1. Literature review

This literature review is organized in three sections. The first section will answer the most fundamental question(s) of urban freight transport, namely the definitions, current trends and issues. The noble goal in urban freight transport (from societal and environmental perspective) is to reduce the level of emission, congestion, noise nuisance and motivate the stakeholders of system to join in taking preventative actions in order to increase the standards of a city. Current literature provides selection of mitigation strategies for the negative impacts of urban freight transport in cities. Among these strategies, two areas will be reviewed and identified research gaps will be discussed in the next sections. The second chapter will review consolidation centers and what type of consolidation schemes are used in the reality. The third chapter will discuss the most common policies and regulations applied in urban freight transportation. The last and fourth chapter will elaborate the collaboration phenomenon by providing various examples (i.e. Freight Quality Partnership, Logistics Pooling) in the context of urban freight transportation.

1.1. General issues in urban freight transportation

1.1.1. Definition and Overview

Urban freight transportation is concerned with the delivery and collections of goods in the urban areas such as cities, towns and suburbs. (European Commission, 2006; Crainic et al., 2004). Good flow comprises retail deliveries, waste disposal and returned products. Urban areas are the centres of various economic and social activities, such as living, working, leisure, production, travelling, and healthcare as well shopping. They are characterized by intense amount of commercial buildings, houses, high variety of streets, roads, bridges and railways (National Geographic, 2015). Approximately 80% of the populations live in the urban areas and this population is expected to increase. (Cherrett et al., 2012). Increasing population and economic growth are expected to trigger an increase in demand and supply of goods and services in cities, therefore flow of goods to and from the cities will increase in parallel. Road transportation is the most common distribution mode used in the urban areas and it takes the biggest share among other inland freight transport modes in EU. Latest available data show that the road transport accounted for 74.9% of the total inland freight transport -based on tonne-kilometres performed in EU.

UK is involved in the top ten countries where road freight transport is the primary mode with the rate of 87.1%. These statistics comprise the regional and inter-regional distribution of the goods by road however; this particular information can be adjusted in the case of urban freight transportation – not in terms of numbers but in terms of extensive usage of road transportation in urban context. In 2013, 303.7 billion miles were travelled by different types of road vehicles (cars, busses, trucks, vans) in the UK. 37% of the total miles were travelled in urban areas and 19.1 % of the total miles were travelled by goods vehicles (Transport Statistics Great Britain, 2014). Urban freight transportation concerns with the movement of things (excluding people) from, to and through the urban areas. Consolidation and short-term storage also became a part of the freight transportation in the urban areas. Urban freight transportation is a system, which several actors interact and they do not always aim for the same goals and objectives. These actors are divided in two main groups: public actors (including local

authorities, national authorities, residents, planning agencies, as well as visitors) and private actors (including shippers, receivers, and transport operators).

Private actors are generally driven by economic motivations such as cost efficiency, on-time delivery and on-shelf availability (Wygonik, Bassok, Goodchild, McCormack and Carlson, 2015). On the other hand, public actors are concentrated on increasing the livelihood of the urban areas. Various objectives, constraints and perspectives turn the urban freight transportation into a very complex system. Dealing with this complexity is important for both private and public actors as transportation create wealth on both public and private settings. In order to ensure the system's operability and efficiency, they should go beyond of acting as an independent entity actor and they should acknowledge each other's operational requirements and constraints (Ballantyne, Lindholm & Whiteing, 2013). Collaboration through not only public funding but also consultation, extended dialogue and innovation is the key for collaborative transportation planning and its continuity in the long term (Crainic et al., 2004). However, the development of such collaboration is still in its infancy era and there is no widely recognized scheme for collaborative planning of the transport activities in urban areas (Lindholm and Browne, 2013).

1.1.2. Different problems, perspectives and mitigation strategies for UFT

Freight transport in urban areas becomes crucial as it sustains the existing life style of the cities. Urban freight transport achieves this mission by enabling trade activities that produce the wealth in cities/countries and effecting cost of the good sold in a region by influencing cost of freight transport (Anderson et al., 2005; Cui et al., 2015). Despite of the economic contributions to a region, road freight transportation, it causes decent amount of air pollution (CO, CO2, NOx, PM10), noise nuisance, the use of non-renewable fossil–fuel, the physical consequences of pollutant emissions on public health, congestion, and the injuries and death resulting from traffic accident (Dablanc et al., 2011). There is no doubt about the fact that goods' vehicles are not alone in the traffic and they are not the only source of negative consequences. According to Lindholm and Blinge (2014), vehicles used for goods' distribution in urban areas cause approximately 40% of the total air pollution.

Shorter journeys, high stop frequency and high congestion levels cause higher level of fuel consumption and many negative impacts of freight transportation are associated with fuel consumption (Verlinde, 2015). Therefore, these negative impacts become more obvious in the eye of habitants and local authorities of the cities when it comes to the urban freight transportation. Decisions related to freight transportation are mostly made according to efficiency measures defined by freight carriers as trucking industry is a highly competitive one and transport operators are under pressure of some requirements that are put forward by their supply chain partners. Therefore, freight carriers will seek for reducing their costs due to the extreme competition while offering flexibility for their supply chain partners, and meeting service criteria by optimizing order delivery times and delivery time windows (van Laarhoven, Berglund & Peters, 2000; Dablanc, 2007; Osterle et al., 2015). Private actors have a significant role in contributing the development of trucking industry and increasing operational performance of their supply chain partners such as ensuring adequate supply at the stores (Osterle et al., 2015).

