the study as well as the author's reflection to the research methodology.
4. ***Analysis & Discussion*** – demonstrates empirical findings and outcome of the analysis by applying SUTP-freight model as the main tool. The chapter is ended by a schematic diagram illustrating relationship between unit of analysis as well as causes and effects.
5. ***Conclusion*** – finalize significant findings concurring with the research aim and questions, which is derived from the Analysis & Discussion chapter. The chapter also involves concluding discussions addressing research implication to theoretical and practical contributions, challenges, and opportunities for future research.

2. Theoretical Framework

In order to contribute more knowledge regarding to sustainable urban freight transport, it is necessary to have some fundamental understanding about some definitions and concepts using in this study. The purpose of this chapter is to provide general knowledge facilitating readers in comprehension of the topic. Thus, the author presents four main relevant theoretical frameworks applied in the study, including Urban Logistics, Land Use Planning, Public-Private Partnership, and Ecosystem Services respectively.

2.1 Urban Logistics

2.1.1 Introduction to Urban Logistics

With the growing number of population living in cities resulting to the rising demand of goods and services and leading to the prosperity of regional and national economy, "Urban Logistics" has become increasingly significant and plays a vital role not only in the economy, but also in society and environment perspective.

Urban logistics, also known as "city logistics" has no obvious absolute definition due to its complexity and the lack of consensus on how to address the issues (Lindholm, 2014). However, Taniguchi et al. (2001) defined city logistics as "The process for totally optimizing the logistics and transport activities by private companies with support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy". Another definition by European Commission (2013) focusing on the movement or mobility in the city defined as "The movement of goods, equipment and waste into, out, from, within or through an urban area". Since the concept of city logistics is very broad and can be discussed in multi-facet, this study focuses on the transportation aspect. Transportation is considered as the main vein of the logistics and supply chains stream, as stated by Hesse & Rodrigue (2006) that the role of transportation is considered an integral part of the value-added process. Additionally, goods transport is a driver of the urban economy and share a large portion of urban daily transport activities (Lindholm, 2014). As a consequence, it is by no means wondered that freight transport has become the main driver in economic prosperity.

2.1.2 Stakeholders

Regarding to the widespread of scope of the urban freight transport, several stakeholders are included. Benjelloun & Crainic (2008) concluded that there are four main stakeholders including shippers, freight carriers, administrators, and residents. Muñuzuri et al. (2005) divided key stakeholders into four groups, including end customer, local government, logistics and freight service providers, residents and retailers. Russo & Comi (2011) concluded that stakeholders in freight transport can also be classified into three classes based on their roles including end-customers, logistics and transportation operators, and public administration.

The study by Ballantyne et al. (2013) argued that there is a difference between *stakeholders* and *actors* in which stakeholders are all that have interest in the freight transport system whereas actors are those that have direct impact on the system, in other words, all actors are stakeholders but not all stakeholders are actors. The illustration of relationships among these actors and stakeholders included in urban freight transport are demonstrated in Figure 1. These various perspectives and classifications of urban freight actors reassure the complexity in this area. As a consequence, undoubtedly, there are several problems and conflicts amongst these stakeholders due to different goals and perspectives; collaboration is the key to more sustainable and livable cities (Benjelloun & Crainic, 2008).

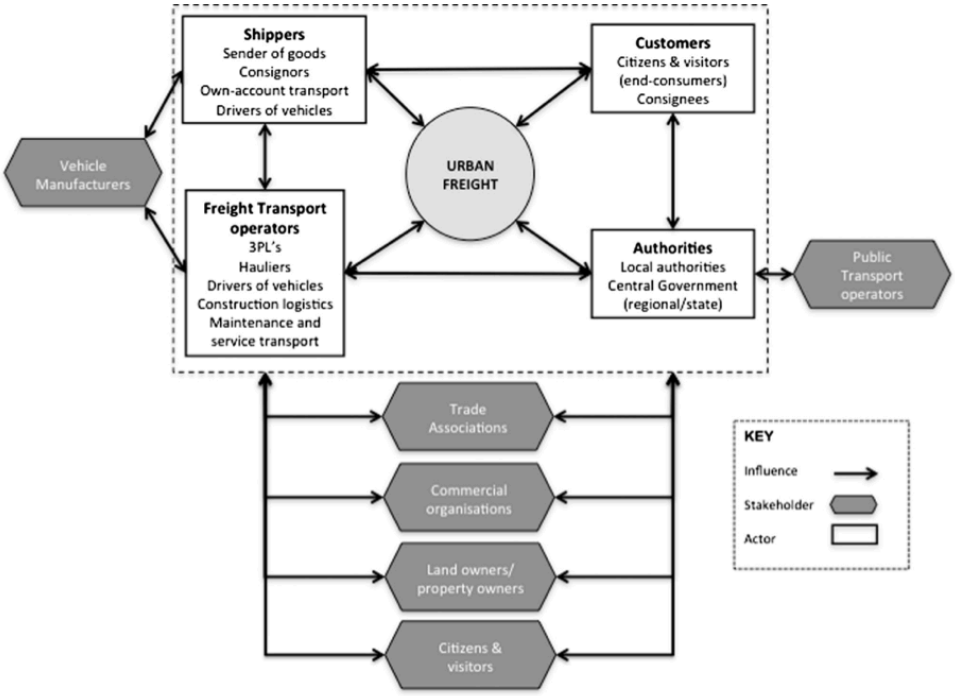

Figure 1: Urban freight stakeholders and their relationship (Ballantyne et al., 2013).

2.1.3 Role of freight transport

Economic Perspective

Goods transport is a driver of the urban economy and shares a large proportion of the daily urban transport activities (Lindholm, 2014). Almost every activity in the cities require goods movement (Cui et al., 2015), and thus highlight the significance of urban freight transport. Commercial vehicle trips that take place in urban areas include service activities at establishments, other goods delivered, ancillary goods deliveries, core and ancillary goods transfers, and home deliveries (Cherrett et al., 2012).

One of the most influential causes is the growth of economy. It steers higher demand of goods and services domestically and internationally, leading to the higher value of export and import, and eventually require more and more transport, in both passenger and freight transport (Miljödepartementet, 2009). Moreover, due to the changing of consumer behaviors and the emergence of e-commerce, the characteristics of freight transport are gradually changed. Hesse & Rodrigue (2004) reveals that recent freight transport tends to be of lower volume, higher frequency and often travel over longer distance resulting to higher volume and demand of freight transport. Additionally, the study also found that the growing rate of truck vehicle miles is almost at the same level of that in GDP.

As a consequence, urban logistics has become a vital player in service, industrial, and commercial sectors; hence an efficient freight system can reduce overall operating costs, which therefore provide a relative advantage to relevant stakeholders as a whole (Cui et al., 2015). Traffic congestion in urban area is one of the most common problems and barriers not only to the environmental sustainability but also to the efficiency of freight transport, which erodes approximately 1% of GDP of the European economy every year (Russo & Comi, 2012). On top of that, an immense contribution of transportation cost in proportion to the total logistics cost tends to increase from 46.5% in 1980 to 58.6% in 2000 (Hesse & Rodrigue, 2004). Accordingly, an increasing cost of transportation also influence other industries either directly or indirectly, which then imply to the competitiveness of the firm in both regional and national level. Hence, it is crucial to improve the effectiveness and efficiency of urban freight transport for a better economic performance and competitiveness.

Social and Environmental Perspective

Though it is undeniable that freight transport has a powerful role in the economic prosperity, it also has gigantic impacts on both social and environmental aspect. Due to the increasing demands resulted from the growing of urban population, urban freight transport activities also increased, which usually have negative impacts on society and environment (Vieira et al., 2015). According to the investigation by Cui et al. (2015), the common impacts include congestion, crashes involving trucks, local air pollution, visual intrusion, barrier effects, noise, energy use, and emissions.

Additionally, most of the transportations to and from urban areas are imbalance; more goods come to the urban area while less of that going out. As a result, transport trips from urban areas are usually more intensive in term of vehicle kilometers per ton due to high proportion of empty running truck leaving urban areas (Allen et al., 2012), thus affect the efficiency of freight transport and contribute to environmental impact respectively. Moreover, the growth of urban freight transport demand also influence higher amount of vehicles enabling freight operators to meet market demand, which is unintentionally threatening the environment. One of the major causes is derived from energy consumption by those vehicles. Petrol and diesel are the main source of energy

used in vehicles accounting for 89% of fuel used in transport (Miljödepartementet, 2009). Consequently, this reflects higher emissions from transport sector, where diesel trucks are the key driver of this contribution (Cui et al., 2015). Hence with the continually growing of economy, the CO_2 emission from freight transport is expected to increase approximately 7% higher than in 1990 (Miljödepartementet, 2009). In other words, "Stronger economic growth means higher production in industry, which in turn results in higher energy use and higher emissions" (Miljödepartementet, 2009).

2.1.4 Sustainable Urban Freight Transport

Regarding to several positive and negative impacts brought by freight transport including three main aspects, economic, social, and environmental areas, the concept of sustainable urban development has become dramatically crucial for numerous stakeholders. A full description of the concept and derivation of the definition of Sustainable Urban Freight Transport (SUFT) can be found in Behrends et al. (2008). Generally, the definition of sustainable development is described as "To ensure that humanity meets the needs of the present without compromising the ability of future generations to meet their own needs" (Barnaby, 1987). Behrends et al. (2008) concluded that the sustainable urban freight transport should fulfill these objectives

- To ensure the accessibility offered by the transport system to all categories of freight transport;
- To reduce air pollution, greenhouse gas emissions, waste and noise to levels without negative impacts on the health of the citizens or nature;
- To improve the resource- and energy-efficiency and cost-effectiveness of the transportation of goods, taking into account the external costs and;
- To contribute to the enhancement of the attractiveness and quality of the urban environment, by avoiding accidents, minimizing the use of land and without compromising the mobility of citizens.

A sufficient comprehensive of freight model is needed in order to understand the process and factors that could affect the efficiency of freight transport. Yet due to the lacking of interest in freight transport, or sometimes known as *freight demand models*, *freight flow models* or *goods movement models*, most freight models are still under improvement and are not as complete as passenger models (Taniguchi, 2014). However, recent findings from Lindholm (2010) presented a framework model for Sustainable Urban Transport Plan for Freight (SUTP-freight) shown in Figure 2. The model illustrates relationship between factors that influence the sustainable urban freight transport, which the four main factors are *Facilities* (where the commercial activities take place)*, Goods* (a driver that require transportation)*, Vehicles* (that provide transport service)*, and Infrastructure* (that support the operation of vehicles). These factors interact directly with *Accessibility, Transport, Traffic, and Land use,* which determine the performance of urban freight transport, and are influenced by the external factors such as legal and institutional, financial, political and cultural, and practical and technological issues. As a consequence, the efficiency of the freight

transport performance will ultimately affect the sustainability of the cities as a whole, including the social, economic, and environmental impacts.

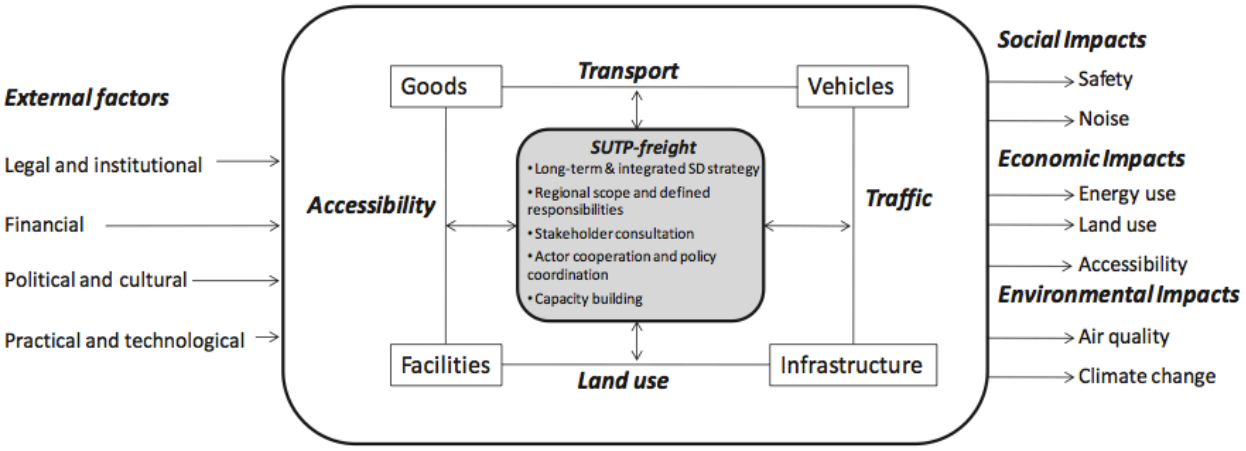

Figure 2: The relationship between factors affecting SUTP-freight (Lindholm, 2010).

The model supports a study by Han-Jan & Steven (1995) regarding to the relationship between the external factors, typically with the legal and institutional factors that could affect logistics decisions that affect the environment. In addition, the model of transportation system sustainability presented in Waddell et al. (2007) also assured the importance of effectiveness of transport system. It demonstrates a sequential effect starting from transportation and land use decision (which influence mode choice, vehicle miles travelled, and traffic congestion), and then affect the environmental sustainability (through land and fuel consumption, greenhouse gas emissions, and air/noise pollution), and finally to the social sustainability (including, e.g. accessibility, equity, and safety). In other words, the series of impacts on economic, environment, and society is like a radius circle from a thrown stone in a river, where the stone represents the sustainable of freight transport.

More specifically, due to the size of vehicles and fuel source, freight transport is concerned as the main contributor of the total emissions from the transport sector (Van Duin & Quak, 2007). Traffic congestion and length of journey of freight movement are the main cause of more pollution emissions and energy consumption by freight transport (Klimat & Sårbarhetsutredningen, 2007). Besides, other negative impacts from freight transport including truck-related crashes, air pollution, visual intrusion, barrier effect, noise pollution, energy use, conflict of routes sharing with passenger transport have also been discovered as common problems brought by freight transport (Van Duin & Quak, 2007).

2.1.5 Sustainable Performance Indicators

In order to assess the sustainable logistics performance, performance indicator is needed. A study by Allen et al. (2012) emphasized relationship between amount of goods carried by freight vehicles, typically HGVs, and their total vehicle kilometers. The study concluded that the more distance travelled, the more road freight activity involved; thus directly affect to the environmental sustainability such as fuel consumption, greenhouse gas emissions, and pollutions. However, Russo & Comi (2012) argued that the indicator should include three main aspects, economic sustainability, social sustainability, and environmental sustainability as shown in Table 1.

Economic Sustainability	**Social Sustainability**	**Environmental Sustainability**
Traffic congestion (e.g. extra time spent to travel, travel time, travel speed)	Reduction of interferences among segment of urban mobility (e.g. car, truck, pedestrian)	Reduction of pollutants
Trip length	Reduction of operating vehicles	Reduction of noise
Delivery time	Reduction of road accidents	Habitat loss
Infrastructure cost	Livability of city	

Table 1: Sustainable Performance Indicator, adapted from Russo & Comi (2012).

2.2 Public-Private Partnership

2.2.1 Introduction to Public-Private Partnership

As there are several stakeholders involved in urban freight transport, which make it more difficult and complicated to have an efficient freight transport; it is necessary to have collaboration (or also known as *cooperation* or *coordination*) between the stakeholders, they are inseparable in sustainable logistics and supply chains as well as in urban freight transport (Carlsson et al., 2012). Klijn & Teisman (2003) defined PPP as "Co-operation between public and private actors with a durable character in which actors develop mutual products and/or services and in which risk, costs, and benefits are shared". Additionally, it is illustrated that there are two main theories hindering this PPP theory; *Enforced Cooperation* and *Game Theory* (Osborne, 2002). The cooperation formed by the former theory is mainly derived from authority's enforcement that influence individuals to cooperate for the optimal results; the latter is an area of economic theory focusing on interrelationship and interaction between individuals, which also aim to the optimal and satisfactory outcomes for both parties (Osborne, 2002).

2.2.2 Drivers

Though there are numerous positive effects obtained from PPP including tangible benefits such as financial savings and intangible benefits such as information, knowledge and risk sharing (Bergqvist & Pruth, 2006; Klijn & Teisman, 2003); they can be categorized into three groups namely resource availability, effectiveness and efficiency, and legitimacy (Osborne, 2002). Firstly, collaboration or partnerships facilitate resource pooling brought by stakeholders, for example, information, expertise, knowledge as well as different perspective from both public and private sector that are not available in an organization (Bergqvist & Pruth, 2006; Osborne, 2002). Moreover, this collaboration also assist and enhance the quality of planning through information and knowledge sharing among stakeholders (Bergqvist & Pruth, 2006). As a result, it allows larger projects to be introduced to tackle with some issues or problems that are hardly handled by single organization (Osborne, 2002). Furthermore, Bergqvist & Pruth (2006) supported that close collaboration between public and private sector, typically in the logistics area, would improve the logistics system as a whole since the infrastructure is better developed and correspond with the demands from private sector. It is not only lead to the environmental sustainability and cities' livability (Benjelloun & Crainic, 2008) but also enable economic sustainability in urban freight transport (Carlsson et al. 2012); the effectiveness and efficiency of urban distribution are improved. Specific resources are developed when there are communication and cooperation, which contribute to higher competitiveness and better improvement in planning process (Bergqvist & Pruth, 2006). Lastly, cooperation also allow greater legitimacy of policy since both public and private sector are able to communicate more directly with each other rather than through the representative (Osborne, 2002).

2.2.3 Challenges

Regardless of numerous advantages that both public and private sector can exploit from collaboration, it also comes with great challenges due to their different roles, power distribution, operational difficulties, and different interests (Bergqvist & Pruth, 2006; Klijn & Teisman, 2003; Osborne, 2002). Inevitably, conflicts between these two actors are usually discovered.

Regarding to planning process, private sectors are potentially influenced by uncertainties of market and technology, most plans are on short-term basis relatively to those of the public sectors (Bergqvist & Pruth, 2006). Typically in transport sector in which material flow is the most fluctuated component in the supply chains according to market conditions, production planning, and distribution system designs. Public sectors, however, usually confront with prioritizing options and setting the goal of a certain investment or performance in their planning process and design (Bergqvist & Pruth, 2006). Additionally, private firms usually confront with high competition and strive for resources efficiency to gain more profitability to shareholders since their performance are normally judged heavily by results unlike that of the public sector (Bergqvist & Pruth, 2006; Klijn & Teisman, 2003). Hence,

companies are more focus on the competitiveness and return of investment compared to public authorities, who aim to work for socioeconomic purposes, do not concentrate much on returns, and able to tolerate more losses as long as they are accepted by the public support (Klijn & Teisman, 2003).

2.3 Land Use Planning

2.3.1 Introduction to Land Use Planning

Land use planning also known as "physical planning", "fysisk planering", "urban planning", or "territorial planning", (FAO, n.d.), is defined as

"A systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options which are most beneficial to land users without degrading the resources or the environment, together with the selection and implementation of measures most likely to encourage such land uses..." (Christou et al., 2006; FAO, n.d.).

