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Urban freight transport from a local authority perspective – a literature review

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Abstract

On the path towards sustainability for the urban area, local authorities make decisions that affect freight transport. However, in many ways, urban freight transport is a neglected issue. The purpose of this paper is to map out the current status of urban freight transport research from a local authority perspective. A literature review is performed, looking through research in urban freight transport during the last 15 years. The review presents a large amount of references and it is clear that the area of urban freight transport has gained a larger interest during the later part of the time period studied. Research mainly focuses on freight measures (pilot actions) performed in an urban context, but the local authority perspective is lacking in many aspects. The review shows some areas that local authorities need to consider when working with freight transport in the urban area, according to the literature: measures; monitoring and evaluation; performance indicators; transfer of knowledge between cities/countries; and, stakeholder involvement.

Keywords: Urban freight transport, literature review.

1. Introduction

It has been concluded in many research projects that there is a problem with freight transport in urban areas (e.g. Behrends, 2011; Browne et al., 2007b; OECD, 2003; Quak, 2011; Zunder & Ibanez, 2004). However, goods are an important facilitator of everyday life and the economy of urban areas (Anderson et al., 2005; OECD, 2003; Ogden, 1992; Quak & de Koster, 2006). Urban transport is not sustainable. The situation is serious and requires action by governments, communities and businesses (Low, 2003). Towns and cities in Europe generate 85% of the gross domestic product (GDP) in the European Commission (2007). Throughout Europe, a majority of the population lives in urban areas, and in Sweden, this number is 85% (SCB, 2008). Congestion, noise, emissions and traffic menaces contribute to the total urban experience. The transport activities are increasing in urban areas, but they are also needed, since goods deliveries are needed to service businesses and persons in the urban area. Urban mobility is an important facilitator of growth and employment, because mobility of persons and goods is essential to the smooth functioning of the economy. However, increased traffic in town and city centres has a strong negative impact on

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sustainable development. A number of health researchers demand stricter restrictions on air quality in European urban areas, on the grounds that citizens are entitled to clean air (Brunekreef et al., 2012). Furthermore, one in three fatal accidents happen in urban areas (European Commission, 2007). Along with decreased possibilities to store goods in the shops for retailers, in line with more expensive costs for urban retail areas, the freight transport increases. At the same time, certain demands on the freight transport to deliver within a short time window could increase the risk that the same amount of goods are delivered on more vehicles.

According to several studies done in different cities, private cars outnumber light- and heavy-goods vehicles (LGVs and HGVs) (Schoemaker et al., 2006). While freight transport only represents from 10% to 18% of the vehicles in cities, it nevertheless accounts for 40% of air pollution and noise emissions (European Commission, 2006). The majority of products shipped into urban areas are produced outside these areas. These products consist of many different components, which are assembled from different areas around the world and shipped from various locations to customers in urban areas. There are also goods produced within urban areas that must be transported inside the area or out from the area. Waste, bulk transport and service transport, i.e. transport activities in close relation to the provision of a service such as maintenance of products, are other goods flows that exist in the area.

In 2003, the OECD presented results from an expert working group, showing that there is a lack of awareness and knowledge by the general public and local authority, a lack of data and dissemination from pilot actions and solutions implemented, a lack of long-term perspectives and there is too little communication and co-operation between stakeholders and cities. Much has happened within the field of urban freight transport during the last decade and it is now a bit higher on the agenda for many local authorities (e.g. Cherrett et al., 2012; Stathopoulos et al., 2012). But, many measures performed do not last after external project funding, e.g. through EU projects, has ended (see, e.g. Quak, 2011). Local authorities do not know how to regulate and control freight transport, and the regulations implemented often increase the transport costs and environmental impacts without the local authority having an understanding of urban freight transport (Dablanc, 2007). The first known regulation on urban freight transport is recorded as early as the first century BC, by Julius Caesar, who banned commercial deliveries and pick-ups during daylight hours in the city of Rome (Quak, 2008). However, this failed due to complaints of noise from the citizens and it could be noted that this is not a new problem (Holguin-Veras, 2012). Similar regulations, i.e. time windows, are still among the most common actions taken by local authorities in order to control or reduce the negative sustainable impacts of freight transport (Quak & de Koster, 2006).

Freight transport is, from a local authority side, seen as a "business problem" (Dablanc, 2007), which more or less fixes itself since there is an economic interest in doing so. This is partly true, since there are no heavy vehicles or goods transport systems that are in the area just driving around for fun. There is an interest from the transport operator's side, amongst others, to have an as efficient transport as possible. But, the possibilities to perform an efficient transport are sometimes in conflict with, e.g. regulations on infrastructure or the transport of people. To avoid these conflicts, and to create an urban environment with good conditions for all types of necessary transport operations, the local authorities need to consider aspects of both people and freight in the planning processes. Furthermore, little attention has been given in the research to

how specific policy measures are affecting goods movements (Allen et al., 2003), and it is not clear how the movements of urban goods should be developed into sustainability or how the system should be dealt with and changed (van Binsbergen & Visser, 2001). This is still true, and there is a need for more analysis in order to understand the implications of changing the practices and outcomes of urban freight transport measures (Patier & Browne, 2010).

The purpose of this paper is to map out the current status of urban freight transport research from a local authority perspective. A literature review is performed, looking through research in urban freight transport during the last 15 years. The method for the literature is described, followed by a discussion of the complexity of urban freight transport, highlighted by many of the definitions found in literature. Thereafter a discussion of the sustainability perspective of the research is followed, which is the main objective for most research projects within the field. How to include freight in local authority transport planning is discussed with five different sub sections identified as important throughout the literature: different measures and how to address them; evaluation and monitoring of urban freight transport; models and simulation tools; transferability of knowledge; and, including stakeholders in the process. The stakeholders are important, and have been addressed in several research studies, why they have been addressed in a separate section, followed by the barriers and drivers for working with urban freight transport. The paper concludes with a short presentation of the main findings.

2. Method

The purpose of a literature review is to condense the existing literature in a field and from this identify areas in which further research would be beneficial (Rowley & Slack, 2004). A synthesis of existing knowledge, to highlight key references in the topic area have been important to be able to develop existing theories and to get a broad understanding of the topic. The aim was to find relevant literature in the field of sustainable urban freight transport, but also regarding neighbouring aspects in order to compare and discuss the field with a broader perspective due to the complex nature of e.g. stakeholder involvement in processes.

Multiple channels were used to find relevant literature regarding urban freight transport planning, urban freight and sustainability connected to urban freight. For academic papers and reports, searches within academic databases were performed; Science Direct (www.sciencedirect.com); Scopus (www.scopus.com), Emerald (www.emeraldinsight.com) and Abi Inform in ProQuest (www.proquest.com). To reach broader, Google scholar (scholar.google.com) was used as well as reviewing references of relevant papers. Books, reports, journals, conference proceedings and theses available on the Internet were used in the literature review. Links within CORDIS (cordis.europa.eu), literature and Google were used to find Internet pages for projects and consultancy reports. Books and scientific papers that are not in full published or in other ways unavailable online have been ordered through a library.

Table 1 Example of number of hits in one search of (sustainable) urban freight transport[1].

Search engine	*Search term*	*Hits*
SCOPUS	Urban freight transport	238
SCOPUS	Sustainable urban freight transport	38
SCOPUS	"Sustainable urban freight transport"	2
SCOPUS	"Urban freight transport"	24
SCOPUS	"Sustainable freight transport"	43
Abi Inform	Urban freight transport	219
Abi Inform	Sustainable urban freight transport	4
Abi Inform	"Sustainable urban freight transport"	0
Abi Inform	"Urban freight transport"	1
Abi Inform	"Sustainable freight transport"	2
Emerald	Urban freight transport	219
Emerald	Sustainable urban freight transport	37
Emerald	"Sustainable urban freight transport"	0
Emerald	"Urban freight transport"	2
Emerald	"Sustainable freight transport"	2

Search terms were obtained primarily from the purpose of this paper and the search for literature have been limited to the last 15 years (1998-2012), even though some important references from earlier research have been included in the review (e.g. for definitions of urban freight transport). Some search terms were used in combination with other terms related to the subject. Some keywords from related references were also used to reach the appropriate references (e.g. transport planning, city logistics, urban distribution, vehicle restrictions, transport policy, policy measures, urban freight demonstration project, transport + urban form, urban transport solutions, evaluation urban freight, indicators urban freight, goods movements). Table 1 presents a sample from the result of the search for (sustainable) urban transport during the literature review. More than 400 abstracts were checked for their relevancy, but since the area of sustainable urban transport is broad, there has been a need for delimitations. Five notes are made regarding this:

- Only literature related to urban freight projects are considered. This excludes references that handle only passenger or people. However, there are references included which have both perspectives that are found relevant for this review.
- There are only references included that handle European cities or European perspectives.
- Only literature from 1998 and forward are considered.
- Regarding language there are only references in English and Swedish considered in selecting process.
- References which consider following categories were excluded:
  - Predicting the impact of new logistics services or urban transport projects
  - Evaluating or impact assessment which are related to fuel or vehicle technologies

[1] This table represents a search made in autumn 2010.