Technology, global competition and consumption cause significant changes in the shape of urban freight transportation. Increasing awareness on the sustainability issues forces all public and private actors to take actions for contributing to the environmental, economic and societal sustainability. Technological developments in goods' distribution vehicles brings new and more environment friendly devices such as electrical vans and cycles. Office depot (Browne et al., 2011), Binnenstadservice.nl (van Rooijen and Quak, 2009) and TNT Mobile Depot (Verlinde, 2015) are successful examples for the combination of electrical vehicles and consolidation centers. Despite of the successful applications, Pelletier et al. (2016) argue that it will take longer time for electrical vehicles to become a common vehicle for goods' distribution in urban areas. Financial incentives, electricity sources, technology infrastructure and associated costs are the influential factors on the maturity of electrical vehicles. Drones are another significant development in parcel delivery industry.

There is very limited amount of information about how the drone network will work but it becomes more apparent that these type of parcel delivery methods will trigger new discussions around the contribution of such method to the sustainability (Supply Chain 24/7, Accessed in 2016). Yet another development will occur in the logistics and supply chain trends and their relation with the urban freight transportations. Kant et al. (2016) anticipates that new collaborative models for city distribution need to be applied in urban infrastructures. The key initiatives will originate from city hubs, which will enable horizontal collaboration among transport operators as well as the receivers and redefine the role of all public and private actors involved. E-commerce and increasing rate of parcel deliveries will play major role in bundling the last mile in different consolidation schemes, in general supported by information and communication technologies. For instance, Bybox (2016) offers Click&Collect services for smaller businesses. Their operations are based on post boxes located on cities and an IT system where entire system is managed.

1.2. Urban consolidation centers

In this section, urban consolidation centers and other type of consolidation schemes will be analyzed. The first section provides the definition of urban consolidation centers and the actors who are involved in the consolidation schemes. Second section covers different type of consolidation schemes, which are compiled, from the existing studies. The third section explains motivation factors and barriers for the different actor when they consider participating in the consolidation projects. Discussion of this section will concluded by presentation of identified research gaps and research questions.

1.2.1. Definition and overview

Physical consolidation schemes are one of the popular partnership and collaboration platforms. Urban consolidation centers (UCC) are the most popular scheme that are applied and studied extensively since 1970s. Browne, Sweet, Woodburn & Allen (2005) completed one of the most detailed analysis of UCCs. They define a UCC as (p.3) "a logistics facility that is situated in relatively close proximity to the geographic area that it serves be that a city centre, an entire town or a specific site (e.g. shopping centre), from which consolidated deliveries are carried out within that area." In addition, various value-added logistics services can also be provided at the UCC such as off-site stockholding, inventory management, consignment, unpacking, preparation of products for display (including hanging, ironing and labelling), goods return and

waste collection services (Allen, Browne, Woodburn & Leonardi, 2014). Later, new aspect has been added to this traditional definition by Allen et al. (2014) which states that the goods are carried from UCCs to their final destination by environmentally friendly vehicles such as electric and gas-powered goods vehicles, or electrically-assisted cycles. UCC projects were developed as a response to the increasing sustainability concerns especially related to the environment and society's wellbeing (Allen, Browne, Woodburn and Leonardi, 2012).

Consolidation in general is crucial as it helps reducing the distribution costs by increasing the loading rate of the vehicles and this can be achieved by consolidating small shipments. The vehicles circulating within Europe scored 24% empty running. As distances, get shorter rates of empty running increase (Verlinde, 2015). Freight transportation in urban context is also characterized by low loading rates. Therefore, consolidation in urban freight transport recognizes as a mitigation strategy that are generally initiated by public actors (Munuzuri, Larraneta, Onieva & Cortes, 2005). Why are the public actors willing to initiate urban consolidation solutions? Because urban areas are struggling with problems such as vehicle congestions (leading to delays), insufficient parking provisions, prioritizing pedestrians and air pollution (Allen et al., 2012). Under these circumstances, consolidation schemes enable actors of urban freight transport to mitigate some of these negative impacts on environmental and societal sustainability. It can be achieved by decreased travelled vehicle km, increased vehicle utilization, decreased number of vehicles used, potential for using renewable energy, enabling multi-modal transportation and decreased unloading times are the most worthwhile benefits that consolidation centers can offer (Allen et al., 2014). Local authorities, shippers, receivers, transport operators and residents of a city can be recognized as the stakeholders of a consolidation scheme. Each stakeholder is motivated to be involved in a consolidation scheme.

1.2.2. Types of consolidation centers

The definitions, majority of the motivation factors and barriers described were compiled from the studies that focus on classical UCC schemes. However, alterations in the consumption patterns of society, commercial trends, sustainability requirements, and local and national policy trends make developing different types of consolidation schemes in the urban areas. The table 1 summarizes different type of consolidation schemes identified in the literature and actively working examples from different parts of Europe.

Table 1: Variation of urban consolidation centers

Type of consolidation scheme	Definition	Real life application
Classical urban consolidation/distribution centers	A logistics facility that is situated in relatively close proximity to the geographic area that it serves be that a city centre, an entire town or a specific site (e.g. shopping centre), from which consolidated deliveries are carried out within that area	The La Petite Reine Model (France, active); La Rochelle (France, active); Chronopost (France-active), Padua (Italy-active), Parma (Italy-active), Milan (Italy-active), L'Hospitalet de Llobregat (Barcelona-active)
Urban logistics zones (Railway stations, inland ports, wholesale markets)	These dedicated zones are places near their clients and provide transshipping and short storage services before the delivery	Presented in Boudoin et al. (2014) as a conceptual center.

