Urban distribution concepts: a SWOT analysis on best practices of urban logistics solutions

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Abstract

Urban areas represent particular challenges for freight transport, both in terms of logistical performance and environmental impact (TURBLOG, 2010). City logistics level includes policies and tools such as the use of efficient and clean vehicles, improved load planning, consolidated distribution of goods, zones with access regulations and the use of Information and Communication Technologies (ICT) as well. Although many of these concepts have been previously identified in many cities across Europe, a targeted assessment of their impacts through a SWOT analysis which pinpoints strengths, weaknesses, opportunities and threats for each one concept of them has not been performed before. The main objectives of this paper is to investigate past and existing practices on the above initiatives by performing a throughout review on corresponding literature. In turn, a SWOT analysis of these city logistics solutions is performed basically in terms of performance and environment. SWOT analysis then, will stoke thoughts for future research in this field and outline directions towards proper risk surveillance that need to be pursued by policy-makers for those urban logistics policies.

Keywords: efficient logistics, innovative policies, SWOT analysis, best practices, urban distribution, urban consolidation centre, clean vehicles

1. Introduction

City logistics could be defined as transport and logistics activities in geographically concentrated in densely populated areas. The organization required is to move large amount and different sized volumes of parcels or goods. City logistics also addresses the movement of freight distribution in urban areas, improving the efficiency of urban freight transportation, reducing traffic congestion and mitigating environmental impacts. The principle challenge is to be able to treat these simultaneously (European Commission, 2010).

There are some statistical data that urge policy-makers to investigate new city logistics schemes in order to cope with the new trends:

- Urban freight represents 10 to 15% of vehicle equivalent miles travelled on city streets and two to five percent of the employed urban workforce. In fact, the share of freight traffic on total urban traffic is in the range of 14% of vehicle-kilometers, 19% of energy use, and 21% of CO_2 emissions (Schoemaker et al., 2006).
- By 2020, 70 to 80% of the European population will live in urban areas.
- A city not only receives goods, but also ships them: outgoing freight represents 20 to 25% of truck-km in urban areas, incoming freight 40 to 50%, and the rest originates from and is delivered within the city.
- Transport companies providing urban freight services are generally very small. In Europe, 85% of short distance truck companies have less than five employees.
- Every year €100 billion, or 1% of the EU GDP, are lost to the European economy as a result of delays and pollution related to urban traffic.
- Urban traffic is responsible for 40% of CO2 emissions and 70% of other pollutants (European Commission, 2010).

The aforementioned trends may have gloomy implications on environment, economy and urban mobility. To this end, European Commission posed city logistics at high priority for research activities. The key role of logistics in ensuring sustainable and competitive mobility in Europe is raised in the mid-term review of the 2001 White paper “Time to decide: 2010” (Commission of The European Communities, 2006). Urban freight transport encompasses several sovereign aspects of urban life such as energy use, air quality (environment), road congestion, noise, and general lack of loading and unloading space.

In the green paper, ‘Towards a new culture for urban mobility’ (European Commission, 2007), EC indicates the importance of the urban dimension of freight transport. Possible solutions proposed include the use of cleaner vehicles, improved load planning, consolidated cargo, access regulations, etc. In the Action Plan on Urban Mobility (Commission of The European Communities, 2009) the Commission declares its intention to aim for ensuring efficient ‘last mile’ delivery. It is also considered how freight transport could be better integrated into Master Plan for urban mobility and ways to monitor and manage transport flows.

In many European cities measures have been implemented in order to support the environmental efficiency of urban freight transport. Many of these have issued to unexpected side-effects. One of the reasons for those deficiencies is that they are governed by lack of assessment in relation to short and long-term results. Moreover, attempts that were made so far are characterized by either low intensity or simply have not paid off, both in national and European level. Consequently, policy makers are unable to identify which measures were effective and promote knowledge transfer. Therefore, a new field of research could constitute the evaluation of these measures in a pilot stage and safer implementation of them.

The core objective of this paper is to review existing and emerging best practices and categorize them into four generic conceptual frameworks according to relevant city logistics solution that address (technological solutions, legal and regulatory interventions, infrastructure projects, vehicle models, etc.) and perform a sound evaluation of them through a SWOT

analysis (Strengths – Weaknesses – Opportunities – Threats). This analysis will stoke further thoughts of research communities regarding implications of these measures to local societies and needs that should be satisfied so as to ensure proper implementation and effectiveness of these solutions.

2. STRAIGHTSOL objectives and pilot cases

STRAIGHTSOL stands for STRAtegies and measures for smarter urban freight SOLutions. It is a three-year European research project launched under theme 'GC.SST.2011.7-4: Urban-interurban shipments' in the call of Sustainable Surface Transport of the Seventh Framework Programme (FP7-SST-2011-RTD-1). The objectives of STRAIGHTSOL are threefold:

1) Develop a new impact assessment framework for measures applied to urban-interurban freight transport interfaces.
2) Support a set of innovative field demonstrations showcasing improved urban-interurban freight operations in Europe.
3) Apply the impact assessment framework to the live demonstrations and develop specific recommendations for future freight policies and measures.