- Evaluation and impact assessment of current urban infrastructure or land use
- Simulation models
- Fuel technologies
- Vehicle technologies
- ITS

A wide search for literature has been performed in the study. A quick analysis of the references was first made by looking at an abstract or similar and thereafter included or excluded from the review. Taking the search terms, the purpose and the delimitations into considerations, there were finally 346 references categorised in the review, see Table 2. However, for the writing of this paper, a number of papers are included in the analysis due to their relevance for the specific topic of urban freight transport related to the local authority transport planning process. The references have been well spread over the years, but there is a noticeable increase during the last decade.

Table 2 Category of references.

Type of source	*Number of references (N=346)*
Journal paper	206
Conference proceeding	15
Book	8
Project report/pamphlet	71
Governmental report/document	16
PhD theses	20

3. The complexity of urban freight transport

Goods are important for the quality and liveability of the urban area, since without goods transport, there would be no shopping, no offices, no restaurants, etc. Goods transport is a driver of the urban economy but also an issue that is important from an emissions perspective, where statistics show that freight transport has an important role regarding sustainability, where Dablanc (2007) shows that goods movements corresponds to 16% to 50% of the emissions of air pollutants, depending on the pollutant considered, by transport activities in a European city. Furthermore, vehicles serving urban delivery operations are a well-established contributing factor to urban traffic congestion and increasing atmospheric pollution (Yannis et al., 2006). Four out of five European citizens live in an urban area and are therefore immediately affected by the quality of the urban environment (European Commission, 2005). An urban area, a city or a metropolitan area is not just a collection of buildings and sufficient infrastructure to support those buildings; each is very much dependent on the relationship between different stakeholders in the area or those somehow connected to the area. Cities that want to compete in the globalised economy need to have the right mix of assets and effective transport services in order to succeed (Docherty, 2004). Freight transport is a part of the many different transport operations performed. Cycling, walking, public transport and private car use are among the means in use. During a day, most of the transport operations performed involve moving people from one place to another. This is what we see and notice when we walk around in an urban area. However, both people and freight need to use the same infrastructure.

There are differences between urban distribution and other types of goods movements, since the prerequisites are different in the urban area compared to the

infrastructure between terminals outside urban areas. The infrastructure is often different with smaller roads, barriers like one-way streets, possible regulations for HGVs, etc. There are also unbalanced flows in the urban area, where a high quantity of goods is transported into the urban areas, but much less is transported out – with ordinary distribution vehicles. Most goods are either consumed within the area or transported out from the area as garbage or by private cars or other ways by the consumers of the goods. But, there are also opportunities for distribution in urban areas that do not exist in other areas since distances are often short and the consignments often small, which makes it possible for distribution of goods by smaller vehicles, or even bicycles. There is also a possibility to use new types of specific urban consolidation centres and other types of innovative measures.

Urban freight transport is not a static situation. New establishments constantly arise that need transport support within an area as well as external establishments, e.g. external shopping centres, which affect the consumption and consumer behaviour within the city centre. Consumers change the behaviour in ways of shopping whereas e-commerce is taking a larger amount of the market share. There are as well developments in vehicle technology and the technology used to improve a single route or shipment, which affects the outcome of urban freight transport. Urban freight is affected not just by the size of the urban area, but also by the urban form: commercial and land use patterns; the strategic organisation of product supply chains in terms of the location of warehousing facilities; and the fact that the logistics management of road freight operations is affected by geographical location, land use patterns and trade imbalances (Allen et al., 2012).

A problem noticed during several years of study within the topic of urban freight transport is that there are a large variety of definitions of the topic. There are similarities between those concepts but little coherence in how they are used. In the following section, some of the most commonly used concepts will be presented with an explanation of urban freight transport, which is used in this study. An urban area consists of a city centre together with suburban areas. “Urban freight”, “city logistics” and “urban distribution” are terms used for goods movements in a city or urban area. “Freight” is the carriage of goods and sometimes the term “goods transport” is used for the same purpose. The term “distribution” is used for the last part of the supply chain, where the goods reach the consignee. City logistics seem to be the main phrase used when coming to European Commission (EC) projects or authority-initiated projects, whilst urban freight and distribution terms are used more in research.

Hicks (1977) gave a very early definition of urban freight transport as “…all journeys into, out of, and within a designated urban area by road vehicles specifically engaged in pick-up or delivery of goods (whether the vehicle be empty or not), with the exception of shopping trips” (p. 101). This, which is the first definition to the author’s knowledge, focuses merely on the pick-up and delivery operations but has little in the way of limitation regarding those. Lacking, though, is, as for most definitions used, the “hidden” logistics like services and construction deliveries that also have another purpose than only pick-up and delivery. To the author’s knowledge, shopping trips by persons are excluded from most definitions.

Some decades later, the following definition of “urban goods movement” was even more simplified, and described as “…being concerned with the movement of goods (as distinct from people) to, from, within, and through urban areas” (Ogden, 1992, p. 14). This is a good and comprehensive definition. In contrast to the previous definition by

Hicks, it could be possible to interpret the inclusion of shopping trips in the above definition, since that is movement of goods, even though performed by a private household. Later definitions have become more detailed and specific, depending on what perspective the author takes or how detailed they need to be for a specific context.

Eiichi Taniguchi, who is one of the founders of the concept of "City Logistics", defines the topic as follows: "City Logistics is the process for totally optimising the logistics and transport activities by private companies in urban areas while considering the traffic environment, the traffic congestion and energy consumption within the framework of a market economy" (Taniguchi et al., 2001, p. 2). This definition has some limitations, considering that only private companies are taken into account and therefore no transport activities performed by the authorities are included. Further, it does not concern emissions, just energy consumption. However, the main problem with the definition could be the word "city", which in many cases implies, or is by stakeholders interpreted as, the central business district of a city whilst in many cases it could be an adjacent area or the total urban area that is considered in urban freight transport or is of interest for measures.

Ogden (1992) acknowledged that the private sector accounts for a majority of the goods movements in the urban area, but that the public actors have an important role to play. OECD (2003) acknowledges goods transport as a fundamental component of urban life. Every day, citizens consume and use goods – food, clothes, furniture, books, cars and, computers – produced by people throughout the world. Urban goods transport enables citizens to have access to these products wherever and whenever they require. Several other authors also give the same explanation (e.g. Anderson et al., 2005; Ogden, 1992; Quak & de Koster, 2006). The OECD (2003) defines urban goods transport as "the delivery of consumer goods (not only by retail, but also by other sectors such as manufacturing) in city and suburban areas, including the reverse flow of used goods in terms of clean waste" (p. 19). This definition excludes considerable goods traffic flows in urban areas – such as goods transported through urban areas (through traffic), building and demolition traffic, the provision of industry with raw materials and semi-manufactured articles and the provision of wholesale trade – that are specifically excluded by the OECD, hence, limiting the urban goods movements to just a small proportion of the total urban freight movements. A more general definition of urban freight, which includes those flows, from an actor's perspective is given by Dablanc (2008) as:

Urban freight is defined as "the transport of goods carried out by or for professionals in an urban environment". This definition does not include shopping trips made by households with their automobiles but it does include home deliveries made for them by professional delivery operators. Freight traffic crossing the urban territory without delivering goods (freight in transit) is also included, as are vans, which account for about half of the deliveries made in a city (p. 248).

With this definition, Dablanc (2008) states that the movement of goods represents approximately 10–15% of the vehicle kilometres made in the urban area. However, this definition also has limitations since it does not specifically include or exclude waste or building (including services) and demolition traffic. The delivery of consumer goods within the urban area is only part of the whole logistics chain and one identified problem with the understanding of freight transport in urban areas is that there is a lack of statistics and knowledge regarding goods movements (Cherrett et al., 2012). A UK study has taken some statistics from a number of surveys undertaken during a period of

15 years, showing amongst other factors that LGVs (vans) represent 42% of the delivery activity and that a high street business could get up to 10 core goods and 7.6 service visits per week during non-peak periods, concluding that service operations cannot be neglected (Cherrett et al., 2012). These numbers could of course vary between different countries as well as between cities, but still need to be taken into consideration in terms of how freight and service vehicles are handled.

4. The aim of sustainable urban freight transport

Sustainable urban freight transport, or rather the sustainability of urban freight transport operations, are, or should be, the main aim for each local authority in their work with freight transport in the urban area. However, the greatest interest should be in the process of how to reach that aim. Today, the fact is that the classic focus on city planning does not fully include goods (Sjöstedt, 2007), and often excludes part of the problem, which includes the demand for transport operations and accessibility to logistics facilities. Therefore, this section will handle both sustainable urban freight transport and how transport planning processes of today appear to local authorities when they identify within what areas there is a need to look deeper.

4.1 What is sustainable urban freight transport?

Historically, to work with logistics means mainly to consider minimising cost and maximising efficiency. Both of those aims can lead to minimising environmental impacts, but this is not given as a specific criteria. To reach sustainability, the parameter of minimising environmental impacts should be included. Logisticians have a good opportunity to work with environmental aspects, since they have the possibility to overview all the links in the supply chain (Murphy et al., 1994). The term sustainable development first gained major prominence in the report "Our Common Future", which is also known as the Brundtland Report, published by the World Commission on Environment and Development. Its definition of sustainable development is still widely used today: "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 54).