The main human activities involved in land use are housing, services and recreation, industrial and commercial sites, transport networks and infrastructures, mines, quarries and waste dumpsites, and construction sites (EEA, 2013).

2.3.2 Relationship between Land Use Planning and Freight Transport

According to the SUTP-freight model presented in the earlier section apparently there is a close relationship between land-use planning and freight transport. An effective land-use planning could lead to an effective and efficient urban freight transport, which enable to reduce the environmental impact eventually. Additionally, with respect to urban freight transport, the urban form including settlement size, intensity of land use, mixing of land uses, provision of local facilities, and accessibility to local transport infrastructure could affect travel distance, journey frequency, mode of travel, travel time and energy consumption (Allen et al., 2012). Undoubtedly, there are strong bonds tying between the *mobility* or freight transport and *immobility* or land use (Hesse, 2004).

Spatial and land use factors also have crucial impact on freight activity in urban areas, land use patterns affect the types and quantities of goods produced, consumed and the total quantity of freight transport handled (Allen et al., 2012). Due to their interdependent relationship, any transformation of land-use planning could imply more or less impact on freight transport (Allen et al., 2012). Urban freight is influenced by the area's size as well as the urban form, additionally the logistics management of road freight operations is also influenced by geographical location, land use patterns and trade imbalances (Lindholm, 2014).

The application of urban land use in relation to freight transport was categorized by Dablanc & Rodrigue (2014) according to city functions and urban distribution, the four main categories are terminals, logistics zones, manufacturing area, and commercial areas. Furthermore, Allen et al. (2012) concluded in the study about the relationship between freight transport and land use in three main aspects. Firstly, the commercial and industrial land use pattern within an urban area can influence the demand and determine the operation of freight transport due to travelling distances of goods transported to and from urban areas (Allen et al., 2012). Secondly, due to the urbanization, urban land's value tends to change over the time, which consequently affect the location of warehousing facilities and thus influence the changes in land use and freight transport respectively (Allen et al., 2012). On top of that, the location of these facilities greatly influence land-use and traffic flows, which unexpectedly result in the impediment of economic growth and environmental sustainability due to traffic congestion and air pollution (Taniguchi, 2014). Geographical location, land use patterns and trade imbalance also influence the efficiency of road freight journeys to, from and within urban areas, due to vehicle usage including capacity, fill-rate, and levels of empty running (Cui et al., 2015). Lastly, the availability of transport networks can also influence the companies' decision-making on business operating location and thus has consequential effects on the overall land usage (Cui et al., 2015).

2.3.3 Land Use Planning Policies

The most common way to handle the urban freight transport more efficiently is by implementing regulation and restrictions, however, there are very few transport plans that are directly related to freight transport (Ballantyne & Lindholm, 2014). Even if there are; they are normally related to ban and aim at reducing noise or damage to pavements caused by heavy vehicles (Ballantyne & Lindholm, 2014). For example, the purpose of "low emission zone" is to ban trucks that cause heavy pollution and promote the use of more environmental friendly trucks or the installation of filters (Russo & Comi, 2011). In stead, the urban freight planning and policy should support the relationship between freight systems and their urban characteristics to enhance economic benefits while reducing negative impacts (Cui et al., 2015).

Policies and measures used with freight transport can be categorized in various ways, Cherrett et al. (2012) has divided the urban freight policies into six categories based on different objectives and management tools, which are market-based measure, regulatory measures, land use planning, infrastructure measures, information-related measures, and management measures. Additionally, measures can also be classified based on the implementation by local authorities, including solutions related to public infrastructure, solutions related to land-use management, solutions related to access conditions, solutions related to traffic management, and solutions related to enforcement and promotion (Russo & Comi, 2011). Also, with regards to the environmental sustainability, Zanni & Bristow (2010) proposed measures aiming to reduce CO_2 emissions and traffic problem from freight, including logistics

infrastructure development such as urban consolidation centers (UCCs), traffic restrictions and regulations, driver training and information and communication technologies, vehicle efficiency, congestion charging scheme and low emission zone (LEZ), where the last two measures are typically implemented in the UK as well as in Sweden (Urban Access Regulation, 2015). Since each policy and measures has specific objective on freight operation, there is no one policy that can meet all the demands and requirements of urban freight transport (Ballantyne & Lindholm, 2014).

Additionally, UCCs have been obtaining more and more interest from numerous researchers. It is referred to a collection of different shipments into a larger badge in order to maximize vehicles capacities, reduce cost per unit, as well as reduce environmental impacts from freight transportation (Kohn & Brodin, 2008). A study by Allen et al. (2012) revealed that UCC able to reduce vehicle kilometers from 60% to 80% resulting to decreasing of greenhouse gas emissions from freight transport respectively. Also, Dablanc & Rakotonarivo (2010) supported that this concept can reduce approximately 500 tons of CO_2 emission each year. Thus it is usually pushed by local authorities aiming to reduce the impacts from freight operation (Cherrett et al., 2012).

McKinnon (2009) concluded in his research, as depicted in Figure 3, that the main driver of land requirement is economic trends, which influence economic growth and logistics-related costs including fuel, labor, capital and space, as well as the shifting of production or source of supply from one country to another.

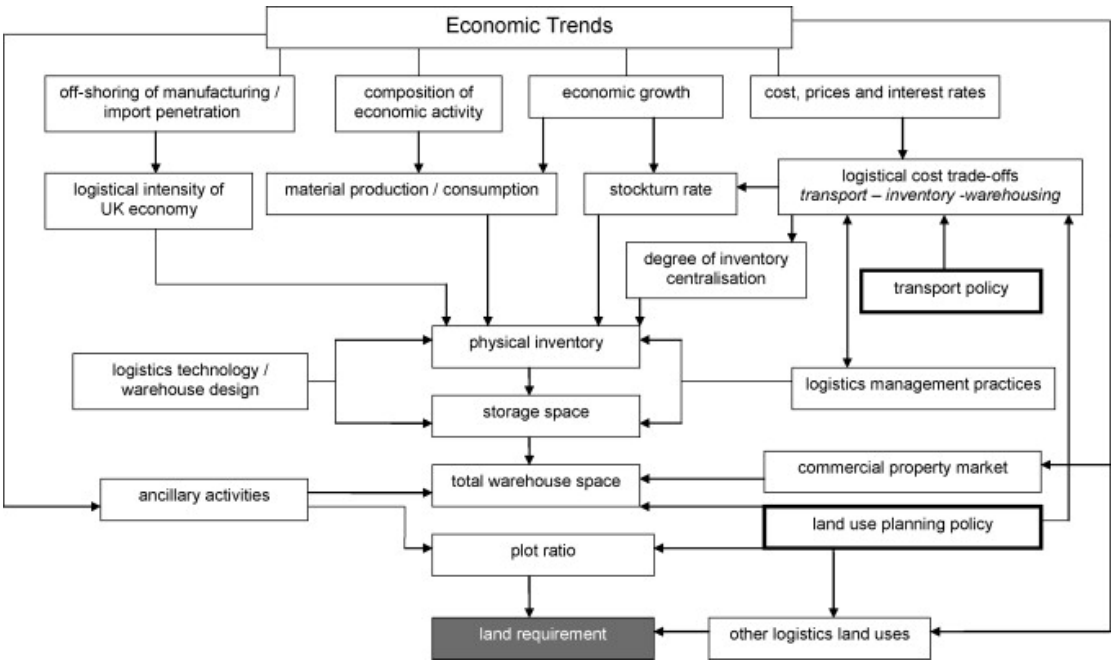

Figure 3: Factors affecting the future land requirements of logistical activity (McKinnon, 2009).

2.3 Ecosystem Services

2.3.1 Introduction to Ecosystem Services

An ecosystem is defined as "the interacting system of living and non-living elements in defined area" (Hester & Harrison, 2010) and ecosystem services is defined as "the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment, 2005). In term of urban ecosystems, it is referred as all natural green and blue areas in the city, including trees and ponds (Bolund & Hunhanmar, 1999). According to Givoni (1991), there are various types of green area in the cities such as large public parks, small neighborhood parks, plants in playground, trees along roads, and plants around buildings. Although those services provided by ecosystem are not directly consumed by human; there are numerous indirect benefits that have significant impacts typically in urban areas such as air filtering, micro-climate regulation, noise reduction, rainwater drainage, sewage treatment, and recreational/cultural values (Bolund & Hunhanmar, 1999).

2.3.2 Ecosystem Services in Urban Areas

According to Hester & Harrison (2010), there is a strong relationship between biodiversity and ecosystem services, 12% of bird species, 23% of mammals, 32% of amphibians and 25% of conifers are threatened with extinction. Pollination of plants is an example showing interdependence of ecosystem services and biodiversity (Kremen et al., 2007). Kremen (2005) stressed the importance of pollination that although it is less likely to be noticeable ecosystem services for humans, the declination of that could lead to tremendous impacts not merely on biodiversity or ecosystem services but also on agricultural production, which ultimately lead to potential impacts on human beings. A diminishing of pollination can also jeopardize agricultural areas, parks, gardens and other green areas in urban areas as well as other pollination-dependent ecosystem services (Niemelä et al., 2010).

According to Hester & Harrison (2010) and Niemelä et al. (2010), Land-based services provided by ecosystem services include

- Supporting Services: the basic services that make the delivery of all other services possible
- Regulating Services: the benefits obtained from the regulation of ecosystem process
- Provisioning Services: the benefits obtained from the supply of food and other resources from ecosystems
- Cultural Services: mainly included religious, aesthetic, recreational and educational services

The importance of these services differs between urban and rural areas (Niemelä et al., 2010). A study by Givoni (1991) stressed the potential impact of green areas in cities that they can influence the quality of urban environment and livability of the city. For example, a city park, green areas and tree plantings can function as carbon sinks (McHale et al., 2007). Additionally, the impact of those green areas in urban areas that are investigated in the study are summarized into three main aspects; air pollution, noise control, and social function (Givoni, 1991).

Firstly, due to the immense emissions, which mostly derived from automobiles, urban air contains a lot of microscopic particles; those green areas play a significant role both directly and indirectly in lessen the impact of air pollution (Givoni, 1991). The direct effect is air filtration, which obtained through vegetation, the most efficient type of that are trees, shrubs, and grass respectively (Givoni, 1991). The indirect effect (regardless of whether there is a vegetation or not) is ventilation, which allows the dispersal of pollutants (Givoni, 1991). In addition vegetation also leads to an effect called "lattice effect", which occurs when particles like dust dropped down and retained on the soil due to the air circulation that is influenced by the vegetation, the larger the trees the more potential impact on those particles (Givoni, 1991). In other words, leaves from those trees, shrubs, and grass can influence the air direction, which then have an impact on the efficiency of air filtration. Niemelä (2010) also supported that shading trees can save energy needed to cool buildings when it is warmer outside, and by reducing wind speeds it can save heating energy in cold weather.

Secondly, traffic congestions and speed of vehicle driving (typically in highways) are the main source of urban noise, which can be mitigated in two ways, by distance and barriers between sensitive areas and the highway (Givoni, 1991). Though the study concluded that the noise mitigation from vegetation tend to have less potential effect, however, it still has an important role in psychological effect that protect affected residents from the source of noise (Givoni, 1991).

Lastly, vegetation like urban parks and playgrounds are necessary for residents in term of social and psychological aspects, for social meeting, recreation, privacy, and more. Nevertheless, the choice of park's location should be planned properly to avoid the abuse of public space for criminal incidents due to the lack of usage of the park (Givoni, 1991).

Additionally, in relation to land-use, several studies such as (Bolund & Hunhanmar, 1990; Defries et al., 2004; Escobedo et al., 2011) reveals the relationship and tradeoffs between land use and ecosystem services that although the patterns of land-use can steer economic development, the unintended cost such as the watershed, atmosphere, human health, and biological diversity are usually hidden. While land-use transformation increases the share of ecosystem services for human consumption, however, it also diminishes that for other ecosystem functions (Defries et al., 2004).

Similarly, the phenomenon of urbanization might influence higher tendency of flash floods since there are less trees absorbing running water; numbers of vegetation and green areas could enhance the livability in the arid areas (Defries et al., 2004). Thus it is significant and challenging for the decision makers in land-use to balance the tradeoff between human needs fulfillment and abundance of biodiversity and ecosystem services (Defries et al., 2004). To maintain those services, cautious planning of land-use and green areas is required (Niemelä et al., 2010).

2.3.3 Ecosystems and Climate Change

Climate change is a significant threat to biodiversity (Niemelä et al., 2010). Biodiversity is vital in ecosystems allowing more varied services and functions to be exploited by human beings. Ecosystem services are dependent on wide range of biodiversity such as the diversity of species, population density, habitat quantity and quality, etc. (Niemelä et al., 2010), which are determined by the birth, growth, death, and dispersal rates of individual species influencing by land-use (Hansen et al., 2001). Climate change, however, can decrease biodiversity due to directional selection and rapid migration, which influence ecosystem functioning and resilience (Bellard et al., 2012) as well as services yield to human beings (Hansen et al., 2001). Furthermore, several natural species such as natural spruce–fir, longleaf pine, and loblolly–shortleaf pine forests are greatly influenced by human-induced climate change (Noss et al., 1995).

Changes of temperature directly effects the survival and reproduction of organisms where warmer temperature tend to increase the diversity of insects because they migrate much faster than trees (Dale et al., 2001). It could also influence diversity in tree forests because temperature-sensitive or native species will be replaced by "weedy" species, which tend to be less sensitive to the climate change (Hansen et al., 2001). Additionally, climate change also influence flowering plants and insect pollinators, which could lead to the extinctions with anticipated consequences on the structure of plant–pollinator networks (Bellard et al., 2012). The most extreme temperature can also lead to species reduction or extinction, locally or globally, if they fail to adapt to the changes (Bellard et al., 2012).

Arid areas typically support species that survive well under dry conditions with less needed of rainfall (Dale et al., 2001). Fire in forests could affect expedition of nutrient cycling, mortality of individual trees, influenced seed germination, loss of soil seed bank, abundance of soil nutrients, etc. (Whelan, 1995). This could impede decomposition processes leaving some organic matter on the forest floor, which could ignite to the fire again and again (Dale et al., 2001). Windstorms can cause high mortality, disrupt canopy, reduce tree density and size structure, and change local environmental conditions (Dale et al., 2001). Thus, it could be implied that the increasing level of CO_2 and climate change affect forest declination and mortality (Mueller-Dombois, 1992).

2.3.4 Ecosystem Services and Economic Theory

Due to the urbanization, it is undeniable that more and more green fields are targeted for new construction of hard infrastructure bringing up controversial questions regarding to the benefits from environmental aspects versus social and economic aspects. Thus it is crucial to consider about the economic benefits that human beings obtain from well-functioning ecosystems, typically in policy- and decision-making process (Fisher et al., 2008). Additionally, Fisher et al. (2008) demonstrated a model explaining relationship of ecosystem services and economics as shown below.

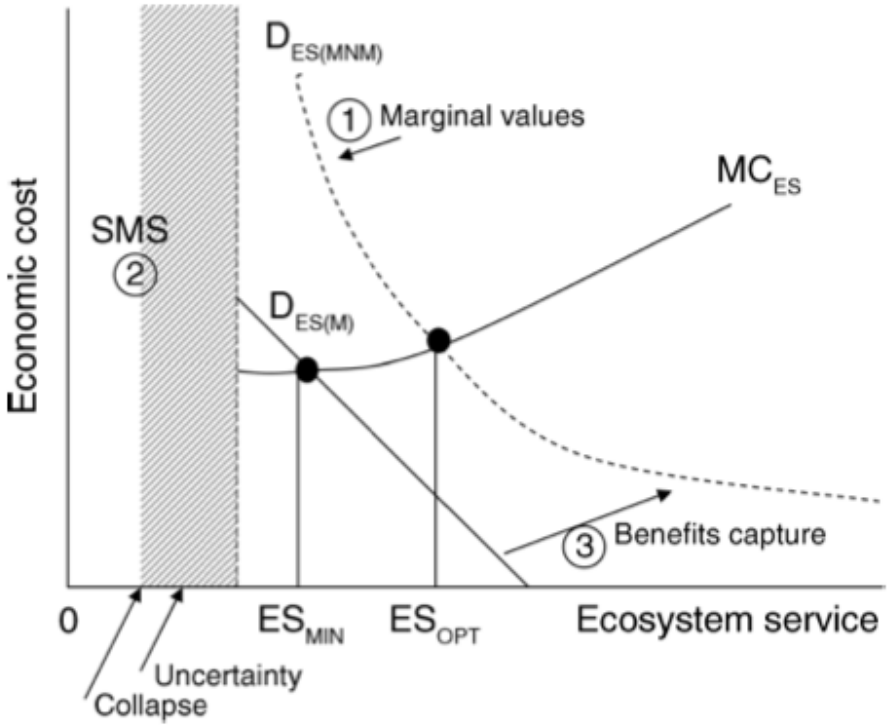

Figure 4: An economic framework for ecosystems services provision (Fisher et al., 2008).

To illustrate, the model presents relationship between economic cost (y-axis) and ecosystem service (x-axis). It can be observed that there are two demand curves; $D_{ES(M)}$ and $D_{ES(MNM)}$, the prior represents marketed ecosystem service benefits where the monetary value refers to the market's willingness to pay for an additional unit, while the latter demand curve include nonmarket services, which are more than the prior one, thus $D_{ES(MNM)}$ curve is above $D_{ES(M)}$ curve. Next, MC_{ES} is a supply curve represents the marginal cost and the opportunity costs of taking and managing additional unit of ecosystem. Lastly, the safe minimum standard (SMS) represents minimum amount of ecosystem structure and process, including diversity, populations, etc. that is necessary to maintain a well-functioning ecosystem. The equilibrium point where the demand and the supply curve intersect with each other is the optimal benefit yield from ecosystem service.

3. Research Methodology

In this chapter, the author proposes her perspective on social science research, which is a significant factor influencing not only the overall working process of thesis paper, but also have potential impacts on the research results. The author's perspective influences different approach of research design and data collection (Bryman, 2016). Additionally, May (2011) supported that:

"An understanding of these issues is important for the actual practice of research to enable the practitioner to understand the influence of wider social forces on the process of research, as well as the arguments and the assumptions that are made about the world and the dynamics and properties it contains."

The methodology also demonstrates how the author study about a phenomenon, including data collection methods, data analysis and so on (Silverman, 2013), which are also included in this chapter.

3.1 Research Approach

Usually the two main philosophical standpoints applied in researches are positivism, also known as objectivism, and constructivism, where the prior often refers to the quantitative study while the latter are used in qualitative study. According to Bryman (2016), positivist stance implies social phenomena that we have seen or used in daily life are the facts that beyond our control, they are independent facts. On the other hand, constructionism or constructivism argued that social phenomena and their meanings are dependent on social actors (Bryman, 2016). Thus through the lens of constructivism, a certain phenomenon is generated from social interaction, or socially constructed. On top of that, the stance of constructivism focused on the process of certain phenomena being formed, it values that culture has a reality carrying on and precede the involvement of particular people and shapes their perspectives (Silverman, 2013).

