2015 IEEE 18th International Conference on Intelligent Transportation Systems

Urban Logistics Integrated in a Multimodal Mobility System

Jorge Freire de Sousa
INESC TEC and Engineering Faculty, University of Porto
Porto, Portugal
jfsousa@fe.up.pt

João Mendes-Moreira
INESC TEC and Engineering Faculty, University of Porto
Porto, Portugal
jmoreira@fe.up.pt

***Abstract*—In this paper we briefly present our feelings about urban logistic and its role in urban mobility. In some way, we can say that this is a position paper based on an extensive review of all known related published material. We support the development of new approaches for the management of passenger and freight transport together as a single logistics system; based on the access to more and more sophisticated flows of data and better communication means, we envisage the dissemination of sufficient information for the correct decision of every citizens between several mobility options in real time (especially with the support of mobile technology); and we sustain that new tools are needed to help the design of innovative business models and policies, and the change of habits and behaviors. We visualize urban logistics as a multi-stakeholder, multi-criteria and multimodal mobility dynamic system.**

Keywords—urban logistics; urban mobility; multi-stakeholder; multimodal transport; big data.

I. INTRODUCTION

A. Background and context

Urban logistics encompass a broad range of activities and relationships, involving quite different actors and stakeholders in producing, storing, trading, and supplying a large variety of goods and services.

Urban logistics are crucial for citizens' quality of life, and play an important economic role with significant benefits for multiple stakeholders along rather complex, dynamic supply chains. But urban freight transport also has quite relevant associated environmental, social and economic problems, particularly in what concerns pollution and gas emissions, noise, traffic congestion, pedestrians' safety, and journey unreliability and delivery delays. This is becoming more critical with an increasing load fragmentation and with small parcels often being carried by almost empty transport vehicles.

Urban transport includes not only the transport of goods. A significant proportion is attributed to the transport of people. In a major part of Europe, many large and mid-size cities have managed the transport of people by developing efficient public transport networks, most of them integrating multiple modes. But planning of freight transport is still very immature. By comparison, the urban transport of goods is almost completely managed by private logistics service providers and/or shippers who look at their own transport requirements without any coordination, leading to many unnecessary movements (from a city perspective) of underutilized vehicles in congested areas.

This is one of the reasons why urban freight operations are acknowledged as creators of numerous negative impacts in terms of sustainability and mobility, both being object of increased awareness and concerns. At the same time, to supply more goods and provide better and faster services, urban freight operators do face various difficulties related to traffic, pollution, policy constraints, parking, or customer demands.

Despite the fact that logistics and distribution of goods are today critical functions in any society, spatial studies, in particular citywide, often neglect their consideration in urban development [1]. And research in the areas of the territory and transport also has not been able to significantly change the situation in this respect.

Effectively, each city has sought its own solutions, most often with unsatisfactory results. But societies are increasingly demanding and city governments have been urged to solve this difficult problem in a socially acceptable way while corresponding to the main questions of the distribution companies [2].

However, the results of the actions carried out have shown that, in most cases, there are unexpected side-effects that compromise their success. The truth is that there are many actors involved, with different perceptions, and there is also a lot of lack of knowledge assimilated in the decision-making centers – and their related support services – about the complex characteristics of urban logistics and its implications on the perspectives and expectations of key stakeholders related with the supply chain [3].

B. Purpose and structure

This paper intends to constitute an additional factor of motivation for a discussion of innovative logistics services solutions in urban areas, and for evaluating their contribution to a healthier urban metabolism and, more generally, to a more sustainable city development.

Besides these strategical issues, it would also be important to place the foundations of an integrated framework supporting tactical and operational decision-making, for collaborative and integrated freight and passengers' urban transport systems. This only can be done in a dialogue between data and transportation scientists.

Given new technology and real-time availability of data, it is a must to think ahead for out-of-the-box solutions and make a major leap forward. Our vision is that only solutions that consider policy, logistics and technology together in a balanced way will be able to be promoted and implemented.

This work is financed by the FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) within project UID/EEA/50014/2013.

978-1-4673-6596-3/15 $31.00 © 2015 IEEE
DOI 10.1109/ITSC.2015.23

There is a clear gap between academic research and the real practices operated in urban logistics. This is partly due to the fact that not all stakeholders' objectives are taken into account in the modelling approaches and also to the difficulties in dealing with such different perspectives.