The STRAIGHTSOL demonstrations represent steps in the direction of achieving essentially CO_2 -free city logistics in major urban centers by 2030. The evaluation of STRAIGHTSOL demonstrations will contribute to reaching policy targets, and it will give inputs for further development of measures and initiatives for cleaner urban freight transport. The demonstrations included in STRAIGHTSOL are:

A. Urban Consolidation Centre in L'Hospitalet de Llobregat, concentrating interurban shipments in terminals to consolidate the flows before urban distribution in order to improve the efficiency of last mile network. Most interurban delivery trucks will unload goods in the terminal and the last mile distribution will be coordinated and carried out by the terminal operator. The city council of L'Hospitalet de Llobregat is a consortium partner (Barcelona, Spain)
B. City Logistics Mobile Depot: Reducing Brussels' CO_2 production and noise pollution by consolidating good flows with the use of electric tricycles and a vehicle. By using a mobile depot in combination with the tricycles and electric vehicle a best practice in energy reduction is created (Brussels, Belgium)
C. Remote 'bring-site' monitoring for more reactive and sustainable logistics. In the demonstration, a subset of textile banks will be equipped with remote monitoring technology to observe daily fill rates and develop more dynamic collection schedules. (United Kingdom)
D. Rail tracking and warehouse management, monitoring the itinerary of freight on the railway network by the use of GPS to inform the warehouse management system on freight arrival, and organizing the warehouse operations and the next leg with truck accordingly. National freight forwarding to other national freight centers will be optimized. (Thessaloniki, Greece)

E. Smart Urban Transport Solution. Optimizing retail supply chain management and "last mile" distribution networks by sharing standardized information collected by RFID technology between involved companies and use of common shippers and transport operations (Oslo, Norway)
F. Night-time distribution in Utrecht. The demonstration will represent the possibilities and impacts of night -time distribution for the retail sector. (Utrecht, the Netherlands)
G. Municipal regulation of loading and unloading of freight, promoting efficiency improvement in loading and unloading operations management and parking regulations for freight deliveries in Lisbon. The development and implementation is supported by the municipality in Lisbon. (Lisbon, Portugal)

3. Methodological approach

Within STRAIGHTSOL framework, in order to perform the review, a concrete methodological framework was introduced for deriving all the proper data that would be included in SWOT analysis. In a nutshell, the methodology which was followed is better described by steps:

1. Preparation of the template tailored for deriving information of each source which was reviewed
2. Identification of sources reviewed by STRAIGHTSOL partners
3. Beginning of the review
4. Completion of review by collecting all fulfilled templates

Projects, studies and papers presenting best practices all over the world, were reviewed and analyzed into a special template, compiled by project partners, geared towards mapping the applications showcased in each source. The template constituted of a part dedicated to a SWOT analysis of each case study that reviewers came across in each source. For each demonstration of those referred before, a variety of sources was reviewed indicating some interesting good practices all over the world.

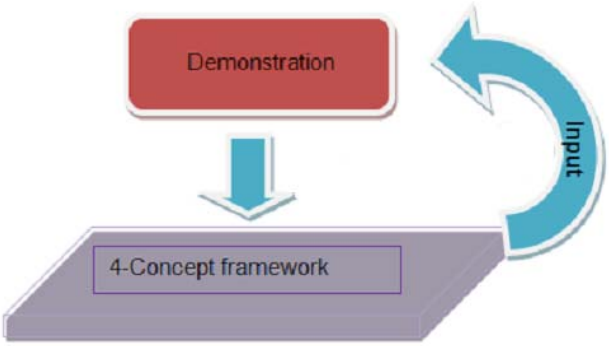
Then, seven concepts addressed within seven demonstrations were further integrated into four generic conceptual frameworks according to each city logistics business model (solution). Criteria of the integration included – inter alias – commonalities that existed between the demos in terms of the nature of the 'tools' utilized. For instance, legal and regulatory framework, technological innovations, infrastructure interventions, vehicle models, reflect different approaches to city logistics solutions. Hence, the four generic concepts that are evaluated through a SWOT analysis were:

- Urban consolidation centre (construction of an urban consolidation centre)
- Clean vehicles (city logistics mobile depot and electric vehicles)
- Urban freight transport management (including night-time distribution, municipal regulation of loading and unloading)

- Supply chain monitoring (remote monitoring for more reactive and sustainable logistics, rail tracking and warehouse management, smart urban transport solution)

A SWOT table for each of these concepts is composed and presented in this paper highlighting strengths of practices investigated, in terms of what has been 'working' properly and its potential positive impact, weaknesses under the light of negative impact on logistics outcomes, opportunities, which is translated into the perspectives of future trends introduced by the implementation of measures and the rest business environment and threats, outlining the pitfalls that these measures may cause in compliance with the external business environment (Nathanail et al., 2012).

