A HOLISTIC APPROACH TO CHALLENGES IN URBAN FREIGHT TRANSPORT PLANNING

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ABSTRACT

Freight transports in urban areas are still not well understood and there is no widespread methodology specifically aimed at the analysis and planning of such areas. To achieve urban sustainability, new models for the management of freight movements within city limits are warranted, in which municipal authorities play a pro-active role. The purpose of this paper is, firstly, to analyse the current state of freight transport in urban areas, and secondly, to identify possible shortcomings of current urban freight transport planning practices. This paper contributes to laying the groundwork for designing strategies and solutions to overcome the challenges involved in securing the mobility of goods and reducing unsustainable impacts from freight transport.

A holistic approach was taken and in-depth interviews with 40 local actors and stakeholders were conducted in four cities around the Baltic Sea. The interviews represented authorities and other organisations connected with urban freight transport. The cities differ in size, economy, and history as well as political and cultural frameworks. A common characteristic of the cities, though, is the strong role the ports and logistics activities play.

The study shows that there is a lack of a holistic understanding of the implications of freight transport in urban areas. Interaction and cooperation of all involved actors is necessary, but lacking, i.e., actors from the public and private sector. All these actors seem to be expecting initiatives to come from elsewhere. On the one hand, city governments expect businesses to set up new logistics services suited to the emerging needs of the customers and retailers. On the other hand, logistics providers wait for municipalities to initiate (and subsidize) new services before starting a business, which may prove unprofitable and highly risky. Furthermore, taking into account freight transport's growing contribution to the negative impacts on the urban environment, compared to passenger transport, city authorities need more capacity and competence to manage and control the freight transports.

***Keywords**: city logistics, sustainable transport, transport planning, urban freight transport*

INTRODUCTION

As cities are dominant centers of production and consumption, most transport, both passenger and freight, starts and ends in urban areas and often bypasses several urban areas on its way. Urban activities are accompanied by large movements of freight characterized by delivery trucks moving between industries, distribution centers, warehouses and retail activities as well as to and from major gateways such as ports, rail terminals, distribution centers and airports (Rodrigue et al., 2006). Although urban mobility is an important facilitator of growth and employment, increased traffic in town and city centres has a strong impact on sustainable development. Congestion as well as air and noise pollution is getting worse year by year. Urban traffic is responsible for 40% of CO_2 emissions and 70% of emissions of other pollutants arising from road transport. Furthermore, one in three fatal accidents now occurs in urban areas (European Commission, 2007a). The significance of urban freight on these unsustainable impacts compared to passenger transport is growing. Though freight transport operations in cities represents only 10 to 18% of road traffic, it accounts for 40% of air pollution and noise emissions (European Commission, 2006b). These challenges are generally common to all European cities even though they are different regarding geographical, historical and cultural circumstances.

On the other hand, for regions and cities seeking to compete in the globalized economy, effective freight transport services are a key success factor (Docherty, 2004). Transport hubs often confer benefits on the region in which they are located. Because of their direct connection to many destinations, they are ideal accessible places at which to distribute material and hence are usually a catalyst for agglomeration and scale economies (O'Kelly, 1998). However, due to globalization and transport network centralization, the hubs increasingly serve distant and dispersed carriers, shippers and final customers and as a result, a decreasing share of the hubs' benefits are materialized locally. A consequence of the transport system dynamics, which are often global in scope, is that the hubs have lost much of their direct relationship with local stakeholders. At the same time, it is the locality of these hubs and gateways that suffer from their extensive land use and traffic externalities (Hall, 2007).

Despite its significance and the problems associated with it, relatively little attention has been paid it by researchers and policy makers. Most studies conducted on sustainable urban transport focus on passenger transport. Integrated transport planning as well as sustainable transport are mentioned as concepts, but freight is rarely explicitly discussed as a part of this integration. This situation is changing as big cities, e.g., London and Paris are paying more attention to freight transport as part of their overall transport strategies (Browne et al., 2007). However, the large majority of cities have not yet found adequate solutions to help optimise the urban movement of goods (Dablanc, 2007). Freight transport issues at the city level are still not well understood and there is no widespread methodology specifically aimed at the analysis and planning of freight movements.

'Sustainable Urban Transport Plans' (SUTP) is a recently developed concept which involves freight transport as one area of many others and highlights the importance of integration of

different transport plans (e.g., public transport, freight, walking and cycling) as well as other planning areas within a city (e.g., strategic planning and land use planning). The concept of SUTP was developed and tested during an EU project called BUSTRIP, Baltic Urban Sustainable Transport Implementation and Planning (UBC Commission on Environment, 2007), which has been a major contributor of empirical data in this paper.

The purpose of this paper is twofold: first, to analyse the current state of freight transport in urban areas, and second, to identify possible shortcomings of current urban freight transport planning practices. This paper should be seen as a contribution to laying the groundwork for designing strategies and solutions to overcome the challenges involved in securing the mobility of goods and reducing unsustainable impacts from freight transport. Its structure is as follows. Section two describes the research methodology used. Section three reviews the relevant literature on urban freight transport and integrated transport planning. In section four a conceptual model on integrated urban freight transport planning is presented, which is used in section five for analysing the empirical data together with a matrix for bringing the factors together. The results are analysed and discussed in section six and the conclusions section ends the paper.