Logistics hotels	Multi-purpose buildings that involves offices, restaurants etc. Consolidation, storage, transshipping as well as parking and maintenance are the services offered in these establishments	Porte de la Chapelle, Paris (in progress)
Vehicle reception point	Places created to provide secured access for operators to manage their deliveries and/or pick-ups during defined period of time	Presented as a part of the Logistics Hotel in Porte de la Chapelle, Paris, France (Boudoin et al., 2014)
Good reception point	These points can be set up at the points where topological or functional barriers prevent vehicles to reach	GS1 Norway (active)
Urban logistics boxes	The interface between the carrier and the customer without any human presence needed in the transshipment place	DHL Packstation (Germany-active)
Mobile depots	A Mobile Depot is a trailer fitted with a loading dock, warehousing facilities and an office. The trailer is used as a mobile inner city base from where last-mile deliveries and first-mile pick-ups are done with electrically supported cyclo cargos.	Brussels (Pilot test), Office Depot (London-active)

Urban consolidation centers are widely acknowledged in the European countries. France and Italy are two of the leading countries that establish different consolidation centers. Different cities establish different type of consolidation centers. Wide variation of the consolidation centers originates from various features as well as various requirements of cities. Diversity of consolidation centers are also related to urban planning measures, urban structure (land use) and commercial, industrial and administrative characteristics of urban areas, and local administration.

1.2.3. Motivation and Barrier Factors to join a consolidation centers

Certain strategic, tactical and operation factors can influence the actors' decisions to participate in a consolidation scheme. Either these factors motivate them to be involved in projects or set barriers to take a part. Following sections present motivations and barriers, which are taken into consideration by local authorities, shippers, transport operators and receivers. These factors are compiled from existing studies; later I categorized them based on different actors considering their roles within urban freight transportation operations. Motivational factors are listed throughout the text and table that categorizes the factors are shown in the Appendix A.

Motivations

Consolidation projects offer solutions for improved last mile delivery and ideas for mitigating the negative impact of the transport activities in urban areas. These solutions generally seek to

balance environmental, societal and economical concerns of different actors. These concerns can motivate the actors of urban freight transportation for designing and being involved in consolidation projects. Namely, shippers, transport operators, receivers and public authorities can share the same motivation factors that affect their participation decisions in a projects. It is important to mention that the residents living in the urban areas are excluded. This is because they are not regarded as a primary actor in consolidation projects. Instead, the residents can benefit from less number of vehicles in the traffic, improved air quality and increased accessibility for other vehicles and pedestrians. It is identified that similar motivation factors can be appealing for more than one actor. More common factors indicate that the participating actors show stronger will to seek a common ground for being involved in a project. Identified motivations concentrate on economic, environmental and operational issues. Among all identified motivations, economical issues dominate the decision making process. This can be interpreted in two ways: First, actors (specifically private actors) require ensuring financial viability of the project during long term period of the projects. Second, impacts of consolidation activity on environmental and societal sustainability appear as outcomes of the project, namely, even though environmental and society related concerns are influent on the decision making process, they are not extensively mentioned as popular as economic motivations.

Financial support and land support from local authorities is one of the frequently mentioned motivations, which becomes essential at the beginning of the projects (Morana, et al., 2014). However, subsidies from local authorities become drawbacks for many UCC projects in the past as these projects cannot create a successful economical plan and they have been terminated when local authorities became unable to support the projects (Kin et al., 2016). Initial investments for project set-ups is a primary constraint in consolidation projects. On the other hand, Allen et al. (2014) argue that cost of initial investments as well as fees can be covered through store cost savings, reduced product losses, increased sales, increased product range, and quick replenishment. Resource sharing is another economical motivation especially for transport operators. Resource sharing allows participants of the consolidation project to share existing facilities, equipment and labour force instead of doing investments in these resources as individual companies (Gonzalez-Feliu, 2012). Sharing these particular resources will not only reduce certain cost items but also it will increase operational efficiency because actors such as retailers benefit from know-how in tracking &tracing, inventory management, management of returned goods, and waste handling (Marcucci et al., 2008; Morana et al., 2014; Allen et al., 2014).

Empty running is one of the significant economical obstacles in urban freight transportation. Improper consolidation, increasing rate of small parcel deliveries to residential and business addresses, and strict delivery windows (i.e. nominated day deliveries, next day deliveries) cause empty running. Consolidation schemes help to increase the vehicle utilization and enable cost savings by allowing the mix of full truck load and less than truck load modes of shipment (Ulku, 2012). Another identified motivation factor is relevant to the receivers (i.e. retail shops in city centres), who are rarely mentioned frequently in consolidation studies. Consolidation centres can be used for short or long term warehousing operations. Shifting the more expensive storage costs from receivers' limited shop spaces to the less expensive centres' rent cost outside the city centre –due to a less centralised location, public subsidy or other cost sharing mechanisms- (Lin et al., 2014). Also, warehousing facilities in urban consolidation

centres can produce convenient service at a lower price than individual central facilities (Marcucci et al., 2008).

Economic motivations are followed by environmental motivations. Environment related motivations are mentioned as frequent as economic motivations in the literature. Consolidation schemes enables the usage of electrical vehicles, bikes and cargo cycles for last mile distribution and decreases the number of heavy-duty vehicles in the traffic (Marcucci et al., 2008; Browne et al., 2011). They have low environmental impact compared to the vehicles with internal combustion engines and can help increasing air quality in urban areas. Also, environmentally friendly vehicles occupy less space on the streets which are already overwhelmed by other vehicles. In addition, efficient consolidation enables transport operators to perform unloading in shorter period of time, which indicates to the reductions in total kerbside time and space occupied while making on-street deliveries (Browne et al., 2011; Allen et al., 2014). The next motivation factor is related to waste management. Consolidation centres can play active role in improved waste handling and return services (Allen et al., 2014). This can be done in cooperation with the local authorities.