Figure 1. Schematic portraying of the methodological approach

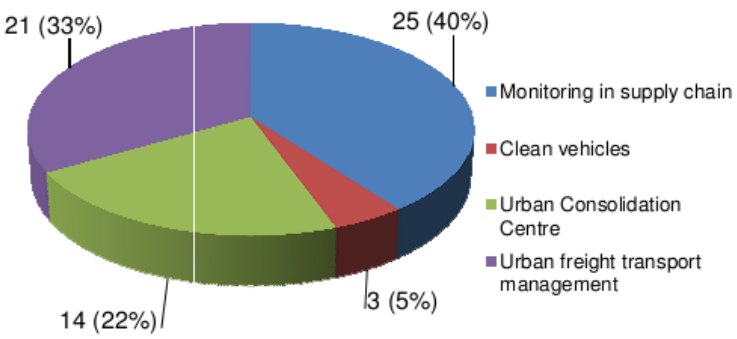


4. Review findings

Out of the total 73 sources that were reviewed most of them deal with interesting issues pertaining to city logistics business model raised. Analysis of results highlights the main idea of most of these sources due to mutual context between them.

The reviewed sources indicate that most of them tackled issues with respect to use of technological platforms for monitoring supply chain legs (40% of sources) whereas 33% contained case studies relevant to issues addressed in 'urban freight transport management' concept. Below, allocation of sources under concepts addressed is shown:

Figure 2. Allocation of sources addressing one and only type of concept



Under the context of constructing an urban consolidation centre incorporating solutions such as consolidated cargo, joined delivery services, etc. a variety of sources were reviewed. Analysis of the urban freight distribution was conducted and also an evaluation of the viability of logistic micro-platforms in Barcelona, which includes the results of the 2007 trial pilot in Sant Andreu (Barcelona Chamber of Commerce, 2008*).* Impacts of the establishment of retail consolidation centre near Heathrow airport were stressed out for evaluating the operations of such logistics centre to meet the freight distribution needs of airport node. (Freight Best Practice, 2002). Scott Wilson Ltd. (2010) examined the prospective function of a Freight Consolidation Centre serving the SEStran area (South East Scotland Transport Partnership). The feasibility of Multi-Carrier Joint Delivery Service (MCJDS) providing social and financial benefits and the motivation of carriers to cooperate in MCJDS while also the setting of the fare and the possibility of financial support from public sector was investigated by Hitoshi Ieda (2001).

Kazuya Kawamura (2008) presented a theoretical evaluation of Delivery Consolidation in U.S. Urban Areas with logistics cost analysis while the University of Westminster Transport Studies Group (2005) identified the potential for the development of Urban Consolidation Centers (UCCs). Ron van Duin et. al (2011) presented a model based on policy, measures aimed to the reduction of environmental impacts, and behavioral interactions implemented in a multi-agent model. Finally, the transport chain and benefices of the London Construction Consolidation Centre (LCCC) were presented by Freight Best Practice in 2006.

City logistics mobile depot and electric vehicles is addressed in SUGAR project (INRETS, 2009). Specifically ULS (Urban Logistics Spaces) are examined in terms of effectiveness. ULS are smaller than urban consolidation centers and they were demonstrated with the employment of electric vehicles for their operations.

Dynamic scheduling and routing of operations is raised within paper “the effect of dynamic scheduling and routing in a solid waste management system by Ola M. Johansson (2004). The paper compares static and dynamic scheduling and routing policies associated with collections from recycling centers, of which there are more than 7,000 in Sweden. Krikke et. al (2004) focuses on the collection of materials (solids and liquids) disassembled from end-of-life cars using on-line monitoring information to optimize route planning. On-line monitoring in optimizing route planning is addressed in this document.

Cargo tracking along its transport chain is subject to ‘Rail tracking and warehouse management’ demonstration. The EURIDICE project (2011) deepens in ‘SeaRail’ concept which deals with intermodal transport which is accompanied with a modern wagon fleet comprising of covered, open and tank wagons. Moreover, the ‘Intelligent Cargo Vision’ concept is analyzed. This is about goods flowing through European freight corridors and the tendency for them to constitute ‘intelligent cargo’, meaning self-aware (identification), context – aware (detection, status monitoring and service access) and connected through a global telecommunication network (RFID, GPS, Galileo, Mobile services, etc). Klumpp et. al. (2011) highlight the avoidance of delays in the last mile delivery when using GPS based real time continuous track and trace system for the monitoring of the cargo transport.

McCormack et. al (2002) evaluate the use of electronic door seals (e-seals) on shipping containers. Through a case study they scrutinize e-seals pinpointing their strengths and weaknesses. E-seals are widely used to secure cargo transferred with the potential of emitting real-time information of cargo status.

Smarter urban freight transport solutions demonstration focuses on technological innovations that will facilitate urban distribution of goods. Eriksson et. al (2004) investigate coordinated goods distribution for deliveries to central parts of the Swedish city Linköping, organized by a local network of carriers. Nemoto et. al (2005) discuss the impacts of information and communication technology on urban logistics systems. Ilic et. al (2009) describe a supply chain visualization tool that is based on EPCIS (Electronic Product Code Information Services). Robøle (2007) emphasizes on urban distribution and the needs of local government as well as of private sector companies like carriers and logistics service providers. GS1 organization (2008) in project STILL (Standard Internation Logistic Label) refers to the GS1Logistic Label which is a global standard for all actors in the supply chain, facilitating a logistic traceability for the logistic units. This label avoids the successive relabeling of logistic units as they move through the supply chain and gives the advantage and benefit to use only one logistic label. The purpose of the document is to give recommendation on the GS1 logistic label and present the different labels for transport and warehousing.