METHOD

In order to understand why freight transports seem only to have a minor role in urban transport planning and how to overcome this barrier, a case study approach has been used involving European cities within the BUSTRIP project. The study has consisted of two parts: 1) a holistic transport review including passenger and freight transport and all modes of transport, and 2) an in-depth review of freight transport.

The BUSTRIP project included 11 cities (Bremen, Gdynia, Gothenburg, Kaunas, Liepaja, Pärnu, Sundsvall, Tartu, Turku, Vilnius and Örebro) and 1 region (the Kouvola region) in the countries around the Baltic Sea. During the BUSTRIP project, a holistic transport review was conducted in each city for all modes of transport. This transport review consisted of two parts: a *self assessment* and a *peer review*. The self assessment part was conducted by the local authorities, where all current developments, plans and projects were mapped in a 'Self assessment report' based on a template (Wolfram, 2004). In this report, questions were answered about the municipality profile (e.g., geography, administration and political issues), drivers (factors that imply actions for sustainability and processes that influence the transport activities), impacts (e.g., indicators for emissions, safety and quality of urban life), and plans and policies that could affect the SUTP. When the reports were finalized, a group of experts (peer review team including the authors) reviewed them and then visited the cities. In a week, the review team conducted approximately 15 semi-structured interviews with, e.g., city representatives, transport operators, politicians and other stakeholders to monitor the contents of the self assessment report, identify missing pieces as well as help the cities' authority personnel find relevant factors to act upon when planning and adopting a SUTP. The aim was to highlight problems as well as possibilities and to help the cities move forward in the SUTP process towards a sustainable transport system.

For this current freight transport study, the information gathered in the self assessment and by the peer reviews was complemented with in-depth interviews in four of the cities (Bremen, Gdynia, Kaunas and Örebro). The criteria for the choice of cities were that logistics and freight transport activities would play a strong role and that all relevant parties were willing to be interviewed. The cities differ in size as well as in economic and social circumstances. The 'political and administrative cultures' are substantially different since the study includes both cities from the old member states (OMS) of the European Union, i.e., Bremen and Örebro as well as cities from the new member states, i.e., Gdynia and Kaunas. The main stakeholders within those cities were interviewed concerning the drivers and barriers in freight transport in urban areas. Thus, approximately 10 in-depth interviews were conducted in each city with actors representing different views of the freight transport issue at various levels and functions. The actors interviewed were local authority representatives (heads of departments, decision makers, politicians, handling officers), hauler and logistics provider companies, trade organisations and others that could play a role in freight issues. The interviews were performed by the same two researchers in all four cities and lasted about 1 to 2 hours each. The interviews were semi-structured and included questions about municipality profile, drivers, impacts, quality of urban life, problems, plans and policies. The same actor groups were interviewed in all four cities and the questions were asked following an interview guide with semi-structured and open ended questions in order to obtain comparable results. Additional questions were asked in some interviews and in other cases it was not possible for all actors to answer the questions. Notes from all interviews were summarised and analysed through meaning condensation, meaning categorisation and thematic analysis. The interviews together with the peer reviews are believed to represent a qualitative view of the urban freight transport problems and possibilities for local authorities in many European cities, not just the four cities involved.

BACKGROUND

The concept of sustainable urban freight transport is reviewed in order to define the scope of our analysis.

The significance and complexity of urban freight transport

Urbanisation has been a clear trend in the past decades. Urban areas now constitute the living environment of over 72% of the population, and as urbanisation continues the proportion residing in urban areas is expected to increase to 84% by 2050 (European Commission, 2009b). Furthermore, towns and cities have been the drivers of the European economy since 85% of the EU's gross domestic product (GDP) is created in urban areas (European Commission, 2007b). Urban areas are therefore essential to the quality of life of European citizens as well as to the smooth functioning of the economy. The urban environment is highly dependent on transport activities of which freight transport is an essential part (Dablanc, 2008). Transport activities are also significantly important in meeting the needs of the citizens.

The unsustainable impacts of transport are numerous and multifaceted. The impacts can be divided into three groups: social impacts (e.g., noise, health and quality of life), environmental impacts (e.g., emissions, use of non-renewable fuels and waste production) and economic impacts (e.g., congestion and inefficiency) (UK Round Table on Sustainable Development, 1996). Furthermore, the impacts differ in time as well as in geographical scale. Some impacts can be limited to a local scale and are palpable only at the locality where the traffic takes place (e.g., noise), while other impacts affect larger regions over a longer period of time (e.g., greenhouse gas emissions). The scale of the local impacts is co-determined by the population density of the locality where the traffic takes place. In the year 2000, the externalities from transport (excluding congestion, with high climate change shadow prices) are estimated to account for 650 billion Euros, being 7.3% of total GDP in EU15 plus Norway and Switzerland (Schreyer et al., 2004). Freight transport is responsible for one third of the external costs (excluding congestion). Road freight transport is by far the dominating mode and represents more than 94% of the freight sector's total external costs. The most significant impacts of the freight transport sector are the local and regional impacts caused by air pollution, accounting for almost half of the total costs. Global climate change and the local traffic/infrastructure impacts contribute 21% each to the total costs. The associated costs of congestion in the EU have doubled from about 0.5% in 2001 to 1% of GDP in 2006 (European Commission, 2006a) and are the largest component within many urban areas (European Commission, 2007b). Road congestion costs are split half-and-half between road freight and road passenger transport although road freight transport only stands for 20% of traffic demand.