With respect to the differences between these two standpoints towards social phenomena and the author's aim and research questions in this study, it draws to the fact that objectivism stance is not congruent with either the research aim or questions. Regarding to the study's aim and the main research questions, which include not only the "what" but also the "how" does certain phenomenon exist in such a way. Plus the author seeks to obtain new insight and experiences from the main actors in urban freight transport including local authorities and freight operators, which is inevitable to involve respondents' personal interactions with different social situations and contexts. The inputs from those respondents are varied depending on their backgrounds, field of interests, responsibilities, etc., which could influence their perceptions towards certain phenomena. Thus the stance of constructivism is more compatible with the aim and research question of this study since it allows the author to obtain more *detailed* understanding from specific stakeholders and enables to answer to the research questions.

This detail can also be perceived differently between the lens of *quantitative approach* researchers and *qualitative approach* researchers. While the prior approach considers that as the correlations between variables, the latter treats it as people's understanding and interactions (Bryman, 2016). The qualitative researchers *seek answers to questions that stress how social experience is created and given meaning* (Bryman, 2016). Silverman (2013) assured that the perspective of constructivism is more likely to appear in qualitative research, in which researchers normally avoid early hypotheses, in stead come up with the question of 'What is going on here?'

Regarding to the research approach, conventionally two main approaches, namely *induction* and *deduction*, are widely used in qualitative and quantitative research respectively, however, due to several factors confronted by the author during the process of study; the research is hardly approached in the linear way. Although initially the research was more likely based on the author's personal interest of the freight transportation within the airport areas with the concept of "Airport City", also known as "Aerotropolis", in the aspect of environmental sustainability, the researcher found that it has been very few researches studying about this topic. Hence, the author attempted to search for similar theories such as "green urbanism", "compact urban design" and so on. Yet this airport city concept had been dropped down due to the accessibility of information.

Due to that, the author had to widen the scope of study to freight transportation in urban areas, specialized in road freight transport while maintaining the interest of environmental sustainability. Simply, the derivation of the scope of study had been adjusted several times in order to make it more appropriate to the author and the public interests, as well as the author's familiarity of theories, and accessibility and possibility of data collections methods. Thus the process of how the author approached the research is usually goes back and forth, which also imply a learning loop between theory and empirical study (Gyöngyi & Karen, 2005). Accordingly, the author applied *Abductive* research approach (Gyöngyi & Karen, 2005), also known as *Spiraling* research approach as shown in Figure 5. It illustrates a process that researchers usually begin with an idea, collect some theoretical information, then rethink and adjust the idea, then start to determine possible research designs, and perhaps go back again to the theories and idea (Berg & Lune, 2012). In other words, by using this approach, *with every two steps forward, you take a step or two backward before proceeding further* (Berg & Lune, 2012), which lead to new insight about existing phenomenon by looking from another perspective (Gyöngyi & Karen, 2005).

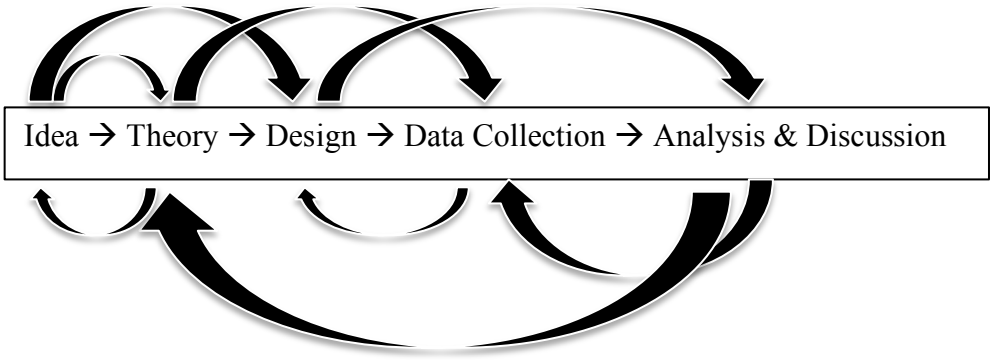

Figure 5: The spiraling research approach, adapted from Berg & Lune (2012).

3.2 Interview as a source of data

In order to obtain more understanding and able to answer the research questions, interview is chosen as the main source of data collection for this study. Since the author wants to get new insight from both public sector (including politicians and city's transport planner) and private sector (including logistics companies, specifically on road freight transport), interview is the most appropriate method for this study. It provides rich insight from people's biographies, experiences, opinions, values, aspirations, attitudes and feelings (May, 2011). Additionally, the purpose of an interview is to optimize the value of information from selected respondents (Brinkmann, 2013). Due to the fact that there are several types of interviews widely used by researchers including structured interview, unstructured interview, semi-structured interview, and group/focus group interview, the author is aware of the strengths and limitations among them, and thus come up with the most pertinent type of interview according to the aim of the research, which is a semi-structured interview.

Semi-structured interview is at the middle between structured and unstructured interview, which contains some specific interview questions, usually referred to *interview guide* that the interviewer want to cover (Bryman, 2016). The interview guide transforms the research questions into questions that can be raised to interviewees in an understandable language to them (Brinkmann, 2013). The pros of this type of interview are that the questions could be adjusted according to different context of interviews, enabling clarification of questions and more flexible than structured interview but limited to the frame of interview guide. It provides more understanding of how research participants view the world (Bryman, 2016), and yields "clarification and elaboration" on the answers given by interviewees (May, 2011). Additionally, "The idea that interviewees may be 'answering' questions other than those we are asking them, and making sense of the social world in ways we had not thought of, lies behind many qualitative interview strategies. The logic that we should be receptive to what interviewees say, and to their ways of understanding, underpins much of the 'qualitative' critique of structured survey interview methods" (May, 2011). Hence after considering the pros and cons of each type of interview,

semi-structure interview is the most appropriate method for this study because it provides certain level of flexibility while enabling comparison characteristics, which are complying with the research aim and questions.

Most of the interviews in this study are conducted via telephone. The author, however, is aware of the opportunities and weaknesses of the chosen means of interview. Disadvantages of telephone interview are, for example, it cannot provide nonverbal signs that allow interviewer to determine interview direction (Berg & Lune, 2012). The body language could imply, for example, interviewee's discomfort or confusion, allowing interviewer to make a restatement or clarification of the questions (Bryman, 2016). Also, it is possible that there might be some hearing difficulties due to signals or disturbing background noises that can interrupt the interview and might influence interview's quality.

Nonetheless, telephone interview also yield several advantages to the research. Due to the characteristics of this study that it requires an involvement from various stakeholders in urban freight transport residing dispersedly, telephone interview is the most feasible method for this study. It is the most convenient method for both interviewer and interviewee to communicate with each other from varied geographical locations. "Telephone interviews may provide not only an effective means for gathering data but also in some instances - owing to geographic locations - the most viable method" (Berg & Lune, 2012). Additionally, several opportunities obtained from telephone interview are also mentioned by Bryman (2016), for instance, it is more cost and time efficient because the interviewer does not need to spend money and time for travelling between interviewees; it enables to reduce or get rid of bias towards interviewer's characteristics (such as ethnicity), and etc.

3.2.1 Choice of respondents

The process of selection refers to the general decisions examining who should be included in the study (Brinkmann, 2013). The procedure of selecting interviewees should also be illustrated since it reveals and reflects the awareness of researchers regarding to possible limitations in the study caused by the chosen participants (Brinkmann, 2013).

As stated previously that there are two main actors included in this research, the private sector and the public sector; thus they are the target respondents for the interview. To clarify, the private sector, in this study, includes all the road freight transport providers who provide goods distribution in cities. Additionally, since the study is conducted in Sweden, the targeting companies are those that are operating business in the country of research.

Initially the author contacted them from the list of logistics companies operating in Sweden via email, which explained roughly about the topic, the aim of study and the needs for their supports. Approximately 15 companies were contacted through

company's official website (via customer service channel), then the request was forwarded to a responsible person who finally reply the email back if he/she is available for an interview. The whole process was varied from 3 days to 2-3 weeks, from submitting the interview request through company's website to the first response to the author's email. Throughout the process, four private companies and one public-private organization are willing to have an interview. Some of contacted companies refused due to unavailability of time and staffs and several of them were not responding.

With respect to the location of contacted companies, four companies are located in Stockholm and one organization is located in Gothenburg. All respondents are at the managerial level of the company. Any conversation before the appointed date and time for the interview between the interviewer and respondents were done through email, all respondents from the private sector are willing to have telephone interview due to their convenience.

For the public sector, the author includes several perspectives from a politician, an urban transport coordinator, an urban freight project leader of municipality, and two researchers in urban ecosystem services. In fact some other authorities such as city planners, transport planners, etc. were contacted as well; unfortunately most of them were not available for the interview. Similar to the private sector, most communication prior to an actual interview were done through email, and then made the appointment for an interview respectively. However, there are some slightly differences, firstly some of the authorities contacts are recognized through the author's personal contact, so they are contacted directly via email, some of them were contacted via a municipality's and public organizations' call center, the author explained the aim and topic of study in general in order to get to the right person. In that case, the interviewer had a chance to talk with respondents directly regarding to the study topic and issues for discussions, however, the interview was not made immediately at that time due to their tight schedules. So, an official emails were sent to make an appointment for the interview thereafter. Most of respondents prefer to be contacted via telephone; two respondents are available for face-to-face interview.

3.2.2 Interview Conduction

Once the date and time for an interview was set, interview guides were sent to the respondents enabling them to have some times for preparation before the appointed interview. Since there are various interviewees representing different companies and organizations, it is necessary to have slightly adjustment in interview questions to be more appropriate and able to optimize the utility of information from different interviewees.

To secure the optimal quality and enable to conduct the interview successfully, the author attempted to follow the recommended criteria proposing by Moser & Kalton (1971) throughout the interview process. Firstly, *Accessibility* refers to the ability of

interviewees to provide necessary answers to the questions, which could be limited by several reasons such as failing to recall, personal reasons, etc. (Moser & Kalton, 1971). Fortunately, most of the respondents in this study provide relatively high level of accessibility since all of them are at the managerial level (for private sector), and are at the leading position (for public sector).

The second criterion is *Cognition,* which refers to an understanding of the interviewees of what is required from them (Moser & Kalton, 1971). To achieve this, the topic of the research and the aim of interview were always stated at the beginning of each interview. Also as a role of interviewee, it is important to not merely to possess the capability in providing utility information, but also the recognition of what the interviewer expected from them (Moser & Kalton, 1971). On top of that, before every interview was started, interviewer officially introduced herself to reassure the respondent that he or she is contacted by the interviewer, not someone else.

Lastly, *Motivation* refers to the degree of involvement or interest of interviewees; they should feel that their participants and answers are important (Moser & Kalton, 1971). Due to the fact that not every participants can provide the same conversational level; thus some participants need less *probing* to motivate them to talk more compared to the others. Probing is defined as "encouraging the respondent to give an answer, or to clarify or amplify an answer" (Hoinville & Jowell, 1978). Thus, sometimes the interviewer needs to apply probing technique to encourage interviewees to provide more information on certain issues. For example, in some interviews, the interviewer might ask *"Could you explain more about that?", "What do you mean when you say…?",* etc.

Moreover, all of the interviews were audio recorded in order to *transcribe* and use for the data analysis thereafter. It is also important to note that before the interviews were recorded, all interviewees were asked for their consent if they are willing to be recorded for the purpose of transcription and study analysis respectively, as well as regarding to anonymity of both the interviewees and the companies/organizations themselves; three respondents preferred to be anonymous. Full record of the interview is treated as one of the solutions to control bias as well as yield reliability of the data analysis (Berg & Lune, 2012). Altogether, the duration of interviews is varied from 24-56 minutes, which are all conducted in English, interview respondents and duration are summarized in Table 2.

To transcribe means to transform, to change from one medium (the spoken word) to another (written word), where the process of transcribing can be perceived as a part of analysis (Berg & Lune, 2012; Brinkmann & Kvale, 2015). With the advance of technology, which could facilitate and enhance the quality of transcription, the author employed oTranscribe.com to assist in the transcribing process; the program permits adjustment of vocal speed, which is a very useful function especially for rapid-

speaking interviewers. Besides the utility of speed adjustment leading to more accurate and more reliable of the transcription, it also facilitate the transcriber to listen to the voice recording and type the text simultaneously on the same page, which can save some times for transcribing. Once the transcribing is completed, it is stored separately in a specified folder, with a specific name indicating each interviewee to avoid confusions and mixing up among other interviews. Then a summarized version of the transcript was sent to individual respondent to ensure the correctness.

Companies/Organizations	Respondents	Position	Duration	Methods
Public Sector				
Trafikverket Syd	Stefan Berg	City Transport Coordinator	48.32 minutes	Telephone
Helsingborg Municipality	Christian Orsing	Chairman of the Board of City Planning	56.18 minutes	Telephone
Malmö Municipality	Max Hanander	Heavy Traffic Department	83.13 minutes	Face-to-face
Ecosystem Researcher	Respondent 1	Ecosystems Department	36.36 minutes	Face-to-face
Urban Transport Researcher	Michael Johansson	Environmental Department	38.54 minutes	Telephone
Private Sector				
DHL	Michael Kallbacker	Branch Manager	24.14 minutes	Telephone
Dachser	Thomas Wennborg	Branch Manager	33.49 minutes	Telephone
KNEG	Hanna Berko	Project Manager	53.58 minutes	Telephone
Freight Operator 1	Respondent 2	Branch Manager	45.26 minutes	Telephone
Freight Operator 2	Respondent 3	Environmental Specialist	51.53 minutes	Telephone

Table 2: Summarized of interviews

3.2.3 Coding

After the labor- and time-intensive work of transcribing, comes real work of the research, *coding*. "Qualitative data need to be *reduced* and *transformed* (coded) in order to make them readily accessible, understandable, and to draw out various themes and patterns", on top of that it directs to the need for focusing, simplifying, and transforming raw data into a more manageable form (Berg & Lune, 2012).
Due to large amount of data that need to be coded, the author created another spreadsheet to manage with the data more effectively and efficiently. The spreadsheet contains three main columns, including *interview contents, source,* and *relevant topic.*
To secure the quality of the coding, the data were processed in two stages, which

permits the author to go back and forth to ensure the consistency and congruence of the conception throughout the coding process.

Firstly, the author read through each transcript and highlighted the data that are relevant to the study by searching for some key words and meaning of the content, for example, something related to 'government's perspective', 'company's perspective', 'urban deliveries', etc. These key words were not set beforehand; instead, they were developed during the process. Thus anything can be coded based on the research interest; this process is called "Data-driven coding" (Brinkmann, 2013).
Each highlighted data were then put into the interview content column, followed by the source of data (from the list of interview respondents illustrated above) as well as the relevant topic of that data (whether they are related to company's perspective and so on). Additionally, in order to have a better differentiation among topics, the data are determined by different colors for each relevant topic. Consequently there are too many categories, making it difficult for comparison, thus the second stage is needed to lessen the categories and reorganize the data in a more understandable way. This data-reduction and transformation process occurs throughout the research (Berg & Lune, 2012).

Next, as illustrated in previous chapter that the study follows abductive approach; the author then go back to the theoretical framework to make comparison among those various categories, matching up to the theories and concepts employed in the study. During this stage the author aims to understand about how respondents perceive about certain issues in comparison to others; those that are similar would then be grouped or combined under the same category (May, 2011). Thereafter, the author ended up with three main categories namely *Traffic*, *Land-Use Planning*, and *Collaboration.*

3.3 Document as a source of data

To complement with the data obtained from interviews, documents such as journals, opened public report from municipality, publications from organizations, and the like are also included in the study. Document usually contains rich of data including statistics, photographs, texts and visual data (Bryman, 2016; May, 2011). Undeniably, with the advance of technology and the emergence of Internet facilitating in searching, mainly most of the documents are searched through Google Scholar, university's portal, and official websites of municipalities and organizations.

Nonetheless, it is noteworthy that since the country of study is in Sweden, when it comes to official publications made by local authorities or municipalities; inevitably some of documents are in Swedish, which is not the author's native or professional use of language. Google Translate was used for the sake of understanding of overall context of the publications and reports. Although this translation tool can only provide limited quality of translation, it yields some basic information and understanding about, for example, the municipality's plan in urban freight transport. This information allows the researcher to have some basic knowledge regarding to certain

topic, and also assist in the interview guide designing process, typically for the interviews with local authorities.

To ensure the quality of documents, also applicable with the interviews, certain criteria for quality assessment are necessary. According to Scott (2014), there are four criteria namely *Authenticity* – Is the evidence genuine and of unquestionable origin?, most of the documents can be traced by referred authors whose studies are usually published and cited by other researchers, or through the official organizations; all documents have a clear source of origin. *Credibility* – Is the evidence free from error and distortion? *Representativeness* – Is the evidence typical of its kind, and, if not, is the extent of its untypicality known?, which can be determined from several previous areas of study, some areas have been perpetually studying while some are quite neglected (e.g. areas related to environmental sustainability in passenger transport versus freight transport, in which the prior obtained more attention compared to the latter). *Meaning* – Is the evidence clear and comprehensible?, which when it comes to the private sources, it is important to note that they are more likely to be authentic and meaningful (Bryman, 2016).

Moreover, once the documents are collected, potential interpretative skill is required in order to understand the meaning of them (Bryman, 2016). Thus the author created another spreadsheet containing significant findings from each source of data, which make the data collection from documents more organized and systematic facilitating in reviewing and comparing among other findings. It enhances the effectiveness and efficiency in the understanding of contents resulting to a better quality of research study. Berg & Lune (2012) suggested that the researchers should initially record the full citation information for the article or other source, which in this study, the author takes the advantage of advanced technology by using a software called "EndNote" to assist in citations and references making. The utility of this software is not only expedites the creation of references list but also increase the accuracy of that potentially. "Bibliography software is extremely useful for storing accurate and complete lists of materials you have read, whether you ended up using them in your current paper or not" (Berg & Lune, 2012). After that, the author noted all the best part of that study, such as the quotable explanations, definitions, and findings that make the study outstanding (Berg & Lune, 2012). Lastly, each notes is identified based on their main claims or themes (Berg & Lune, 2012), for example, it can be identified as a "definition", "quotable statement", "perception supporting x or y", etc.

3.4 Ethical Concerns

According to May (2011), ethics is referred to the information of reasons for an action in conducting research and to protect participants and the morality of inquiry. Similarly, Bryman (2016) stated that ethical issues should not be neglected ignored because they are directly related to the integrity of research. Diener & Crandall (1978) described ethical principles in four main areas:

- Whether there is harm to participants
- Whether there is a lack of informed consent
- Whether there is an invasion of privacy
- Whether deception is involved.

Harm to participant involves the influence on participant's development, loss of self-esteem, stress, and 'inducing subjects to perform reprehensible acts' (Diener & Crandall, 1978). In order to ensure no harm to participants, it is crucial to ask the subjects if they need any assistance or explanations during the performing of interview (Berg & Lune, 2012). Since English is not a native language of both interviewer and interviewee, it is possible that the choice of wording could lead to misinterpretation and misunderstanding of each other. Thus every participant was asked if they need any additional explanation to clarify some areas before, during and after the interview.