In a case study carried out in 2011, DHL Smarttruck and Blue Dart piloted a new “Smart Truck” for pick-up and deliveries. The vehicle includes various technologies such as a route planner, using real-time GPS systems and local traffic data to calculate an ideal sequence of deliveries, with the flexibility to allow for last-minute pick-ups. Enterprise and consumer-side demonstrators were also presented that indicate the value of information technologies in determining and communicating environmental impacts of products such as carbon footprint (Dada et. al, 2010).

Night-time distribution is a concept that could make city logistics operations more efficient towards performance aspects and environment. The review included sources indicating best practices concerning that concept. Macharis et. al (2010) examine the effect of more off-peak and/or night time deliveries at the distribution centers of large retailers on the most important stakeholders, i.e. the shipper, the carrier, the retailer and society adopting a stakeholder-targeted approach. The concept of unattended deliveries is addressed as case studies by Ruesch (2008). Night-time deliveries with foci to noise reduction for better engagement to local authorities is also a trial undertaken by Kelly (2007). Shifting deliveries to off-peak hours and assessing their environmental, time and cost impacts is being examined by Palmer A. (2010).

Regulations and legal framework for more effective urban loading and unloading operations is a crucial issue (apart from technological intervention and stakeholder cooperation as well as integrated business schemes). FREILOT project (2011) focuses on increasing energy efficiency for urban logistics. To this end, loading space booking is being investigated in great detail. MOSCA project (2003) represents an information platform which allows on the one hand the integration of loading and unloading time windows of shops and additional information relevant for goods transports via an open

"shop-owner" Internet user interface. CURACAO consortium underlines the effectiveness of road-charging and discusses public opposition towards this measure. Allen et al. (2008) summarize legal regulations that regard urban freight distribution with respect to time regulations, emission standard regulations or access and loading regulations.

5. SWOT analysis

A SWOT analysis is a tool that business planners use to gauge an organization and its environment. SWOT stands for strengths, weaknesses, opportunities and threats. Strengths and weaknesses are internal factors (product oriented). Opportunities and threats are external factors (environment oriented). To perform a SWOT analysis, consider the following:

- Strengths: what advantages do you have? What resources and contacts do you have access to? What recognitions have you received? What are your intangible assets? What do you do well?
- Weaknesses: what do you lack? What can be improved? What are some of the gaps that need to be addressed? What should be avoided?
- Opportunities: what specific opportunities are available to you to take advantage of? What are the opportunities facing your industry that you could possibly pursue? What are the trends that might open new opportunities?
- Threats: what obstacles do you face? What is your competition up to? Are the requirements for your company changing? Are you having any cash flow problems? Can any of these weaknesses seriously threaten the vitality and longevity of your business?

Carrying out a SWOT analysis can be a real eye opener. Not only will it highlight what needs to be "fixed" or immediately addressed, it will also show what someone has been doing right (http://wiki.answers.com).

Each of the aforementioned actions for city logistics operations describes a different perspective for improving the performance of city logistics activities together with the alleviation of any possible environmental burdens, the efficient use of energy resources for urban distribution, etc. Concepts have been previously implemented either as pilot cases or as already established regimes in city contexts around the world. Below, each concept is briefly described before investigating its SWOT aspects:

1. Urban consolidation centre is constructed and operated to improve the performance of urban freight deliveries. Usually, these kinds of services are provided in the suburbs or outside urban areas to facilitate interurban-urban transport flows. Operation of urban consolidation centers reduces the number of vehicles entering urban areas while also maintaining the level of service. The shipment consolidation in urban consolidation centre joins the load of several carriers. In parallel, more flexible regulatory frameworks are adapted to ease cooperation of involved stakeholders. Expected outcomes of this kind of initiatives are the reduction of costs and truck-kilometers as well as mitigation of CO_2 emissions and energy consumption.