Hence, it is in urban areas where the unsustainable impacts of freight transport are most severe (Maibach et al., 2007). Freight movements absorb infrastructure capacity and affect the environment with unsustainable impacts like emissions, noise and accidents. Road freight vehicles emit a greater proportion of certain emissions per kilometre than, for example, cars do. To attain a sustainable transport situation in the urban area, all of these factors need to be looked into and considered. Urban freight transport is therefore essential for meeting the needs of citizens and the economy, but at the same time urban freight transport is increasingly becoming a disturbing factor for the quality of life and the urban environment. To handle this complexity, guiding principles are needed. Taniguchi et al. (2003) presented the three pillars of sustainability, mobility, and liveability as the strategic basis for planning and managing urban freight movement systems. These systems need to take into account that freight movements are not isolated activities, but are the activities within logistics that achieve the movement of products along a supply chain. As transportation bridges the distances between economic activities, it is the location of the logistics activities in relation to transport infrastructure that determines the nature, the origin, the destination, the distance and even the possibility of movements to be realized (Rodrigue et al., 2006). In turn, the availability of transportation co-determines location decisions of economic facilities, which leads to changes in the land-use system (Geurs and van Wee, 2004).

Transports do not end at city borders, and urban freight transport is highly influenced by national and European legislation as well as technological development. Furthermore, cities

can have special preconditions, e.g., geographical locations or conditions, political and cultural values. Hence, both external factors and local preconditions can influence the urban freight transport system. May et al. (2006) identify barriers to urban freight transport planning and implementing measures which may lead to less effective results; however, external factors may also contribute to the effectiveness of local actions. Based on May et al. (2006), the external factors can be grouped into four main categories:

- *Legal and institutional factors*, which include laws, regulations and responsibilities of superior levels or other agencies;
- *Financial factors*, e.g., budget constraints or supportive funds;
- *Political and cultural factors*, which influence the acceptance of measures and attitudes, e.g., in relation to work procedures; and,
- *Practical and technological factors*, i.e., skills and expertise of staff can hinder, but also support the implementation of initiatives.

FRAMEWORK

To better understand the complexity of transport between logistics, transportation, infrastructure and land-use, Sjöstedt (1996) presented a system-oriented conceptual model which is based on four basic elements: *facilities* where the economic activities take place, *goods* that demand transport to and from these facilities, *vehicles* that provide transport services and *infrastructure*. These elements interact in pairs in four different subsystems, which are: accessibility, land use, transport and traffic. Together, the interaction of the subsystems determines the performance of the transport system. Industrial production facilities and shopping centres are usually located within city borders as well as transport infrastructure facilities like sea ports or rail terminals. As a consequence, logistics facilities like warehouses and terminals are established in the vicinity of commercial centres and transport infrastructure. Hence, urban areas are centres for economic activities which take place in commercial, transport and logistics facilities. Economic activities require the movement of goods. A prerequisite for a functioning urban economy is the accessibility of goods to these facilities. Providing this accessibility is the main function of urban freight transport and it is the accessibility needs which drive the whole urban freight transport system. In order to provide accessibility of goods to the facilities, these facilities need to be connected to traffic infrastructure. The land use subsystem comprises the supply of transport infrastructure as well as the location of the facilities in relation to the traffic infrastructure, which are both crucial factors for accessibility. In the traffic system, actual physical movements of vehicles are realised in physical networks in which traffic units absorb infrastructure capacity. In the transport system, the demand for goods movements to and from the facilities is matched by transport services which require vehicles to be moved.

Integrated transport planning

Municipal transport planning and sustainable development focus on passenger transport rather than on freight transport issues. Results from a survey sent to cities in the BESTUFS

(Best Urban Freight Solutions) project show that half of the responding cities had no responsible authority for freight transport issues (Zunder and Ibanez, 2004). Freight is considered a phenomenon connected to private industry and driven by business. Private firm operations are often neglected by the public authorities since freight transport in the urban area is poorly understood and there is a lack of systematic methodology for planning such activities (Crainic et al., 2004). A combination of company initiatives and public policies are necessary to develop a sustainable urban freight transport system (Anderson et al., 2005). Anderson et al. (2005) stated that to handle the impacts and to realize a sustainable city, there is a need for actions, measures and a workable and acceptable set of targets. However, those targets are hard to reach unless there is cooperation between local authorities and transport operators to help the process.