The next set of motivation factors is related to the operational adjustments. These adjustments indicate to the pre-haulage and post-haulage operations of transport operators as a result of being involved in consolidation schemes (Kin et al., 2016). Any benefits that can be obtained from using consolidation schemes and help improving business performance, become effective when transport operators are in the verge of decision making. Consolidation projects help strengthening business connections in the market and enabling business developments of the actors (Morana et al., 2014). Consolidation projects aim to bring as many partner as possible in order to reach the threshold demand. Conflict of interest can become inevitable in this case when competitors or organization with conflicted objectives gather under the same roof. However, adoption of regulation for fair competition can help tackling problems arising from conflict of interest and motivate organization to be the part of consolidation projects (Zhang et al., 2013).

In addition, consolidation schemes trigger can enable horizontal collaboration among transport operators by increasing the coordination. It can enable horizontal collaboration among retailers too by promoting some agreements that allows retailers aggregate their orders during last-mile distribution (Marcucci et al., 2008). Yet another motivation factor that can adjust operation performance is to provide value-added services. These services are frequently mentioned as a crucial part of consolidation schemes. Based on the type of consolidation schemes, portfolio can vary such as scrap retrieval, tracking & tracing, off-stock holding, consignment, unpacking, preparation of the products for display, goods return, waste collection, and price labelling (Marcucci et al., 2008; Allen et al., 2014). Value-added services offer benefits to the receivers by reducing their on-site space requirements, saving time by reducing the tasks that have to be performed on-site (Triantafyllou et al., 2014). Moreover, consolidation schemes can offer İncreased delivery reliability by consolidating number of trips performed by multiple carriers to form single trip with better capacity usage (Verlinde et al., 2012; Morganti and Gonzalez-Feliu, 2015).

Barriers

Despite of many motivation, literature identifies many critical issues that appear as barriers in front of initiating consolidation projects. They make to join in a consolidation project less appealing for the actors. Identified barriers are found to be more relevant for four actors (excluding residents), namely local authority, shippers, transport operators and receivers. Very few barriers have been identified that are relevant to all four actors. First and foremost, major amount of initial investments for infrastructure, facilities, and human, technical resources and additional costs caused by additional handling operations in consolidation centres are mentioned as primary barriers (Verlinde et al., 2012; Janjevic et al., 2013; Morana et al., 2014; Nordtømme et al., 2015; Kin et al., 2016). Even tough local authorities are willing to subsidy the cost of establishing a consolidation scheme; they still want some fundamental issues being cleared before starting the projects. This is mainly because financial subsidies will not last forever and they will be withdrawn as soon as project become less efficient and less profitable. Lack of higher customer density (lower shipping volume through UCC) and insufficient volumes that ensures the viability of UCC are two most significant barriers in front of realising the consolidation projects (van Rooijen et al., 2010; Gonzalez-Feliu et al., 2014).

Conflict of interest among different organizations make the management of operational responsibility difficult. Unclear contractual documents and disputes related to ill-defined responsibility become barriers when organization try to solve conflicts (Morana et al., 2014; Olsson and Woxenius, 2014). Lack of proper definition of responsibilities can lead to difficulties in distributing possible costs and benefits which potentially can be obtained from consolidation projects (Olsson and Woxenius, 2014; Nordtømme et al., 2015). In some cases, even tough projects manage to solve these issues, certain competition laws do not allow certain organizations to work together (Marcucci et al., 2008) and do not allow to share commercial information related to customers and volumes with the other organization in the same potential projects (Nordtømme et al., 2015).

Yet another barrier can originate from the resistance of individual companies for making changes in their routines. Because, possible changes that transport carriers will make in their distribution schemes can result in poor service quality (Morana et al., 2014; Olsson and Woxenius, 2014) or potential habitual changes in practices and in policies of individual companies (especially transport operators) can result in loosing direct link to their customers as freight will go through consolidation centers (Janjevic et al., 2013; Morana et al., 2014; Nordtømme et al., 2015). Moreover, product types can become one of the barriers. This barrier can appear in two different circumstances. First, certain legislations can forbid the loading of a vehicle with products of different sort or when dealing with the competition regulations that can limit the development of sharing approaches (Morana et al., 2014). Second, physical and organisational conditions can breach freight compatibility (in terms of dimensions, type of packaging, stock units, need for specific loading/unloading equipment) and make impossible to load certain product together (Morana et al., 2014).

In conclusion, consolidation projects should aim to bring as many participants as possible in order to ensure the viability of the project, because projects need to gather certain amount of finance, assets and knowledge. The correct combination of participants will not only guarantee the viability of the project but also will attract the attention of the market and make potential participants. For instance, Binnenstadservice is a consolidation /distribution centre project from

the Netherlands, which solely focus on the receivers (small/medium size retailers), rather than the carriers. Identification of the target market enables the project initiators to make better planning during the initial phase of the projects (van Rooijen and Quak, 2010). This helps actors to understand each other's barriers.