- Advantages of using consolidation centers include the potential of achieving more deliveries per day because of the limited time of each delivery (thanks to consolidated load) and the less time spent by delivery trucks in congested roads. Consequently, number of vehicle kilometers is reduced as well as the number of vehicles which undertake that shipments. Better vehicle and driver utilization is also pinpointed for suppliers as a result of quicker turnarounds. A matter of high importance is the improvements achieved in volume/weight utilization rate for vehicles on deliveries – and from inward flows from suppliers too – thereby reducing the unit costs of transportation for the 'last-mile' distribution (economies of scale are achieved).
  The use of alternative modes of transport is facilitated and is becoming more feasible. Studies on the most suitable modes are more feasibly launched, i.e. indicating electric vehicles as the one that match better to urban context and rail network for merchandize transfers inside centre area. Finally, constant check of the consolidated cargo increases stock transparency.
- However, there are some disadvantages that, in turn, can provoke negative impacts in the future. Direct interface between shippers and customers is lost and suppliers need the point of view of final consumers in order to adjust their productivity and measure customer satisfaction. Furthermore, cargo may have already been consolidated before reaching urban consolidation centre and thus, trying to channel cargo flows in the urban consolidation centre (hereinafter UCC) may urge negative impacts.
  Under funding context, unexpectedly high cost of construction and operation of UCC and purchasing or updating equipment and infrastructure makes challenging to participate or pay for carriers and citizens. Public subsidizing could be a step towards resolving such issues but even national governments should be convinced on the effectiveness of fostering such initiatives. Part of the institutional framework is the regulatory context that should underpin activities of UCC and a potential lack of enforcement or regulations for vehicles may constrict establishment of UCC schemes. Local actors may hinder new legal framework in favor of transport context, probably due to private interests.
  Another drawback that may arise is that UCC are not nostrum for all cases. For small cities, a construction of the UCC may boost supply level over local freight demand and lead to under-operating. On the other side, a UCC when serving large cities may not meet demand level especially in storage requirements. Finally, an erroneous placement of UCC may cause the opposite results than the expected ones, by increasing costs of transportation.
- UCC acts as an interurban node where transshipment activities take place, thus, it assists efficient transport modality. Intermodality could be promoted by the establishment of

intermodal units and infrastructure. Besides this, a proper establishment of UCC results surely to cost saving and logistics efficiency.

Feasibility and viability of such concepts depend on the proper study of their functionality and their location. It should be taken into consideration that each case of implementing project like UCC is unique and should be treated respectively. Political will is also an issue, because public funding and legal support are the cornerstone for the successful accomplishment of such projects. Special additional measures should also be implemented so as to better perform that initiative. Measures include off-peak hour deliveries, multi-use lanes, etc. Public authorities consent and market uptake are prerequisites in order to guarantee the successful operation of the project and the production of compensative benefit.

Future pitfalls request proper interaction. Eliminating competition and establishing a monopolistic scheme is a possible danger for these situations thus leading to legal constraints. A construction of UCC usually changes the structure of the supply network of a region. A single UCC for an urban area is unlikely to be attractive for many suppliers' flows due to the degree of diversion required from normal route. What is needed is UCC to be integrated efficiently into the existing network or a new network to be created without radically sabotaging the old one.

2. 'Clean vehicles' is a well-known initiative with a restricted range of activities due to their small energy autonomy. They are capable of performing 'last-mile' distribution and, apparently, have a low load factor due to their size. The concomitant use of a small mobile depot which can accommodate electric vehicles, acts as a small consolidation centre inside cities. Mobile depots are trailer/truck utilized with all depot facilities (labeling, loading docks, data entry) and drive directly from interurban company's premises to inside city places. Then, electric vehicles (such as tricycles) perform the 'last-mile' distribution. Basic advantage of this concept is significant reduction of truck-kilometers and environmental emissions (as well as reduced noise levels).
    - Clean vehicles 'offer' a variety of benefits to companies and local society. Environmental alleviation is achieved through the gradual reduction of air pollutants and decrease in level of noise nuisance. Lower energy needs for electric vehicles result in financial benefits for the companies. Company image is ameliorated due to efficient use of fleet and sources and increase of attractiveness.

      Electric vehicles because of being lighter and smaller than other transport units, they are more flexible for moving inside the city. Regarding their quality as mechanical structures, they are more technically viable than conventional vehicles. Public acceptance of this idea might be strong because of the positive impact on environment and mobility.

- On the other hand, there are some drawbacks concerning the use of electric vehicles especially from transport operators' side. At first, there is a lack of dense electric vehicles supply infrastructure (this regards wider use of electric vehicles, not only for freight distribution activities). Another sober technical issue is that electric vehicles require high rate of maintenance and its cost remains relatively high. Another deficit of electric vehicles has to do with the restricted service area because of their limited energy autonomy which requires often re-supply. Electric vehicles are moving slower than conventional ones, have low load capacity and cannot bridge the gap amongst urban context and interurban area due to the aforementioned short range area of deliveries capability. As a matter of fact, 'small' logistic providers may not have the financial background to occupy a fleet of electric vehicles (environmentally efficient vehicles).
- In general, environmentally efficient vehicles are very effective if they will be utilized to serve specific needs and perform targeted operations. Before the implementation of any range of measures, an information campaign should be deployed in order for keeping people updated to the benefits of new policies. Clean vehicles concept is a promising concept that it leads to the mitigation of traffic congestion, noise nuisance and air pollutions with result of less external costs. Secondly, subsidies and appropriate (financial) incentives are considered to be necessary, at European or national level, especially at the beginning of the implementation of this concept in order to ensure the feasibility of the concept as well as to attract as many investors and potential future operators as possible in the context of public private schemes.

  Special regime in favor of the prioritization of electric vehicles in urban mobility should be processed from the part of the public and state authorities (legislation issues, ie. relieved access restrictions to the inner city for low emission vehicles). As in all cases, this new policy should be also supported by auxiliary regulations. Future research should tackle issues like upgrading of vehicle load factor with sacrificing the current size of electric vehicles which characterizes their level of flexibility.