Integrated transport planning is a concept widely used and recognised today to describe sustainable development and is a prerequisite for reaching sustainable development, but the concept is not easy to understand (e.g., May and Roberts, 1995, Potter and Skinner, 2000, Bertolini et al., 2005). May et al. (2006) distinguish between three different forms of integration: 1) operational integration, usually of public transport; 2) strategic integration between transport policy and land use; and, 3) institutional integration within local, regional and national governments. They concluded that all three kinds of integration are important. The complex interrelations between different stakeholders in the policy making process were shown by Bertolini et al. (2005); see Figure 1, which also shows what kinds of cooperation and communication are needed. Tools are available, but a systematic approach and analysis is lacking and therefore has an uncertain outcome. More recent research (e.g., Hull, 2008) showed that this is still the case.

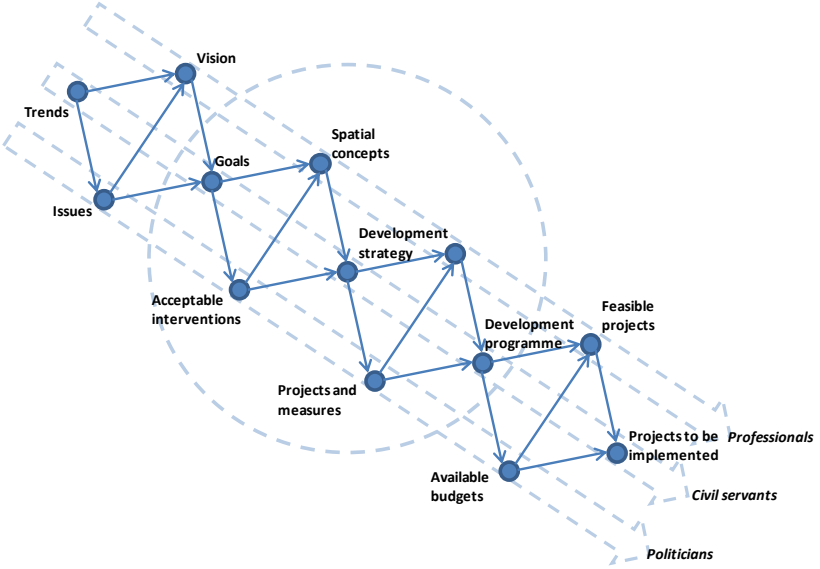

Figure 1 – Policy making as a network of interrelated actions (Bertolini et al., 2005)

Hull (2008) suggested that there are new approaches to planning practices and that there are well-known tools and instruments to approach inter-sectoral work practices between transport planners and other professions, but that these tools are rarely used. Other research groups suggest, in line with the previous groups, that multi-instrumentality could be a success factor for transport policy implementation (Vieira et al., 2007). Hull (2005) found in a

research study of UK local transport authorities that these authorities feel hindered in their work by 'short-termism' in political decision making as well as contradictions within policy objectives. Hull (2008) concluded that few local practitioners sufficiently understand the local structures so that they may work across them. Rather, the responsibility for implementing sustainable transport solutions is placed with the local transport authorities. The concept of sustainability needs to 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 (2008), who stated that to attain a sustainable city and active citizen support, new forms of communication between citizens and experts and the involvement of all major stakeholders are needed. There must be a willingness to change, and an active involvement of all actors is the most effective way to achieve change.

A more integrated approach than previously used to create sustainable development in the urban area has lately been encouraged by the European Commission in several strategies for transport planning. Sustainable transport is highlighted and the commission strongly recommends authorities develop and implement Sustainable Urban Transport Plans (SUTP) (European Commission, 2005). The problem of urban transport was also addressed by the *Green Paper towards a new culture for urban mobility* (European Commission, 2007a) which highlights the importance of integrated solutions involving stakeholders, citizens and other planning departments.

The SUTP is an integrated approach to manage urban transport by adopting long-term and strategic action plans with the goal of overcoming deficits in the coordination and cooperation across administrative borders (city and surroundings, agglomerations across regional/national borders), as well as between authorities in national hierarchies (local, regional, national governments) regarding their respective plans and policies. The SUTP aims at improving qualities of the planning approach in terms of procedures and actor relations as well as designing planning instruments to ensure the efficient implementation of policies and measures and ultimately target achievement. Concerning urban freight transport, core planning principles of the SUTP are (Wolfram, 2004):

- The existence of an *urban freight transport strategy*, which should be embedded in an overall sustainable development strategy with a long-term perspective (ca. 20-30 years);
- *Regional scope*, defining the whole "urban agglomeration" as the transport planning area as essential since this is the scale at which most transport movements are taking place; and defining responsibilities to ensure full commitment and put liabilities into place;
- *Stakeholder consultation*, to secure maximum transparency throughout the process and to improve the quality, acceptance, effectiveness and legitimacy of the actions;
- *Actor cooperation and policy coordination*, to ensure integration between all transport modes and policy sectors, as well as geographical coverage of the entire functional urban agglomeration; and,
- *Capacity building*, in order to ensure that key personnel have the necessary skills.