The aim of a sustainable transport strategy is "to answer, as far as possible, how society intends to provide the means of opportunity to meet economic, environmental and social needs efficiently and equitably, while minimizing avoidable or unnecessary adverse impacts and their associated costs, over relevant space and time scales" (UK Round Table on Sustainable Development, 1996). Reaching sustainability is often discussed in terms of the triple bottom line with the three dimensions, society, economy and environment, all three of which need to be considered equally to reach sustainability. This could also be referred to as the triple-P: planet, profit and people, and Quak (2008) summarises how freight transport affects the sustainability for those three in urban areas:

- Impacts on the planet: pollutant emissions, the use of non-renewable natural resources, waste products and the loss of wildlife habitat.
- Impacts on people: physical consequences of pollutant emissions on public health, injuries and death resulting from traffic accidents, the increase in nuisance, reduction in air quality and damage of buildings and infrastructure.

- Impacts on profit: inefficiency and waste of resources, decrease in journey reliability and delivery punctuality, potentially resulting in less service to customers and lost markets, decrease in economic development and, congestion and decreasing city accessibility.

Richardson (2005) identifies five consequences as indicators of transportation sustainability: safety, congestion, fuel consumption, vehicle emissions and access. There is a risk in approaching just one of these indicators with the belief that the others will remain constant, since they are interdependent and are affected by one another. However, with a lack of good guidelines of how to grasp the complexity, it is hard for the local authorities to do so. To reach sustainable urban freight transport, there are key factors that need to be taken into account. Allen and Browne (2010) identify some key issues to be addressed as follows (p. 287):

- Vehicles making deliveries should impose as few social and environmental impacts as possible.
- Planners (from urban, city, municipal or local transport authorities), freight transport companies and other businesses must co-operate to ensure that these objectives are met.
- Urban planners may need to influence or control the movement of goods vehicles.
- Transport companies must optimise operational efficiency to reduce traffic congestion and environmental impact.
- The types of policy measures required depend on factors such as:
  - the economic, social and environmental objectives of the urban authority;
  - the level of freight transport and other road traffic; and
  - the size, density and layout of the urban area.

Urban freight transport plays an essential role in meeting the needs of the citizens, but at the same time contributes significantly to the non-sustainable effects on the environment, economy and society. Guiding principles are needed to handle this, and the three pillars of sustainability, mobility and liveability could constitute basic guidelines for providing a strategic basis for planning and managing urban goods movement systems (Taniguchi et al., 2004). If external effects are calculated, the social cost for emissions from freight transport in urban areas could be quite high due to the numbers of people that are affected. Sustainable development activities today mainly focus on passenger transport at the local authority level. Freight transport is considered a phenomenon exclusive to the private sector on both the supplier and user sides, and is driven by business economic parameters (Dablanc, 2011). According to Crainic et al. (2004), public authorities are not concerned about the operations of private firms. Consequently, they state that freight transport at the city level is still poorly understood, not quantified and lacks any methodology specifically aimed at the analysis and planning of freight movements. Since freight transport is mainly business-to-business, as mentioned, models cannot be worked out without a public-private understanding and co-operation. A combination of company-driven initiatives and public policies will be necessary in developing a sustainable urban freight system (Anderson et al., 2005).

Mori and Christodoulou (2012) discuss the development of a city sustainability index (CSI), whereby the definition of city sustainability is important. However, the bottom

line is that cities are independently non-sustainable. One of the reasons is that cities depend on non-urban areas elsewhere through both direct and indirect trade and movements of physical materials. A definition of sustainable urban freight transport is developed and presented by Behrends et al. (2007), concluding that there is a need for action in the urban freight area and that an integrated approach that involves all actors is necessary. However, to conclude the discussion of sustainability, Harding (2006) grasps the problem in a very comprehensive way: "Hence, at this time, it is best to urgently address the *un*sustainable nature of natural resource use, rather than putting this on hold while we argue endlessly about *exactly* what sustainability means!" (p. 230).

4.2 Transport planning

Freight transport should be included in local authority overall transport planning. But, what is the basis for transport planning as of today? The origins for transport planning are traditionally economics and engineering, with the aim of accommodating traffic and ensuring value for money. The next stage in the process is approaching a wider range of perspectives in the planning process. Sustainable urban development requires a rethinking of priorities, which is also discussed by Banister (2005). Transport policy change is a complex and difficult process in which politicians have a position of mandate and power – no matter how good the integration with stakeholders and the planning process are, the politicians have the possibility to "make or break" initiatives (Hysing, 2009).

Transport planning is traditionally the mainly quantitative method used by civil engineers for town planning and land-use, which leads to, or is a part of, prognosis-based traffic strategies. A classic transport planning process of a local authority is described by Black (1981) in seven steps: Formulation of goals and objectives; Data collection; Analytical Methods; Forecasting; Formulation of alternative plans; Evaluation; and, Implementation. Banister (2002) presents a similar model that originates from half a century ago, and argues that most planners would use this model, or variations of the same, since they feel comfortable with it and there are not many other alternatives. The traditional predict and provide method on transport planning is not useful in today's complex environment, where it is necessary to take the social situation into account, not just "simply to define how the work is to be done" (Kane & Del Mistro, 2003).

The model presented above does not take any certain mode of transport into consideration, but can be applied to any type of transport. There are limitations to the planning model including a weak theoretical framework that might be too positivistic, as there is no attempt to understand the behaviour of people. Looking into the model and the discussions around the model by Banister (2002), it is also evident that the main issue addressed throughout the model is people transport, as also discussed previously, including different modes of transport for transporting people and not goods. Goods are mainly discussed in the context of how people will be transported to collect goods that they buy. In 1996, based on transport planning for infrastructure, Richardson and Haywood concluded that transport planning processes are likely to fail due to the fact that it is almost impossible to take into account the complexities regarding socio-political, economic and environmental aspects and, hence, there is a need for transport planning processes that can find suitable approaches for those aspects.

Zunder and Ibanez (2004) show the results of a questionnaire sent out to European cities, 25% of which had no one in charge of freight and another 44% had less than one

half full-time equivalent (FTE) working on the topic. Half of the answering cities had no freight policy or planning at all, but the real figure of European cities that do not take freight into consideration is assumed to be much higher. Similar results are concluded by Lindholm and Behrends (2012) based on a case study of cities in Northern Europe. Banister (2005) argues that there are possibilities for creating a sustainable urban area through transport planning. However, he mainly addresses people transport and states that there is simply no room for cars in the sustainable city, but there are alternatives like walking, cycling and good public transport, and mentions freight transport only in terms of, e.g. home deliveries of goods ordered through e-shopping. He argues that radical change is needed and all stakeholders and parties need to agree and be involved in order to reach sustainability. The same should be valid for freight transport. However, Falkemark (2006) presents the conclusion that an adaptation to sustainability of the (Swedish) transport system is not likely to occur, since the probability that the needed radical measures to break the road dependencies of transport are unlikely to occur. And, to include *all* stakeholders needed and come to a consensus is a considerably problematic aspect (Banister, 2005; Falkemark, 2006). One of the biggest problems is the speed of the process. In many projects or policy processes, there is only time for limited facts to be considered and limited comparative analysis and limited time for different stakeholder groups to state their point of view. The most engaged businesses linked to lobbying groups are often the ones heard and taken into account, since smaller groups with fewer resources do not have the time or possibility to raise their voice (e.g. Falkemark, 1999a; Falkemark, 1999b).

The EC has set up several strategies to improve the *urban* environment as well as the transport development in the EU. European environment policies and legislation aim at supporting national and local authorities in their planning management. The first step taken to work with transport policy in the EC was a White Paper (European Commission, 2001), in which it was stated that a real change in common transport policy is needed and 60 measures to achieve it were presented. The thematic strategy on urban environment (European Commission, 2005) is one of the strategies presented by the EC that aims at encouraging local authorities to adopt a more integrated approach to urban management. Sustainable transport is one of the highlighted essential parts of this approach and the commission strongly recommends local authorities to develop and implement Sustainable Urban Transport Plans (SUTP[2]). The Green Paper towards a new culture for urban mobility (European Commission, 2007) specifically addresses the problem of urban transport activities. It is emphasised in this report that nothing will happen if local authorities do not adopt an integrated approach towards transport – involving stakeholders, citizens and other planning departments as well as take into account national and European recommendations and legislations. Freight transport is explicitly mentioned as important when considering the overall transport activities taking place in the urban area. However, the question is how those could be incorporated in the overall planning. This is also followed up in the most recent White Paper for transport (European Commission, 2011), where urban freight is explicitly mentioned in one of the ten goals towards a competitive and resource-efficient transport system, as to "achieve essentially CO_2-free city logistics in major urban centres by 2030" (p. 9), which is an ambitious and encouraging goal. Nevertheless, also smaller

[2] The SUTPs have been developed into Sustainable Urban Mobility Plans (SUMP), including the same parts as before but has a slightly different approach. This can be found on www.mobilityplans.eu (12th mars, 2012).

cities should take up this goal. Furthermore, for an urban area it would be valuable to focus more also on other types of emissions, since it is the local emissions, such as, e.g. NO_X and particulate matter that mainly affect the inhabitants and the urban environment together with congestion, noise and vibration (even though, as acknowledged in the White Paper, also those types of emissions would be substantially reduced when addressing CO_2).

