

# A FRAMEWORK FOR STRUCTURING CITY LOGISTICS INITIATIVES

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**Abstract:** Interest in the problems and conceptual solutions for city logistics is increasing each year. City is the place of largest concentration of economic and social activities, and logistics is very important for the sustainability and the economy of the city. Numerous research projects indicate that the state of urban logistics is quite critical. City logistics system is extremely complex, with a large number of participants with different roles, problems, interests and goals. They all want an attractive city by all criteria, but individual goals are often in conflict. The introduction of changes, which are positive in terms of one group, can cause a number of adverse effects for the others. Problems and complexity of logistics in urban areas caused the development of various initiatives, measures of city logistics. Different authors and researchers, according to their own interests and aims, have defined different groups of city logistics initiatives. In this paper we define a framework for structuring city logistics initiatives that provides the basic characteristics required for their analysis and evaluation. In addition, we present various classifications of city logistics initiatives.

**Keywords:** city logistics, initiatives, criteria, classification, structuring.

## 1. Introduction

With the growing demands for more efficient supply and environmental protection, interest in city logistics (CL) i.e. goods distribution and logistics systems of urban areas is increasing. The productivity and profitability of companies and satisfaction of the resident's requirements in terms of the availability of various goods at lower prices, depends on the efficiency of the urban logistics system. An efficient logistics system is an essential requirement for the survival in the sense of global economic competition.

In order to make deliveries more efficient, to preserve the environment and to increase the attractiveness of the city, various initiatives are defining and different conceptual solutions are applying (see e.g. Tadić et

al., 2014b; Tadić et al., 2014c). However, changes are slow, and main problem is the lack of planning activities and comprehensive and long-term city logistics policy. Cities have different demographic, geographic, economic, sociological, cultural and historical features. Therefore, CL initiatives do not have the same effects, and in some cities they are not even applicable (Tadić et al., 2014a). In addition, there are many different stakeholders in CL who have different and sometimes conflicting interests (Tadić, 2014; Zečević et al., 2002). The city administration expects from logistics providers to offer new logistics services which would meet the growing demands of users, especially of retails, and which would be acceptable for the environment. On the other hand, providers of logistics services expect from city government legal

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or financial assistance and subsidies for the implementation of new city logistics concepts before starting the business that can prove to be unprofitable or extremely risky (Dablanc, 2007). Goods and transport flows in the city are the result of the logistical decisions. Logistics decisions, based on the requirements of the production and distribution sector, depend on the behavior of economic actors, such as households and companies. On the other hand, the spatial organization of industrial, commercial and logistics systems, but also the present legal framework and regulations have a direct impact on the planning, organization and implementation of the logistics activities in the city. These interactions provide the complex characteristics of city logistics and logistics chains in the city (Tadić et al., 2015).

The problem of planning the logistics activities and commodity flows in many cities was solved partially and individually, depending on the requirements and characteristics of the company to which the research was related and for which needs it was done. The best solutions for individual businesses were sought, rarely for one or more groups, and almost never for all groups, for all participants in the socio-economic life of the city, for the whole city (Zečević and Tadić, 2006). But, interest in the problems and conceptual solutions for city logistics is increasing each year.

Different authors and researchers, according to their own interests and aims of research, were using different criteria for structuring of CL initiatives (Tadić, 2014). Since there is no clear structure nor are there clear characteristics for evaluate CL initiatives, it is hard to provide substantial insights into the

success factors and the barriers of initiatives to improve the urban logistics. In this paper we develop a framework which can be used to analysis and evaluate CL initiatives. This framework contributes to the field of CL, since it provides the various classifications of CL initiatives with basic characteristics of urban logistics and it explains the relations between these characteristics.

## 2. Criteria for Structuring City Logistics Initiatives

With the increasing visibility and recognition of the unsustainable impacts of urban freight transport and logistics the governmental interests as well as the research activities in this area have increased. This has resulted in a substantial number of initiatives from both (local) governments and researchers that aim at improving sustainability of urban logistics operations in the late nineties (e.g. Allen et al., 2000; Ambrosini and Routhier, 2004; Taniguchi et al., 2003).