Model for sustainable urban freight transport

Considering the relationship between external factors, the planning principles and the impacts, a model has been developed according to Figure 2. The Sjöstedt-Model is extended to include three items: 1) the external factors which influence the urban freight transport system, 2) the SUTP concept and its planning principles as integrating elements, and 3) the unsustainable impacts as outcome of external factors and urban freight transport planning and measures.

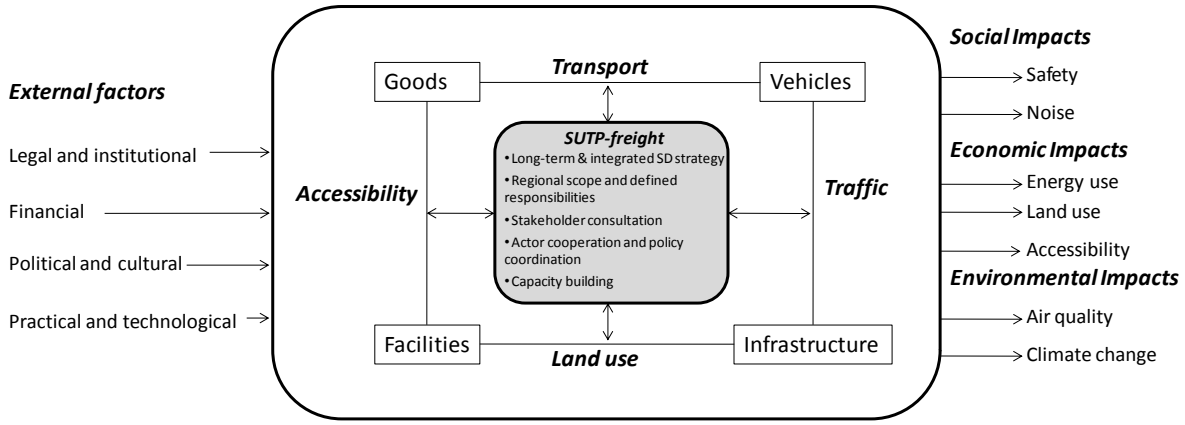

Figure 2 – The relationship between factors affecting SUTP-freight (adapted and developed from Sjöstedt (1996)).

The model above is used to analyse the interviews from the case study and it highlights the important relationships between different factors that affect freight transport in urban areas. Most of the negative impacts of freight transport take place at the traffic system level where vehicles consume energy and produce emissions. However, the impacts are the result of the interaction of goods, facilities, infrastructure and vehicles in the four subsystems: accessibility, land use, transport, and traffic. Integration is at the core of any promising approach aimed at reducing the impacts and achieving a sustainable urban freight transport system. The subsystems: accessibility, land use, transport and traffic need to be targeted in an integrated way, and local as well as external factors need to be acknowledged.

RESULTS FROM THE INTERVIEWS

The information gathered in the interviews is extensive and what will be presented here is only the most relevant information in line with the purpose of the paper. Despite the fact that the analysed cities differ in size, economy and cultural background, they all face the same challenges, which are generally agreed upon among all actor groups. The results presented here are therefore valid for all cities and are sorted under the areas shown in Figure 2, focusing on the areas: External factors, Planning principles, Land use, Accessibility, Transport, Traffic, and Impacts.

External factors

External factors are factors that are hard for the local authority to have any direct influence over, e.g., national laws, cultural traditions or the political willingness to affect the situation. In the case cities, it is mainly the local external factors such as local regulations of road infrastructure that are highlighted, e.g., weight or time restrictions, which have to be determined politically. To implement a restriction of any kind in an urban area demands a political willingness to do so, a good cooperation between departments, and cultural acceptance. There are often long processes and freight transport is seldom an area where this effort is put since freight transport is regarded as non-prioritized. In both OMS and NMS there is an economic aspect where freight transport gets very little room in local budgets.

Local authorities are hindered to work with, e.g., infrastructure networks or financial instruments such as road pricing on a larger scale since many of these are controlled by national or even European legislation. Therefore, national factors are discussed vaguely. The most obvious problem regards the railway infrastructure where there is still a Russian gauge in the NMS in Eastern Europe. This gives poor prerequisites for using the railway where it could be troublesome handling the shift between Russian and European gauges. Therefore, long haul rail transport is quite uncommon in NMS countries.

Planning principles

There is a lack of awareness of freight transport problems and possibilities in the case cities. “There are more urgent matters to handle” and “We never thought of the handling of freight issues” were two typical comments from the interviews. There is also a lack of competence of the local authorities of personnel having knowledge and education about freight and logistics. In the NMS, freight transport movements in the cities are not well understood and do not seem to be a high priority or a primary source of problems. Though it was recognised that it most probably will become a problem in the future, there is no planning department dedicating time to freight transport issues. In the NMS there is a lack of data regarding freight transport in contrast to OMS, where municipalities have good data about freight traffic in urban areas and they see urban freight as a growing threat to local sustainability. However, the planning in OMS is limited to achieve traffic optimisation and ambitious approaches to actively tackle the problem and steer the development have failed. Bad experiences lead to reluctance to continue working on the issue at a strategic level, according to many interviewed local authorities. There are long-term strategies for sustainable development where public transport, walking, cycling and regulations of car traffic are included. But in total, evidence in forms of documents from the municipalities shows that cities do not have sustainable freight policies embedded in their overall sustainable development strategy.