McKinnon (2003) has addressed the freight transport operations and presents six policy options to achieve the British sustainable distribution strategy (as presented in the White Paper by the UK Department for Transport, 1998). It is presented here to give an example of how to work with policy options in a city. The sustainable distribution strategy is as follows:

- improve the efficiency of distribution;
- minimise congestion;
- make better use of transport infrastructure;
- minimise pollution and reduce greenhouse gas emissions;
- reduce noise and disturbance from freight movements;
- manage development pressure from the landscape; and,
- reduce the number of accidents, injuries and cases of ill health associated with freight movement.

The *policy options* presented by McKinnon (2003) to work with those are, e.g. to provide additional infrastructural capacity, restrain the growth of freight movement (measured in tonne-kms), improve the vehicle loading, reduce the ration of vehicle-kms and tonne-kms and raise the energy efficiency of freight transport operations. To deal with these options, there are several *policy instruments* that could be used (McKinnon, 2003). Those could be grouped into five categories: fiscal measures, financial incentives, regulations, infrastructure and land-use planning and advice and incentives. May and Crass (2007) present a list of policy instruments that cover infrastructure and management, technology, regulation, information and pricing. But, they also conclude that no one policy could make the transport situation sustainable. However, the list of policy options together with the policy instruments gives a good basis for the authorities to start the work of reducing the negative impacts from the transport sector. Road transport comprises a major part of the transport modes and this needs to be acknowledged in the frame for the policy options and instruments in order to create a good mixture of carrots and sticks. It is possible that the negative environmental impacts will be reduced for each moving vehicle, but this is not enough. Finding ways of reducing the need for transport and shifting the modal split through regulations and land-use planning, etc. is important.

In the EC project PROSPECTS[3], three types of constraints regarding decision-making contexts in European cities were identified: lack of direct control, intervention of other levels of government and involvement of other stakeholder groups (May, 2005). It was also discovered that there are differences between different-sized cities, whereby small cities have more freedom, large cities have more power and medium-sized cities suffer

[3] PROSPECTS (2008) was an EU project with the aim of providing cities with the guidance that they need in order to generate optimal land use and transport strategies to meet the challenge of sustainability in their particular circumstances The durance of the project was 2000–2003.

most from the constraints mentioned above. That politics do affect the decision-making process is evident, but the political decision can also hinder the implementation of sustainable practices. This is confirmed by Prado-Lorenzo et al. (2011) who after a comprehensive case study conclude that competition among political parties positively affects the sustainability of cities. Decision-making contexts are complex, difficult to change and time consuming. Vision, plans and consensus are important prerequisites to succeed.

Policymaking or decision making within freight transport concerns "making choices regarding a system in order to change the system outcomes in a desired way" (Marchau et al., 2008) and requires an integrated view, wherein all interactions are regarded. There are numerous uncertainties in this system, but one important uncertainty should be mentioned, which is that the different stakeholder interests could result in conflicting desired outcomes of the system. To deal with these uncertainties, Marchau et al. (2008) suggest an adaptive approach whereby the vulnerabilities in policies are identified and the implementation reassessed and redefined in order to be ahead of the problems and avoid failure.

Different models can be used in order to include freight transport in decision-making processes that are already developed. However, known models either focus on finding specific measures to implement (which is a traditional approach to urban freight transport) or on transport in general (i.e. not specifically aimed at freight transport). For preparing a relevant and good decision-making process for local authorities, technical planners and management officers at the local authority must be aware of the processes in transport operations, and they also need to understand the complete picture. This knowledge is necessary for comprehending the complexity of transport operations, as well as knowing how to handle them from a social perspective. Good co-operation between vehicle industries, infrastructure industry, transport buyers, transport providers and others is needed in the planning processes.

4.3 Including freight in local authority transport planning

According to the discussion above, freight transport is only vaguely included in the transport planning research today, although there is a need to do so if the aim is sustainability for transport operations in the urban area. Three areas to consider in order making urban freight transport sustainable are identified by Abassi and Johnsson (2012) to be: information (educating stakeholder and sharing information), integration (cooperation, coordination and collaboration among stakeholders) and innovation (new types of measures). Five areas of interest are identified for how to include freight transport in municipalities' overall transport planning: measures; evaluation and urban freight transport indicators; models and tools for urban freight transport planning; transferability and transfer of knowledge; and, stakeholder cooperation and freight partnerships. Most local authorities that consider urban freight transport would want to find a solution to the potential problem. These solutions are often considered to be so-called "measures", e.g. a consolidation centre or a low emission zone and have become a traditional way of handling freight transport by local authorities. However, those measures have, as mentioned earlier, not always been successful when considering implementation and the long-term perspective. The field of city logistics is ever growing and it is impossible to set a certain fixed ontology (Anand et al., 2012). The research field needs to be continuously developed and improved in order to mirror the daily activities and therefore the frameworks and conceptual models will have to be

flexible. Sharing and transferring knowledge (see, e.g. *Transport Policy* Vol. 18, 2011) as well as proper evaluation (e.g. Browne et al., 2010b; Muñuzuri et al., 2012a) of the actions taken have been increasingly discussed regarding urban freight transport. But, there is also a possibility to look into slightly non-traditional evaluation tools. A potential more long-term approach that has been raised in some cities consists of Freight Quality Partnerships (FQPs, in, e.g. London, Paris and Gothenburg, see Lindholm & Browne, 2013). Those approaches are all possibilities to include freight transport in the overall transport planning (OECD, 2003) and will be further developed below.

4.4 Measures – traditional approach to deal with urban freight transport

Several approaches towards changing the environmental performance of freight transport in urban areas have been experimented with in cities throughout Europe. Several EC projects have been responsible for describing different possible measures, of which the BESTUFS[4] project has taken a leading role and identified more than 100 demonstration projects (e.g. Allen et al., 2007; BESTUFS, 2010; Schoemaker et al., 2006), but also others have played an important role (e.g. projects within the CIVITAS[5] initiative; the NICHES[6] project; and the TURBLOG[7] project). The UK national project Green Logistics[8] (2008) has also created several overviews, which are thorough and valid also outside the UK. In Sweden, the project called "Den Goda Staden"[9] has discussed several types of measures and possibilities for how to work with freight transport in urban areas (Tornberg & Cars, 2008). Many measures have been performed within city centres with the objective of reducing the negative environmental impacts of freight transport (Patier & Browne, 2010; Quak, 2008; Zunder & Ibanez, 2004) but few have managed to fulfil a complete implementation. Quak (2011) concludes from analysing 106 different urban freight transport initiatives that there have not been any great breakthroughs towards improving the sustainability of urban freight transport. Unsuitable policies regarding freight transport could have a negative impact on cost and effectiveness of the urban freight transport operations (MDS Transmodal, 2012).

In order to evaluate different measures for a planning process of urban freight transport, a summary of the concepts is made, generalising and categorising the measures based on an extensive literature review of more than 200 sources regarding urban freight transport, see Figure 1.

Several references include works that review concepts and measures within urban freight transport (e.g. Anderson et al., 2005; Benjelloun et al., 2009; Bérnard et al., 2007; Jonsson et al., 2009a; Muñuzuri et al., 2005; Quak, 2008) and many others that specify single, or single types of, measures (e.g. Browne et al., 2005; Browne et al.,

[4] The BESTUFS (2010) project was divided into two parts, I and II, wherein a large amount of different urban freight solutions were presented, discussed and evaluated. Best practices are collected and presented at a webpage.

[5] The CIVITAS (2012) initiative aims at supporting cities to introduce ambitious transport measures and policies towards sustainable urban mobility, including all modes of transport.

[6] The NICHES (2012) project and the following NICHES+ project aimed at finding innovative solutions for sustainable urban transport.

[7] TURBLOG (2012) had the purpose of developing a transferability model and to extend the research and knowledge dissemination between EU and Latin America.

[8] The UK project Green Logistics (2008) had the purpose to identify and evaluate a range of measures and technologies in the area of green logistics.

[9] Den Goda Staden (2012) ("The good city") was a project conducted in Sweden between the years 2005 and 2010 including three municipalities and several national governments with the ambition to develop a common knowledge and experience within the area of city development and transport.