According to Berg & Lune (2012) there are two forms of consents; *informed consent* and *implied consent.* The prior refers to the acknowledgement of the subjects to participate as their choice without fraud or manipulation, the consent is done in a written form called *informed consent statement,* which explain the risks and benefits of the action (Berg & Lune, 2012). It is also important that a researcher needs to illustrate to respondents as clear as possible regarding to the research itself, who are the support, what are the objectives of the research and the like (Bryman, 2016). The latter is usually found in a lengthy questionnaire, in which the consent can be implied when the participants take their time to complete that (Berg & Lune, 2012). Additionally, it can be implied when a researcher start an interview by explaining the project as well as the risks and benefits to a respondent at the beginning, once the respondent insist to take part in the interview, the implied consent is made (Berg & Lune, 2012). Consents of interviewees in this study were mainly done through the implied consent.

The issue of privacy is related to the issue of anonymity and confidentiality in the research process (Bryman, 2016). Berg & Lune (2012) described confidentiality as "an active attempt to remove from the research records any elements that might indicate the subjects' identities" and anonymity as "the subjects remain nameless". To secure the privacy of interviewees, the author asked every respondent if they would like to be anonymous, as a result, three of them preferred to be nameless.

Last but not least, the issue of deception arises when researchers are not doing as they actually said, they might limit participants' understanding in order to achieve the most natural or accurate response for the experimental question (Bryman, 2016). As the topic of this study does not involve with so sensitive issues, all necessary information were conveyed to the respondents so they can fully understand what does the interviewer wants and how do their responses fulfill the aim of the study.

3.5 Reflection on the methods

Semi-structure interview is the main source of data in this research, however, due to immature experience and skills of the researcher in interviewing, some significant points can be improved to enhance the value of findings.

- The interview guide should have been tested with, at least, some experts in urban goods distribution before the actual interview with contacted companies. This can potentially enhance the quality and value of findings from the interview, both from the public and private sectors.

- The choice of respondents in public sector should be more selective. It should mainly involve more authorities that are responsible for freight-related issues, such as traffic planner. However, since this topic has long been neglected from the public authorities, it is very difficult to find those people who are directly work with this topic and available for the interview.

  For the private companies, it should be more focus on specific type of services in urban deliveries, for example, express delivery, small parcels, bulky delivery, etc., which enable to have more detail insight regarding to specific type of urban delivery.

- Regarding to the limitation of telephone interview, apart from some limitations addressed in previous section, the author also found some technical problems such as unclear voice, disrupting background noise, and other external factors can not only influence the accuracy of transcribing, but can also annoy the interviewee. There was an interview that involved with this technical problem; so three calls were made in order to solve the hearing problem.

- Lastly, if the author has good knowledge and skill of local language, it can increase data accessibility to more specific publications and reports made by local authorities. Plus more understanding of the local language can also support more understanding, leading to more detailed insight from the public sector.

4. Analysis and Discussion

In this chapter the author aims to propose some significant empirical findings yielded from ten semi-structure interviews with authorities and companies as well as some discussions in three main categories respectively; *Traffic, Land-Use Planning,* and *Collaboration*, the order is arranged regardless of any priorities or preferences. The analysis and discussion is mainly based on the SUTP-freight model and other previous studies to supplement the findings. The chapter is ended by a schematic diagram (Figure 6), which visualizes the causes and effects of threatening urban ecosystems services and facilitates the reader's understanding of the chapter.

4.1 Traffic

Firstly the category of *Traffic* is derived from the sustainable urban freight transport model proposed by (Lindholm, 2010). Traditionally, regarding to the model, this component focuses merely on the movement of vehicles, which is described as *"actual physical movements of vehicles are realized in physical networks in which traffic units absorb infrastructure capacity"*

Although in the model, *"the movement of goods that require vehicles to be moved"* is categorized under another component in the model called *Transport system*, which highlights the movement of goods, the empirical findings reveal that these two components are related to each other and should not be analyzed separately. Thus the author combines these two descriptions under the same category, traffic, in which the quantity or demands of goods movement would influence the movement of vehicles, traffic and the environment respectively.

4.1.1 Traffic Related Problems

According to the interviews with private sectors, most companies highlighted that there are several challenges in urban areas that prohibit them to the environmental sustainability in urban freight transport. Main problems addressed by many companies are related to traffic congestion, parking places, and loading/unloading areas.

"Stockholm is a very large city so there's a terrible traffic situations…if it's only 40 kilometers from the airport to the city it might, depending on the traffic situations, take like an hour or two hours to get there."
Respondent 2 – Freight Operator 1

"It is hard to find a space to park and, mostly, people park in double lines, within the cities it is hard to distribute things because of the traffic situation. It is a lot of cars, hard to find a space to park the car or the delivery truck; I think it's all the time difficult for the delivery companies."
Respondent 2 – Freight Operator 1

"That could be some big problem with the traffic because other cars and so on they don't respect of the loading zone so there are some areas where are only made for off loading goods and so on like off loading zone and pick up zone, sometimes you find other cars that are parked in these places and you have difficulties to find places where to off load the goods."
Thomas Wennborg – Dachser

These problems could affect not only urban delivery performance since drivers need to spend some time on the road or finding space for loading/unloading, more time is required per delivery, resulting to late delivery, which then affect companies' service level, reliability and so on. The influence of traffic congestion is having great impact on local and national economy as highlighted by Russo & Comi (2012). Due to this problem plus growing demand of urban freight delivery, more vehicles is needed in order to fulfill that needs and enhance or maintain service level. Thus, if this cycle is to be continued, these problems could be more and more serious in the future, not only from the economic perspective, but also the social and environmental perspective (Taniguchi, 2014; Givoni, 1991, Klimat & Sårbarhetsutredningen, 2007).

4.1.2 Cause of Problems

Regarding to the parking and loading/unloading zones, the cause of these problems could be resulted from low priority and involvement from the public authorities in relation to freight transport (Allen et al., 2013; Aronsson & Brodin, 2006; Vieira et al., 2015). It was accepted by one of the respondents that

"This is very interesting because we haven't been working with these issues in a systematic way, not like for car parking places, that's an issue that we have. We have a very strict strategy for, how it's working and how it should be and what it costs and everything but for heavy trucks, we don't have a systematic approach, we don't have a plan, we don't have a regulation for that in a way that if we have a street like this we should have three loading zones, we don't have any guidance…we don't have anybody going out looking at them, you know changing them if they need to be changed and moving them if they need to be moved."
Max Hanander – Malmö Municipality

Although it is claimed by several researches that there is an increasing level of awareness and attention in urban freight transport from the government, yet the findings show little involvement from the authorities at the national level.

"No plan in our national plan on transportation and so on. We're targeting this problem that urban freight is very important to work with but we haven't done more than that yet."
Stefan Berg – Trafikverket Syd

"They [municipalities] work for themselves but they work together with us too…I'm trying to plan how our role in that work, our national transport administration, what's our role in the urban freight planning in the cities, but we are not there yet."
Stefan Berg – Trafikverket Syd

"I think most people today agreed that we have to do something, we can't continued to do the same way that we've done for so many years…so thing has to be done, what it is I don't really know but there's a great impact, of course, and most government in Sweden try to reduce using of the cars, of course, but probably the government don't do as much as they should, really."
Respondent 2 – Freight Operator 1

Regarding to these responses, apparently the public sector realized that something should be done with urban freight transport but what is it, they are still not clear and not yet have an obvious direction. Instead, they push this responsibility to local authorities to tackle with those problems. Although it is mainly responsible by local municipality and authorities to handle with urban freight transport, it can be argued that this question should have been taken more seriously from the national level. If there is no concrete plan or strong vision regarding to freight transport at the national level, it could be difficult for the local authorities to plan or handle with this question alone. They might not have sufficient resources to tackle with these problems themselves, thus more interest and support from national level should be involved in order to solve the problems and improve the efficiency of urban freight transport in the long-term.

4.1.3 Reaction from Public and Private Sectors
This section demonstrates how local authorities and urban freight operators are attempting to minimize environmental impacts from urban freight transport.

Firstly, due to the fact that urban population is growing, number of freight vehicles seems to grow continuously corresponding with more demands in cities. The main sources of energy, however, are petrol and diesel. Heavy traffic congestion causes more energy consumption and greenhouse gas emissions. Both local authorities and freight companies mentioned about alternative energy such as the usage of electric vehicles and biogas in order to reduce the environmental impacts from freight transport. Although it is true that this solution can reduce some impacts, the problem of traffic congestion still remains unsolved. Plus there are some limitations of these alternative energy vehicles in term of, for example, financial investment on electric vehicles and effectiveness of deliveries in the urban areas, which are limited by the capacity of those vehicles.

"There are some challenges in using electricity vehicles, for example, because they currently are too small, looking at our profile of shipments. We need vehicles that can handle larger volumes and the existing electric vehicles are usually too small, which mean that it will be too inefficient. We'd have to have 3 or 4 electric vehicles to match one diesel vehicle in capacity, and currently it's more expensive invest too so there is a financial but also production limitation to use electric vehicles at the moment. We watch this closely and I know that there initiatives globally within the DHL business that are looking into electric vehicles."
Michael Kalbacker – DHL

“There're still some areas in Stockholm, and Göteborg and Malmö have bad air. So it's still a problem but I don't know really how to tackle this, we can use small electric vehicles but they're still very small vehicles, we still have to use larger trucks even for city distribution.”
Respondent 3 – Freight Operator 2

“If you just change the fuel or if you have biogas cars, you have an electric vehicle and so on, then you will not have this climate change impact from the transportation, but the problem is that many, at least, Swedish municipalities are planning just to change the fuel and then they think that everything is okay, but then once again you have the problems of a lot of traffic will take more places in the cities, which mean that more traffic, perhaps less green areas, and ecosystem services.”
Michael Johansson – Urban Transport Researcher

Secondly, as mentioned earlier that there is a relation between the movement of goods and the movement of vehicles, which influence the traffic in urban areas as well as the sustainability of urban freight transport as a whole. The higher amount of goods being loaded on the vehicles (fill-rate), the lower delivering trips in the cities will be generated, and thus decrease traffic in the cities. Regarding to the interviews, the fill-rate is influenced by the imbalance of trade to and from the cities; more goods are being imported to the cities while few are being exported from the cities. As a result, most companies are running on Less Than Truckload (LTL), which definitely influence transport efficiency and environmental impact.

“We try to optimize our routes so our vehicles are loaded as much as possible. Of course, the truck load depends on the geographical area in which they operate where some vehicles has a higher fill rate and others a lower fill rate.”
Michael Kalbacker – DHL

“We try not to have the empty run but sometimes that could happen and Stockholm is a big city with a lot of consumers that we’re not producing so much, so then it’s difficult to find the exports for the truck”
Thomas Wennborg – Dachser

Due to this fill-rate question in urban freight transport, most public authorities addressed about implementing consolidation center aiming to maximize the fill-rate and minimize the movement of trucks or freight vehicles running into the cities.

“Our strategy is to have less traffic in the city center, which hasn’t at its destination in city center. We have a lot of traffic which go right through the city center with the destination on the other side, this traffic we want to move outside the city and that’s why we have built a freeway with municipality funding…we don’t want to see a situation where every stores having 4-5 different lorries coming each day or each mornings, if we can divide the goods so, for instance one lorry can have deliveries for 4-5 stores instead, so packed them in a more efficient way.”
Christian Orsing – Helsingborg Municipality

"I think one of the most important things you have to invent new business model for the city in the future, new ways to distribute things, that's one of the most important area. I think the consolidation of goods is very important in the future, as a consolidation. Nowadays in big cities, different companies are driving their goods to many shops in the cities, I think you have to consolidate that to get more goods in every single truck, it's quite important in the future. It's very good way to make a system more energy efficient than driving several trucks..."
Stefan Berg – Trafikverket Syd

Most local authorities perceive that the consolidation center concept can solve traffic congestion problem and lessen the impacts from freight transport in the cities. Some municipalities have tried a pilot project to investigate how the system would work in reality. For example, the municipality of Malmö had tried a project called "SamCity" aiming to reduce heavy trucks running into the city by using this consolidation center to collect goods that are going to be distributed in the city by using eco-friendly energy vehicles such as biogas or electric trucks to reduce emissions and noise from freight transport. The authority who responsible for this project, however, admitted that the result was not really satisfied due to small number of clients and insufficient volume of goods collected at the consolidation center.

"We are not totally satisfied because it was as we noticed after a while, a too short period of time, one year, we didn't get as many clients or customers as we wanted, we didn't reach the volumes that we wanted because, the shops didn't want to pay more... it's a barrier to get the shops to pay more to get the goods by the electric vehicles instead of the normal heavy trucks where they get from for free today."
Max Hanander - Malmö Municipality

According to the reflection from the freight companies' point of view, most of them do not agree with this concept. They pointed that this concept has been operating and including in their business model, therefore, it is unnecessary to repeat that again.

"I can't really see how that should be done though. I mean we do everything we can to consolidate all the transport today. I mean when the goods arrived at the habour or the airport, so of course that would be stored at the airport because the customs regulations and that we have to transport that to the customers so in a way there is already the consolidation centre at the airport or at the habour. I can't really see how it should work really."
Respondent 2 – Freight Operator 1

"We believe that it creates more waste, it creates more transportation, more complexity and does not benefit the customers. A company who are about to receive a shipment will have to travel to the consolidation points or someone has to transport it from the consolidation points to the customers, that is not optimal. There's no benefit for us, the environment or the customers to take everything to the consolidation point and from there distribute it. It is kind of the same as what we already do…"
Michael Kalbacker – DHL

"I know there are some governments or municipalities that have chosen to do that with their own goods and that's ok, but the risk is that they pick out some of the goods, and not all the goods, which means that even if they distribute their own goods in the same truck or the same delivery, it means that other actors like Postnord, Schenker, DHL will distribute the same area anyway because we have other customers close to municipalities. So that mean that there might be no less transport, it could be even worse"
Respondent 3 – Freight Operator 2

Although some projects are subsidized or funded by local authorities, an interesting question raised by a private company is how to commercialize this in a fair market regardless of government intervention. This is a significant question that is perhaps overlooked by the local authorities. Previous studies showed most of UCC were closed down after the termination of government's subsidization due to high operating costs such as rental costs and additional handling costs incurred from the consolidation (Dablanc & Rodrigue, 2014). It could imply some differences of interests between the public and private sector where the prior put more concentration on intrinsic or intangible values (i.e. livability of the city) while the latter tend to focus more on the tangible values (i.e. profitability of the company or shareholders). Furthermore, theoretically it seems to be a remarkable concept because it draws goods and vehicles together. By consolidation, more goods are being loaded on a truck, thus able to decrease average travel distance of freight, simply, lower ton-kilometers (tkm), and thus lower emissions and traffic problems from freight (Kohn & Brodin, 2008). In practice, however, it does not gain much attention from the private sector and does not seem to work out efficiently with municipality-base distribution alone due to high cost of operation and unmet amount of goods.

According to Russo & Comi (2012), the main driver for the public authorities to reduce traffic congestion and other freight-related questions is to have an attractive city for inhabitants and visitors. On the contrary, the main considerations for companies are heavily related to economic issues, maximizing service quality and productivity while minimizing costs (Russo & Comi, 2012). For private firms, interests in environmental issues are most likely aim for a company's global image, companies are focusing on performance development and because mostly the environmental issues would add more costs with low financial returns, they do not have high priority in business plan (Vieira et al., 2015).

The following statements from public authorities and private companies reassure the conflict of interests between these two sectors towards consolidation center as a solution to sustainable urban freight transport. Research by Vieira et al. (2015) also supported that the conflict of interests between different stakeholders in freight transport regarding to time and delivery issues, which involve with their own costs and problems independently, discourages them to collaborate with each other.

"I think it could break-even definitely, but I'm not sure it's very profitable but as a municipality we should recognize that we have values, which are values that can't be quantified in money because they're qualitative values like fresh air, silence, whatever and I think as municipality, we may need to pay for that somehow, in the future, but that's long-term."
Max Hanander – Malmö Municipality

"It works fine as long as someone pays for that for the delivery, and I think so far Göteborg municipality has paid for it, for the solution. The problem is how could that be commercialized within the rule of competition, so that's the main problem"
Respondent 3 - Freight Operator 2

The findings support the conclusion by Duin et al. (2010) that the main constraints of UCC implementation are costs and benefits allocation and the willingness to cooperate from freight companies.

Also responses from interviewees reveal that there are some dissimilarity between local authorities and freight operators in term of planning scale. It appears that local authorities tend to view the problems or design the plan at the macro level whereas the companies are more likely to pay attention at the micro level. This can also prove that why, most of the time, there are some gaps of understanding between them since they normally consider about certain issues at different levels. According to the interview, while the local authorities see that a multimodal transport is the future of logistics solution, companies view trucks as the only means of transport for city distribution. Dablanc & Rakotonarivo (2010) added that local authorities lack of the attempt to solve day-to-day problem on the road freight, instead, they focus more on other things such as road-rail or other multimodal transport; road traffic problem has not been solved.

"So a lot of the lorries companies are looking into the investment into gas, into vehicles, electric vehicle-driven vehicles…and that is what the future business is, combining all the freight and also the customers, a lot of logistical solutions regarding both sea freight, lorries and rail-road. So a lot of big companies in Helsingborg in logistics, they're also rail-road, lorries and sea, and make complete combine effort to the customers needing logistical services…I think we have to be more efficient on how we combine the freight and that comes back to using trains, using quay, using sea freight and using lorries, but using in a better and more effective way."
Christian Orsing – Helsingborg Municipality

"It's very hard to say, I don't think today there's other options to transport goods, for example to and from city and the airport...it's hard to find any other solutions today. We do a lot of railways transport from Europe to Sweden, also trucks carrying goods if you could have more goods on railways, there will of course have lesser impact on the environment of course. But when it comes to distribution within the city, I can't see any other way really"
Respondent 2 – Freight Operator 1

While there are numerous requests from the private sectors for some actions from the public sectors, some necessary information needed in planning or project design are usually covered by private companies. Some authorities claimed that it is very difficult to get freight-related information from companies because mostly they are confidential; they are lacking of information regarding to domestic goods movement. They only rely on assumptions, which could be distorted and influence how they are going to handle with urban freight transport sustainably. Furthermore, it is ensured by Muñuzuri et al. (2012) that usually freight-related information such as amount of goods loaded per vehicle, route design, location of customers, inventory policies and the like, which maybe beneficial for competitors, are protected as business confidential or missing in official statistics.

"We lack of information of different kinds of goods that are flowing in the city and the statistics of all goods, we have quite good information of goods between Sweden and European, EU and so on but we don't have information of what type of goods, how much of goods in the cities, national authorities just now see if we can have or get better statistics in urban freight in big cities, even in the medium-size cities, that's among the things we're working just now."
Stefan Berg – Trafikverket Syd

"It is companies they don't want to get to know or get that statistics when they have to, it's secured. There is no legal way to get information of exactly what type of goods and the volume of it and the weigh of it and so on, we can't get it, it's own by the business, by the companies…it's confidential, yes. It's business confidential for them, they don't want to getting to ask...it's hard to get information, the companies they don't want to leave it to outer part."
Stefan Berg – Trafikverket Syd

"The statistics is very important…we have to know exactly what type of goods in the city of Stockholm, or in the city of Göteborg, how it flows, which we don't have it now. We have no idea how much goods out and in from a big city just now we don't know."
Stefan Berg – Trafikverket Syd

Apparently, the reaction to sustainable urban freight transport from the private companies and public authorities are different, except for the alternative source of energy. The interviews support the finding from Dablanc & Rodrigue (2014) that the public authorities are more interested in urban freight than before and attempt to promote innovative solutions to improve urban logistics efficiency and environmental sustainability, however, most strategies were failed leaving them reluctant to go further. Most authorities view the consolidation center as the opportunity to reduce urban traffic and environmental impacts from freight deliveries; however, freight companies view it as a threat to both environmental sustainability and transport efficiency and effectiveness. Additionally, it is also argued by the public sector that some significant freight-related data are covered by most private companies due to the trade confidentiality. Numerous freight-related statistics are missing, which

potentially influence their planning and decision-making process, leaving problems unsolved in the long-term.