Furthermore, there are indications from the interviewed local authorities that regional integration with neighbouring municipalities does not take place concerning freight transport, but a non-formalized cooperation takes place regarding passenger transport. In some cases there is even competition that hinders, e.g., consolidation. A further insufficiency is a lack of cooperation between city departments. This is especially valid for cities in the NMS where

the old hierarchical administrative structures from the communist era still influence the way of working. Nevertheless, the consultation with private stakeholders is adequate in all cities even though the continued cooperation is lacking. However, the good consultation may also cause problems since there are indications in some of the interviews that for economic reasons authorities are reluctant to introduce restrictive measures against private local stakeholders.

Land use

To a large extent land use and accessibility go hand in hand. Locations of logistics activity facilities in relation to locations of consignor and consignee facilities, together with the connecting infrastructure is the key element of logistics. The localisation of all types of facilities is often limited by the city spatial planning, which in turn does not include freight transport as a factor during the development of the plan. This is a general problem in both OMS and NMS. The freight forwarders always consider the infrastructure and the possibilities in the infrastructure for accessing the facilities when planning localisation. But, the consignor and consignee are often concerned with how the customer will access the facilities rather than the freight transport solutions regarding the infrastructure issue.

Accessibility

The accessibility of goods to facilities in urban areas is a prerequisite for a functioning urban economy. The expected economic growth during the next decades will lead to more goods being produced as well as being consumed in urban areas. The production of goods has been increasing, especially in cities in the NMS. Common to all cities in the Baltic Sea Region is the development of the logistics sector. All the evaluated cities see themselves in a preferable location for logistics activities, e.g., location for transport hubs, as well as being able to handle at least two modes of transport. They actively market themselves, from the local authority planning department or freight forwarder side, as a logistics hub with the goal to establish more transport and logistics intensive companies. Overall, goods demanding accessibility is expected to continue to increase. This fact could have negative consequences regarding the high service level standards as well as how the impacts from the shipment design affect the unsustainability of urban freight transports.

In the economic slowdown of 2008/2009 there tended to be a sudden fall in freight transport demand; however, previous recessions have shown that freight transport is bound to recover quicker than the rest of the economy (European Commission, 2009a). Hence, in case of an economic recovery, a strong transport growth can be expected in the NMS cities. A steady increase can also be expected in cities in the OMS.

Transport

Road transport dominates the modal split for the connection of transport hubs with their hinterland. However, in many cases there are substantial waiting times involved, e.g., due to

congestion on access roads or due to terminal queues. There is a demand for rail services which potentially can offer better speeds and lower costs; however, infrastructure capacity constraints and operational barriers lead to a lack of rail transport services, which is also reinforced by infrastructure investments mainly in the road transport side. In the NMS, rail transport services suffer from interoperability problems between the European and Russian rail network. Consequently, the modal split of the hinterland transport of ports in the OMS is ca. 30% while in the NMS it is significantly lower.

The load factor of the urban distribution vehicles is one aspect that affects the transport situation and that is discussed as a regulation possibility in some cities in order to increase the transport efficiency. Consolidation through cooperation between neighbouring facilities and competitors is lacking, though.

Traffic

The growth of traffic flows is a problem in all cities according to the interviewees. Statistics show that the growing number of vehicles on the roads will increase the queues during rush hour and at other times, and the lack of traffic infrastructure is a common challenge. In cities in the OMS, the infrastructure currently provides the sufficient basic capacity to connect the logistics facilities with the higher ranking transport network. However, the capacity will not be sufficient to meet future demands. Significant infrastructure investments are required to secure accessibility. In the NMS, the commercial and logistics activities have been growing faster since the infrastructure has been developed. Though significant transport infrastructure is currently under construction, the growth in capacity is still outpaced by the growth in demand for freight transport.

An additional common challenge is the lack of loading space in central business districts, which causes problems for delivery operations and obstructs traffic flow, pedestrians and cyclists in central business districts. In the OMS there are some examples of technical solutions to minimise the freight traffic impacts, e.g., clean vehicle access to certain areas, and also some examples of Low Emission Zones where old vehicles are prohibited. The NMS generally has an old vehicle fleet for distribution traffic which together with a lack of alternative fuels increases the negative sustainable impacts from freight transport. Most cities favour and encourage alternative fuels both in NMS and OMS, but this encouragement is mainly directed towards private passenger cars and public transport rather than freight traffic. The lack of alternative fuels is also a fact in OMS, but there is in many cases an alternative fuel infrastructure network dedicated to public transport bus fleets that could be used more extensively also by freight vehicles.