1.3. Regulatory measures for urban freight transportation

This chapter elaborates the policies and the details of these policies, which are applied by the local authorities in order to regulate freight transportation in urban areas. The first section will explain why certain policies are needed to regulate freight transportation. In the second sections, the most common freight policies, which are discussed in the existing literature, will be elaborated from multiple actors' perspectives. Namely, the issues regarding applied policies, where certain actors obey the cost of policy actions and other actors obtain economic, social and environmental benefits, will be explained. The last section will pose identified research gaps and research questions that offer room for further research.

1.3.1. Overview

The main concern of the authorities on local levels are to make a city more liveable for the citizens who are in need of fulfilling their basic needs and for the ones who live in the city to experience it (Osterle et al., 2015). These actions create a decent amount of material flow to, from and through the city as well. Freight transportation is fundamental to enhance the quality and liveability, and to sustain the existing life style (Anderson et al., 2005; Lindholm, 2012). On other side of the coin, goods' transport has substantial negative impacts on the local air quality, limiting accessibility of pedestrians as well as other vehicles, health and safety of other road users, use of resources and cost of governmental regulation and planning of the freight transport in urban areas (Verlinde, 2015). All the negative impacts and necessity of creating a sustainable in the cities put a lot of pressure on local authorities. In the end of the day, they bring regulatory measures into the action both for organizing the traffic related issues and for meeting the sustainability objectives.

Urban freight transport is an equation with multiple variables and constraints. Local authorities need to consider many subjects at the same time in order offer powerful solutions to the problems of urban freight transport. Different structures of logistics systems, different patterns of customer demand, transportation prerequisites are some of the subjects that local authorities should be considering while incorporating with the other urban transport subjects such as public transport and urban planning (Lindholm and Blinge, 2014). Urban freight transportation takes its place in local transport strategy and planning very rarely compared to the attention given to the passenger transport (Lindholm, 2012). So far, many policies have been brought into the action with positive intentions on reducing negative impacts of the freight transportation, however these policies sometimes were gathered from different local authorities without considering particular characteristics of the city and the attributes of materials flow. According to Lindholm and Blinge (2014), local authorities do not share their experiences; therefore, they cannot gain enough understanding to solve the problems efficiently. Most common local policies are low emission zone, time access (or time window) restriction, road pricing, congestion charging, emission control for vehicles, weight restriction limited traffic zone, vehicle load factor controls. In addition to these policies, there are other application that are developed by public-private initiatives; they are kerbside loading facilities,

loading/unloading bays, night time deliveries, off-peak delivery hours and quiet delivery schemes. The following table identifies the relevant studies that discuss existing policies and initiatives and it shows studies which elaborate policy and consolidation topics together.

1.3.2. Existing Urban Freight Transport Policies

Urban freight transportation is regarded as a local issue by the local authorities and they become responsible for the intervention of negative impacts that are caused by the freight transportation (OECD, 2003; Quak, 2008). Local authorities aim to minimize the negative impacts on the environment and society by putting forward some regulatory and preventative actions. Expect some big scale cities such as London, Bristol, Amsterdam, New York, Rome etc., it is hard to find an integrated urban freight planning into the local transport planning. This indicates that local authorities do not emphasize to develop efficient solutions for the freight distribution in urban areas; instead, they intend to apply very strict regulations that cause operational and economic inefficiencies for mostly the private actors of urban freight transportation (Quak, 2008). Each single local authority tends to handle their own issues related to urban freight transportation. This means that a certain service provider, which operate in different cities of the same country, needs to adjust their operation based on different application of the same regulation (Dablanc, 2007). Transport operators are able to develop their own solutions to deal with the regulations applied in particular regions. However according to Quak (2012) local authorities do not recognize these solutions due to the fact that they address a regional focus and do not specifically target the problems in urban scale. If transport operators can manage to communicate their problems which are arising from counterproductive regulations on local levels and demonstrate their ability to produce sustainable solutions for urban freight transport, local authorities can propose more comprehensive and timely regulations.

Proposing up-to-date regulations and making regular follow-ups on the performance of the regulations will enable local authorities to find a balance to meet the expectations of all actors involved (Munuzuri et al., 2005; Lindholm and Bilinge, 2014; Marcucci, Gatta and Scaccia, 2015). It becomes more important that local authorities should align with the speed of change in cities as well as dynamics of urban freight transportation and adapt their policy-making strategies. However, wheels of collaborative transport planning are turning slowly for the freight transportation industry instead local authorities are more into the identification of problems related passenger transportation (Cui et al., 2015). Existing literature provides many evidences about the stakeholders that benefit from applied policy and regulations and other group of stakeholders who need to bear the cost and performance implications. In the next sections, four policies will be discussed based on the existing studies in the literature. These policies are the most popular and the most extensively studied policies in the literature.

Time window restrictions

Time window restrictions is one of the earliest policies that has been applied extensively in European countries such as Netherlands and Italy (Quak and Koster, 2007; Quak and Koster, 2009). This policy aims to keep the trucks away from the city centres during specified period of the day. Society can get benefit from decreased disturbance, congestion, noise and increased accessibility to the city centres during they rush into the city centres for working, shopping or as a tourist. However, retailers will be affected by time window restrictions negatively as they will be forced to change their vehicle routing due to mismatch between their distribution

planning and policy's requirements. In addition, parallel time windows in different cities will increase the number of delivery routes and this will increase the number of vehicles kilometres, which will result in increased emission levels.

The Netherlands is one of the countries that apply time window restrictions extensively. Quak and Koster (2007; 2009) identified that duration of time window length affect environment and cost for retailers. If the length of time windows is decreased, this will reflect on retailers' distribution cost, total driving time as well as emission levels. Shortened length of time windows will result in increases on distribution costs of retailers, total driving time and emission levels. Decreased length of time windows will result in increased emission levels as time window restrictions affect the vehicle routing plans and will force transport operators to make longer number of vehicles kilometres.