The main purpose of the paper is to contribute to a better understanding, structuring and modelling of urban logistics as a multi-stakeholder, multi-criteria and multimodal dynamic system, aiming to optimizing the design of services and the utilization of vehicles, and to developing tools to support the design of innovative business models and policies.

The remainder of the paper is structured as follows. In Section 2 we briefly review recent urban freight transport literature, initiatives and projects. In Section 3 we identify some ways of integrating and managing data in order to improve decision outcomes and operational performance. In Section 4 we place some guiding principles to new methodological approaches to deal with urban mobility systems; then, we carry on about some preliminary conditions for the development of an analytical framework that contributes to the conceptualization and research processes leading to a gradual transition to a multimodal mobility system. We conclude by highlighting the main findings of the paper in Section 5.

II. SHORT LITERATURE REVIEW

We will limit this brief overview of published works to two features – recent academic literature reviews, and European research projects. We will also mention the most influential (presented or published) works in our conjectures.

City logistics and urban freight transport have been receiving increasing attention throughout the years, with a particular emphasis since mid-nineties, partly due to the pressure imposed by the sustainability debate in recent years, due to their several external effects, extensive to virtually all citizens [4-5]. As a consequence, there was a growing number of private and public sector initiatives that justified an overview and classification of such projects [6]. In 2008, Quak included in his PhD. Dissertation 106 urban freight transport initiatives [7].

As the number of related industry-based projects and initiatives increased, there was a need to carry out sound scientific research. As a result of that, a big number of reviews emerged recently in academic literature. Some of them are not exclusively urban [8-12] but contain useful lessons to city logistic. Others are urban-specific [13-15] and they are part of the most recent reviews included in the proceedings of the biennial International Conferences on City Logistics, born in 1999, and that have become an important world-wide knowledge platform for researchers in the field.

Many European research projects also contributed to important steps towards a different logistical concept and merit to be mentioned: Bestufs, Cityfreight, Citylog, Citymobil, Fideus, Freilot, Straightsol, Sugar, Turblog.

Previously, logistics mainly aimed at maximizing profit, whereas sustainable logistics now aims to add the ecological and societal dimensions to the originally purely economic concept of logistics [16]. These three goals are often referred to as the three P's: people, planet and profit. This triple bottom-line was recently extended to a fourth P: policy [17]. This is in line with the quadruple helix proposed by [18] in which the main actors for city innovations are: government, companies, citizens and researchers.

An alternative vision of sustainability has emerged recently [19]. The author proposes four characteristics, noted as the four A's, on the basis of which sustainable development should be considered: awareness, avoidance, acting and shifting, and anticipation.

III. POTENTIAL ROLES FOR BIG DATA

The availability of open urban data [20], from different sources [21-22] has the ability to open new opportunities for logistics. How can this data answer, particularly in what concerns the four P's previously referred: people, planet, profit and policy? We discuss some ideas along this section.

A. Predicting travel time for the long term

Establishing duties for deliveries may be improved by travel time predictions, typically for the long-term. However, the irregularity of the deliveries' itineraries and the dispersion of the actual data by many different entities [23] are probably the main reasons why studies on long-term travel time prediction are so scarce in the scientific literature [23-27].

Scenario: new open urban data are being introduced in different cities worldwide, making possible to better predict long-term travel times and therefore to better plan logistics routes.

Beneficiaries: people and profit.

B. Running away from rush areas

There is already knowledge on how to build Origin-Destination (O-D) matrices over streaming data [28]. This can be done using different data sources, such as taxi-GPS data or telecom data [29], for instance. How can logistics take use of it? Which would be the benefits?

Scenario: development of dynamic approaches for route planning, using real-time O-D matrices in order to recommend less congested roads by taking into account the expected traffic conditions in the different areas of the city along time.

Beneficiaries: people, planet and profit.

C. New insights on public policies for logistics

VENIAM is a startup located in Porto, Portugal that intends to provide transmitters in the buses that, together with mobile Wi-Fi hotspots, will give insights about the real constraints on public mobility. The time of using questionnaires to better understand the mobility of the city turned out definitely.This new data can be used by municipal authorities to better adjust public policies.

Scenario: mobile Wi-Fi hotspots open new opportunities to better understand city mobility and, consequently, to better define public policies for logistics.

Beneficiaries: planet and policy.