Impacts

Impacts are dependent on all previous sections: External factors, Planning principles, Land Use, Accessibility, Transport, and Traffic, as illustrated in the model in Figure 2. The impacts show the effects of handling by actors, by decisions and performance regarding freight transport.

There is no clear connection in any of the cities studied between environmental impacts and freight transport, but there is a higher recognition of the freight transport problem in the OMS than in the NMS. All of the cities studied measure air pollution in the urban area using sensors controlled and monitored by the local authority. The persons responsible see the high air pollution results as a problem. The proportion of emissions that are connected to freight transport is not known since statistics of freight transport vehicle movements are scant. The emissions have been highlighted in recent years because of the air quality standards from the European Commission (European Commission, 2008), and most cities are trying different ways to reduce those emissions. National laws and regulations as well as international demands also influence these decisions at the city level. Congestion is also a growing problem, caused by private cars as well as freight transport. In the NMS car ownership is increasing, which is the main contributing factor to the increased congestion. The main action to reduce congestion is new infrastructure, both in OMS and NMS. In the OMS some actions have been tested to reduce the number of freight vehicles in the central business districts, but these have led to poor results with no obvious reduction of vehicles.

ANALYSIS AND DISCUSSION

To bring the factors together, the results are applied on a matrix developed by Behrends et al. (2008). The original matrix was developed based on a definition of sustainability in urban freight transport, the causal chain of transport – traffic – technology and an actor-based model of a transport system. It was implied in the paper by Behrends et al. that it would be of interest to test the matrix on a real case. In this paper, the original matrix is tested and further developed. We have combined the matrix with the model of relationships between actors in Figure 2. The results are presented at the end of this section.

The most interesting as well as clear results are merged and included in the new matrix adapted from that of Behrends et al. (2008); see Table 1 below. The purpose of the matrix is to show the complex relationships between different actors, the need for an approach that involves all actors and how they relate to different factors. The matrix visualises the actors, their responsibilities and the possible measures that can be taken. For this study, the matrix has been adapted from the original to match the model presented in Figure 2, and presents the shortcomings and potentials of urban freight transport issues in urban areas according to the purpose of this paper.

To simplify, the matrix does not include external factors or impacts as columns. The external factors are not something that the actors can influence directly; rather, these factors are something that provides a framework for what the actors have the possibility to do. External factors could be influenced on a higher level by all actors, although not as a direct decision from the actors individually. The impacts are excluded from the matrix, since the impacts are something that show the effect of the actions the actors take individually for all factors. Further on, the technical capabilities which were a part of the Behrends et al. (2008) matrix have been excluded since they are considered to be a part of both external factors and traffic in the model used by us.

Table 1 – Matrix bringing the factors and actors together, showing potentials (+) and shortcomings (-) (adopted and developed from Behrends et al. (2008))

INVOLVED ACTORS/ FACTORS	**City administration/ local authority**	**Consignor/ consignee**	**Freight forwarder**	**Transport operator**
Planning principles	*- Lack och freight transport competence (knowledge)* *- No long-term sustainable freight transport strategy* *- Lack of freight data* *- Lack of internal cooperation* *- Lack of cooperation with neighbouring municipalities* -/+ Stakeholder consultation is good, but the cooperation is lacking + awareness is growing			
Land use *Infrastructure - Facilities*	*- The spatial planning to reduce urban sprawl does not include freight transport*	*- Localisation of facilities, not considering connections to transport infrastructure* *- Localisation of facilities, limited by city spatial planning*	*- Localisation of terminal, limited by city spatial planning*	
Accessibility *Facilities - Goods*	+ Cities improves prerequisites for logistics connection to interregional networks	*- Lack of awareness how to affect transport via shipments (size, frequency, number etc.)*	*- Lack of alternatives to standard high quality service level (short lead times)*	
Transport *Goods - Vehicles*	+ Ideas for load factor regulations	*- Lack of cooperation with neighbouring facilities*	*- External consolidation (lack of cooperation with competitors)* + Internal consolidation	*- External consolidation (lack of cooperation with competitors)* *- The modal split is low* + Internal consolidation
Traffic *Vehicles - Infrastructure*	*- Not sufficient infrastructure capacity* *- Lack of loading space* *- Freight transport actions limited to achieve traffic optimisation* + Alternative fuel infrastructure strategies + Heavy vechicle regulations (low emission zones, weight, time)	n/a	n/a	*- Old vehicle fleet* *- Lack of alterntive fuels*

The consignor/consignee can have their own vehicle fleet and therefore be a transport operator as well.. A freight forwarder is not always used as an actor in the transport system. If not, the transport operations will then be handled by a transport operator directly. Those two aspects are marked in the “traffic”-row in the matrix by n/a. An actor that is excluded from the matrix is the university, since the impact from universities is not considered to be direct as are the other actors. The university rather influences other actors through its research. Nevertheless, the so-called triple helix of the university, the local authorities and the transport industry, must not be forgotten and the universities play an important role in developing new concepts and technical innovations, finding new approaches and developing monitoring methods for impacts for the other actors. As concluded by Behrends et al. (2008), the matrix shows that all actors are affected by others in a causal chain of activities, but that it is mainly one actor that dominates certain segments. By setting requirements it is possible for actors to influence other actors and the final impacts.