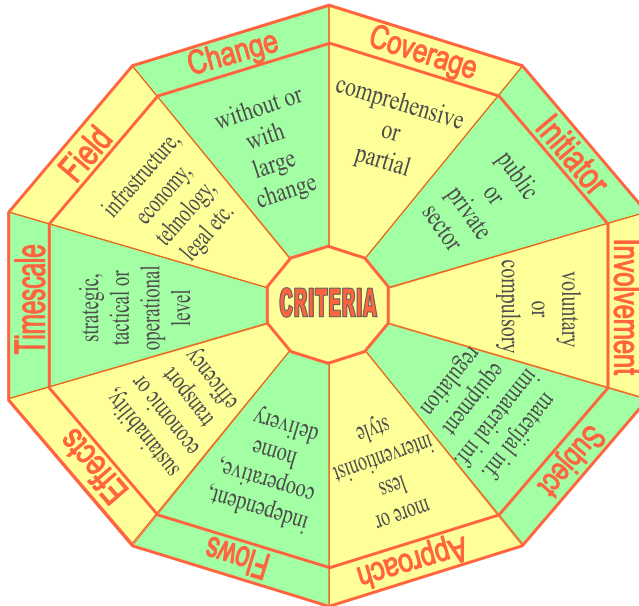
In order to study of the characteristics, requires and impact of the measures, the authors propose different classifications of initiatives CL (Tadić, 2014). The classification can be carried out according to one or a combination of several criteria. In this way class of the related initiatives are generated. However, given the complex structure and large number of interactions within the city logistics system, it is difficult to determine the affiliation of initiatives a particular class. Thus, according to certain criteria, the initiative can be found in different classes.

In order to identify the key success factors or barriers for the variety of CL initiatives it is necessary define some of the basic

characteristics (initiator, actors involved, subject, objectives, reasons for involving, expected results, spatial dimension, typical logistics flow, timescale etc.). Based on these characteristics, we define a framework for structuring initiatives in more classes. By analysis of initiatives per each of the criteria, can be identified the barriers and the factors that are indispensably for successful implementation, as well as success factors. We also identify several areas that are not yet fully covered in literature of urban logistics.

We distinguish ten areas which could affect the results of CL initiatives. The literature review shows that these criteria are actually the answers to several fundamental questions on urban logistics. The basic dimensions, characteristics of the urban logistics, i.e. criteria for structuring CL initiatives are (Fig. 1):

- **Coverage.** The CL initiative can be comprehensive (cover different logistics processes) or partial (relate only to a certain logistics process).
- **Initiator.** The initiative can be initiated by private actors (senders, receivers, logistics providers, carriers) and by public actors (national government or local authorities).
- **Involvement.** Actors can be involved either voluntary (active role) or compulsory (passive role).
- **Subject.** The subject of the initiative can be material infrastructure (e.g. logistics centres, loading and unloading zones), immaterial infrastructure (research, learning, training, and telematics), equipment (vehicles, loading and transport units) and traffic regulation (time windows, heavy vehicle network, and road pricing).
- **Approach.** Initiatives may have more (the setting up or management of certain services or infrastructures, and incentive measures) or less (restrictive measures, pricing measures, permissive measures) interventionist style.
- **Flows.** Initiatives may be related to the different logistics flows (e.g. an independent delivery, cooperative delivery, home delivery).
- **Effects.** According to the dominant impacts or effects, the CL initiatives can be divided into those that contribute to improving sustainability (environmental, economic and social), economic efficiency or transport efficiency.
- **Timescale.** Initiatives can have different temporal scales, times for planning and implementation – strategic (e.g. urban logistics center, environment-friendly vehicles, underground logistics system), tactical (e.g. loading and unloading zones, road pricing) and operative (e.g. time windows).
- **Field.** Initiatives can be divided into eight groups, depending on their field of application: infrastructural measures, operational and organisational measures, economical measures, land use measures, technological measures, legal measures, co-operational and educational measures.
- **Change.** According to the changes in the urban environment, initiatives can be divided into two groups: without change (focused on rearranging) and with large change of the existing urban context (radical changes).