2010a; Ison, 2000; van Rooijen & Quak, 2010), all of which differ slightly but present the results and impacts from different approaches. The more academic a text becomes, the more focus there is on different stakeholders and the different interest groups; the impacts on different actors are more often discussed in academic papers. Hence, more complexity can be found around the measures. Two of the most extensive mappings of measures found are in Muñuzuri et al. (2005) and in Quak (2008), but many examples of measures are also presented by Goldman and Gorham (2006). Each of the references reviewed have slightly different categorisations and definitions of concepts and terms, and several of the concepts have synonyms in the references. Muñuzuri et al. (2005) compile and classify measures (or *solutions*) into four groups: public infrastructure (transfer points and modal shift), land-use management (parking and building regulations), access conditions (spatial and time restrictions) and traffic management (scope of regulations and information). Another classification is given by Benjelloun et al. (2009), which includes description, business model, functionality, scope and technology. One of the most recent classifications is made by Russo and Comi (2011), who incorporate material infrastructure (actions to optimise freight transportation), immaterial infrastructure (policies towards actors' knowledge and co-operation), equipment measures (development of sustainable devices) and governance measures (regulations) as the main headings. This classification is of interest since it considers not only actual physical measures, but also the policies regarding actor involvement. Similar to this, Stathopoulos et al. (2012) have classified urban freight transport policies into six groups: 1) market-based measures; 2) regulatory measures; 3) land-use planning; 4) infrastructural measures; 5) new technologies; and 6) management measures, where "soft" or "immaterial" measures could be found in the last category. Measures that regard innovative vehicles and ITS are not considered in particular in this paper and are therefore not included in the figure, but are brought up in references.

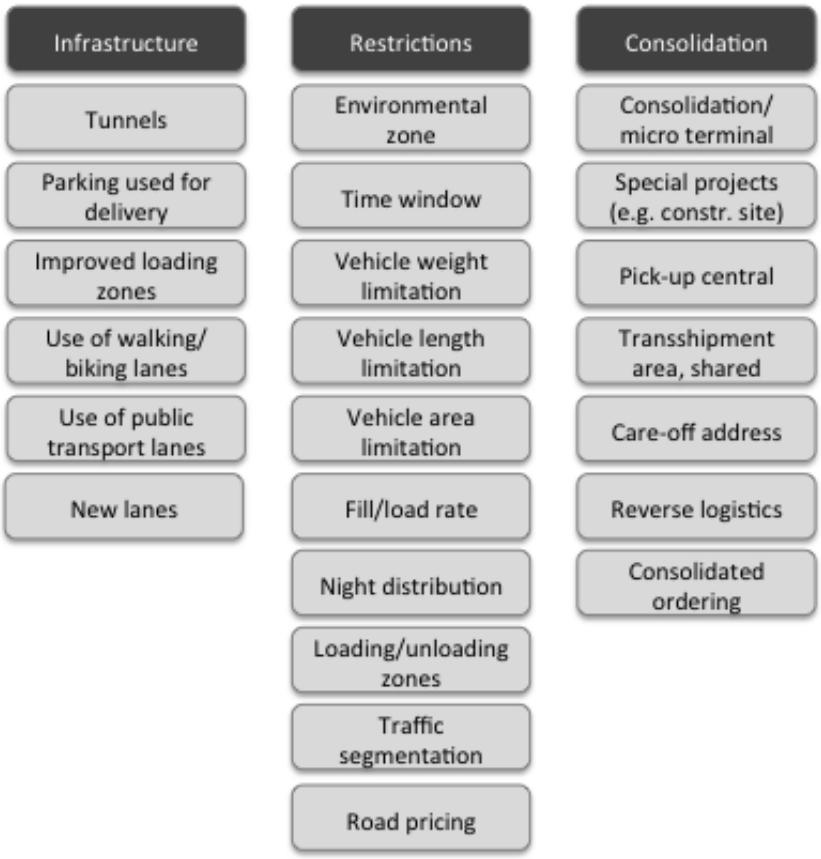

Figure 1 Categorisation of measures for urban freight transport.

The three categories in the figure above will be described below: infrastructure; restrictions; and, consolidation.

The infrastructure of an urban area is rather hard, and costly, to alter and therefore most measures regarding infrastructure focus on how to use the existing infrastructure as efficiently as possible, e.g. using the *public transport infrastructure* or improving the *loading and unloading* possibilities, but also the use of *biking and walking lanes* or the use of *tunnels*. Quite a few studies have regarded intermodal opportunities for city logistics (Nemoto et al., 2005; Wild & Huschebeck, 2002; EXTRA Consortium, 2001; Shepherd et al., 2006). During the 1990s, a large research project was conducted in the Netherlands aiming to find ways to develop an *underground distribution system*. Although the project did not continue, it is described in terms of both successes and failures in several reports and papers (Gordijn, 1999; Pielage, 2001; van Binsbergen & Bovy, 2000; Visser et al., 2008).

The restrictions (which also could be completed with incentives) include measures that local authorities can use for vehicles entering an area, street or similar area. Traditionally, the restrictions hinder freight vehicle in their work within the urban area, but lately these measures have been acknowledged to be used to assist freight transport (Browne et al., 2007b). Increased *weight limits* could increase the economic and environmental benefits (McKinnon, 2005), whereas the total time taken to complete the collection and deliveries could be doubled if the weight limits were lowered (Anderson et al., 2005). However, such difficulties are sometimes inevitable with restrictions, due to the infrastructure within the urban area. *Environmental zones* are in general described as being successful in terms of contributing to reduced emissions in urban areas (Allen

et al., 2007; Rapaport, 2002); they could, however, have negative consequences for smaller transport companies (Anderson et al., 2005; Browne et al., 2010a). Based on the literature review, *fill rate restrictions* are not tested very widely, but have some fairly unsuccessful results (Becker, 2006; Ottosson, 2005a). OHDs, like *night distribution*, are analysed by, e.g. Anderson et al. (2005), Browne et al. (2007b), Taniguchi and van der Heijden (2000) and Yannis et al. (2006). Except for consolidation measures, the *congestions-charging* measures or *road pricing* are amongst the most common hits in the literature review regarding measures. Congestion charging (implemented for all types of transport) has been susceptible to several studies as the measure requires planning and large investments and often is perceived negatively by citizens. However, there is a change of level of acceptance from early studies wherein the literature shows a more negative standpoint (Raux & Souche, 2004; Schade & Schlag, 2003) to later studies like that of de Palma et al. (2006b), who conclude that acceptability is higher at least when limited to new links, or when the stakeholders get new services. Other overviews of congestion charging are presented by, e.g. de Palma et al. (2006a), Hensher and Puckett (2008), Ison (2000) and Santos (2004).

Consolidation is the most commonly discussed measure in the literature; the basic concept is that goods for a specific area are consolidated in one point instead of all consignees getting deliveries directly from many different consignors, in order to improve distribution efficiency, hence the sustainability. It is the same basic concept as used by freight forwarders for larger transport operations. Within an urban context on a smaller scale, the concept has been discussed during some decades (the earliest found are from Cadotte & Robicheaux [1979] and most commonly referred to as urban consolidation centre [UCC]), but also known as, e.g. micro terminal, urban distribution centre, urban transhipment centre, co-operative delivery system, logistics centre or city terminal. A common misunderstanding is that the local authority should run such a consolidation terminal, but that is just one of the scenarios. The most extensive report found about this type of measure is presented by Browne et al. (2005). The objectives of a consolidation centre can be different, but most involve environmental aspects. Social functioning and security are other fields in which an attractive urban area is one of the main purposes (Jonsson et al., 2009b). Browne et al. (2005) list the advantages as environmental and social benefits, better planning of logistics operations and better inventory control. The disadvantages could be a potential high set up cost, limited benefits due to the fact that most deliveries in an urban area already are consolidated in terms of difficulties for a single centre to handle a wide range of goods and an increase in delivery costs. Trials of consolidation centres show that there could be difficulties to convince customers to join the scheme (Eriksson et al., 2006; Marcucci & Danielis, 2008). Lewis et al. (2007) report that there is a need for change management to succeed with an urban consolidation centre. Other critical factors for success or failure could be the organisation of the UCC, subsidies, number of users, vehicle types and location of the UCC (van Duin et al., 2010). According to the reports found, the most successful consolidation centres have been targeted on one commercial centre or one location. The principles are the same, but the organisation and the set-up might be easier to handle. The owner of the business centre may also set recommendations or restrictions, as in the case of Heathrow Airport where deliveries are forced to go through a consolidation centre (Campbell et al., 2010). The same principles are valid for *special projects*, e.g. construction sites (Andersson, 2008; Ottosson, 2005b). A *pick-up central* is mainly used by customers to pick up goods, instead of a transport company delivering the goods to

the door. The main benefits of a pick-up central are the reduced failure rates for both delivery and redelivery (Edwards et al., 2009; McLeod et al., 2006), but a pick-up central also enables flexible pick-up time and place for the customer, which can be combined with other activities (Weltevreden, 2008). Consolidation could also be achieved through a *change in order patterns*. Ordering less frequently or co-ordinating the order from common suppliers in, e.g. an industrial area can decrease transport. The project "Godssamverkan in Lundby" (translated: freight co-operation in the Gothenburg city district Lundby) is an example of change in order pattern within companies (Axelsson, 2006). Another example of ordering consolidation is when, e.g. local authorities separate the goods from the transport and arrange for a separate call for tender for the transport operations (Johansson et al., 2008; Wetterwik et al., 2000). The uses of care-off addresses (e.g. a shop to uses a transport terminal as their delivery address) or different alternative reverse logistics solutions are other types of measures.