Akyol and Koster (2013) did a similar study in the Netherlands. They look for policy scenarios, which will balance distribution cost of the retailers, municipalities' satisfaction and emission levels. They also confirmed that tight windows limit to short delivery periods which cause higher distribution costs and higher emissions levels. Time window restrictions, which force transport operators to make deliveries during evenings and nights, cause inefficiencies also. This type of deliveries cause increase in unloading times, increase in drivers' wages and decrease in residents' satisfaction. Considering the fact that transport operators make their deliveries in multiple cities, negative impacts of time window restrictions become more obvious as different cities will have different ways of implementation. Both studies mentioned the harmonisation of the policies among different cities. According to Akyol and Koster (2013), the scenarios, where time windows overlap partially and tight time windows are applied in certain number of cities; have higher efficiency compared to more overlapping scenarios. Therefore, harmonised time windows will lead lower costs for retailers and lower levels of emission.

Low emission zones

Low emission zones (LEZ) restrict polluting vehicles from entering a defined area and it focuses on the vehicles with higher emissions (Urban Access Regulations in Europe, Accessed in 2016). Low emission zone finds great acceptance in various European countries and its history goes back until 1990s. United Kingdom, Germany, Czech Republic, Austria, Italy, Netherlands, Belgium and Denmark are some of the countries that implement LEZ. Some of these countries such as Sweden introduced LEZ in late 90s for public transportation busses (Browne et al., 2005b). The motivation behind of this policy is to improve air quality for the habitants of a particular city/country. According to European Commission, air pollution causes 310 000 premature deaths in Europe each year and this number is bigger than deaths caused by road accidents (Urban Access Regulations in Europe, 2016). LEZ requires the vehicles to be suitable for Euro Standards, which are identified by European Union. The aim is to minimize three main air pollutants; these are emissions of fine particles (PM_{10} and $PM_{2.5}$), nitrogen dioxide and (indirectly) ozone.

Dablanc and Montenon (2015) concluded that LEZ affected the urban freight industry and caused reduction in the number of transport operators in the case of London and Berlin. It is interpreted in two ways; first of all, LEZ pave the way of modernization in vehicle fleets where companies switched from less environmental friendly vehicles to the ones which fit into the

Euro Standards (Ellison et al., 2013; Tretvik et al., 2014; Dablanc and Montenon, 2015). Second, natural selection that is aroused from LEZ enabled small firms to be involved in the urban freight market without breaking labor laws or disobeying safety standards (Dablanc and Montenon, 2015). More outcomes that are successful are obtained from London; according to Dablanc and Montenon (2015), it occurred due to successful planning of the public authorities where they informed transport operators well in advance. A previous study done by Browne et al. (2005b) tested behavioral responses of the transport operators towards LEZ implementation in London. Majority of the transport operators were willing to work under LEZ scheme via purchasing new vehicles, operating unsuitable vehicles with the policy in places that are out of the LEZs, and switching to the vehicles that are not subject to the regulations (Browne et al., 2005b; Tretvik et al.2014). Only few respondents mentioned that they would accept paying the fines and would not do any alteration in the current state of their operations or vehicle fleets (Tretvik et al., 2014).

Shippers and receivers do not feel the pressure of LEZ regulations as much as transport operators do feel. Tretvik et al. (2014) tested the responses of various stakeholders towards LEZ. Shippers and receivers are mainly sensitive to the cost of shipment and the price changes reflected to the cost of shipment, which may occur due to public policy and regulations. However, Tretvik et al. (2014) identified that very few operators passed the increase in their own cost (due to LEZ) on the cost that are given to their customers, while the other operators intend to absorb the increases caused by LEZ in their profit margin. However, Quak and van Duin (2010) mentioned that this situation may be changed in the long term if transport operators would not consider finding other ways to keep their cost in balance by avoiding peak hours, training for eco-driving or optimizing their routes. In addition to the economical pros and cons of LEZ, Ellison et al. (2013) found out slight improvement in the air quality of areas in and near LEZs, where concentration of PM_{10} and NO_x decreased.

Road pricing and Congestion charging

Road pricing is established to reduce the congestion via pricing the use of road infrastructure at specific times of the day. Prices can vary depending on congested time or on the certain vehicles. Road pricing is a type of policy, which is enforced for not only the heavy goods' vehicles but also public transport vehicles as well as private cars. Road pricing does have extensive usage in many European countries as well as in the USA such as Sweden, Denmark, UK, Germany, Spain, Italy, Poland, Brussels and New York. Road pricing can enable reduction in congestion for other road users, pedestrians, carriers, improvement in traffic flow and faster travel times as congestion in expected to be reduced. However, transport operators need to bear the costs and it is likely that they reflect these costs on the customers' prices. Holguin-Veras (2010) studied common misconceptions and possible mitigation plans for dealing with the consequences of road pricing.

According to Holguin-Veras (2010), carriers can react to road pricing policies in three ways: (1) Changing the amount of use of the facilities (2) Transferring the costs to the customers' prices and (3) Taking possible actions to gain increases in efficiency and productivity. Changing the customer prices will be prevented by the fact that freight transport industry is under pressure of considerable competition. Switching deliveries to the off-hours delivery times has been proposed as a mitigation strategy to avoid negative impacts of the road

pricing policy. However, off-peak deliveries increase the operation cost for both carriers and receivers as some variable cost items will increase such as wages of the drivers and workers. Thus, Holguin-Veras (2010) proposed that authorities offer some tax incentives to the private actors to make off-hours deliveries more attractive and possible to use.