D. *"Uberising" logistics*

Taxi companies are facing, in several countries, the concurrence of a new type of service introduced by the company Uber in 2009. This service gives the possibility to any citizen, once registered, to transport other citizens. The payment is done according to the time and distance of the race they do. Such kind of service can also motivate better carrier cooperation. How could this kind of service be applied to logistics? Which would be the benefits?

Scenario: to extend Uber-like service to logistics by enabling any citizen to carry goods from an origin to a destination.

Beneficiaries: people, planet and policy.

IV. TOWARD A MULTIMODAL MOBILITY SYSTEM

A. *Guiding principles for a leap forward*

In this section, the authors decided to follow quite closely the terms of the work described in [30].

Large scale changes will be necessary to deal with the challenges facing the urban mobility systems. In fact, the mobility sector, public authorities, and customers must break away from conventional thinking.

Our proposal is that the complex multidimensional changes, necessary for the development of multimodal sustainable urban mobility systems, should go towards an integrated planning of multiple stakeholders. This creates exciting prospects, not only for strategic planning, but also for government officials and other stakeholders in making urban mobility more effective and efficient. Urban mobility is a highly dynamic and complex concept and needs to be redesigned to meet the sustainability and user requirements.

Overall, multimodal mobility presupposes three conditions: the presence of multiple transport means customized to the specific situation; sufficient information for the correct decision between several options in real time (especially with the support of mobile technology); and a change in social habits and behaviors.

Intelligent transport systems with modern data communication are advancing, but technical solutions alone are unlikely to reduce the impacts of transport to a level which is deemed sustainable. The strategy agenda must coordinate efforts, diversify the portfolio of public and private financing, change business models, and create a renaissance of civil participation.

Overall, we feel that multimodal mobility will become essential for city center accessibility, and its attractiveness will depend on the quality of mobility services offered. The future is not about reducing mobility as such, since mobility is the prerequisite for social participation, progress, and growth. Rather, a socio-technical transition towards a sustainable urban mobility system should organize transportation smartly while fulfilling the multi-dimensional complexity of the changes outlined.

B. *Preliminary views for an incremental transition*

1) Preamble

Which are the main factors that determine the success or fail of an urban logistic initiative? In which way can the answer to this question contribute to the formulation of an initial analytical framework to support the conceptualization and research of processes leading to a gradual transition to a multimodal urban mobility system?

There are two particular issues that need to be addressed here: first, the extent to which the objectives of a project or just of a simple initiative are achieved over time; second, the extent to which these objectives are embedded in the practice of a city, making them potential guides to a sustainable transition to a new stage of urban logistics. Cities need to respond strategically to generic pressure over their mobility by developing managed systemic changes in their organization.

During a significant period of time – say, until about 10 years ago – and in spite of a huge number of initiatives concerning urban logistics and mobility, changes were slow, and on the whole, it appeared as though none of the stakeholders were willing to make fast progress [5].

In a more recent past, mainly – but not exclusively – due to a large number of urban freight transport projects and initiatives (see Section II), the future of urban mobility has been intensely debated and various forms of foresight approaches have emerged in the field [4-6; 30-31].

From our review, we derived some shortcomings common to most of the unsuccessful projects and we synthesized some focal topics by including them in the four clusters identified in [4]: the new mobility, the city logistics, the intelligent system management and the livability.

2) Shortcomings

Apparently, financial unfeasibility of the projects is one of the main causes for failure. Forget the real non-financially viable ones and see what happens with the others, in which total benefits outweigh total costs. In the conclusions of the STRAIGHTSOL Project [32], three main factors are identified for desired solutions – beneficial for society as a whole, but complex to put in the market – not being able to find a successful business model: dispersion of costs and benefits; difficulty in quantifying benefits; reluctance caused by factors like trust, competition, dependency or uncertainty.

These – often non-rational – factors are partially responsible for the absence of coordination between shippers, logistics service providers and retailers, meaning basically that they don't consider the activities of each other when they are planning their own activities.

An additional disturbing factor is that there is a dichotomy between the city and the logistic activities. "Because a city is a complex, costly and constrained space, in most cases it is only a space of circulation and unloading and loading … freight

operators penetrating in a city center do so only for the time needed to accomplish their delivery. They do not act and feel as if they belonged to the urban environment they work in" [5]. Clearly, the development of a balanced solution needs to consider the characteristics of the city, with consequences not only on the behavior of logistics service providers but also on the city government planning processes related to land use and urban development.