**Fig. 1.**  
A Framework for Structuring CL Initiatives

For some of the defined criteria for structuring CL initiatives, in literature there are consistent classifications. For example, several authors list the same key actors that are involved in initiatives. But for most of the criteria, in the reviewed literature there is no clear and consistent classification of CL initiatives. In the next section we provide clear classes for the framework's criteria.

### 3. Classifications of CL Initiatives

An initial list of measures related to urban freight transport was given by COST 321 (1998). About 60 measures were identified and classified into eight different classes and four major areas: mobility demand, infrastructure supply and land use, vehicle supply and behaviour.

Following the COST 321 results, in 2000, the European Commission established a thematic network called, Best Urban Freight Solutions (BESTUFS). The two projects (BESTUFS I and BESTUFS II) provided handbooks and a best practice guide (Allen et al., 2008). Identified measures to improve the logistics flows in urban areas and reduce the environmental impact of the operation were classified into three main groups: goods vehicle access and loading approaches in urban areas (e.g. efficient usage of infrastructure; guidance on measures for goods vehicle access and loading in urban areas, technology in urban freight), principal issues involved in last mile solutions (e.g. home shopping via e-commerce) and principal issues associated with urban consolidation centres (urban distribution centres).

Investigation of CL initiatives was also conducted under another European projects, such as City Ports, City Freight, CIVITAS, NICHES, etc. The classification proposed by City Ports combines two criteria (Panebianco and Zanarini, 2005): what is regulated or subject of the initiative (infrastructure, logistical platforms, time of activities etc.) and how to regulate or approach – more or less interventionist style. According to the *subject*, initiatives can be divided into four classes (Russo and Comi, 2010): measures related to material infrastructure, such as city terminals or urban consolidation centres, loading and unloading zones and dedicated freight lines or truck routes for freight transportation; measures related to immaterial infrastructure, such as different telematics systems and intelligent transportation systems; measures related to equipment, such as standardized load units and environment friendly transport units; and measures related to traffic regulation (time window access, heavy vehicle network, road pricing, vehicle weight restriction, load factor control, low emission zones). Taniguchi et al. (2014) define six typical *approaches* for the CL problem solving: infrastructure approach (development of bypasses/ring roads, urban distribution centers, loading facilities), regulatory approach (pricing policy, land use planning, licensing, regulations and associated instruments), logistical approach (use of small delivery vehicles, improve terminal operations, improve driver competencies), cooperative approach (different forms of partnerships, load sharing systems, joint delivering), technology approach (use of electric delivery vehicles, use of ICT, implement a vehicle parking reservation system), behavioural change approach (promotional activities to raise awareness through the provision of information).

In City Freight project (Stratec, 2005), all initiatives were divided into six *fields* of applications: operational, market, environmental, land use and infrastructure, policy and regulative and technological initiatives. Otherwise, the field of application is the most frequently used criteria for the structuring of the CL initiatives. So, Stathopoulos et al. (2012) define six classes of CL initiatives: market based measures, regulatory measures, land use planning, infrastructural measures, new technologies, and management measures. Ruesch et al. (2012) share all initiatives into eight groups: infrastructural measures, operational and organisational measures, economical measures, land use measures, technological measures, legal measures, co-operational and educational measures. Van Duin and Quak (2007) consider that the main fields of attention in city logistics can be classified in three categories: Improvements of flows (the actual transport) including cooperation between companies, consolidation centers, transport reorganizing, and routing improvements); Hardware (the means) including infrastructure, parking and unloading facilities; Policy (the context) including licensing and regulation. In Study on Urban Freight Transport (EC, 2012), the authors offered a classification of the CL initiatives into six categories: regulatory measures; market-based measures; land use planning measures; infrastructure measures; new technologies; management and other measures.