However, it can be also argued that the concept of UCC might not work effectively in this digital age. The emergence of ecommerce greatly influences how goods should be moved to and from urban areas. Online customers are more and more demanding from e-retailers, for example, free-shipping, free-return, fast delivery with high service quality and so on. It might be true that online shopping could reduce personal transportation, however, those ordered goods are still need to be delivered to either a service point or a private residence. This is another question if the reduction of personal car usage is more or less than the increasing need of freight vehicles used to fulfill customer demands. This argument comply with a finding from Hesse & Rodrigue (2004) that freight transport characteristics are changing due to the emergence of ecommerce that influences consumer behavior. Thus, the concept of UCC might not always work as numerous findings have shown due to this technological factor that influences the whole system of logistics and supply chains management.

4.1.4 Alternative Solutions

Some alternative solutions are proposed by both public and private enterprises in order to lessen the traffic in urban areas, as well as to reduce greenhouse gases released from urban freight transport. The following statements are some examples from different respondents regarding to tax rebate, alternative energy, sharing bus lane for freight transport, nighttime delivery, and reducing price for public transport respectively. Typically regarding to the mitigation of greenhouse gas emissions from freight transport, it is also interesting to observe that while freight companies needed some tax exemption, the local authorities require those companies to pay some extra due to the greater impacts caused from freight operations (Dablanc, 2007b). As most additional charges are resulted from measures or regulations, it will be further illustrated in the later section.

"If they could support by giving some tax rebate or something like that for haulers if they are using environmental trucks then you'll see the possibility…when you can prove that it's more cost effective to have an environmental truck within the city, the you will see the possibility. So you will never invest in the environment if you will not get the money from investment…if they could support by giving some tax rebate or something like that for haulers if they are using environmental trucks then you'll see the possibility."
Thomas Wennborg – Dachser

"Maybe the cargos and the distribution cars can use that public lane for buses, it's the measure, the plan for future to let distribution cars, distribution trucks use the bus lane, for example."
Stefan Berg – Trafikverket Syd

"It could be many solutions because mostly we are not allowed to distribute goods during the night time, I mean it could be noise but if you have silent vehicles, maybe electric vehicles, maybe might be allowed to deliver during night time, that would of course be work for the transport, for the traffic jam with that situation."
Respondent 3 – Freight Operator 2

"I think that the biggest thing is that if it would be cheaper to go by bus, for example, more people will choose that and that would affect the traffic situation, definitely."
Respondent 2 – Freight Operator 1

To discuss about this issue, the problems emerge from the increasing number of vehicles running on the road, which most of the time running with LTL. Although the public sector attempted to solve the problem by promoting the consolidation center, it does not obtain much interest and cooperation from the private sector due to business issues. So, if the freight operators are restricted with limited number of trucks, they could adjust their business strategies and find an optimal solution to meet customer demands. Singapore is one of the most interesting countries when it comes to traffic controlling question. To tackle with the traffic problem more effectively, the land transport authority of Singapore implemented a scheme called *Vehicle Quota System (VQS)* to control the growth rate of vehicles on the road sustainably (Land Transport Authority, n.d.). They control the number of new vehicles by issuing a *Certificate of Entitlement (COE)* that is required in order to register a new vehicle in Singapore or simply, no certificate no car. The certificate provides the right to own a vehicle for 10 years, after this period, only freight vehicles are allowed to renew the certificate for another 5 years by paying the prevailing quota premium, other types of vehicle will be deregistered after the 10-year certificate has expired. The certificate can only be obtained through a real-time bidding system, which is opened twice a month. In other words, the government has set a fixed number of new vehicles in advance and the system is applied to all categories of vehicles on the road, including freight vehicles.

Since one of the main causes of climate change is related to urban traffic problems, which is resulted from the increasing number of both private and freight vehicles, it is necessary to have the right reaction to the right cause. VQS could be another alternative strategy for the public authorities in Sweden to tackle with urban freight transport more effectively. It could compromise the urban traffic stress and mitigate enormous impacts (such as noise and air pollution) from the transport sector and could be used as a tool to accomplish the national commitments regarding to GHG reduction by 40 percent by the year 2020.

For the private companies, although it might seems challenging to operate the deliveries with limited vehicles while sustaining the service level and quality, they could benefit from the system by having less traffic in urban areas, less problem of parking space or loading/unloading area, improve delivery performance, etc. They

might need to adjust their business strategies and come up with innovative delivery solutions that create more values to the whole supply chains.

4.2 Land-Use Planning

The second category is *Land-Use Planning,* although it is not directly derived from the sustainable urban freight transport model, it is the initial source *(Land-Use)* where the author started from, which is described as "the supply of transport infrastructure as well as the location of the facilities in relation to the traffic infrastructure" (Lindholm, 2010). However, since how the land is planed for being used also influence the actual land-use in urban areas, as well as the main objective of this study, which is more or less relevant to land use planning; the author made slightly adjustment (from land-use to land-use planning) according to the findings and aim of the study. The category comprises of two subcategories, land-use planning in *Transport Sector* and land-use planning in *Urban Ecosystem Services*.

It should be noted that the key point deviating this adjusted component from the former one is the extra element related to urban ecosystem services that is added since it is relevant to environmental sustainability and influenced by land-use planning.

4.2.1 Investment in Transport Sector

Regardless to the fact that the authorities have paid more interested and awareness of the importance of efficient freight transport than the past, the priority and investment plan related to freight transport are still lagging behind. In this section, the author aims to propose some statements from authorities related to investment and plan for the transport sector.

"People want to have other thing in the cities, not urban freight, unloading or loading places and so on, that's more problems, in the future there will be more and more conflict…the cities will be more and more housing areas, shops in the cities, and that leaves no room or space for cars, either it's the truck or normal cars, I think, people want to walk and cycling."
Stefan Berg – Trafikverket Syd

"We don't have any allocated investment in that way...we don't have an investment for that (heavy truck infrastructure) but we have for bicycle lanes and public transport, but for freight transport it's more part of the traffic system, so if we build a new road it's for the heavy traffic as well, it's not specifically for heavy traffic, it's for traffic in general, cars, that's how we work. And I guess that's another evidence of the fact that we are not working with heavy traffic in the same way as we do with the other traffic modes."
Max Hanander - Malmö Municipality

"When it comes to investment, you pay road, for public transport for cars, lorries and so on. It's always important that you weigh different areas of interest. In Helsingborg, we work a lot with environmental issues, so it's also important for us to have an efficient public transport as well…so buses have a high priority regarding investment, also bicycles road have a lot investment space in our budget…We'll invest more than 400 million SEK in high efficient bus line, rapid bus called Helsingborg Expressen, and this is incorporation with state funding with regional finding and municipality funding, and this Helsingborg Expressen, rapid bus will be almost like a tram with very big buses…by these investment we'll speed up public transport for about 30% of the inhabitants in Helsingborg. So that is the most important ideas that we're investing right now."
Christian Orsing – Helsingborg Municipality

Specifically, regarding to freight transport in land-use planning, some local authorities also consider about location of logistical facilities in urban land-use planning to improve transport efficiency and reduce environmental impacts from transport sector.

"We try to develop how we up on transport and freight, and one part is how we handle the city logistics because our town center is quite small but with a lot of traffic and narrow road. So, together with the city's canals, we try to find out how we could develop the logistics, material handling and daily goods deliveries to our merchants in a more efficient way…and one of the most important things is how we plan our city."
Christian Orsing – Helsingborg Municipality

Regarding to the fact that there is an increasing trend of people living and working in the urban areas, good transport and city's plan are the key factors influencing urban livability and sustainability. One of the respondents mentioned about land-use planning in relation to urban transport that since we have limited resources, it is important for the local authorities to prioritize the mode of transportation that people want to have in the city, we cannot plan for everything. However, other external factors, typically political related, can influence the effectiveness of the investment in public transport as well.

"You have other aspects in Sweden that you have market working region between where you can live in Helsingborg but you can also work in Malmö, or in Kritianstad, or in Hamstad, which make that, in someway, you are more or less forced to own or to use a car no matter what. No matter how do you plan an actual city, so you have a problem of that you are perhaps working in a different cities, which mean if you do not have good public transportation system, good train, good buses, then you take the car, and then it doesn't matter how you plan a city because you must have the car to go to work."
Michael Johansson – Urban Transport Researcher

"So if you have people moving into a city, you have urbanization, and if you will not manage or handle the transportation to reduce or use of car traffic or car use then you will have in some way or another, a problem with infrastructure, which means that you take land, mean values and make hard infrastructure in form of asphalt, and that is a problem, I can see in many cities."
Michael Johansson - Urban Transport Researcher

"You within a city perhaps prioritize, what transport mode will you have in the future, is it the car, or is it the bus, or is it bicycle, and then you must focus on future infrastructure or planning due to how you prioritize the infrastructure or transportation modes, we should say that we must reduce the car traffic, then we must plan for something different, you can't plan for everything because if you will have a lot of urbanization within the city, and we plan for cars, we plan for buses, we plan for bicycles, we plan for everything, do we have the space for that? I do not know, I'm not sure, so you must prioritize what transportation mode will be the future in this city."
Michael Johansson – Urban Transport Researcher

So, the highest priority regarding to the investment of infrastructure in transport sector is devoted for public transport. The local authorities prioritize public transport investment and plan the city for automobile independent. Consequently, the geometric of roads and junctions are usually not sufficient to accommodate heavy trucks, which could result to serious problems, typically in density or high congestion areas (ASCE, 1988). It can be argued that although most investments are not specifically related to freight transport, less private vehicles running on the road result to less traffic congestion, less problem of parking spaces, more effective urban distribution, which could suppress the growth of new freight vehicles to respond with increasing customer demands, and thus compromises serious problems and diminishes environmental impacts from freight transport.

Furthermore, local authorities emphasize the importance of urban land-use planning, which determine the location of facilities, industrial areas, residential zones and so on that facilitate transportation within vicinity areas and improve sustainability in urban areas. This kind of urban design and planning can help to mitigate gas emissions from transport sector due to a shorter distance travelling from one place to another, facilitating alternative means of transport, as well as improving transport performance (Stanley et al., 2011). However, simultaneously the value of land will also increased resulting to more expensive accommodations, facilities and cost of living, which could influence the location preferences of people and companies to reside in a less expensive place but require more travel distance than the more expensive one.

Findings also show that there are some internal conflicts of interests, for example the policy that promotes inter-regional working. It could not only steer more needs of personal car usage (if the public transport system is not effective enough) but also more needs of land being taken up for new constructions and the like that support more transactions, which imply to more transportation needed to deliver goods and

services to the new facilities and so on. This could lead to the increasing of distance travelled in both passenger and freight transport (Miljödepartementet, 2009). As a result, it might work reversely towards the local planning and investment that aim people to use more public transport, cycling, or walking to vicinity areas.
Thus, the authorities should be more aware of these issues and ensure that they are supporting each other so that the new investments would work more effectively and the urban land-use would be more efficiently organized corresponding with people's needs.

4.2.2 Measures/Regulations

One of the most common ways that most public authorities apply to handle with the urban land-use planning is the implementation of measures or regulation, especially when it comes to the transport issues (Ballantyne & Lindholm, 2014). Yet, due to the nature of the transport industry, that it is very complicated as it includes various stakeholders with different area of interests, not every active measures or regulations are effective. For example, low emission zone, which aim to restrict heavy polluted vehicles for the entrance into specified zones. According to the interview with some authorities, they pointed to the same direction that this restriction is not really effective in practice, mainly due to the scarcity of human resources to work in a specific area.

"Helsingborg is international city and a lot of the lorries companies are hold international competition and we also have a lot of the equal means of transportation. We have a lot of European, Eastern-European companies which are active on the Swedish transport market and in many reasons they're doing in the illegal way but it's very hard to prove and it's very hard to fine those vehicles if they made something wrong and the city can't fine them. So, I don't think that is an effective way to do it. If we should be effective, we have to make legislation on national level."
Christian Orsing – Helsingborg Municipality

"On paper it's really good, but in practice we don't have any follow up because the police in Sweden, at the moment, they have a problem with prioritizing the traffic because as I heard, no one in the police force wants to work with traffic anymore. So it's really a big problem because no one is looking after the heavy traffic because we can't do it because it's the responsibility of the police, and they can't do it because they don't have the resources anymore. So it's really a problem in that way, we can blame the police but it's not really a matter of blaming anyone, because it's more a matter of making it work but it's hard today because we have so many other issues that's more prioritized by the police in Malmö, we have social problems, and large social problems in some areas, then it's hard to prioritize the traffic."
Max Hanander – Malmö Municipality

Additionally, some cities such as Stockholm and Gothenburg also implement *Congestion Tax* to tackle with the congestion problem in urban area. However, the effectiveness of this measure is still ambiguous, in short-term it seems to work effectively; there are several factors influencing that in long-term effect, for example, price elasticity, inflation, etc. (Börjesson, Eliasson, Hugosson, & Brundell-Freij, 2012). According to the interview with several private companies, although the price of congestion charge has increased, they are more likely to be price-inelastic and continue deliver goods on the additional charge.

Thus, perhaps more strict measures are needed in order to make it work more effectively. Nonetheless, this could be another challenge question for the authorities to offset between losses and gains from the increasing/decreasing level of harshness of restriction.

"I wouldn't say the regulations so far are so tough so there are not any problems for the moment to find vehicles that could be in the city line but the I know that there might be harder restriction in the future and I'm quite sure that our haulers will need to adapt to the new regulations."
Thomas Wennborg – Dachser

"We are more sensitive to change as well because companies today when we are part of the European Union, can freely move even across the borders, so for instance decision making is made that are being important for lorries companies is the taxation on Swedish lorries companies is too high, they can easily move their trucks to Denmark, or to Germany or another country, or for in stance, today we have a lot of Swedish companies on the surface which are being made up of Eastern European lorries, so that's the way they're invading taxes and that's something we're more sensitive for today."
Christian Orsing – Helsingborg Municipality

To summarize this section, the findings reveal that there are few measures and lag regulations applied on freight transport, which could explain some of the negative impacts brought by freight transport. Additionally, very few measures and regulations are related to urban land-use, which reflect few interests in this area. It can also be observed that most local authorities apply similar measures and restrictions regardless of the awareness of differences between cities. According to Anderson et al. (2005), since one city area is different to another, it is significant to match the appropriate measures with a specific urban area. Moreover, to make the measure more effective, they should be mixed with other measures because each measure has its own strengths and weaknesses; there is no one perfect regulation that can meet all demands (Ballantyne & Lindholm, 2014).

Discussion regarding to this issue can be referred back to VQS, which is also a regulation used to control the vehicle growth and traffic congestion in Singapore, the main role of this system is to limit the number of vehicle growth, not the usage of those vehicles. Although it is true that vehicle growth is the key driver in traffic congestion and could lead to several mega-project constructions to handle with the increasing vehicle population, how people use those vehicles is also a crucial factor of those problems. If it is difficult and expensive to own a vehicle, then it is more likely that the owner would drive as much as possible to make it worth for the investment. Thus, apparently VQS alone is not sufficient to control urban traffic effectively in the long-term. Correspondingly, land transport authority of Singapore implemented an additional system to foster the effectiveness of VQS that is the *Electronic Road Pricing System (ERP)*, which is similar to the congestion tax in Sweden, used to control the road congestion where the drivers pay according to their vehicle usage.

Although the illustration of VQS and ERP system used in Singapore are not directly related to land-use planning, it is somehow influence the urban land-use planning. Less vehicles running on the road would imply more spaces in urban areas are available for something else, for example, new investment for more effective public transport, improvement of highways and transport routes, more green areas, etc. Furthermore, as mentioned in the previous section regarding to the long-term effectiveness of congestion tax used in Sweden, VQS could be considered as a complementary regulation to control the urban traffic and integrate that in land-use planning more effectively and efficiently. Several studies relevant to the integration of transport and land-use, and more illustration of these two systems can be found in (Haque, Chin, & Debnath, 2013; Lam & Toan; Tuan Seik, 2000).

4.2.3 Urban Ecosystem Services

To recall the urban ecosystem is referred to all natural green and blue areas in the urban areas. Also as illustrated in the theoretical chapter regarding to the significance of urban ecosystem services provided by urban ecosystems, it is necessary to illustrate about what are the factors compromising and supporting the services provided by urban ecosystems. This section, the author aims to highlight some key findings related to threats and opportunities of the urban ecosystem, which are resulted from urban land-use planning.

4.2.4 Threats

Despite of numerous benefits yielded from urbanization, mainly from the economical perspective, it is the key factor threatening urban ecosystems. The more population moving into the city, the more buildings and other hard infrastructures are constructed to accommodate and facilitate more people, activities, transactions, etc. Consequently, more green and blue areas in the city are going to be taken up for those purposes, thus it is crucial to concern about this issue otherwise they would not only directly affect urban ecosystems services but also indirectly affect urban livability and eventually expedite the climate change phenomenon (Grimm et al., 2008).

The following statements were expressed by the experts of urban ecosystems regarding to the concerns of green areas in the cities and their perspectives towards urban ecosystems development in the future.

"We are a bit afraid that (urbanization) might mean that you take more and more of the green survives in the urban conglomerate into production into new roads, new houses and so on. And it's also a reason why we look at more and more at effectiveness when it comes to transportation so that we need less hard infrastructure for roads, parking places and so on."
Respondent 1 – Ecosystem Researcher

"Now we have a challenge because now we need to have more houses and infrastructure, so actually I don't know there is two things working against each other, a better one as an environmental problem and ecosystem services is also on one hand, and the pressure from needing more infrastructures, more houses on the other side. And if we're looking these at the politicians at the moment they seem to be much more stressed about building new houses than to keep the green space, so we don't know, we'll see what happens."
Respondent 1 – Ecosystem Researcher

"You cannot just built as you did yesterday, you must think what will happen in 50 years onwards, what happens if we take this area and just make some houses, some parking places, and then we lose green areas for that, and that is very interesting, I think that you must have an ecosystem discussion within this challenge because otherwise if we would have this in 50 years, that could be devastating and we could why didn't we take notice about the green values in the city, we have no green values we just have grey areas, we have houses, parking, and roads, we have nowhere to relax, we have no biodiversity in the cities, that it is threatening I think."
Michael Johansson – Urban Transport Researcher

Again, this is a very difficult and challenging question in urban land-use planning, a trading off between values gained from ecosystems services versus economic growth generated from the urbanization.