This leads us to a fourth source of trouble: inaccurate local rules and regulations and poor role of local government and authorities. "Public sector managers play a key role in determining and regulating societal externalities and standards for environmental quality. Policy conclusions and regulatory policies based on inaccurate modeling affect the entire economy … Besides, most urban freight transport regulations or initiatives are not evaluated on their effects in practice" [33]. Unsurprisingly, the private sector focuses on controlling the internal costs, and is less worried with the external problems caused by their operations. The search for a global solution must include a powerful definition of the role of governmental regulation.

Finally, technology innovation has been considered to be a key success factor in meeting the challenges of urban mobility, and it certainly is. Although undeniably important, it has often only provided temporary and partial solutions. This is particularly relevant in the public transport sector but also in the underuse of location-based services, enabling consumers to (re)discover their proximities to products.

3) Innovative practices and clusters of activity

The preceding list reviewed some sources of unsuccessful initiatives. We would like, now, to outline four policy visions or four clusters, which emerged from the observation of innovative practices on the ground [4], each one of them bringing a different systemic view to an incremental transition of the cities and their mobility towards a multimodal, multi-stakeholder and multi-criteria dynamic system.

The "new mobility" cluster addresses the way citizens plan their daily activities. Past research has shown that the quality of transport information affects customers' mode of transport choice. A small example: OPT – the first company in Portugal developing intelligent and automatic solutions for decision support in transport planning – created and settled a system that allows anyone to know how long it will take for the next buses to arrive at a particular stop in the public transport network using a text message in a mobile phone. The SMSBUS system showed not only a significant decrease in passenger waiting time – both real and perceived – but also an increase in the usage of buses for non-commuter trips and in the distances made on foot, as a higher confidence in arrival times allowed people to walk to further stops. Thus, it is important that multimodal travelers are provided with information prior to and during a trip.

Another research stream in this cluster started to assess potential new business models for mobility providers, due to decreasing levels of car ownership in travel trends, and regarded such reorientation strategies as a key megatrend in the automotive industry. For instance, the growing importance of car-sharing is expected to support changes in mobility patterns. More than half of the participating companies in a barometer survey in Germany referred by [30] perceived it feasible to combine car-sharing with electric mobility in the future.

The "city logistics" cluster addresses the business of goods movement. Most solutions for logistics service providers in urban freight transportation are in cooperation or collaboration. Important success criteria to new business models are hard constraints like revenue or profit improvement and a fair sharing model of the costs. However, also soft criteria like not losing the identity and finding an eligible partner are crucial success factors.

Since 2004, whole area of Motomachi (500 shops as well as 850 individual homes), in Yokohama, Japan, is covered by a system of cooperative freight transport, responsible for the joint delivery of around 85% of the goods. Both pickup and delivery are taken by a neutral carrier, financially supported by a Shopping Street Association with 2.4 million yen (17,000 Euro) per year. Each carrier pays the neutral carrier 150 yen (1.1 Euro) per parcel. A number between 1000 and 1200 parcels are treated per day. The number of trucks was substantially reduced. No subsidies are given by public authorities, just providing parking space on street. Objectives were reducing CO_2 emissions and congestion as well as keeping good atmosphere of streets [34].

Another issue is to determine allocations between transportation requests and transportation offers. Turning back to the example of the tech startup called VENIAM. They are testing a new way to create mobile Wi-Fi hotspots all over the city in Porto, Portugal. They sell the routers and service to the city, which in turn provides the Wi-Fi free to citizens, like a public utility. In exchange, the city gets an enormous amount of data — with the idea being that the data can be used to offset the cost of the Wi-Fi in other areas. For example, in Porto, sensors tell the city's waste management department when dumpsters are full, so they don't waste time, man hours, or fuel emptying containers that are only partly full.

There is an ongoing revolution in delivery services by applying the concept of transforming a hardware (or infrastructure) driven industry in a business model enabled by information and mobile applications. Two examples: Amazon.com is testing its own delivery network for the "last mile", e.g. drones and AMZL. The aim is to delivering goods the same day they are purchased, offering shoppers one less reason to go to physical stores. With its own trucks, Amazon could offer deliveries late at night, or at more specific times. Many startups (Transfix, CargoMatic, KeyChain Logistics) are looking to provide information exchanges and marketplaces [35]. CargoMatic, for instance, is transforming local shipping, by connecting local shippers with carrier companies who have extra space on their trucks.