Quak and van Duin (2010) tested behavioral changes of the transport operators in the Netherlands against the future road pricing policies. The responses varied based on whether the transport operators work as for-hire carriers or as private carriers. They intend to react on two different ways without doing any changes in their operations; for-hire carriers will pass the cost on to their customers and private carriers will absorb the costs in profit margins. Transport operators and receivers will need to find more innovative ways to tackle the disadvantages of road pricing in the future. This is mainly because the current time window restrictions and road pricing bring transport operators to a deadlock. They would be forced to make deliveries during the morning rush hours and have to pay higher charges as strict time window regulations would not allow them to make deliveries during the time when charges are relatively lower. In order to avoid the disadvantageous situations, carriers and receivers seek for long term solutions such as increasing vehicle load factor, delivering the goods to a UCC which is located in a nearby city, and switching to off-hour (or night time) delivery schemes.

Off-hour (Off-peak hours or Night time deliveries) deliveries

Off-hour deliveries aim to remove goods' vehicles from the urban areas and shift the deliveries to the off-peak hours in order to improve road safety and ease congestion. While society get certain benefits due to change in delivery times, transport operators and receivers need to bear certain complexities while distributing the goods. Existing studies provides various perspectives on off-hour delivery schemes from all around the world. Holguín-Veras et al. (2011) found that pilot applications of off-hours delivery schemes can reductions in costs and improvements in delivery conditions and staff utilization because of increased reliability in delivery times in New York. However, Verlinde (2015) argued that there is an uncertainty about the impact of nighttime deliveries on total cost of logistics. This is mainly because nighttime deliveries make a significant contribution to, for instance, wages of the drivers or workers working at the receiver's facilities.

Verlinde (2015) also argues that different stakeholders have different preferences regarding nighttime deliveries. According to the study done in Brussels, receivers do not prefer getting the deliveries during the night time in order to avoid extra cost of working over-time (Marcucci et al., 2015). On the other hand, transport operator prefers making the deliveries between 7 pm – 7 am. It is because during this time of the day, carriers can avoid other chargers and restrictions such as road charging, congestion charging and time window restrictions. Society agrees on the nighttime deliveries in case the vehicles would meet certain noise standards. In addition, ByBox (2016) proposed that consolidation schemes and nighttime delivery schemes could be combined successfully. The solutions offer electronic lockers boxes for deliveries to the addresses of smaller businesses. It aims to decrease the number of unattended deliveries in the addresses and the negative impacts that these unattended deliveries caused such as congestion, transportation cost of extra visits and increased emission levels.

1.4. Collaboration in the context of urban freight transportation

Collaboration does not have a place as a stand-alone topic in the of urban freight transportation literature. However, the current application in the urban freight transportation can be recognized as collaborative practices. Also current trends in research makes statements about regarding the need for collaboration in working operations between the actors, who are actively involved in urban freight transportation. The first section will convey some observations about how collaboration is elaborated in the urban freight transportation literature and what collaboration examples exist. Second section will propose identified research gaps and questions that need to be raised for future research.

1.4.1. Overview and Aspects of Collaboration

Urban freight transportation is characterized by certain measures, such as average delivery rates, types of business, types and location of stores, deliveries by day of the week, deliveries by time of the year, type of the vehicles for core goods' deliveries and back-loading, dwell time of the core goods' delivery, location of unloading, supply chain type, delivery scheduling, vehicle routing, and courier operations (Cherrett et al., 2012). These measures and related decision making processes turn urban freight transportation into complex and heterogeneous system. Actors involved in urban freight transportation is one of the key factors that drives this complexity and heterogeneity (Allen et al., 2010). New trends in private and public sectors, technological innovations in distribution as well as in supply chain management push some private and public actors to consider collaborative strategies in order to share certain responsibilities, increase operational efficiency and to reduce some cost items (Gonzalez-Feliu et al., 2013; Blanquart and Carbone, 2014). Collaboration is a popular phenomenon in supply chain and logistics literature, which extensively elaborate communication, information sharing, strategic alignment, and process integration among upstream supply chain partners. However, especially urban freight transport does not consider collaboration as a stand-alone concept even though many concepts discussed earlier such as consolidation schemes implemented extensively in many places (Gonzalez-Feliu and Morana, 2011). Actors comprise a set of companies and authorities, which are pursuing for different objectives and goals. Apart from the context, success and/or failure of collaboration efforts heavily depend on understanding what drives the behavior of different actors. Information about such driving forces and criterion become crucial for collaborative transport planning (Stathopoulos et al., 2012).

One of the most significant examples of collaboration in urban freight transportation context is Freight Quality Partnerships (FQP). This is a concept, which has been originated in the UK in 1996, and it creates freight transport partnerships among public and private actors (Allen et al., 2010). The main aims of FQPs is to (1) increase understanding about needs of freight transport industry, (2) to provide centralised contact for consultation among different actors, (3) to obtain economic, social and environmental benefits by agreeing on achievable actions and (4) to offer a venue for delivering the solutions as well as the results (Establishing FQPs, 2006). In the UK, most common type of FQPs is the partnership that aim for entire city or town. After local authorities, freight transport associations, road transport associations and freight transport companies are the most common types of members in FQPs (Allen et al., 2010). A survey has been done among FQPs in the UK in 2009. Three most important achievements of FQPs are listed as follows (1) Offering a venue for improved communication

and discussion (2) providing substantial understanding about the nature of freight transportation issues and (3) offering information provision such as creating freight maps and freight guidance (Allen et al., 2010).