In CIVITAS (CITY VITALity Sustainability) project a large number of innovative city logistics measures were developed to try to tackle the problems caused by freight deliveries and pickups in the cities. CIVITAS project has been implemented in four phases. Initiatives of the first phase

of the project (CIVITAS I) are classified into three groups (van Rooijen and Quak, 2014): consolidation of deliveries (using the urban consolidation centers, permits for certain categories of delivery vehicles and restrictions for other types and promoting cooperation between logistics providers, carriers); routing for goods vehicles; and using more environmentally friendly vehicles (clean vehicles). Initiatives of the second phase of the project (CIVITAS II) are also divided into three groups (McDonald et al., 2010): new distribution schemes; vehicle and driver support; and freight partnerships.

According to the *initiator*, decision maker, CL initiatives can be divided into political and non-political. Public sector is responsible for policy (governmental) initiatives and private sector is responsible for non-political (company) initiatives. By defining and applying of certain measures, local authorities force companies to change their operations to become more sustainable. On the other hand, companies implement the specific measures to increase internal benefits (e.g. increasing efficiency) and thus reduce the unsustainable impacts of their operations on the environment. The majority of CL initiatives are not initiated by private parties, but by public actors. Ogden (1992) proposes the next classification of the policy initiatives: traffic management, zoning of land-use, infrastructural investments, licensing and regulations, road pricing, and terminals and (intermodal) transshipment centers. Van Binsbergen and Visser (2001) propose another classification of the policy initiatives: active involvement (initiatives that require active involvement a developer, a provider, or an operator); planning initiatives (infrastructure planning and space planning); financial initiatives (that deal with taxes and

pricing or financial support); legislative initiatives (licensing and regulation); communication and consultation; and agreements and covenants. Munuzuri et al. (2005) define five classes of the governmental initiatives: public infrastructure (transfer points, logistics centers, underground systems); land use management (reserving space for loading/unloading and other logistics activities); access conditions (spatial and time restrictions); traffic management (measures aimed at improving freight flows, the use of ITS and schemes of cooperation); and enforcement and promotion (different promotion tools in order to support certain measurements without imposing them, and enforcement tools in order to ensure application of other specific solutions). Quak (2008) divides all policy initiatives into three classes: planning, financial and legislative measures. Company initiatives can be divided into six classes (Ogden, 1992): improving the urban pick-up and delivery practices, the consolidating of urban freight, off-hours shipping and receiving, improving truck technology, and the use of communication, navigation, and routing systems. For these initiatives, Browne i Allen (1999) propose another classification: technology initiatives (innovations of logistics systems); initiatives of logistics activities reorganizations (night delivery, consolidation, improving the operations of pick-up and delivery); and changes in the supply chain organisation.

In relation to *timescale*, the time and cost of implementation, initiatives CL can be divided into three classes (Russo and Comi, 2010): strategic initiatives associated with long-term capital investment programs (development of new infrastructure) and new technologies (environmentally friendly



vehicles); tactical initiatives associated with limited resources and minor changes in infrastructure (loading and unloading zones and road-pricing); and operative or short term initiatives (time windows and specific permits).

According to the *involvement*, CL initiatives can be divided into two groups (Browne et al., 2005): voluntary initiatives (actors are involved voluntary) and compulsory (actors are involved involuntary) initiatives. The actors who are involved involuntary have passive role. These actors are usually obliged by legislation to be involved. An example can be the compulsory use of a city consolidation center, or the compulsory use of low-emission vehicles in a low emission zone. The actors who are involved voluntary can have several roles (De Brito, 2003): managing/organizing, executing, and accommodating. The active actors in the public sector can have three roles (van Binsbergen and Visser, 2001): developer (of technology), provider (of financial means), and operator (e.g. traffic management). Quak (2008) proposes the following roles for the voluntary involved actors: funding, initiating (or developing), managing/organizing, executing, accommodating and using.