"So very often there is a conflict between hard infrastructure with green vegetation and also density of housing areas and vegetation, and especially at this moment when we were talking about that we need so many new houses to supply everybody with a flat or with a house that would be even more stress."
Respondent 1 – Ecosystem Researcher

"When talk about actual urban planning, then I think that the economical factor weighs more than ecological factor, and that's a bit of problem."
Michael Johansson – Urban Transport Researcher

In short, the empirical studies reveal that the emergence of urbanization and perpetual conflict between hard infrastructure and green areas in the cities are the dominant threat of urban ecosystems development. Especially when the tangible benefits generated by new constructions are more visible and gain more interest from the local authorities than those of ecosystem services; it would be more likely that urban green areas are going to be taken up to respond those needs. Consequently, the urban ecosystem would be incapable to provide optimal services, which eventually influence the environmental sustainability in urban areas. Thus, it is necessary that the local authorities attempt to overcome or compromise these threats and strengthen the opportunities of urban ecosystem development.

4.2.5 Opportunities

Though urban ecosystems are threatened, findings from the interviews with experts in urban ecosystems unveil some opportunities for further development in this area. The two main opportunities can be obtained through the increasing awareness and involvement of ecosystems in urban planning from local authorities, and people should be acknowledged about the values of ecosystems. It is crucial to understand how human and ecological systems are connected with each other, and increase public awareness of the significance of well-functioning ecosystems (Fisher et al., 2008).

"Ecosystem services have been implemented more and more into municipal planning, into urban planning, but also into registration but also in the country level. I were involved in one project financed by the Swedish Environment Protection Board and there we have investigated in how many city plans that ecosystem services are mentioned and we have compare over time period from 1960-70s until today, and we have seen the concept of ecosystem services are mentioned more and more in recent urban planning."
Respondent 1 – Ecosystem Researcher

"People who live in a city, they're going to a park just to enjoy to the nice view, just to relax but they do not go to the park because of the biodiversity or whatever. So I think we must have that kind of information or a knowledge education just to know that when you are in a park, you can relax but also you can see these other more green values that the park or green will create."
Michael Johansson – Urban Transport Researcher

Although the ecosystem services do not have direct monetary benefits, by converting ecological values to economic values for the sake of comparison or analysis of costs and benefits for certain decisions, it can facilitate the planning or decision-making process. As presented in the theoretical chapter regarding to the relation of ecosystems services and economic cost, it reflects policy makers on which tradeoffs society can and cannot make (Fisher et al., 2008). So, public authorities (e.g. urban planner, traffic department, urban green areas department, etc.) would realize what are the costs and benefits of taking a hectare of green area.

"If you can find ecosystem services related to something that you have economic benefits from that is reducing the amount of water going to sewage plants or that has to be treated in a way then we can say that an artificial wetland for taking care of sewage plays a big role in ecosystem services with cleaning the water, reducing the amount of water but at the same time, it's a sponsor for biodiversity also makes the green areas which could be made for tourists and things like that…then you can calculate more or less the plus and the minus. We keeping the areas the green space and by turning it into a parking place what are the economic plus and minuses, it is where the ecosystem services comes into operation so to say."
Respondent 1 – Ecosystem Researcher

The findings demonstrated that there is an increasing interest obtained from the public authorities and more involvement of the ecosystem services in the urban plan than it used to be, which reflect good opportunities for the development of urban ecosystems in the future. Also, by visualize the value of ecosystem services into a comparable unit, such as monetary currency; it could enhance the opportunities of some green areas to be protected from new constructions. Ecosystem services can also be secured by leaving green areas close to each other, and becoming larger nature and landscape entities in the future (Niemelä et al., 2010). Lastly, it is also important to provide adequate knowledge to people living in communities about the value of ecosystems services because they could be a vital driver and key protector of the urban ecosystems from the threats.

4.3 Collaboration

Lastly, *Collaboration* category is emerged from the empirical study. Although it is not involved in the model as the previous components, it is addressed and concluded by several researchers such as (Benjelloun & Crainic, 2008; Hesse, 2004) as the key driver to sustainable urban freight transport.

Collaboration or cooperation is another tool widely used not only in business-to-business sector, but also in business-to-government sector, which is formed for different purposes. In this case, the main goal of collaboration between these two sectors is to reduce the environmental impact from urban freight transport. According to the interviews, every respondent agree that the cooperation between local authorities and private companies is crucial and necessary in order to cope with this issue more effectively and efficiently, which confirm the study by Zanni & Bristow (2010).

"This is something I have to do together with the market because there are different freight companies and we have the market share which we want to work together with it, not disturb the private market in the logistics sector, we want to work with them closely…so that is something we think about when we plan the city, how different needs and different interests can coexist and not disturb each other but in stead they can benefit each other"
Christian Orsing – Helsingborg Municipality

"To work with environmental questions and issues, you have to collaborate…you can't act alone and I think you have to develop, the cars and trucks have to be developed and fuel has to be developed for the whole sector, not for one company or so."
Respondent 3 – Freight Operator 2

"I'd say that it's the best for developing as collaborating you can do very much more together than you can do on your own. With the challenges that we have today it is essential that there is a collaboration among different organizations both within the public and private sector."
Hanna Berko – KNEG

"I should say we need more collaboration in a lot of area even in urban planning because it's not only the municipality who owns, if you can say that, the urban planning, you have private companies who will build, you have commercial transportation companies, which can be a part of new areas and so on, I think collaboration is someway a key for sustainable city planning in the future."
Michael Johansson – Urban Transport Researcher

Obviously, regardless of the conflict of interests between public and private sectors, they are attempting to accomplish a common goal, which is the sustainable urban freight transport. Both public authorities and private companies agreed that collaboration is necessary and needed in order to improve urban freight transport sustainably.

4.3.1 Drivers

Due to the fact that there are various actors and stakeholders involved in urban freight transport, the collection of these variety is thus become the main driver in the collaboration. Through information and knowledge sharing, collaboration could lead to a good quality of planning (Bergqvist & Pruth, 2006). From the public authorities point of view, collaboration yield great opportunities to get more understanding about several actors in freight transport industry, leading to the right decision-making and effective plan for freight transport. From the private sector perspective, whose major interest is related to company's profitability and competitiveness, by collaboration they can potentially reduce some risks and costs of their business operations, and mutually benefit from the abundant of knowledge and information shared from other members.

"Generally, the drivers for the collaboration is that the members area from different fields and holders of various technical capabilities. With the infrastructural challenges within the transport area today it is a must to collaborate to develop the industry. It is also a question about doing things more efficiently together with others. I also believe that sharing different technologies, research and knowledge within their separate field is a big driver for our members…I'd say that KNEG works quite well as a neutral platform, to meet and to discuss and to learn about each other, about each others reality, difficulties and obstacles and how things work within different organization."
Hanna Berko – KNEG

"When they listen to each other, I think they are understand that they must collaborate and find new solutions, they can't work on their own anymore. Efficiency is the driving force, you have to do in a more efficient, less expensive way."
Stefan Berg – Trafikverket Syd

"Opportunities are of course that we are different types of companies, we have truck companies, we have fuel companies, we have transport companies and so on…Volvo can make trucks or transport companies and fuel distributors can make fuels that all companies can use, that's I think collaboration is the main reason."
Respondent 3 – Freight Operator 2

According to these findings, variety of knowledge, skills and competent of different members are main driver attracting different actors into the collaboration, which allow them to fulfill or complement to each other. However, the problem of benefits allocation and cost sharing could be crucial questions to consider about as well, who is going to responsible for what, how the benefits should be distributed fairly, and the like. Although this paper does not aim to propose a mathematical model, it is noteworthy to mention that game theory is usually applied in many industries, typically in relation to the cooperation issue. Thus, this model could be an alternative tool to support and facilitate the collaboration among different stakeholders.

4.3.2 Barriers

Barriers are inevitable in collaboration, however, what is considered as a barrier can also be different from one actor to another.

Public authorities perceive that the main difficulty in public-private collaboration is the communication regarding to new solution for urban distribution, for example, the concept of consolidation center. It is still a controversial issue since each company has its own business strategy and goal to pursue for; it is very challenging for the public authorities to communicate this concept to be acceptable by private companies. Moreover, the accessibility of data is also another great barrier for the authorities to have full operation capability in the collaboration due to business confidentiality.

"It's a big challenge to collaborate, we have tried it for 20 years, I mean we have come no where, it's not easy…in the private companies they have their own business model that they don't want to change their own big business model but they have to do if collaborate and consolidate. Lots of companies have their own business models that they think their business model is the best, I think it's hard to talk to the companies and tell that you have to change…the transport administration and municipalities have to listen to the companies more, it's quite important too and we have to do things to be easy for them to build new business model, it's very important that too...it's easy to say but it's hard to do, you have to trust the other part and you have to open your own system, that's hard, that's another important thing I think."
Stefan Berg – Trafikverket Syd

On the contrary, the private companies expressed that although there are some confidential information hidden from competitors, most necessary data are uncovered for mutual benefits. It is also noteworthy that the continuity of authorities' policies and other political factors can potentially influence the effectiveness of collaboration. For example, local authorities might implement some policies that support only short-term plan, while the private companies invested for a long-term plan and vice versa. In other words, the problems arise when the duration of planning between two sectors are too different.

"The difficulty is of course, some of the members are competitors to us...anyway we have enough level of openness between us, we accept that we don't tell everything about logistics. If regarding trucks and fuels, normally I think we don't have any secret for that, because we're all benefit from better cars, better trucks, better fuels."
Respondent 3 – Freight Operator 2

"One issue could be regarding political decision making within the transport area where there is a lack of long-term planning. As an example regarding fuel freight where in quite short-term period there is a political decision that supports a certain technique, however, development within that area results in a total change and support of a different technique. This is something that also KNEG's members are working for, of course, it affects infrastructural investments. So the use of ethanol is one example, as fuel which was preached politically today lacks support which can question future priorities within the area. This makes investments on a long-term basis hard."
Hanna Berko – KNEG

Hence, it can be concluded that the conflict of interests between these two sectors is the main constraint in the collaboration, which make it difficult for the public authorities to communicate and persuade freight companies to be interested in their innovative solutions, and for private enterprises to make investment for sustainable freight transport.

In fact, some significant points from the interviews are also worth for discussion. Firstly, it appears that mostly both sectors are cooperating with each other for a certain project, which could be either successful or not. Some respondents revealed that although there are some successful projects, for example, the alternative energy for freight vehicles, it cannot be commercialized in the market due to high investment cost and so on. Bergqvist & Pruth (2006), illustrated that most plans from the private enterprises are on short-term basis compared to the public sectors, however, the empirical findings argued vice versa. Typically regarding to policies, which could be fluctuated all the time, and thus become one of the greatest constraints in long-term and continuous development. The authorities should also concern about how to support those successful projects afterwards for public use or non-member stakeholders. How does the continuity and generalization of that project for the public benefits should work? How do other stakeholders in urban freight transport should be involved and benefit from the successful project, so that they could continue

improving in a more sustainable way? Hence, it is important to consider about these issues in the collaboration for the long-term effects as well.

To conclude the chapter, Figure 6 illustrates the relationship between each category as well as the causes of urban freight transport problems and the effects on ecosystems services. Three circles represent the main categories derived from SUTP-freight model and empirical findings, which influence the sustainability of urban freight transport. The blue-shade areas represent the causes and red-shade areas represent the effects or the problems influenced by the blue areas, which are mainly driven by the reactions of public and private sectors. Four common reactions or approaches discovered from these two sectors – *Consolidation center, Multimodal transport, Measures/Regulations, and Alternative fuel* – the most conflicts were found in the first approach while the least conflicts were appeared in the last approach. The influences of these reactions consequently become either drivers or barriers of the urban traffic, land-use planning, and collaboration. For example, the most controversial concept, consolidation center could drive the sustainable urban freight transport because it increases the fill-rate of trucks, decrease the movement of freight vehicles, thus decrease emissions and other freight-related problems. However, the conflicts and the lack of cooperation from freight companies in this concept could be the key barrier to the sustainable urban freight transport. It could limit the capability of freight transport sector to mitigate gas emissions, prohibit urban transport efficiency, contribute to more cost of logistical activities, etc. Consequently, these effects could directly and indirectly influence the abundance and well functioning of ecosystems services, which then return back to the economic, social, and environmental sustainability eventually.

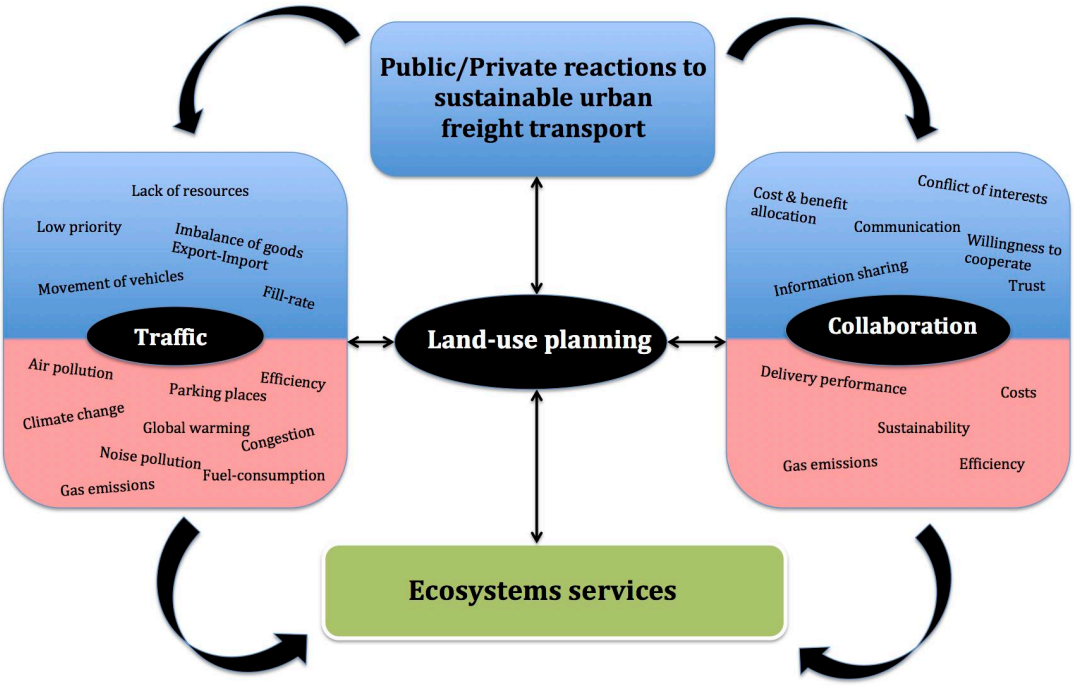

Figure 6: Schematic diagram illustrating relationship and interaction between categories and the effects on ecosystems services.

5. Conclusion

Regarding to the research aim that is to yield insight into how the public and private sectors react towards sustainable urban freight transport and their influences on environmental sustainability, this paper provides different perspectives from public authorities and freight operators towards their approaches to sustainable urban freight transport. So far, this topic has been gradually obtaining more interest from the public sector than the past; however, numerous issues still have been neglected. The study found that traffic-related question is the most controversial issue, mainly due to the conflict of interests and different level of perspective from public and private sector resulting to negative effects on CO_2 emissions as well as urban ecosystems services.

With respect to the land-use planning, empirical findings show some possibilities for the local authorities to handle with the tradeoffs between economic and ecosystem services benefits, for example, by providing knowledge relating to value of ecosystems or applied economic model into policy- and decision-making process. By including the role of ecosystem services into consideration, it can lead to a better urban planning. The land can be organized more effectively and efficiently, facilitating overall transportation while maintaining well functioning of ecosystem services, which is required for natural biodiversity as well as human well-beings.

Last but not least, good collaboration between multiple stakeholders is increasingly required for a sustainable urban freight development because this question is too huge to be responsible by a single organization. Thus, a better communication and understanding of each other obtained through the collaboration could result to a better quality of planning and more innovative solutions to more sustainable urban freight transport, which yield optimal benefits locally and globally.

5.1 Answering to the research questions

RQ1: How do public and private sectors approach sustainable urban freight transport?
RQ2: How do their reactions affect CO_2 emission and ecosystems services?

Approaches	Public (RQ1)	Private (RQ1)	Impacts on CO_2 and Ecosystems Services (RQ2)
Consolidation Centers	✓	X	(-)
Measures/Regulations	✓	✓	(+/-)
Alternative Fuels	✓	✓	(+)
Collaboration	✓	✓	(+)

Table 3: Public-Private approaches to sustainable urban freight transport and impacts on CO_2 emissions and ecosystems services.

To answer the research questions, Table 3 illustrates main approaches from both public authorities and private companies, which can be concluded into four main approaches – consolidation centers, measures/regulations, alternative fuels, and collaboration. Besides the concept of consolidation center, both sectors share similar attitudes and reactions towards sustainable urban freight transport. According to these reactions, it can be concluded that, the approach of alternative fuels and collaboration show obvious positive impacts on CO_2 emission and ecosystems services. Measures/Regulations are, however, still cannot be concluded yet in this study. On the paper, the restrictions themselves (e.g. LEZ and congestion charge) seem to be positively affect on the environment. Nonetheless, in practice it does not seem to work effectively on the environmental aspect due to the a lack of human resources to control those restricted trucks. Last but not least, the consolidation center approach, as it does not obtain much attention and cooperation from the private companies, it leaves numerous problems unsolved such as traffic congestion and low fill-rate. Thus it can be concluded that it has negative effect on CO_2 emissions as well as ecosystem services.

6. Concluding Discussions

The study's topic and objective are initially derived from the author's concern of environmental impact, specifically regarding to freight-induced CO_2 emission and urban ecosystem services deterioration. Urban freight transport is considered as a key driver in total CO_2 emission from transport sector; however, very few studies have been done and it has long been neglected by public authorities. To yield new insights into this area, how the public authorities and private enterprises approach to urban sustainability and their effects on CO_2 emissions and ecosystem services were studied.

The qualitative approach is appropriately applied in the research. Data collections from ten semi-structured interviews are well conducted and yield rich information to the analysis and discussion. The aim of research and research questions are answered. Also, the gap of knowledge between the public and private sectors regarding to sustainable urban freight transport question are fulfilled.

Implications for researchers and academia, the study yields new insights and contributes new aspects to the concept of sustainable urban freight transport that it should include collaboration between public and private sector as well as the ecosystem services in the model. A good collaboration between these two actors can compromise freight-induce problems enabling well functioning of ecosystem services, which in turn sustain the economic, social as well as environmental development.

Implications for public authorities and private companies, this study can be used to better understand each other's needs and perspectives towards sustainable urban freight transport, which are vital in the designing and planning of new policies, investments, business strategies, etc. It can also be used as a tool to cooperate not only with the public administrations but also with other stakeholders to maximize profits while minimizing financial and ecological costs.

The challenge of the study, however, is freight-related information from the public sector because this topic has long been neglected; it is new to most authorities. Some quantitative information from both public and private sectors are not accessible. Thus, the result of the study can only demonstrate the anticipated effect of CO_2 emission and ecosystem services. It does not include which reaction is more or less powerful than another one. Thus this could be an opportunity for a future research regarding to the potential of each reaction approached by these two sector, which reaction is the most powerful that should be prioritized and supported to enhance urban freight transport effectively and efficiently in long-term. Some other areas are also possible for future research, for example, future development of urban consolidation centers, future roles

of public authorities in urban freight transport, development of public-private cooperation, etc.