3. Urban freight transport management is a framework which includes many initiatives starting from adaptation of 'distribution-friendly' regulations. Within STRAIGHTSOL context, 'night deliveries' and 'loading/unloading regulations' demonstrations fell under this category. Adaptation of legal framework and introducing more flexible regulations in local and national level while allow regulatory framework to serve technological interventions in urban supply procedures are some actions that rely on urban freight transport management. Technology is introduced through the e-monitoring of loading bays. Night deliveries and regulations for on-street loading and unloading processes contribute in shorter time for performing a delivery and increased satisfaction of transport operators and retail shop keepers.

- Shifting from peak to off-peak and from day to night-time deliveries should be coupled with a sound legal framework that looks ahead for ensuring on-street loading and unloading activities. Introduction of loading/unloading framework shares some common strong points with concept of 'night deliveries' in the light of concrete legal initiatives for underpinning new policies.
  As far as shifting to off-peak operations concerned it becomes easier to adjust the supplier's operations because carriers perform deliveries when it suits them. Thus, low traffic congestion at night will increase productivity (C2C travel speeds and high level of service). Subsequently, decrease in truck-kilometers and energy consumption and minimize environmental impacts. Regarding introduction of new legal framework for loading/unloading on-street operations, the control center that surveys urban distribution operations (together with the already established framework) provides better control of the study area and emission of freight vehicles are easily mapped. Deliveries are shorter in time and more effective after this stricter framework that hinders illegal parking of passenger vehicles into a parking place devoted to freight loading/unloading. Improved urban mobility is assisted by both urban distribution initiatives.
- Both of these concepts are subject to the wider 'urban freight management'. From the state-of-the-art review some weaknesses of these initiatives were highlighted. Night deliveries are case-sensitive in terms of cargo type. Different types of cargo that cannot be transported together. This, intuitively, reduces load factor of the transport and inhibits advantages of scheduled night deliveries in case of low cargo volume. Else, unattended night deliveries can be risky in terms of need of receiver's presence to delivery place: this consists of any unexpected events that may force receiver's presence (i.e. damage). Also in some cases, when the receiver has to carry out the last-mile for collection of parcels (central located locker boxes) so it is unclear whether this is an advantage or not. Sometimes, thought, the cost of the infrastructure for the receiver is high.
  Concerning loading/unloading regulations and new access state for on-street loading spaces, the most significant weakness is the unforeseen reaction of drivers to the new scheme. Drivers should get used to the new situation because it provides a totally different direction to urban mobility as it separates road activities.
- Night deliveries require purchasing of silent rolling equipment on behalf of receivers for performing the unloading and storage of goods (when unattended) at the lowest level of noise possible. The measures involving investments from the receiver might not stand a chance as receiver and courier are not in a mutual professional relationship. They are linked through the sender who entrusted the delivery of a package destined for the

receiver to the courier. However, marginal costs to shippers and carriers should be offset by the productivity gains associated with faster deliveries during the off-peak hours. Carriers with a wide customer base, doing deliveries for different sectors of the economy are less likely to be able to participate in off-peak deliveries, thus, carrier centered policies are also needed. Finally, the need for a robust legal framework remains vital, because amendments in existing frameworks may be necessary with respect to night working and labor legislation.

Loading and unloading operations may require innovative tools to be added for strengthening the new policy. One of them is parking lot booking (space devoted to freight activities). This new function may cause difficulties to getting used of this system because it is totally different from the current. Legislation consideration about booking public spaces is also essential. After implementing the new policy, police enforcement and proper marking is crucial – especially in the initial phase – to avoid illegal parking and allow drivers to get used to the new situation. In parallel, baseline actions should be fostered. Allocating resources for collection of traffic and environmental data for analysis, and continuous monitoring of performance and assessment are part of initial actions undertaken towards the proper operation and effectiveness of these measures.

4. Supply chain monitoring with the use of ICT tools helps surveillance both of transport legs and of inventory and 'inner-warehouse' operations. To this end, RFID technologies for bank monitoring, barcodes for instant identification of goods, and GPS (with e-seals) that assist monitoring of cargo during its transportation are tools tailored for automation of processes along supply chain. The positive outputs of 'TO-BE' situation is optimized route planning for collection of goods according to the level of fill of banks, increased efficiency for city logistics operations and seamless awareness of position and status of cargo.
    - Strengths of using such technologies along supply chain are multiple and are pinpointed in different aspects of supply process. At distribution centers, increased efficiency in warehouse management (flows of goods, fill levels of inventory, especially in banks or warehouses) better security (eduction of claims), as well as full visibility to every activity. At retail distribution centers optimized cross-docking shipments and achieving efficient recall of goods. In outlets, real-time monitoring of sales, enhancing shopper convenience by technological means and speeding up check out processes. Special technologies (e-seal) allow cargo visibility and status of cargo awareness through a range of Key Performance Indicators such as humidity, temperature, g-shock, etc.).