According to the dominant *effects*, CL initiatives can be grouped into three categories: sustainability, economics (profit) and transport efficiency. Sustainable urban development is the main motive for the application of CL initiatives by the public sector (local government). Sustainable development includes three sustainability issues, i.e. environmental, economical, and social sustainability, on the short and the long-term. But, private sector is mainly involved in the CL initiatives because of

economic motives, lower costs and higher incomes, or higher profits. This reason differs from sustainability, which also includes an economical component. Thompson and Hassall (2006) identify four goals for urban area initiatives: improve health and safety, reduce community impacts, reduce freight costs, and improve supply chain efficiency. Taniguchi et al. (2004) presents three main targets of activities that can be achieved by city logistics: mobility, sustainability, and liveability. These three targets are supported by eight goals that form the directions to address common issues: global competitiveness, efficiency, environmental friendliness, congestion alleviation, security, safety, energy conservation, and labour force. Each of these goals relates to one or more key stakeholders.

Some initiatives are comprehensive, *cover* different logistics processes and actors (cooperative logistics systems, consolidation of flows using logistics centres, underground logistics systems). But, initiatives such as loading-unloading zones, restrictive measures, pricing measures are less interventionist and cover only some of the logistics processes, systems and actors. CL initiatives can be applied to all actors or to only some actors (receivers, logistics providers, carriers for their own needs and for third parties) or some economic activity, industry (trade, catering or construction industry). On the other hand, some initiatives are linked to the central city zone and are not applicable to the total urban area. In addition, initiatives can be defined in order to regulate specific *flows*, such as home deliveries, flows of independent and small retailers, cooperative flows etc. The initiatives can be divided also to those that regulate the supply flows and reverse flows

as well as flows of core goods deliveries and collections, auxiliary i.e. non-core goods deliveries, waste collection, postal collection and deliveries, and money collection and deliveries (Allen et al., 2000).

According to the *changes* in the urban environment, initiatives can be divided into two groups (Quak, 2008): initiatives within the current urban context and initiatives with changing urban context. Initiatives of the first class are focused on a better utilisation of available infrastructure (e.g. road, vehicles, and warehouses). They do not require large investments and are easy to apply. These include the various policy initiatives (road pricing, licenses and regulations, parking and loading/unloading zones) and initiatives taken by the logistics provider (carrier cooperation, vehicle routing improvement, technological vehicle innovation). Initiatives with changing urban context are complex and difficult applicable. They generally require a significant financial investment, building infrastructure systems and the involvement of different stakeholders. This group includes initiatives modifications and construction of infrastructure systems (logistics centers, underground systems, etc.) and initiatives that involve change or the reorganization of logistics activities.

#### 4. Conclusion

Logistics, despite the fact that it encourages the urban economy, is still quite neglected in the terms of research and planning. Urban logistics systems are very complex. They involve many stakeholders and the ability to manage such systems depends upon multiple factors (e.g. structure and location of economic activities, urban land use patterns, types of goods, infrastructure and existing regulations) (Tadić et al., 2015).

Selection, admissibility, successful implementation and sustainability of the solutions require an analysis of fundamental characteristics of CL initiatives, which is usually not the case. In this paper, we define a framework for structuring initiatives in more classes. By reviewing a large number of papers and projects, a set of criteria for the classification of CL initiatives is identified.

Defined a framework for structuring initiatives can be a useful tool for city authorities when designing CL solution, which ideally should be done in co-operation with private sector, especially logistics providers. By analysis of initiatives per each of the criteria, can be identified some of the basic characteristics such as decision maker, actors involved, reasons for involving, subject of the initiative, objectives, expected results, spatial dimension, typical logistics flow, timescale etc.

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