4.5 Addressing measures

The OECD (2003) suggested a pack of policy recommendations to deal with the increasing challenges in sustainable transport. It states that single measures by local authorities are not enough to cope with the need for sustainable development. National government initiatives are essential, goods transport is significant, public-private partnerships are necessary and inter-sectorial co-operation is of outmost importance. The extensive literature review by Quak (2008) of 106 unique urban freight measures shows that only a few of them are successful in implementation (after project period end). Environmental zones with emission restrictions for heavy vehicles and time restriction are among those that are the most common. Air quality improvements have been one of the main purposes with these actions, which seem to work out quite well. Weight and length restrictions are also common, but have mainly been introduced due to physical circumstances in the urban area like fragile historical centres and narrow infrastructure. However, other types of actions where policy innovations with, e.g. stakeholder agreements (such as with transport operators) have been set up do not seem to give the same results (Dablanc, 2008). Considering air quality aspects, Dablanc (2008) concludes that traditional "command and control" methods seem to be the most effective.

Based on a study of five of the most common urban freight transport measures, i.e. time windows, vehicle type restrictions, loading/unloading policies, fiscal policies and the promotion of transhipment and consolidation centres, Danielis et al. (2010) confirm that policies have differentiated impacts by type of goods and distribution channels. There is no policy that can fulfil all demands and features of urban freight transport, since they have different effects. Quak (2008) shows in his PhD thesis that for the example of time windows, municipalities should consider harmonising in order to reduce the risk of sub-optimisation, e.g. negative effects on cost and environment. Allen and Browne (2010) suggest that strategies that are designed by the public and private sector to increase load consolidation and/or less frequent deliveries have the potential to reduce the number of freight vehicle kilometres substantially. Further, Allen and Browne (2010) suggest that there might be a need to avoid unnecessary use of weight and time restrictions in order to achieve higher consolidation – those restrictions should only be used where required by special situations. Further on, a study made by Ballantyne et al. (2011) shows that the vast majority of the initiatives and measures taken by the local authorities to deal with, or assist, freight transport are overlooked by

the operators, e.g. freight delivery maps, provision of overnight lorry parking facilities and the possibility to attend FQPs.

A lot of projects, as presented above (for example CIVITAS, 2012; NICHES, 2012; and, BESTUFS, 2010), analyse and present "best practices" of city logistics measures. Those are of course important to discuss, but equally important are the "failures" – in order to learn from others' mistakes. Marsden and Stead (2011) acknowledge this as one important area for further research and that the search for policy lessons is important for the framing of the problem. Enforcement of regulations is one of the cornerstones in succeeding with the implementation of measures in cities. This is one of the main reasons for "failure" according to Muñuzuri et al. (2012a), who conclude that for at least Spanish cities no city logistics measures will work if the enforcement issues are not solved. However, it is not unlikely to believe that this is a main reason for failure also in other countries.

The many failures have proven the difficulty of finding the business case that fits for urban freight transport. Aastrup et al. (2012) suggest that one reason might be that the transport operators that currently perform deliveries in urban areas will lose those activities. On the other hand, one can argue that this final leg of the transport chain is the most costly, due to inefficiencies, and therefore might not be as interesting for the transport operators. One of the few real, documented successes within city logistics is that of Binnenstadsservice.nl in Holland. This is the concept of an urban consolidation centre that has a business case (they only received a subsidy from the government for the first year to cover some of the costs and are now covering their own costs with the income from their services), driven by a private company and focusing on the retailers rather than the carriers (van Rooijen & Quak, 2010). Another successful concept is the "Cargohopper", also in Holland, with a similar business case as that of Binnenstadsservice.nl, but operated by one transport operator that has added this service to their ordinary services (Cargohopper, 2012). An analysis performed by Aastrup et al. (2012) suggests two key issues for a UCC in order to succeed: the main issue for the retailers would be the reduced number of daily deliveries resulting in easier store handling, but also to "keep it simple". Both Cargohopper and Binnenstadsservice.nl have worked according to those two issues.

4.6 Evaluation and urban freight transport indicators

In order to identify successful projects, but also to identify risks and potential problems, it is necessary to evaluate the measures. However, even though there have been a large number of measures carried out throughout Europe, there are still not many that are fully evaluated regarding their efficiency (Patier & Browne, 2010). How to evaluate, monitor and assess urban transport measures have been widely researched. Nevertheless, there is little consensus on what the process should look like.

Filippi et al. (2010) argue for the importance of not only ex-post evaluation, but also ex-ante evaluation. The ex-ante evaluation of measures is often forgotten or not thoroughly performed, which gives the results that the measure cannot be proven to be very effective in order to reduce negative impacts from freight transport. Russo and Comi (2010) also highlight the importance of ex-ante assessment, but argue that there is a need for simulation of the effects before an implementation in order to evaluate the potential impacts. This has an implication for transport planning activities, whereby it should be principally important to consider both ex-ante and ex-post evaluation. In addition, Ambrosini et al. (2010), argue that there is a need for a broad range of data

collection methods in order to build effective and efficient models for decision making (e.g. traffic counts, roadside surveys, interviews with stakeholders, questionnaires to stakeholders, accompanied trips with delivery vehicles). However, several studies have shown that collecting freight data as well as evaluation are lacking in many cities (Kanaroglou & Builung, 2008; Muñuzuri et al., 2012a). Browne et al. (2010b) conclude in their analysis of urban freight studies in the UK during the last 30 years that there is a need for a more consistent unit of analysis in order to gain better comparability between projects.

In order to evaluate and transfer knowledge about measures that have been implemented, there is a need for proper indicators of measure. There are many "models" presented, or step-by-step analyses for how to evaluate specific projects or overall urban freight status, e.g. Awasthi and Chauhan (2011), Eliasson and Mattsson (2006), Murphy and O'Cinneide (2006), Omrani and Gerber (2009), Patier and Browne (2010) and Taniguchi and Tamagawa (2005). According to Parris and Kates (2003), more than 500 sustainability indicator efforts are presented in the literature, of which almost 300 have an urban scope. These are not just regarding freight transport though. There are also several models presented for how to use these indicators, with computer modelling or other suggested calculation methods, e.g. Muñuzuri et al. (2010) and Muñuzuri et al. (2012b) who also state (2010) that the most valid sustainability indicator for urban freight transport is the ecological footprint,10 even though this is not much used due to complex calculation processes. Modelling and simulation of urban freight transport demand and output are often used for short- and medium-term perspectives in planning processes (Anand et al., 2012; Comi et al., 2012; Gonzales-Feliu and Routhier, 2012; and, Holguin-Veras et al., 2012). However, there is still no consensus on a sustainability definition or a general set of indicators to monitor these. Parris and Kates (2003) offer three reasons for this: 1) the ambiguity of sustainability development; 2) the plurality of purpose in characterising and measuring sustainable development; and 3) the confusion of terminology, data and methods of measurement. It is hard to find a model or computational process that would easily find the optimal solution for freight transport in an urban area, since the destinations and amounts of goods vary greatly over seasons as well as weeks. It is necessary to see the whole picture and to understand the effects of different actions in order to judge its relevance and importance.

A consistent data set for evaluation is presented by Patier and Browne (2010), who identify both core indicators and additional indicators for urban freight transport measures, which are based on all three aspects of sustainability. Those indicators are tested on several implemented measures in both France and the UK and are presented as robust and general, wherein the core indicators should be used by all evaluation exercises while the additional indicator will add value depending on the context. Patier and Browne (2010) make a key point by stating that there is a need for as much data as possible regarding urban freight transport measures in order to create an understanding as well as be able to evaluate and exchange knowledge and experiences.

Taniguchi and Tamagawa (2005) focus on the many stakeholders in the urban freight context and make an attempt to present an evaluation model that takes into consideration the criteria for each stakeholder. With a focus on evaluating different measures, indicators for different stakeholder requirements are presented by, e.g.

[10] The ecological footprint is defined as the amount of land (hectares, Ha) that the delivery activity corresponds to, i.e. how large a part of the earth it would take to produce the resources needed for the transport of the goods.

Awasthi and Chauhan (2011), Muñuzuri et al. (2005), Omrani and Gerber (2009), Patier and Browne (2010) and Russo and Comi (2011).

Building on the knowledge from the literature mentioned above, five areas of requirements are summarised: 1) accessibility, including transport work, traffic flow, easy access (into the area), easy delivery (goods) and good mobility (people); 2) environmental, including emissions reduction and energy use; 3) costs, including unchanged or reduced costs (running) and unchanged or reduced costs (initial); 4) life quality, including noise reduction, more green areas, more pedestrian areas, increased safety, increased security and aesthetics; and 5) delivery characteristics, including just-in-time delivery, frequent delivery, door delivery and special delivery (e.g. temperature, large size, bulk or others that require a special vehicle or special hygienic demands).