UK is not the only country where FQPs take place, Sweden and the Netherlands are others examples in where FQPs can be observed. Lindholm and Browne (2013) identified three elements of successful partnership. The first element is the formation, relevant stakeholders and objectives are identified at this stage. Management is the second element, which specifies the details of meetings, project management principles and action plan. The last element is the outcome. Outcome stage is related to the dissemination of knowledge, consideration of business propositions, and offering solutions from multiple perspectives. Later, Lindholm (2014) published a follow-up study where Gothenburg's FQP has been evaluated based on these three elements, and failures and success factors. According to Lindholm (2014), FQPs that are lacking concrete outcomes, important stakeholders, long-term plan with the clear objectives and steady information flow to the relevant stakeholders, are eager to fail in the partnership as it occurred in the case of Gothenburg's FQP.

Beginning from early 2000s, collaboration platforms and different means of partnership among public and private actors became a phenomenon. These partnerships were established through physical consolidation schemes and other forms of public-private partnership such as FQPs (Verlinde, 2015). Today, active examples of the physical consolidation schemes and FQPs can be found in different parts of Europe, for instance, France (La Petite Reine, Chronopost), Italy (Milan, Padua, Vincenza), the Netherlands (Binnenstadservice.nl), London (Office Depot-Micro Urban Consolidation Center) (van Rooijen and Quak, 2010; Browne et al., 2011; Gonzalez-Feliu et al., 2014; Allen et al., 2010). Despite of some successful examples of collaboration through consolidation and partnership schemes, today's urban freight transport systems are still suffering from lack of integrated freight transport planning. There are two major reason for this; first, local authorities did not emphasize urban freight transportation as much as public passenger transportation in their transport strategies (Lindholm, 2014). Second, negative impact of the trucking industry on sustainable city life are taken as impediments for environment and public health (Gammelgard, 2015) and this situation strength the hands of public actors to apply compelling municipal measures (Ville, Gonzalez-Feliu & Dablanc (2013). Main barriers in front of a successful integration initiatives are generally related to financial concerns and stakeholder acceptability (Nørdtomme et al., 2015). Collaboration comes as natural part of various urban freight transportation measures as public and private stakeholders need to agree on working together in a collaborative manner for efficient freight transport planning. Urban freight transport does not produce its own collaboration phenomenon yet such as VMI or CPFR. However, there are topics that are rising as potential venues for future research. In conclusion, it can be argued that if private and public actors would be given the chance of participating each other's decision making processes by consultation, information sharing and co-operation, public actors can design their policies with better attributes and private actors can become more willing to join sustainability efforts of public actors. The question of which issues national and local authorities should focus on for balancing local concerns and the requirements for sustainable material flow requires further investigation.

1.5. Summary and identified research gaps

UFT is a system, which several actors interact and they do not always aim for the same goals and objectives (Behrends et al., 2008; Verlinde, 2015). Various objectives, constraints and perspectives turn the urban freight transportation into a very complex system. In order to ensure the system's operability and efficiency, actors should go beyond of acting as an independent entities and they should acknowledge each other's operational requirements and constraints (Ballantyne et al., 2013). Despite some successful examples of collaboration through consolidation centers and partnership schemes (i.e. Freight Quality Partnership), today's UFT systems are still suffering from lack of freight integrated planning in the local transport strategies, therefore effective mitigation strategies are not offered on local levels. There are two major reason for this; first, local authorities did not emphasize UFT as much as public passenger transportation in their transport planning (Lindholm, 2014). Second, negative impact of the trucking industry on sustainable city life are taken as impediments only when it gets formal complaints from the locals of an urban area (Gammelgaard, 2015).

There is a significant difference between local authorities, which adopt UFT focused policies, and local authorities do not adopt policies also considering UFT related problems in urban areas. The latter mention sustainability (environmental, financial, and societal) concerns and its connection to freight transport, however discussion remain limited mainly because their transport strategies do not provide any plans for mitigating problems arising from freight transportation in the cities. For instance, UCC is one of the useful mitigation strategies and a concept that are supported by local authorities for its advantages on enabling more efficient freight flow in urban areas. However, it has been noted in the literature as well as local transport strategies, local authorities have difficulties in recognizing other requirements of initiating a UCC project than financial requirements. Lack of recognition resulted in failed UCC projects because local authorities couldn't offer financial support for projects any longer. However, more sophisticated planning may offer better results in initiating feasible UCC projects. It has been identified that supporting UCC with freight policies and including other public and private stakeholders (i.e. chambers of commerce, freight quality partnerships, retailers, freight carriers) in projects may succeed working business models. However, existing knowledge does not provide any information about how local authorities implement UFT policies and what kind of cultural and political factors bound decision-making processes in local authorities.

Collaboration through not only public initiatives but also consultation, extended dialogue and innovation is the key for freight conscious transportation planning and its continuity in the long term (Crainic et al., 2004). However, there is no widely recognized scheme for collaborative planning of the transport activities in urban areas (Lindholm and Browne, 2013). One of the efficient ways of developing collaboration is to harmonize different private-led and public-led initiatives together. In order to increase the understanding and make contribution to the collaboration concept, consolidation centers and regulatory policies will be investigated together from system perspective in order to evaluate whether, as complementary initiatives, efficient mitigation strategies can be offered if consolidation centers are harmonized with the correct set of policies or not.

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