References

Allen, J., Browne, M. and Cherrett, T. (2012). Investigating relationships between road freight transport, facility location, logistics management and urban form. *Journal of Transport Geography*, *24*, pp.45-57.

ASCE. (1988). Issues and Problems of Moving Goods in Urban Areas. *Journal of Transportation Engineering, 115*(1), 4.

Ballantyne, E. E. F., & Lindholm, M. (2014). Identifying the need for freight to be included in local authority transport planning *Sustainable urban logistics: Concepts, methods and information systems* (pp. 37-48): Springer.

Banister, D. (2011). Cities, mobility and climate change. *Journal of Transport Geography, 19*(6), 1538-1546.

Barnaby, F. (1987). Our Common Future: The 'Brundtland Commission' Report*,* 217.

Bart, I. L. (2010). Urban sprawl and climate change: A statistical exploration of cause and effect, with policy options for the EU. *Land Use Policy, 27*(2), 283-292.

Beatley, T. (2000). *Green urbanism : learning from European cities*: Washington, DC : Island Press, cop. 2000.

Behrends, S. (2011). *Urban freight transport sustainability - the interaction of urban freight and intermodal transport.* (Doctoral Thesis), Chalmers University of Technology.

Behrends, S., Lindholm, M. and Woxenius, J. (2008). The impact of urban freight transport: A definition of sustainability from an actor's perspective. *Transportation planning and technology*, *31*(6), pp.693-713.

Bellard, C., Bertelsmeier, C., Leadley, P., Thuiller, W. and Courchamp, F. (2012). Impacts of climate change on the future of biodiversity. *Ecology letters*, *15*(4), pp.365-377.

Benjelloun, A., & Crainic, T. G. (2008). Trends, challenges, and perspectives in city logistics. *Transportation and land use interaction, proceedings TRANSLU, 8*, 269-284.

Berg, B. L., & Lune, H. (2012). *Qualitative research methods for the social sciences*: Upper Saddle River, N.J. : Pearson Education, cop. 2012, 8., [rev.] ed.

Bergqvist, R., & Pruth, M. (2006). Public/Private Collaboration in Logistics: An Exploratory Case Study. *Supply Chain Forum: International Journal, 7*(1), 106-116.

Bolund, P., & Hunhanmar, S. (1999). Ecosystem services in urban areas. *Ecological Economics, 29*(2), 293-301.
Borken-Kleefeld, J., Berntsen, T. and Fuglestvedt, J. (2010). Specific climate impact of passenger and freight transport. *Environmental science & technology*, *44*(15), pp.5700-5706.

Börjesson, M., Eliasson, J., Hugosson, M. B., & Brundell-Freij, K. (2012). The Stockholm congestion charges—5 years on. Effects, acceptability and lessons learnt. *Transport Policy, 20*, 1-12.

Brinkmann, S. (2013). *Research Design in Interview Studies*: Oxford University Press.

Brinkmann, S., & Kvale, S. (2015). *InterViews : learning the craft of qualitative research interviewing*: Los Angeles : Sage Publications, cop. 2015, 3., [updated] ed.

Brownstone, D., & Golob, T. F. (2009). The impact of residential density on vehicle usage and energy consumption. *Journal of Urban Economics, 65*(1), 91-98.

Bryman, A. (2016). *Social research methods*: Oxford : Oxford University Press, Fifth edition.

Carlsson, C.M., Emtairah, T., Gammelgaard, B., Jensen, A.V. and Thidell, Å. (2012). *Rethinking Transport in the Øresund Region: Policies, Strategies and Behaviours. Øresund EcoMobility. Interreg IVa*. Lund University.

Cherrett, T., Allen, J., McLeod, F., Maynard, S., Hickford, A., & Browne, M. (2012). Understanding urban freight activity – key issues for freight planning. *Journal of Transport Geography, 24*, 22-32.

Christou, M.D., Struckl, M. and Biermann, T. (2006). Land Use Planning Guidelines in the context of Article 12 of the Seveso II Directive 96/82/EC as amended by Directive 105/2003/EC. *European Commission, Joint Research Centre, Major Accident Hazards Bureau, Ispra*.

Cidell, J. (2015). The role of major infrastructure in subregional economic development: an empirical study of airports and cities. *Journal of Economic Geography, 15*(6), 1125-1144.

Cui, J., Dodson, J., & Hall, P. V. (2015). Planning for Urban Freight Transport: An Overview. *Transport Reviews, 35*(5), 583-598.

Dablanc, L. (2007a). Goods transport in large European cities: Difficult to organize, difficult to modernize. *Transportation Research Part A, 41*, 280-285.

Dablanc, L. (2007b). Goods transport in large European cities: Difficult to organize, difficult to modernize. *Transportation Research Part A: Policy and Practice, 41*(3), 280-285.

Dablanc, L., & Rodrigue, J. P. (2014). *City Logistics: Towards a Global Typology.* Paper presented at the Transport Research Arena (TRA) 5th Conference: Transport Solutions from Research to Deployment.

Dale, V. H., Joyce, L. A., McNulty, S., Neilson, R. P., Ayres, M. P., Flannigan, M. D., Wotton, B. M. (2001). Climate Change and Forest Disturbances: Climate change can affect forests by altering the frequency, intensity, duration, and timing of fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, or landslides. *BioScience, 51*(9), 723-734.

DeFries, R.S., Foley, J.A. and Asner, G.P. (2004). Land-use choices: balancing human needs and ecosystem function. *Frontiers in Ecology and the Environment*, *2*(5), pp.249-257.

Diener, E., & Crandall, R. (1978). *Ethics in social and behavioral research*: U Chicago Press.

EEA. (2013). Land take. from European Environment Agency. [online] Retrieved from: http://www.eea.europa.eu/data-and-maps/indicators/land-take-2/assessment-2 [Accessed 28 February 2016].

Escobedo, F.J., Kroeger, T. and Wagner, J.E. (2011). Urban forests and pollution mitigation: Analyzing ecosystem services and disservices. *Environmental pollution*, *159*(8), pp.2078-2087.

European Commission. (2011). Roadmap to a Single European Transport Area - Tpwards a competitive and resource efficient transport system. [online] Retrieved from: http://ec.europa.eu/transport/themes/strategies/2011_white_paper_en.htm [Accessed 15 March 2016].

European Commission. (2013). A call to action on urban logistics. [online] Retrieved from: http://ec.europa.eu/transport/themes/urban/doc/ump/swd(2013)524-communication.pdf [Accessed 15 March 2016].

Eurostat. (2015). Number of lorries, by load capacity and type of motor energy, 2012. [online] Retrieved from: http://ec.europa.eu/eurostat/statistics-explained/index.php [Accessed 28 February 2016].

FAO. (n.d.). Guidelines for land use planning. [online] Retrieved from: http://www.fao.org/docrep/t0715e/t0715e02.htm#what%20is%20land%20use%20planning [Accessed 10 March 2016].

Fisher, B., Turner, K., Zylstra, M., Brouwer, R., Groot, R. d., Farber, S., Harlow, J. (2008). Ecosystem services and economic theory: integration for policy-relevant research. *Ecological applications, 18*(8), 2050-2067.

Givoni, B. (1991). Impact of planted areas on urban environmental quality: A review. *Atmospheric Environment. Part B. Urban Atmosphere, 25*(3), 289-299.

Grimm, N. B., Faeth, S. H., Golubiewski, N. E., Redman, C. L., Wu, J., Bai, X., & Briggs, J. M. (2008). Global change and the ecology of cities. *Science, 319*(5864), 756-760.

Gyöngyi, K., & Karen, M. S. (2005). Abductive reasoning in logistics research. *International Journal of Physical Distribution & Logistics Management, 35*(2), 132-144.

Hansen, A. J., Neilson, R. P., Dale, V. H., Flather, C. H., Iverson, L. R., Currie, D. J., & Bartlein, P. J. (2001). Global change in forests: responses of species, communities, and biomes interactions between climate change and land use are projected to cause large shifts in biodiversity. *BioScience*, *51*(9), 765-779.

Haque, M. M., Chin, H. C., & Debnath, A. K. (2013). Sustainable, safe, smart—three key elements of Singapore's evolving transport policies. *Transport Policy, 27*, 20-31.

Haw-Jan, W., & Steven, C. D. (1995). Environmentally responsible logistics systems. *International Journal of Physical Distribution & Logistics Management, 25*(2), 20-38.

Hesse, M. (2004). Logistics and Freight Transport Policy in Urban Areas: A Case Study of Berlin-Brandenburg/Germany. *12*, 1035-1053.

Hesse, M., & Rodrigue, J.P. (2004). The transport geography of logistics and freight distribution. *Journal of Transport Geography, 12*, 171-184.

Hesse, M. & Rodrigue, J.P. (2006). Global production networks and the role of logistics and transportation. *Growth and Change*, *37*(4), pp.499-509.

Hester, R. E., & Harrison, R. M. (2010). *Ecosystem services*: Cambridge : RSC Pub., cop. 2010.

Hoinville, G., & Jowell, R. (1978). Survey research practice.

Klimat & Sårbarhetsutredningen. (2007). *Sweden Facing Climate Change: Threats And Opportunities : Final Report* 2007. Stockholm: Fritze.

Klijn, E.-H., & Teisman, G. R. (2003). Institutional and Strategic Barriers to Public—Private Partnership: An Analysis of Dutch Cases. *Public Money & Management, 23*(3), 137-146.

Kohn, C., & Brodin, M. H. (2008). Centralised distribution systems and the environment: how increased transport work can decrease the environmental impact of logistics. *International Journal of Logistics: Research and Applications, 11*(3), 229-245.

Kremen, C. (2005). Managing ecosystem services: what do we need to know about their ecology?. *Ecology letters*, *8*(5), pp.468-479.

Kremen, C., Williams, N. M., Aizen, M. A., Gemmill‐Herren, B., LeBuhn, G., Minckley, R., Vazquez, D. P. (2007). Pollination and other ecosystem services produced by mobile organisms: a conceptual framework for the effects of land-use change. *Ecology Letters, 10*(4), 299-314.

Lam, S. H., & Toan, T. D. Land Transport Policy and Public Transport in Singapore. *Transportation, 33*(2), 171-188.

Land Transport Authority. (n.d.). Overview of vehicle quota system. [online] Retrieved from: https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/vehicle-quota-system/overview-of-vehicle-quota-system.html [Accessed 30 March 2016].

Lindgren, E. (1998). Climate change, tick-borne encephalitis and vaccination needs in Sweden—a prediction model. *Ecological Modelling, 110*(1), 55-63.

Lindholm, M. (2010). *A sustainable perspective on urban freight transport: Factors affecting local authorities in the planning procedures*.

Lindholm, M. (2012). How Local Authority Decision Makers Address Freight Transport in the Urban Area. *Procedia - Social and Behavioral Sciences, 39*, 134-145.

Lindholm, M. (2014). Successes and Failings of an Urban Freight Quality Partnership – The Story of the Gothenburg Local Freight Network. *Procedia - Social and Behavioral Sciences*, 125.

Lindholm, M., & Behrends, S. (2012). Challenges in urban freight transport planning – a review in the Baltic Sea Region. *Journal of Transport Geography, 22*, 129-136.

May, T. (2011). *Social research : issues, methods and process*: Maidenhead : Open University Press, 2011, 4. ed.

McHale, M.R., McPherson, E.G. and Burke, I.C. (2007). The potential of urban tree plantings to be cost effective in carbon credit markets. *Urban Forestry & Urban Greening*, *6*(1), pp.49-60.

McKinnon, A. (2009). The present and future land requirements of logistical activities. *Land Use Policy, 26*(Supplement 1), S293-S301.

Miljödepartementet. (2009). *Sweden's fifth national communication on climate change : under the United Nations framework convention on climate change*: Stockholm: Fritzes: Ministry of the Environment, Regeringskansliet, 2009.

Millenium Ecosystem Assessment. (2005). Ecosystems and Human Well-being. [online] Retrieved from: http://www.millenniumassessment.org/documents/document.356.aspx.pdf [Accessed 30 March 2016].

Mindali, O., Raveh, A., & Salomon, I. (2004). Urban density and energy consumption: a new look at old statistics. *Transportation Research Part A: Policy and Practice, 38*(2), 143-162.

Moser, C. A., & Kalton, G. (1971). *Survey methods in social investigation*: London : Heinemann, 1971, 2. ed.

Mueller-Dombois, D. (1992). Potential effects of the increase in carbon dioxide and climate change on the dynamics of vegetation *Natural Sinks of CO2* (pp. 61-79): Springer.

Muñiz, I., & Galindo, A. (2005). Urban form and the ecological footprint of commuting. The case of Barcelona. *Ecological Economics, 55*(4), 499-514.

Muñuzuri, J., Cortés, P., Onieva, L. and Guadix, J. (2011). Estimation of daily vehicle flows for urban freight deliveries. *Journal of Urban Planning and Development*, *138*(1), pp.43-52.

Niemelä, J., Saarela, S.-R., Söderman, T., Kopperoinen, L., Yli-Pelkonen, V., Väre, S., & Kotze, D. J. (2010). Using the ecosystem services approach for better planning and conservation of urban green spaces: a Finland case study. *Biodiversity and Conservation, 19*(11), 3225-3243.

Noss, R.F., LaRoe, E.T. and Scott, J.M. (1995). *Endangered ecosystems of the United States: a preliminary assessment of loss and degradation* (Vol. 28). Washington, DC, USA: US Department of the Interior, National Biological Service.

Osborne, S. (2002). *Public-private partnerships: Theory and practice in international perspective*: Routledge.

Russo, F., & Comi, A. (2011). Measures for Sustainable Freight Transportation at Urban Scale: Expected Goals and Tested Results in Europe. *Journal of Urban Planning & Development, 137*(2), 142-152.

Russo, F., & Comi, A. (2012). City Characteristics and Urban Goods Movements: A Way to Environmental Transportation System in a Sustainable City. *Procedia - Social and Behavioral Sciences, 39*, 61-73.

Silverman, D. (2013). *Doing qualitative research*: Thousand Oaks, CA : Sage Publications, 2013, 4. ed.

Stanley, J. K., Hensher, D. A., & Loader, C. (2011). Road transport and climate change: stepping off the greenhouse gas. *Transportation Research Part A: Policy and Practice*, *45*(10), 1020-1030.

Taniguchi, E., Thompson, R. G., Yamada, T., & Van Duin, R. (2001). *City Logistics. Network modelling and intelligent transport systems*.

Taniguchi, E. (2014). Concepts of City Logistics for Sustainable and Liveable Cities. *Procedia - Social and Behavioral Sciences, 151*, 310-317.

Tuan Seik, F. (2000). An advanced demand management instrument in urban transport: Electronic road pricing in Singapore. *Cities, 17*(1), 33-45.

Urban Access Regulation. (2015). Urban Access Regulations in Europe. [online] Retrieved from: http://urbanaccessregulations.eu/userhome/map [Accessed 20 February 2016].

Van Duin, J. H. R., & Quak, H. J. (2007). City logistics: a chaos between research and policy making? A review. *Urban transport XII-urban transport and the environment in the 21st century*, 135-146.

Vieira, J. G. V., Fransoo, J. C., & Carvalho, C. D. (2015). Freight distribution in megacities: perspectives of shippers, logistics service providers and carriers. *Journal of Transport Geography*, *46*, 46-54.

Vierth, I. (2013). Why do CO2 emissions from heavy road freight transports increase in spite of higher fuel prices? [online] Retrieved from: http://www.diva-portal.org/smash/get/diva2:780491/FULLTEXT01.pdf [Accessed 18 February 2016].

Waddell, P., Ulfarsson, G. F., Franklin, J. P., & Lobb, J. (2007). Incorporating land use in metropolitan transportation planning. *Transportation Research Part A: Policy and Practice*, *41*(5), 382-410.

Whelan, R. J. (1995). *The ecology of fire*: Cambridge University Press.

World Bank. (2014). Transport Overview. [online] Retrieved from: http://www.worldbank.org/en/topic/transport/overview [Accessed 20 March 2016].

Appendix

Appendix I: Interview Guides

Public Sector

1. What are your roles/responsibilities in urban freight transport planning?
2. How does the urban freight transport is planned today, in term of planning of land being used for freight and urban traffic control?
3. What are the problems of urban goods transport or city logistics in term of efficiency have you seen so far, what are the recent projects or plans you are doing recently regarding sustainable urban goods transport?
4. Regarding to the measures or restrictions for goods transport, what are the current measures that we use to control the city traffic, and also to tackle with environmental impact from goods transport in the city?
5. How do you perceive about collaborations between national, local authorities and transport sector (e.g. freight operators, service providers,…) what are the opportunities and difficulties have you seen from the collaborations?
6. What are you doing currently for sustainable city goods transportation (incl. goods traffic planning, traffic control, and green area in the city)?
7. How the urban land-use is planned for goods transport in the municipality (e.g. parking places for freight vehicles, investment on transport infrastructure,…)?
8. What are the barriers for the sustainable development in city goods transport have you seen so far?
9. What is happening recently in urban ecosystem services in Sweden?
10. How do you think about the relationship between ecosystem services and transportation, how are they interacting with each other?
11. In your opinion, how should the efficient urban transport and logistics look like in order to sustain urban land-use and ecosystem services, and how does it help in sustaining urban ecosystem services?
12. What are the drivers of ecosystem services development and deterioration?
13. How can we maximize urban development while maintain or reduce the impacts on ecosystem services?

Private Sector

1. Mainly what are the characteristics of goods you are handling on road transport?
2. What is the main type of vehicle you use in city distribution, and source of energy?
3. What are the characteristics of delivery (e.g. time of delivery, amount of deliveries, how many trips per day, distance of the trip,…)
4. Could you share some experiences of the current situation of urban freight transport (e.g. the urban traffic, transport routes,…) and also some examples of frequently occurring problems in urban deliveries, how does it affect the transport performance?
5. What is the company doing recently for sustainable urban freight transport?
6. In your opinion, what are the barriers or obstacles for the company to tackle with the environmental issues in urban freight transport, and how local authorities should help or support in this area?
7. What are the opportunities and challenges that you see from this collaboration?
8. According to several studies and perspectives from local authorities, they have pointed to the same direction that they want to promote the concept of urban consolidation center to reduce environmental impact from freight transport and able save urban land-use space, how do you think about this concept?
9. What are the examples of opportunities and challenges that the company experienced during the collaboration, and how to overcome those challenges?
10. Could you please roughly explain what are the roles of different members in the organization?