4.7 Models and tools for urban freight planning

As described earlier, models and tools for transport planning rarely include or take into account freight transport in the urban area. However, lately, a few more examples have been published considering the development of greater interest in urban freight transport, and Gonzales-Feliu et al. (2012) lists the most commonly used as: WIVER-VISEVA (developed based on a model called WIVER); VENUS (developed by IVV Aachen); and, FRETURB (developed by LET). Furthermore, Gentile and Vigo (2013, this issue) have developed a model called CityGoods that can create scenarios, which then can be used for calculation of urban distribution. Another model that have been developed, but regarding decision making processes, is the Multi-Actor Multi-Criteria Analysis (MAMCA) methodology (Macharis, 2005). This is a valuable and generally good tool for how to approach the decision-making process and is suitable to use also for freight transport. The methodology is an important input to the analysis that needs to be made and highlights the importance of including the stakeholders' views. The model includes seven steps: 1) definition of problem and identification of alternatives; 2) identification of key stakeholders and their objectives; 3) translation of stakeholder objectives into criteria; 4) construction of indicators for each criterion; 5) construction of an analysis matrix where each alternative is connected to the objectives of the stakeholders; 6) completion of multi-criteria analysis giving a ranking of the alternatives; and 7) implementation. The sixth step in the MAMCA model could be made by, e.g. software tools. Furthermore, as concluded by Macharis et al. (2010), even though the results of the analysis are a tool to help in understanding the possibilities, the final decision still lies in the hands of the decision makers and their "political courage".

4.8 Transferability and transfer of knowledge

The more different approaches are tested and new measures are implemented in cities, the more important becomes the possibility to share knowledge. Transferability and transfer of knowledge has therefore become a more important part of the urban transport field. In this literature review, transfer of knowledge regarding urban freight transport presents a limited amount of the literature. Most of the literature regarding transferability in the review discusses transferability of policies in other disciplines such as political science, public administration, organisational learning and management. Marsden and Stead (2011) state that "although there is only a limited amount of literature on policy transfer in this field, the findings suggest that transport has much in common with other fields of public policy in terms of the main aspects and influences on policy transfer". However, lessons learned from other cities are becoming more and

more used, since it is a quick and cheap way of finding solutions without "reinventing the wheel" (Marsden & Stead, 2011). This is also noted through more and more workshops and conferences discussing urban freight transport in European cities. The most common definition of transferability is that of Dolowitz and Marsh (1996): "A process in which knowledge about policies, administrative arrangements, institutions, etc. in one time and/or place is used in the development of policies, administrative arrangements and institutions in another time and/or place" (p. 344).

Franzén et al. (2011) suggest that the basic assumption behind transferability is "what proved to be effective in one place may confirm to be useful again, in another place" but the translation of the concept into practice is more challenging and in some cases even tricky. Franzén et al. (2011) emphasise the differences between transferability and the selection of measures that could fit for a given situation. The former is just a kind of recommendation of how to transfer best or good practices, the latter deals with both the selection of measures/technical solutions to transfer plus an evaluation of the efforts and resources required for them to succeed (including also an analysis of the barriers to overcome). Hence, transferability requires the appropriate knowledge of both origin and receptor context about the institutional domain, the funding availability and the society. Based on this approach, transferability may involve more study fields from psychology to anthropology, public health to security.

Transport policy transfer researchers often base their evaluation of transferability on a framework developed by Dolowitz and Marsh (2000) consisting of a number of questions: Why do actors engage in policy transfer? Who are the key actors involved in the policy transfer process? What is transferred? From where are lessons drawn? What are the different degrees of transfer? What restricts or facilitates the policy transfer process? How is the process of policy transfer related to "success" or policy "failure"? A special issue of the journal Transport Policy (Vol. 18, 2011) included a number of papers with different interpretations of, and references to, this framework (e.g. Bray et al., 2011; Marsden et al., 2011; Timms, 2011); however, none of them focused on freight transport but rather transport policy in general or people transport of different kinds. Nevertheless, the frameworks presented and used are of great use also when focusing on freight transport in particular, even though, as Dolowitz and Marsh (2000) point out, policy transfer is, however, not by definition a certain explanation of policy development and success.

Timms (2011) examines and compares urban transport policy transfer processes, focusing particularly on the transfer of transport policy within the EU, with "bottom-up" and "top-down"perspectives. A "bottom-up" perspective considers the views of policy transfer from a city perspective. A "top-down" step considers the policy transfer questions from an EC perspective. Macário and Marques (2008) suggest a valuable ten-step process providing a logical framework for the transferability process, which is also used in the TURBLOG project (TURBLOG, 2011):

1. Diagnosis of the problems.
2. Characterisation of the city.
3. Analysis of the city context and implications of the problems identified.
4. Look around for similar contexts.
5. Selection of examples of source urban contexts.
6. Identification of measures with potential for transferring.
7. Packaging and dimensioning the measures for transferring.

8. Ex-ante assessment of measures to transfer.
9. Identification of the need for adjustment.
10. Implementation of measures and steering of results.

The above framework identifies the sequence and the interrelations between the various questions that should be addressed in order to assess the potential for success. Transferability is not as easy as some models suggest, but needs some degree of freedom. A model should include many options for alternative ways and should as well consider, e.g. the follow-up, evaluation and assessment steps of the measure in order to complete the transfer of knowledge to others.

4.9 Stakeholder co-operation and freight partnerships

A final aspect in the discussion of how to include freight in the local authorities' overall transport planning regards an increased co-operation with stakeholders, which has been mentioned earlier, but few studies acknowledge the possibility to involve them in regular discussions and meetings through different types of freight networks or partnerships. The needs of the stakeholders have to be considered in order to reach long-term sustainability (Carlsson & Janné, 2012).

Håkansson and Ford (2002) suggest that no interaction can be understood without reference to either the wider network or the interrelations of which it is a part, since the total network structure is dependent on all interactions and it therefore could be precarious for one of the actors in the network to try to control the complete network. Integrated transport planning is a concept widely used and recognised today to describe, and as a prerequisite for, how to reach sustainable development, but the concept is hard to understand and use for many of those who need it the most (Bertolini et al., 2005; May & Roberts, 1995; Potter & Skinner, 2000). May et al. (2006) distinguish between three different forms of integration: operational integration, usually of public transport; strategic integration between transport policy and land use; and institutional integration within local, regional and national governments. They conclude that all kinds of integration are important. Tools are available, but the approach and analysis is demanding and has an uncertain outcome.

Hull (2005) found in a research study amongst UK local transport authorities that they feel hindered in their work by "short-termism" in political decision making, as well as by contradictions within policy objectives. More recently, Hull (2008) draws the conclusion that few persons working at the level of local authorities sufficiently understand the local structures well enough to find out how to work across them, but the responsibility for implementing sustainable transport solutions is placed on the local transport authorities. The paradigm of sustainability should be shared by all public sector actors, as well as key stakeholders. Successful partnerships require engagement, priorities and agendas. This is also confirmed by (Banister, 2002) who states that to reach a sustainable city, active citizen support, new forms of communication between citizens and experts and the involvement of all major stakeholders is needed. There must be a willingness to change, and the active involvement of all actors is the most effective way of achieving a change.

Collaboration between different actors is important in creating an efficient transport system and not only argued for by the OECD (2003) but also by, e.g. Tornberg and Cars (2008). Public-private collaboration in a triple helix context (the industry, the universities and the government or local authorities) is highlighted by Bergqvist (2007)

as a necessity in achieving changes over a long-term perspective. The ability to succeed with this collaboration is dependent on the partners' skills and the ability to handle the complex situation with different perspectives on goals and desired outcomes. Nevertheless, stakeholder co-operation is one of the identified success factors of different projects (Hesse, 1995). Van Binsbergen and Visser (2001) suggest that policy makers should work with a concept of consultative planning whereby top-down long-term approaches are complemented with bottom-up implementation. This concept includes regular consultations for identification of problems and ex-ante and ex-post evaluations, generation of commitments whereby actors are convinced to be actively involved, concerted actions whereby actors are persuaded to adopt a certain policy and involvement in implementation whereby actors spend resources in implementation on certain policies. Van Duin (2012) argues that the perspective has recently changed, from a situation wherein logistics is a business problem handled by private parties, to a "more public logistics", with a better involvement of public organisations. This is a perspective that needs to be further developed and realised to an even greater extent. Since 2007, the Swedish Ministry of Enterprise, Energy and Communications has worked with a logistics forum ("Logistikforum" in Swedish) as an advisory board (Logistikforum, 2012). This group has presented a report that highlights the importance of working together on urban freight transport in order to reach sustainability (Näringsdepartementet, 2010). The same report also highlights the importance of looking at urban freight transport in particular.

A Public-Private Partnership (PPP) most commonly has the meaning of the bringing together of private and public actors in a long-term partnership for the funding of a construction, maintenance or similar project (European Commission, 2004), whilst it is defined in a broad sense by Browne et al. (2003) to also include consultation and dialogue in the public decision making, which is more in line with what is discussed here. A success factor for urban freight transport could be the involvement of stakeholders (Browne et al., 2007a). To involve stakeholders from both the authorities and private business could be a challenge, considering the difficulty of harmonising different views and exchanged ideas and, when handling a changing and complex environment, there could never be a perfect solution regarding a freight strategy (Hensher & Brewer, 2001). Hensher and Brewer (2001) identify three factors that contribute to the inefficiency of developing a freight strategy connected to information and knowledge: the incompleteness, asymmetry and parochial nature. They suggest a collaborative process with a long-term perspective, whereby the interaction between key stakeholders is efficiently increased to handle the situation with complex issues such as freight strategies.