      Impacts include lower empty travels, traffic congestions inside cities, reliability on arrivals time and mitigation of delays, exact positioning of cargo throughout transport chain, less truck-kilometers, energy efficiency and reduction in CO_2 emissions.

- As technology is widely incorporated into supply process more and more technical and institutional issues have to be resolved and predetermined before proceeding to actions. Confidentiality issue is one of the most common because information provided by ICT tools needs to be shared to interested partners only and not to wider audience to ensure market competition of involved parties.
  Similar aspect is the technical one. Potential monitoring or telecommunication failure or inaccurate readings could lead to the diffusion and use of insufficient information, directly affecting the process of scheduling of activities, as far as reliability issues are concerned. Serious problem is the – still – high cost of investment, probably not so affordable for all kinds of interested stakeholders. An average SME may not justify such expensive equipment based on cost efficiency studies. Sometimes, though, low value of cargo transported does not justify at all the use of added-value services. This is also backed by the fact that those who invest are not always the ones who take advantage of their investments. Common issue regarding technologies with wireless network required is lack of signal or poor telecommunication network coverage will cause the seamless operation of the systems making them unreliable. GPS technology usually encounters some problems when it comes to high buildings or high vegetation or often tunnels.
- Interoperability issues need to be under serious consideration especially when the transport coverage is international and involves different countries. To this end, introduced legal framework should face address privacy restrictions and institutional-based constraints regarding hardware and software operation in certain places of transport networks.
  Training of personnel who handles and manages transport legs is of high importance, due to the sophisticated character of new technologies and complicating systems. This should be in line with proper affixation of all mechanical equipment to wagons, banks, doors, etc. to avoid iterative or erroneous reading of sensors.
  There are also other sensitive points that are identified under technological umbrella. These include campaigns and public support of policies to be implemented. For instance, wide use of technology may require the existence of national initiative that may not exist until now. Implementation also requires that there are mechanisms for having all relevant parties interested.

Actions towards optimization of logistical performance require a robust framework of collaboration between the involved stakeholders, separating tasks and roles and acting as a safety valve in case something falls out. Additional needs that have to do with interested parties and their close cooperation are homogeneity in perspectives while clarifying confidentiality issues in order not to plague free market competition. Governmental actions should satisfy the needs of private sector and underpin private initiatives

launched for servicing their business needs in compliance with local society welfare. Thus, regulatory framework and financial incentives could be the cornerstone of public sector's contribution to such schemes for reaching to an effective outcome.

6. Conclusions - Discussion

The most important outcome from this procedure was the determination of instructions towards the adoption (identification of strengths) or the rejection (dissemination of failure results and weaknesses) of several tested urban freight solutions in order for policy-makers to identify best practices and adopt them or reconsider unsuccessful city logistics concepts. In addition, opportunities and threats for each concept are outlined via the needs and implications for successful implementation of each measure.

In the context of the general conclusions, various solutions might face various fitting problems, the most significant of which are listed below:

- Spatial, technical, organizational and applicability issues.
- Unaffordable investment from the part of the responsible stakeholders resulting in inability to face high initial and operational costs.
- Lack of public funding and subsidy in combination with the private sector's unwillingness to pay.
- Law barriers or little compliance of proposed urban freight solutions with the existing legislative framework (e.g. mobility restrictions) and respective regulations (e.g. environmental restrictions).
- Low public acceptance, especially towards the adoption of sophisticated systems and of pricing measures, or indifference and negative attitude due to the lack of appropriate awareness and cultural approach of city logistics' payoff (i.e. lack of necessary information and diffusion of benefits).
- Lack of authorities' approval to undertake extra costs, as well as mobility, socioeconomic and environmental burdening in favor of the prioritization of freight activities over all the rest.

Another important finding is that mobility modifications are difficult to be respected by transport network users without enforcement and control, while pricing policies are almost impossible to be accepted by society without provision of proof, guarantee and respective clarifications concerning the traffic, environmental and socioeconomic benefit addressed to the public as payoff and compensative profit.

In order to fully implement new city logistics schemes there are some implementation channels of high importance that should be investigated during strategic planning:

- Political will, social interest, responsibility and sense of duty
- Public subsidy and E.U. funding through directives, regulations and action plans
- Compliance with regional, national and international transport planning policies
- Private investment and contribution (initiatives) to pioneer freight traffic solutions

- Promotion of public private partnership business schemes to maintain live interest and collaboration of all the involved stakeholders
- Technical feasibility and economic viability of new concepts
- Public acceptance through information campaigns (adoption from society of new cultural approach) and diffusion of payoffs, benefits and ROI period

Nevertheless, it should be stressed out that the real-time technology effectiveness testing and applicability, the simulation of concepts to real life conditions, as well as the validation of concepts results and final assessment of systems, constitute tasks to be further elaborated and processed and may lead to fully understand the operational conditions of each initiative.
In conclusion, the general principle to be adopted would be that freight urban logistics solutions which are about to be introduced shall incorporate strategic planning as the initial part of it and involve evaluation processes so as to timely identify the objectives of each initiatives ,the proper tools for achieving them and the pitfalls to be avoided.