The "intelligent system management" cluster addresses the relationship between infrastructure and the public institutions that operate it. The two previous examples of Yokohama and Porto already contain some useful elements related with this cluster, but some other alternatives to the status quo may be appointed. In France, for example, private companies are generally involved in the City Logistic Projects of the last decade. Actually, cities increasingly allow companies to use

public premises (parking, tram networks, bus stations, etc.) when innovative and green schemes are proposed. Thus, companies avoid heavy investments and benefit from financially viable projects and the cities can attain their objectives in terms of reduced congestion, pollution, and energy consumption [6].

The ongoing Dutch project named Freight Hitchhiking is a good example of an integrated effort towards a multimodal vision of the city mobility. Under the responsibility of DINALOG, this project will design integrated people and freight synchromodal transportation networks and the related coordination, planning and scheduling policies to enable efficient and reliable delivery of both persons and small to medium-sized freight volumes. These issues are risk management and gain sharing, identifying the enablers (related to ICT and data) and proof of concept leading to demonstration.

Last cluster, the 'Livability' cluster, addresses how society interacts with mobility. "The use of livability and social welfare as organizing principles in transportation policy are similarly radical challenges to organizations that measure their effectiveness in terms of passenger-kilometers of service provided. City logistic involves local government intervention in a realm in which it is relatively inexperienced – and therefore requires collaboration and partnership with the private sector" [4].

This is also true beyond transport. In New York City, by combining data from multiple agencies and using predictive analytics, the city increased the rate of detecting dangerous buildings, as well as improved the return on the time of building inspectors looking for illegal apartments. Policy changes have also been triggered by studies that, for example, showed correlations between foreclosures and increase in crime, and the effects of subsidized housing on surrounding neighborhoods [20].

4) Concluding remarks

Not by developing a new taxonomy, as in [6], nor by adopting a multi-level perspective on socio-technical transitions, as in [31], conceptualized – or not – through a strategic issue management framework, as in [30], but simply by providing the means to explore the similarities and differences in the elements characterizing City Logistics projects, we tried to contribute toward a better understanding of performance and success factors, which should lead to better preparation and design of new initiatives.

The four policy visions discussed here correspond to low-cost and incremental initiatives, with the participation of multiple modes and multiple stakeholders. In [32] a general conclusion is that most of the tested concepts are beneficial for society but difficult to implement because they appear to be financially unviable or require changes in the behavior of the main stakeholders. In our vision, the institutional adaptation, crucial for the success of a sustainable mobility system in a city, is rather complex, but we believe that innovation itself may prove to be the most promising path and the key "will be leadership from political figures and policy professionals who have the optimism and vision to innovate" [4].

A last word respects the assessment of the projects. The evaluation must cover different perspectives: the benefits and costs to society, the financial viability and the integration and comparison of the different solutions supported by the stakeholders involved [19]. Methodologies like Social Cost-Benefit Analysis (SCBA) or Strategic Impact Assessment (SIA); Business Modeling; and Social Multi-Criteria Analysis (SCMA), Multiple Criteria Group Decision Making (MGDM) or Multi Actor Multi-Criteria Analysis (MAMCA) must be used in order to build the complete evaluation phase.

In short, urban responses will be variable. However, three issues are important to understand whether a certain initiative is expected to be part of a purposive transition in a particular city [31]: the experience and perception of the different stakeholders and their translation to a common understanding of its virtues; the level of capacity and capability to operationalize this shared understanding processually, and the degree of behavior changes that take place as a consequence of its implementation.

V. MAIN FINDINGS

On the basis of the review of very recent initiatives, assessments and new developments, we tried to identify some of the lessons learned from described successes and failures as well as to reflect about the main factors that have been absent in most of the real practices operated in urban logistics.

We can shortly resume our main findings in the next paragraphs.

Both people and goods co-exist in the urban environment. Their flows compose the complex system of urban mobility. Capacity of urban transport is currently underused. The challenge is to design and operate the network in a way that each mode's performance increases as a result of a better and shared use of the network and transport resources. A new approach to urban mobility demands the management of passenger and freight transport together as a single logistics system [36].

The efficiency and effectiveness of physical flows in urban areas are becoming more and more dependent on sophisticated information flows, on pervasive data sensing and collection, on faster communications, and on advanced computer based management systems. In section 3, we proposed several ways of profiting from the availability of open urban data not only for that but also to contribute to the change of habits and behaviors of the citizens.