Appendix II: Categorization of interviews

Category	Sub-category	Statement	Source
Traffic	Problems	"Stockholm is a very large city so there's a terrible traffic situations…if it's only 40 kilometers from the airport to the city it might, depending on the traffic situations, take like an hour or two hours to get there."	(Respondent 2, 2016)
		"It is hard to find a space to park and, mostly, people park in double lines, within the cities it is hard to distribute things because of the traffic situation. It is a lot of cars, hard to find a space to park the car or the delivery truck; I think it's all the time difficult for the delivery companies."	(Respondent 2, 2016)
		so on they don't respect of the loading zone so there are some areas where are only made for off loading goods and so on like off loading zone and pick up zone, sometimes you find other cars that are parked in these places and you have difficulties to find places where to off load the goods."	(Wennborg, 2016)
	Cause of problems	"This is very interesting because we haven't been working with these issues in a systematic way, not like for car parking places, that's an issue that we have. We have a very strict strategy for, how it's working and how it should be and what it costs and everything but for heavy trucks, we don't have a systematic approach, we don't have a plan, we don't have a regulation for that in a way that if we have a street like this we should have three loading zones, we don't have any guidance…we don't have anybody going out looking at them, you know changing them if they need to be changed and moving them if they need to be moved."	(Hanander, 2016)
		"No plan in our national plan on transportation and so on. We're targeting this problem that urban freight is very important to work with but we haven't done more than that yet."	(Berg, 2016)
		"They [municipalities] work for themselves but they work together with us too…I'm trying to plan how our role in that work, our national transport administration, what's our role in the urban freight planning in the cities, but we are not there yet."	(Berg, 2016)
		"I think most people today agreed that we have to do something, we can't continued to do the same way that we've done for so many years…so thing has to be done, what it is I don't really know but there's a great impact, of course, and most government in Sweden try to reduce using of the cars, of course, but probably the government don't do as much as they should, really."	(Respondent 2, 2016)
	Public/Private reactions	"There are some challenges in using electricity vehicles, for example, because they currently are too small, looking at our profile of shipments. We need vehicles that can handle larger volumes and the existing electric vehicles are usually too small, which mean that it will be too inefficient. We'd have to have 3 or 4 electric vehicles to match one diesel vehicle in capacity, and currently it's more expensive invest too so there is a financial but also production limitation to use electric vehicles at the moment. We watch this closely and I know that there initiatives globally within the DHL business that are looking into electric vehicles."	(Kalbacker, 2016)
		"There're still some areas in Stockholm, and Göteborg and Malmö have bad air. So it's still a problem but I don't know really how to tackle this, we can use small electric vehicles but they're still very small vehicles, we still have to use larger trucks even for city distribution."	Respondent 3, 2016
		"If you just change the fuel or if you have biogas cars, you have an electric vehicle and so on, then you will not have this climate change impact from the transportation, but the problem is that many, at least, Swedish municipalities are planning just to change the fuel and then they think that everything is okay, but then once again you have the problems of a lot of traffic will take more places in the cities, which mean that more traffic, perhaps less green areas, and ecosystem services."	(Johansson, 2016)
		"We try to optimize our routes so our vehicles are loaded as much as possible. Of course, the truck load depends on the geographical area in which they operate where some vehicles has a higher fill rate and others a lower fill rate."	(Kalbacker, 2016)

	"We try not to have the empty run but sometimes that could happen and Stockholm is a big city with a lot of consumers that we're not producing so much, so then it's difficult to find the exports for the truck"	(Wennborg, 2016)
	"Our strategy is to have less traffic in the city center, which hasn't at its destination in city center. We have a lot of traffic which go right through the city center with the destination on the other side, this traffic we want to move outside the city and that's why we have built a freeway with municipality funding…we don't want to see a situation where every stores having 4-5 different lorries coming each day or each mornings, if we can divide the goods so, for instance one lorry can have deliveries for 4-5 stores instead, so packed them in a more efficient way."	(Orsing, 2016)
	"I think one of the most important things you have to invent new business model for the city in the future, new ways to distribute things, that's one of the most important area. I think the consolidation of goods is very important in the future, as a consolidation. Nowadays in big cities, different companies are driving their goods to many shops in the cities, I think you have to consolidate that to get more goods in every single truck, it's quite important in the future. It's very good way to make a system more energy efficient than driving several trucks..."	(Berg, 2016)
	"We are not totally satisfied because it was as we noticed after a while, a too short period of time, one year, we didn't get as many clients or customers as we wanted, we didn't reach the volumes that we wanted because, the shops didn't want to pay more... it's a barrier to get the shops to pay more to get the goods by the electric vehicles instead of the normal heavy trucks where they get from for free today."	(Hanander, 2016)
	"I can't really see how that should be done though. I mean we do everything we can to consolidate all the transport today. I mean when the goods arrived at the habour or the airport, so of course that would be stored at the airport because the customs regulations and that we have to transport that to the customers so in a way there is already the consolidation centre at the airport or at the habour. I can't really see how it should work really."	(Respondent 2, 2016)
	"We believe that it creates more waste, it creates more transportation, more complexity and does not benefit the customers. A company who are about to receive a shipment will have to travel to the consolidation points or someone has to transport it from the consolidation points to the customers, that is not optimal. There's no benefit for us, the environment or the customers to take everything to the consolidation point and from there distribute it. It is kind of the same as what we already do…"	(Kalbacker, 2016)
	"I know there are some governments or municipalities that have chosen to do that with their own goods and that's ok, but the risk is that they pick out some of the goods, and not all the goods, which means that even if they distribute their own goods in the same truck or the same delivery, it means that other actors like Postnord, Schenker, DHL will distribute the same area anyway because we have other customers close to municipalities. So that mean that there might be no less transport, it could be even worse"	(Respondent 3, 2016)
	"I think it could break-even definitely, but I'm not sure it's very profitable but as a municipality we should recognize that we have values, which are values that can't be quantified in money because they're qualitative values like fresh air, silence, whatever and I think as municipality, we may need to pay for that somehow, in the future, but that's long-term."	(Hanander, 2016)

		"It works fine as long as someone pays for that for the delivery, and I think so far Göteborg municipality has paid for it, for the solution. The problem is how could that be commercialized within the rule of competition, so that's the main problem"	(Respondent 3, 2016)
		"So a lot of the lorries companies are looking into the investment into gas, into vehicles, electric vehicle-driven vehicles…and that is what the future business is, combining all the freight and also the customers, a lot of logistical solutions regarding both sea freight, lorries and rail-road. So a lot of big companies in Helsingborg in logistics, they're also rail-road, lorries and sea, and make complete combine effort to the customers needing logistical services…I think we have to be more efficient on how we combine the freight and that comes back to using trains, using quay, using sea freight and using lorries, but using in a better and more effective way."	(Orsing, 2016)
		"It's very hard to say, I don't think today there's other options to transport goods, for example to and from city and the airport...it's hard to find any other solutions today. We do a lot of railways transport from Europe to Sweden, also trucks carrying goods if you could have more goods on railways, there will of course have lesser impact on the environment of course. But when it comes to distribution within the city, I can't see any other way really"	(Respondent 2, 2016)
		"We lack of information of different kinds of goods that are flowing in the city and the statistics of all goods, we have quite good information of goods between Sweden and European, EU and so on but we don't have information of what type of goods, how much of goods in the cities, national authorities just now see if we can have or get better statistics in urban freight in big cities, even in the medium-size cities, that's among the things we're working just now."	(Berg, 2016)
		"It is companies they don't want to get to know or get that statistics when they have to, it's secured. There is no legal way to get information of exactly what type of goods and the volume of it and the weigh of it and so on, we can't get it, it's own by the business, by the companies…it's confidential, yes. It's business confidential for them, they don't want to getting to ask...it's hard to get information, the companies they don't want to leave it to outer part."	(Berg, 2016)
		"The statistics is very important…we have to know exactly what type of goods in the city of Stockholm, or in the city of Göteborg, how it flows, which we don't have it now. We have no idea how much goods out and in from a big city just now we don't know."	(Berg, 2016)
	Alternative Solutions	"If they could support by giving some tax rebate or something like that for haulers if they are using environmental trucks then you'll see the possibility…when you can prove that it's more cost effective to have an environmental truck within the city, the you will see the possibility. So you will never invest in the environment if you will not get the money from investment…if they could support by giving some tax rebate or something like that for haulers if they are using environmental trucks then you'll see the possibility."	(Wennborg, 2016)
		"Maybe the cargos and the distribution cars can use that public lane for buses, it's the measure, the plan for future to let distribution cars, distribution trucks use the bus lane, for example."	(Berg, 2016)
		"It could be many solutions because mostly we are not allowed to distribute goods during the night time, I mean it could be noise but if you have silent vehicles, maybe electric vehicles, maybe might be allowed to deliver during night time, that would of course be work for the transport, for the traffic jam with that situation."	(Respondent 3, 2016)
		"I think that the biggest thing is that if it would be cheaper to go by bus, for example, more people will choose that and that would affect the traffic situation, definitely."	(Respondent 2, 2016)

Land-Use planning	Transport sector	"People want to have other thing in the cities, not urban freight, unloading or loading places and so on, that's more problems, in the future there will be more and more conflict…the cities will be more and more housing areas, shops in the cities, and that leaves no room or space for cars, either it's the truck or normal cars, I think, people want to walk and cycling."	(Berg, 2016)
		"We don't have any allocated investment in that way...we don't have an investment for that (heavy truck infrastructure) but we have for bicycle lanes and public transport, but for freight transport it's more part of the traffic system, so if we build a new road it's for the heavy traffic as well, it's not specifically for heavy traffic, it's for traffic in general, cars, that's how we work. And I guess that's another evidence of the fact that we are not working with heavy traffic in the same way as we do with the other traffic modes."	(Hanander, 2016)
		"When it comes to investment, you pay road, for public transport for cars, lorries and so on. It's always important that you weigh different areas of interest. In Helsingborg, we work a lot with environmental issues, so it's also important for us to have an efficient public transport as well…so buses have a high priority regarding investment, also bicycles road have a lot investment space in our budget…We'll invest more than 400 million SEK in high efficient bus line, rapid bus called Helsingborg Expressen, and this is incorporation with state funding with regional finding and municipality funding, and this Helsingborg Expressen, rapid bus will be almost like a tram with very big buses…by these investment we'll speed up public transport for about 30% of the inhabitants in Helsingborg. So that is the most important ideas that we're investing right now."	(Orsing, 2016)
		"You have other aspects in Sweden that you have market working region between where you can live in Helsingborg but you can also work in Malmö, or in Kritianstad, or in Hamstad, which make that, in someway, you are more or less forced to own or to use a car no matter what. No matter how do you plan an actual city, so you have a problem of that you are perhaps working in a different cities, which mean if you do not have good public transportation system, good train, good buses, then you take the car, and then it doesn't matter how you plan a city because you must have the car to go to work."	(Johansson, 2016)
		"We try to develop how we up on transport and freight, and one part is how we handle the city logistics because our town center is quite small but with a lot of traffic and narrow road. So, together with the city's canals, we try to find out how we could develop the logistics, material handling and daily goods deliveries to our merchants in a more efficient way…and one of the most important things is how we plan our city."	(Orsing, 2016)
		"So if you have people moving into a city, you have urbanization, and if you will not manage or handle the transportation to reduce or use of car traffic or car use then you will have in some way or another, a problem with infrastructure, which means that you take land, mean values and make hard infrastructure in form of asphalt, and that is a problem, I can see in many cities."	(Johansson, 2016)

		"You within a city perhaps prioritize, what transport mode will you have in the future, is it the car, or is it the bus, or is it bicycle, and then you must focus on future infrastructure or planning due to how you prioritize the infrastructure or transportation modes, we should say that we must reduce the car traffic, then we must plan for something different, you can't plan for everything because if you will have a lot of urbanization within the city, and we plan for cars, we plan for buses, we plan for bicycles, we plan for everything, do we have the space for that? I do not know, I'm not sure, so you must prioritize what transportation mode will be the future in this city."	(Johansson, 2016)
		"Helsingborg is international city and a lot of the lorries companies are hold international competition and we also have a lot of the equal means of transportation. We have a lot of European, Eastern-European companies which are active on the Swedish transport market and in many reasons they're doing in the illegal way but it's very hard to prove and it's very hard to fine those vehicles if they made something wrong and the city can't fine them. So, I don't think that is an effective way to do it. If we should be effective, we have to make legislation on national level."	(Orsing, 2016)
		"On paper it's really good, but in practice we don't have any follow up because the police in Sweden, at the moment, they have a problem with prioritizing the traffic because as I heard, no one in the police force wants to work with traffic anymore. So it's really a big problem because no one is looking after the heavy traffic because we can't do it because it's the responsibility of the police, and they can't do it because they don't have the resources anymore. So it's really a problem in that way, we can blame the police but it's not really a matter of blaming anyone, because it's more a matter of making it work but it's hard today because we have so many other issues that's more prioritized by the police in Malmö, we have social problems, and large social problems in some areas, then it's hard to prioritize the traffic."	(Hanander, 2016)
		"I wouldn't say the regulations so far are so tough so there are not any problems for the moment to find vehicles that could be in the city line but the I know that there might be harder restriction in the future and I'm quite sure that our haulers will need to adapt to the new regulations."	(Wennborg, 2016)
		"We are more sensitive to change as well because companies today when we are part of the European Union, can freely move even across the borders, so for instance decision making is made that are being important for lorries companies is the taxation on Swedish lorries companies is too high, they can easily move their trucks to Denmark, or to Germany or another country, or for in stance, today we have a lot of Swedish companies on the surface which are being made up of Eastern European lorries, so that's the way they're invading taxes and that's something we're more sensitive for today."	(Orsing, 2016)
	Urban ecosystems services	"We are a bit afraid that (urbanization) might mean that you take more and more of the green survives in the urban conglomerate into production into new roads, new houses and so on. And it's also a reason why we look at more and more at effectiveness when it comes to transportation so that we need less hard infrastructure for roads, parking places and so on."	(Respondent 1, 2016)
		"Now we have a challenge because now we need to have more houses and infrastructure, so actually I don't know there is two things working against each other, a better one as an environmental problem and ecosystem services is also on one hand, and the pressure from needing more infrastructures, more houses on the other side. And if we're looking these at the politicians at the moment they seem to be much more stressed about building new houses than to keep the green space, so we don't know, we'll see what happens."	(Respondent 1, 2016)

		"You cannot just built as you did yesterday, you must think what will happen in 50 years onwards, what happens if we take this area and just make some houses, some parking places, and then we lose green areas for that, and that is very interesting, I think that you must have an ecosystem discussion within this challenge because otherwise if we would have this in 50 years, that could be devastating and we could why didn't we take notice about the green values in the city, we have no green values we just have grey areas, we have houses, parking, and roads, we have nowhere to relax, we have no biodiversity in the cities, that it is threatening I think."	(Johansson, 2016)
		"So very often there is a conflict between hard infrastructure with green vegetation and also density of housing areas and vegetation, and especially at this moment when we were talking about that we need so many new houses to supply everybody with a flat or with a house that would be even more stress."	(Respondent 1, 2016)
		"When talk about actual urban planning, then I think that the economical factor weighs more than ecological factor, and that's a bit of problem."	(Johansson, 2016)
		"Ecosystem services have been implemented more and more into municipal planning, into urban planning, but also into registration but also in the country level. I were involved in one project financed by the Swedish Environment Protection Board and there we have investigated in how many city plans that ecosystem services are mentioned and we have compare over time period from 1960-70s until today, and we have seen the concept of ecosystem services are mentioned more and more in recent urban planning."	(Respondent 1, 2016)
		"People who live in a city, they're going to a park just to enjoy to the nice view, just to relax but they do not go to the park because of the biodiversity or whatever. So I think we must have that kind of information or a knowledge education just to know that when you are in a park, you can relax but also you can see these other more green values that the park or green will create."	(Johansson, 2016)
		"If you can find ecosystem services related to something that you have economic benefits from that is reducing the amount of water going to sewage plants or that has to be treated in a way then we can say that an artificial wetland for taking care of sewage plays a big role in ecosystem services with cleaning the water, reducing the amount of water but at the same time, it's a sponsor for biodiversity also makes the green areas which could be made for tourists and things like that…then you can calculate more or less the plus and the minus. We keeping the areas the green space and by turning it into a parking place what are the economic plus and minuses, it is where the ecosystem services comes into operation so to say."	(Respondent 1, 2016)
Collaboration		"This is something I have to do together with the market because there are different freight companies and we have the market share which we want to work together with it, not disturb the private market in the logistics sector, we want to work with them closely…so that is something we think about when we plan the city, how different needs and different interests can coexist and not disturb each other but in stead they can benefit each other"	(Orsing, 2016)
		"To work with environmental questions and issues, you have to collaborate…you can't act alone and I think you have to develop, the cars and trucks have to be developed and fuel has to be developed for the whole sector, not for one company or so."	(Respondent 3, 2016)

		“I'd say that it's the best for developing as collaborating you can do very much more together than you can do on your own. With the challenges that we have today it is essential that there is a collaboration among different organizations both within the public and private sector.”	(Berko, 2016)
		“I should say we need more collaboration in a lot of area even in urban planning because it's not only the municipality who owns, if you can say that, the urban planning, you have private companies who will build, you have commercial transportation companies, which can be a part of new areas and so on, I think collaboration is someway a key for sustainable city planning in the future.”	(Johansson, 2016)
	Drivers	“Generally, the drivers for the collaboration is that the members area from different fields and holders of various technical capabilities. With the infrastructural challenges within the transport area today it is a must to collaborate to develop the industry. It is also a question about doing things more efficiently together with others. I also believe that sharing different technologies, research and knowledge within their separate field is a big driver for our members…I'd say that KNEG works quite well as a neutral platform, to meet and to discuss and to learn about each other, about each others reality, difficulties and obstacles and how things work within different organization.”	(Berko, 2016)
		“When they listen to each other, I think they are understand that they must collaborate and find new solutions, they can't work on their own anymore. Efficiency is the driving force, you have to do in a more efficient, less expensive way.”	(Berg, 2016)
		“Opportunities are of course that we are different types of companies, we have truck companies, we have fuel companies, we have transport companies and so on…Volvo can make trucks or transport companies and fuel distributors can make fuels that all companies can use, that's I think collaboration is the main reason.”	(Respondent 3, 2016)
	Barriers	“It's a big challenge to collaborate, we have tried it for 20 years, I mean we have come no where, it's not easy…in the private companies they have their own business model that they don't want to change their own big business model but they have to do if collaborate and consolidate. Lots of companies have their own business models that they think their business model is the best, I think it's hard to talk to the companies and tell that you have to change…the transport administration and municipalities have to listen to the companies more, it's quite important too and we have to do things to be easy for them to build new business model, it's very important that too...it's easy to say but it's hard to do, you have to trust the other part and you have to open your own system, that's hard, that's another important thing I think.”	(Berg, 2016)
		“The difficulty is of course, some of the members are competitors to us...anyway we have enough level of openness between us, we accept that we don't tell everything about logistics. If regarding trucks and fuels, normally I think we don't have any secret for that, because we're all benefit from better cars, better trucks, better fuels.”	(Respondent 3, 2016)
		“One issue could be regarding political decision making within the transport area where there is a lack of long-term planning. As an example regarding fuel freight where in quite short-term period there is a political decision that supports a certain technique, however, development within that area results in a total change and support of a different technique. This is something that also KNEG's members are working for, of course, it affects infrastructural investments. So the use of ethanol is one example, as fuel which was preached politically today lacks support which can question future priorities within the area. This makes investments on a long-term basis hard.”	(Berko, 2016)