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References

A. D. May and A. Koh D. A. Blackledge and C. Humphrey M. Fioretto (2007). “CURACAO – Coordination of urban road-user charging organizational issues”

Alexander Ilic, Thomas Andersen, Florian Michahelles (2009). “EPCIS-based Supply Chain Visualization Tool“. ETH Zurich

Ali Dada, Anton Rau, Matthias Konkel, Thorsten Staake and Elgar Fleisch (2008). “The Potential of the EPC Network to Monitor and Managethe Carbon Footprint of Products”

Allen, J., Thorne, G. and Browne, M. (2008). “BESTUFS II: Good Practice Guide on Urban Freight Transport”

Barcelona Chamber of Commerce (2008). “Microplataformes de distribució urbana. El cas de Barcelona”

Christof Kandel, Prof. Dr. Matthias Klumpp and Tristan Keusgen (2011). “GPS based track and trace for transparent and sustainable supply chains”

Commission of the European Communities (2009). COM (2009) 490 final. “Action Plan on Urban Mobility”. European Communities, Brussels.

DHL Smarttruck - DHL and Blue Dart (2011) pilot “Intelligent delivery trucks in India”

E. Nathanail, M. Gogas, K. Papoutsis (2012). “Urban freight and urban-interurban interfaces - Best practices, implications and future needs.” Deliverable D2.1 STRAIGHTSOL – STRAtegies and measures for smarter urban freIGHT SOLutions”.

Edward McCormack, Mark Jensen and Al Hovde (2002). “Evaluating the Use of Electronic Door Seals (E-Seals) on Shipping Containers” Univ. of Washington, Cambridge Systematics, Science Applications International Corporation, Inc.

EURIDICE consortium (2011). “European Interdisciplinary Research on Intelligent Cargo for Efficient, safe and Environment - friendly Logistics - (EURIDICE)”. Exploitation opportunities by EURIDICE consortium

European Commission (2007). “Towards a new culture for urban mobility. Green paper on urban mobility”. DG TREN, European Commission. Brussels, Belgium

European Commission (2010), “European Green Cars Initiative – Logistics and Co-Modality”, Version November 2010

Freight Best Practice (2002). “Heathrow Airport Retail Consolidation Centre: Introducing a consolidation centre away from the airport”

Freight Best Practice (2006). “London construction Consolidation Center”

GS1 Logistic Label (2010) . “Standard Internation Logistic Label – STILL

Harold Krikke, Ieke le Blanc, Maaike van Krieken, Hein Fleuren (2004). “Low-frequency collection of materials disassembled from end-of-life vehicles: On the value of on-line monitoring in optimizing route planning”

Hitoshi Ieda (2001). “WHY DON'T MULTI-CARRIER JOINTDELIVERY SERVICES IN URBAN AREASBECOME POPULAR:A GAMING SIMULATION OF CARRIERS' BEHAVIOUR”

INRETS consortium (2009). “SUGAR – Good Practices Analysis” Deliverable 3.3

J. H. Ron van Duin, Antal van Kolck, Nilesh Anand, Lori Tavasszy, Eiichi Tanaguchi (2011). “Toward an Agent-Based Modeling Approach for the Evaluation of Dynamic Usage of Urban Distribution Centers”. The 7th International Conference on City Logistics

Jan Eriksson, Rune Karlsson, Tobias Fors, Olof Fredholm, Anna-Maria Lång and Tomas Svensson (2004). “SAMLIC Pilotförsöket“

Kazuya Kawamura (2008). “Evaluation of Delivery Consolidation in U.S. Urban Areas with Logistics Cost Analysis” University of Illinois at Chicago (UIC)

Kelly, S.(2007). “Night-time deliveries – Wandsworth trial”

Ola M. Johansson (2004). “The effect of dynamic scheduling and routing in a solid waste management system”

Palmer, A., Piecyk, M. (2010). “Time, cost and CO2-effects of rescheduling freight deliveries”

Project consortium (2003). “MOSCA – Decision Support System Integrated Door-to-door Delivery: Planning and Control in Logistic Chains”

Project consortium (2011). “FREILOT- Urban Freight Energy Efficiency Pilot”

Ruesch, M. (2008). “Best Practice Update (2008) – Updated Handbook from Year 2001: E-Commerce and urban freight distribution (home shopping)”. BESTUFS II – Deliverable D 2.4 Part I

Schoemaker J., Allen J., Huschebek M., Monigl J. (2006). “Quantification of Urban Freight Transport Effects I”, BESTUFS Consortium, www.bestufs.net.

Scott Wilson Ltd (2010). “Freight Consolidation Centre Study by South East Scotland Transport Partnership“

Sel, S., Bentato, F., Macharis, C., Van Hoeck, E., Verlinde, S., Witlox, F. (2010). “Dal- en Nachtdistributie – Bevindingen pilots”

Stud.techn. Ola Robøle (2007). “Godstransporter i by”

Toshinori Nemoto, Johan Visser, Ryuichi Yoshimoto (2005). “Impacts of Information and Communication Technology on Urban Logistics System”

Transport Studies Group (TSG) (2005). “Urban Freight Consolidation Centers”. University of Westminster