In order to enable a successful implementation of new concepts for urban logistics and city mobility, a 5th A should surely be added to the 4 A's, as proposed by Macharis, the A of Actor involvement. New business models are needed for that. Revenue and/or profit improvement and a fair sharing model of the costs are hard constraints to successful initiatives. But, the loss of identity and the absence of an eligible partner are also vital barriers to success. There is too a big role to play by the local governments.

Many cities have developed - or are in the process of developing - strategic plans for urban freight transport. This

fact reflects an increased awareness and it can be expected that the challenges of the urban transport system will be met by new policies during the next decade [32]. Hopefully, this will be achieved by structuring and modelling urban logistics as a multi-stakeholder, multi-criteria and multimodal dynamic system, aiming to optimizing the design of the network, the diversification of services and the utilization of vehicles, and to developing tools to support the design of innovative business models, practices and policies.

REFERENCES

[1] M. Hesse and J. Rodrigue, "The transport geography of logistics and freight distribution", Journal of Transport Geography, vol. 12, pp. 171-184, 2004.

[2] E. Störmer, B. Truffer, D. Dominguez, D., Gujer, A. Herlyn, H. Hiessl, H., Kastenholz, A. Klinke, J. Markard and M. Maurer, "The exploratory analysis of trade-offs in strategic planning: lessons from Regional Infrastructure Foresight", Technological Forecasting and Social Change, Vol. 76, pp. 1150–1162, 2009.

[3] S. Melo, "Evaluation of urban goods distribution initiatives towards mobility and sustainability: indicators, stakeholders and assessment tools", Ph.D. Thesis, Faculty of Engineering, University of Porto, 2010.

[4] T. Goldman and R. Gorham, "Sustainable Urban Transport: Four Innovative Directions", Technology in Society, Vol. 28, pp. 261-273, 2006.

[5] L. Dablanc, "Goods transport in large European cities: Difficult to organize, difficult to modernize", Transportation Research Part A, Vol. 41 (3), pp. 280-285, 2007.

[6] A. Benjelloun, T.G. Crainic and Y. Bigras, "Toward a Taxonomy of City Logistics Projects", Procedia - Social and Behavioral Sciences, Vol. 2(3), pp. 6217-6228, 2009.

[7] H.J. Quak, "Sustainability of Urban Freight Transport: Retail Distribution and Local Regulations in Cities", Ph.D. Thesis, Rotterdam Erasmus University, 2008.

[8] A. Caris, C. Macharis and G.K. Janssens, "Decision support in intermodal transport: a new research agenda", Computers in Industry, Vol. 64, pp. 105–112, 2013.

[9] E. Demir, T. Bektas and G. Laporte, "A Review of Recent Research on Green Road Freight Transportation", European Journal of Operational Research, Vol. 237(3), pp. 775-793, 2014.

[10] H. Sternberg and M. Andersson, "Decentralized intelligence in freight transport - A critical review", Computers in Industry Vol. 65(2), pp. 306-313, 2014.

[11] M. SteadieSeifi, N. Dellaert, W. Nuijten, T. Van Woensel and R Raoufi, "Multimodal freight transportation planning: A literature review", European Journal of Operational Research, Vol. 233 (1), pp. 1-15, 2014.

[12] E. Demir, Y. Huang, S. Scholts and T. Van Woensel, "A selected review on the negative externalities of the freight transportation: Modeling and pricing", Transportation Research Part E: Logistics and Transportation Review, Vol. 77, pp. 95-114, 2015.

[13] N. Anand, H. Quak, R. van Duin and L. Tavasszy, "City logistics modeling efforts: Trends and gaps-A review", Procedia-Social and Behavioral Sciences, Vol. 39, pp. 101-115, 2012.

[14] J. Visser, T. Nemoto and M. Browne, "Home delivery and the impacts on urban freight transport: A review", Procedia-Social and Behavioral sciences, Vol. 125, pp. 15-27, 2014.

[15] E. Taniguchi, R. G. Thompson and T. Yamada, "Recent Trends and Innovations in Modelling City Logistics", Procedia - Social and Behavioral Sciences, Vol. 125, pp. 4-14, 2014.

[16] C. Macharis, S. Melo, J. Woxenius and T. van Lier, "The 4 A's of Sustainable Logistics", Sustainable Logistics, Transport and Sustainability, Vol. 6, Emerald Group Publishing, 2014.