Freight quality partnerships are a way of including stakeholders in the discussion of urban freight transport. Hofenk (2012) confirms that it is important for different stakeholder groups, which might have different interests, that a planned measure be in line with each value at the same time as the initiator needs to provide good reasons to take part. A freight quality partnership has the potential to support these aspects and the stakeholder groups could have the possibility to share their prerequisites and requirements with other stakeholders to discuss. Collaboration with stakeholders through partnerships are discussed by some authors. Dablanc et al. (2011) identify three prerequisites that need to be fulfilled in public consultations of freight transport in order to succeed, as a result of a case study in the Paris region:

- There is a need to implement a dedicated consultation process, i.e. freight issues cannot just be included in ordinary "neighbourhood consultations", but need to be addressed to the right stakeholders.
- Freight consultations need to be implemented on a metropolitan or even a regional level, since the urban freight transport is part of a larger supply chain and therefore alone is not sufficient. The municipal decision needs to be integrated with regional consultations to guarantee effectiveness.
- The institution in charge of the consultations needs to have sufficient legal and political influence to enforce the decisions taken at the consultations.

However, earlier, Dablanc (2008) argued that local partnerships are not very useful, except for a limited number of cities, since representatives of all the varieties of actors participating in urban freight transport are not included in those partnerships. "Traditional command-and-control policies" would be more useful according to Dablanc, however, used in a more innovative way than is the fact today, with, e.g. better enforcement. Hofenk (2012) though, suggests, amongst other factors, that the retailers and carriers' willingness to improve urban freight transport through supporting initiatives is dependent on their perceived need for change and their trust in the initiative. To understand the need for change as well as to gain trust, there is a need to understand also other stakeholders' perspectives.

In the UK, FQPs have been implemented at various locations during more than a decade and were acknowledged already at the end of the 1990s by the government in the Department of the Environment Transport and Regions (DETR) report (DETR, 1998). The FQPs have been shown to improve the co-operation between private and public stakeholders (Allen et al., 2010).

Lindholm and Browne (2013) have been discussing FQPs and other types of networking groups for stakeholder involvement, and based on that research, a list of nine factors is compiled of how to assess the different partnership approaches. Those nine factors have been grouped into three main areas of interest: *Formation of Partnership* (objectives, relevant stakeholders, political involvement); *Management* (action plan, manageable number of participants, regular attendance, strong project management); and *Outcomes* (accept complexity and avoid seeking single solutions, consider urban freight as business propositions).

5. The stakeholders of urban freight transport

By concluding in the previous section that a wider co-operation with stakeholders is important, it also becomes important to identify the stakeholders that need to be included in these discussions. In urban freight transport flows (and all other transport flows), the realisation of transport demands results from the decisions taken by many different stakeholders and these stakeholders often show a strong interdependence. Co-operation and communication are possibilities to reduce the barriers between different stakeholders. Transportation systems are complex and dependent on the existence and roles of different modes, regulatory and legislative bodies, service providers, builders, financing systems, technologies, land-use patterns and human behaviour (Richardson, 2005).

Russo and Comi (2011) identify three stakeholder classes that should be taken into consideration: 1) end-consumers, including inhabitants and visitors; 2) logistics and transportation operators, including the shipper, the transportation company and the

receiver; and 3) public administration, including both national and local governments. Taniguchi and Tamagawa (2005) examine a methodology for evaluating city logistics measures based on the behaviour of several stakeholders associated with urban freight transport. They consider the five different stakeholders of administrators, residents, shippers, freight carriers and urban expressway operators. They assume that they behaved on the basis of their own criteria for evaluating the effects of city logistics measures. There is a need to understand the complicated relationship between stakeholders as well as their role in the urban transport system. It is not only the freight carriers that are affected by the city logistics measures implemented by, e.g. local administrations. All stakeholders have different requirements on urban freight transport, wherein the inhabitants want as little disturbance from freight movements as possible, the transport and logistics operators want to fulfil their customers' needs and the public administration would like to minimise external effects and to create an attractive urban area. The stakeholder requirements could be monitored and evaluated with the help of different indicators.

According to Taniguchi et al. (2001), there are four key stakeholders involved in urban freight transport that interact with each other in some way or another: shippers (manufacturers, wholesalers and retailers), residents (consumers), freight carriers (transporters and warehouse companies) and administrators (national, state and city level). A similar division of stakeholders is used by Anand et al. (2012), who also adds a private stakeholder named "Deterministic private actor" including B2B shippers, 3PL service providers, retailers and inhabitants. All of these also have own objectives, e.g. the residents who do not want to be disturbed during night hours.

Residents are included though in another identification of stakeholders that is made by van Binsbergen and Visser (2001), whereby a more comprehensive picture of stakeholders is identified with their different interests in the urban area. For this identification, it is highlighted that different actors have sometimes-conflicting interests. Sjöstedt (1994) presents models that highlight interactions and show important actors affecting freight transport and the number of stakeholders is more extensive than the ones previously presented, even though the stakeholder group "Consumers" is excluded here as well as in the one by van Binsbergen and Visser (nevertheless, in that model, likely to be recognised in the group "Residents"). The Sjöstedt model is system oriented around three basic elements: *goods* that demand transport, *vehicles* being used and *infrastructure*. The elements interact in pairs in three different subsystems. The *activity system* comprises all activities that require movement of goods. In the *transport system*, vehicle operators match the demand for transport services. In the *traffic system*, finally, actual movement of vehicles is realised in physical networks in which traffic units absorb infrastructure capacity (Sjöstedt, 1996).

Four main groups of stakeholders, with a direct and important impact on urban freight transport, have been drawn from the above discussion: city administrations/local authorities; consignor/consignee; freight forwarder; and transport operator. However, a further discussion of stakeholders and their relationship is considered to be essential.

6. Barriers and drivers of sustainable urban freight transport

Barriers and drivers to sustainable urban freight transport or policy planning processes are researched only to a limited extent (van Binsbergen & Visser, 2001). A barrier, or an impediment, is an obstacle, which prevents a given action or policy measure being implemented, or limits its possibilities. A barrier could be a part of a structure or a

process. A driver is something that helps an action, measure or policy instrument to be brought forward and gives it a better potential to be implemented.

Minken et al. (2003) grouped barriers into four categories: 1) legal and institutional barriers; 2) financial barriers; 3) political and cultural barriers; and 4) practical and technological barriers. Nonetheless, a policy implementation should not be disregarded due to barriers. Instead, there should be policy instruments to help overcome the barriers, at least for long-term strategies. Institutional barriers, process barriers, political and acceptability barriers, information and skills barriers, financial barriers and legislative and regulatory barriers are another division of barriers presented by May and Crass (2007), who analyse four different studies and recommend for authorities to have clear objectives, set up aims in order to fulfil those objectives and to have a good consultation process as the way of overcoming the barriers.

The drivers of urban freight transport sustainability could be the mirroring aspects of the barriers and the same categories that are used for barriers are therefore used in order to categorise drivers.

7. Conclusion

This paper has focused on the local authority perspective on urban freight transport, presenting a literature review of the last 15 years of research within the field. Although the research regarding urban freight transport has increased considerably during this time frame and it is no longer possible to say not much is being done within the field, to a large extent, the research conducted evaluates single measures to solve specifically occurring urban freight transport problems without taking a systematic approach. The research of how local authorities' handle urban freight transport today was put forward in this paper. It can be concluded from the literature review that urban freight transport is complex and that it is not considered in the local authority transport planning of today and not much research is done within the area. Local authority transport planning often focuses mainly on public transport, but there is a big difference between freight and passenger journeys, which should not be neglected (Allen et al., 2012; Anderson Bomar & Becker, 2010). Nevertheless, freight is an acknowledged contributor to the unsustainability of the urban area in the research and the main reason for conducting urban freight research.

Four main areas are identified throughout the literature in order to work in a more structured way with urban freight transport for local authorities: measures; evaluation; transferability; and stakeholder involvement. Working with *measures* is the most common approach for local authorities to tackle singly occurring problems. There are three main types of measures that are trialled in many cities, but single measures are not enough to reach sustainability and there are few measures that have a good business case. Urban freight transport solutions are not being investigated on a wider scale to cope with the long-term unsustainable trends. In addition, few of the project evaluations or dissemination activities show and explain what aspects have gone wrong with actions concerning urban freight transport. Evaluation becomes important in order to understand the effect of the measures implemented. *Monitoring and evaluation* (ex-ante and ex-post) based on *performance indicators* (accessibility, environmental, costs, life quality and delivery characteristics) are shown to play an important role in the development of actions regarding urban freight transport. Evaluation is in turn important for the dissemination and *transfer of knowledge* between different cities/local

authorities. Finally, it could be concluded that *stakeholder involvement* increases the possibilities for long-term successful results.

The existing models, frameworks and tools focus on transport planning in general, or for specific measures. The local authority perspective need more research as well as transferability of knowledge and how to go beyond demonstration measures. It would be interesting to study how to get urban freight transport on the agenda for local authorities on as equal terms as public transport, cycling and walking as possible in the overall transport planning. To reach this for an urban area it is necessary to include freight transport in the overall transport planning, but also a need for a long-term perspective and a development of current transport planning methods in order to include freight.

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