Within this article we have presented a qualitative view of the current state of freight transport in urban areas as well as a matrix highlighting the apparent shortcomings in urban freight transport planning. The study shows that a holistic understanding of the implications of freight transport in urban areas is lacking. Previous results of the general transport situations in cities were in this study combined with freight transport in particular. The common challenge for the cities is that freight transport is growing. The number of deliveries to the city centres and through the city centres as well as transports to and from major gateways such as ports, rail terminals, distribution centers and airports is increasing and therefore the emissions and other negative effects are also increasing. Freight transport is needed for the cities to be liveable, but they need to be handled in an efficient way to reduce the negative impacts as much as possible. The development seems to be a bit of a raised awareness of the problem for some actors, but the main area of interest for most local authorities is still public transport and handling the movement of private cars.

Results from the interviews show that interaction and cooperation of all involved actors is necessary, but lacking, i.e., actors from the public and private sector. Furthermore, city authorities need more capacity and competence to manage and control the freight transports. The results from this study confirm results from earlier studies of freight transport in urban areas, but this study adds an important qualitative and holistic approach, which gives a broader understanding of the freight transport situation. It also gives a basis for future strategy designs, by the collected empirical data in the matrix presented.

The interviews clearly showed that freight transport is not a prioritized matter and there is an overall lack of knowledge in the area. This is common for all four cities interviewed, and it seems like the differences in history or in other patterns does not matter, even though different cultural settings could affect the interpretation of messages. The interviews corroborate previous results that freight transport issues are seen as a ‘business problem’ rather than something that could be influenced by the local authorities. A couple of the cities have tried strategies with different measures like weight or time restrictions for heavy vehicles, with the aim of reducing freight transport, but so far few of those have been successful in a long-term perspective. Awareness that freight transport is an increasing contributing factor to negative environmental impacts is either low or the knowledge of what to do is very limited. Since many projects that have been run within the area of urban freight transport have not led to any positive changes, another reason for lack of commitment in taking action is likely to be due to failure experiences.

Freight traffic accessing transport facilities as well as shippers and receivers is increasingly facing impediments since urban congestion and a lack of loading areas, etc. in city centers negatively influences the operation conditions for freight vehicles, causing low average speed and long stand-still periods. As a consequence, transport networks face the risk of containing their service levels in the future. Provided that in the long term transport volumes are going to increase, the handling capacity of seaports, rail terminals or logistics facilities and their access roads and rail tracks needs to be increased as well. However, the urban locality constrains the possibilities for capacity extensions for two reasons: First, logistics and transport facilities compete with other land-use forms, e.g., non-logistics businesses and

housing, for limited physical space, and second, new investments or extensions of existing facilities are often opposed by adjacent residents because of the externalities that increasing transport activities impose on them. Transport and logistics companies are aware of these increasing problems that urban transport imposes on the performance of their services. However, transport and logistics companies have no or limited contact with city authorities to discuss these problems. Furthermore, local authorities are reluctant to impose restrictive measures on freight transport since these are seen as a risk for regional competitiveness. Economic interests on the one hand and environmental and social interests on the other hand are perceived as trade-offs and there is no long-term strategy to balance these interests.

CONCLUSIONS

Freight transport services are increasingly important for the regional competitiveness while freight traffic is a growing threat for urban sustainability. Although not clearly stated, we have interpreted that there is a certain indication that a deeper integration of freight transport and urban sustainability strategies can be beneficial for the efficiency of urban and inter-regional freight transport networks as well as for local sustainability and regional competitiveness. Here we definitely have more to do. However, local authorities do not care enough about the issue and for transport and logistics operators the 'last mile problem' is neglected to a large extent. There is a lack of role models and inadequate monitoring, evaluation and dissemination of performed studies and projects makes it hard to follow good experiences as well as avoiding the bad examples. To overcome the barriers and to start dealing with the problem, first of all an overall awareness is needed to understand that freight transport is an area to work with both from the local authority side and the transport operator side. The conclusions are summarised as follows:

- *Cooperation and communication* is needed between and within city authority departments as well as with stakeholders and other actors, which is also confirmed by earlier studies;
- *Information* is needed about possible actions for different actors and what steps need to be taken to cope with the increasing problem and to understand the possibilities;
- *Knowledge* is needed in order to understand the factors affecting urban freight transport and to be able to cope with the problems.

A part of a solution must be an integrated planning procedure, where all types of transport are included – from walking and cycling, cars and public transport to freight transport. This is important in order to understand the complete picture of a city's transport situation. Further research is needed to find ways to help the cities understand their problems, increase their knowledge and to be aware of the possibilities to secure the mobility of goods in urban areas. Sets of indicators do exist as well as planning methods, but the next step needs to be a development of implementation guidelines and conceptual models.

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