[17] T. van Lier, H. Buldeo Rai and C. Macharis, "Sustainable logistics in urban areas: what gets measured, gets managed", presented at City Logistics and Freight Transport Workshop, Nectar Cluster, April, 16-17, 2015, Vilamoura, Portugal.

[18] C. Macharis, G. Barrera, J. Menge and S. Verlinde, "The triple helix in city distribution", presented at City Logistics and Freight Transport Workshop, Nectar Cluster, April, 16-17, 2015, Vilamoura, Portugal.

[19] C. Macharis, "Innovative solutions for sustainable logistics". Presentation at Logistics Day 2014 – Cluster for Logistics, Luxembourg, 28/04/2014, invited speech.

[20] L. Barbosa, K. Pham, C. Silva, M. R. Vieira and J. Freire, "Structured open urban data: Understanding the Landscape", Big Data, Mary Ann Liebert, Inc. Vol. 2(3), September 2014.

[21] C. Chen, D. Zhang, N. Li and Z.-H. Zhou, "B-Planner: Planning Bidirectional Night Bus Routes Using Large-scale Taxi GPS Traces", IEEE Transactions on Intelligent Transportation Systems, Vol. 15(4), pp. 51-65, 2014.

[22] P. Bajardi, M. Delfino, A. Panisson, G. Petri and M. Tizzoni, "Unveiling patterns of international communities in a global city using mobile phone data", EPJ Data Science, Vol.4(3), 2015.

[23] A. Simroth and H. Zähle, "Travel Time Prediction Using Floating Car Data Applied to Logistics Planning", IEEE Transactions on Intelligent Transportation Systems, Vol. 12(1), pp. 243-253, 2011.

[24] J. Mendes-Moreira, A. Jorge, J. Freire de Sousa and C. Soares, "A data mining approach for trip time prediction in mass transit companies", in Proceedings of the workshop W11 on Data Mining for Business, pp.63-66, 2005.

[25] G. Klunder, P. Baas and F. Beek, "A Long-term Travel Time Prediction Algorithm Using Historical Data", Technical Report. TNO, 2007.

[26] J. Mendes-Moreira, A.M. Jorge, J. Freire de Sousa and C. Soares, "Comparing state-of-the-art regression methods for long term travel time prediction", Intelligent Data Analysis, Vol.16(3), pp. 427-449, 2012.

[27] J. Mendes-Moreira , A.M. Jorge , J. Freire de Sousa and C. Soares, "Improving the Accuracy of Long-Term Travel Time Prediction Using Heterogeneous Ensembles", Neurocomputing, Vol. 150 Part B, pp.428-439, 2015.

[28] P.S. Castro, D. Zhang, C. Chen, S. Li and G. Pan, "From taxi GPS traces to social and community dynamics: a survey", ACM Computing Surveys, Vol. 46(2), article 17, 2013.

[29] M. Domenico, A. Lima, M.C. González, A. Arenas, "Personalized routing for multitudes in smart cities", EPJ Data Science, Vol. 4(1), 2015.

[30] A. Spickermann, V. Grienitz and H. A. von der Gracht, "Heading towards a multimodal city of the future? Multi-stakeholder scenarios for urban mobility", Technological forecasting & social change, Vol. 89, pp. 201-221, 2014.

[31] M. Hodson and S. Marvin, "Can cities shape socio-technical transitions and how would we know if they were?", Research Policy 39, pp. 477-485, 2010.

[32] Straightsol, Final Report, Research partially supported by the European Community Framework Programme 7, Sustainable Surface Transport (SST) Program, Grant no. 285295, April 22, 2015.

[33] H. Quak , R. Peeters and T. van Woensel, "Urban Freight Transportation: Challenges, Failures and Successes", unpublished paper.

[34] E. Taniguchi and R. G. Thompson, City Logistics: Mapping the Future, CRC Press, 2014.

[35] A. Goodchild, E. Wygonik and N. Mayes, "Moving Goods to Customers: Land Use, Logistics, and Emissions", presented at City Logistics and Freight Transport Workshop, Nectar Cluster, April, 16-17, 2015, Vilamoura, Portugal.

[36] A. Trentini and N. Malhene, "Flow Management of Passengers and Goods Coexisting in the Urban Environment: Conceptual and Operational Points of View", Procedia-Social and Behavioral Sciences, Vol. 39, pp. 807-817, 2012.