

8th INTERNATIONAL CONFERENCE
"TOWARDS A HUMANE CITY"
New Mobility Challenges
Novi Sad 11th and 12th November 2021

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THE CATEGORIZATION OF URBAN CONSOLIDATION CENTRE CONCEPTS

Key Words

City logistics
UCC concepts
Urban freight
transport
External effects
Systematic
literature review

Abstract

The purpose of this paper is to provide structured information on urban consolidation centre concepts regarding their impacts on urban freight transport external effects. The aim is to provide a framework for future research focused on urban consolidation centre impact modelling. A systematic literature review was performed to identify journal articles focused on urban consolidation centres and related impacts of such facilities on urban freight transport externalities. According to the reviewed concepts and included city logistics initiatives, we proposed a categorization of urban consolidation centre concepts. The categorization can be useful for researchers to allow and shape modelling efforts and for practitioners to guide them in the decision-making process.

1. INTRODUCTION

Urban consolidation centers (UCC) have a central role in many solution **concepts** to reduce the impact of urban freight transport (UFT) (in [1] according to [2, 3]). Also, numerous additional city logistics (CL) initiatives are used to improve UCC impacts. Individual implementation of CL initiatives does not create a sustainable and competitive CL system [4]. Therefore, the implementation of the UCC is not a guarantee that all the problems and challenges generated by the UFT will be solved. Especially because in practice it has been shown that the UCC initiative is often unsuccessful [5]. However, the UCC enables more efficient implementation of many other CL initiatives and vice versa. Therefore, the UCC is rarely implemented without

additional CL initiative, whether it has already been implemented at the time of the UCC introduction, or its implementation is planned together with the UCC. For example, regulatory and restrictive measures are often applied in urban areas to reduce the negative effects of UFT, which could be beneficial to the UCC [1]. Also, the UCC fleet can gain a competitive advantage, compared to conventional trucks used by carriers, by using environmentally friendly vehicles for local freight transport [1]. Therefore, when we speak about the implementation of the UCC initiative and its results, we often refer to the results of the combined implementation of the UCC and other UL initiatives, i.e. UCC concepts.

The decision of an initiative or concept implementation to decrease external effects of UFT is not an easy task. High number of alternative UCC concepts further increases complexity of decision making process. The need to identify and categorize effective UCC concepts for UFT externalities reduction is essential for both efficient urban logistics policy and future research. Such categorization should create a framework to facilitate and guide practitioners in decision making process and inspire future research related to presented concepts. Therefore, here presented research aimed to identify and classify UCC concepts by a systematic literature review of journal articles content.

The paper is structured as follows. The process of systematic literature review is presented in Chapter 2. Further, the results of the content analysis are shown in Chapter 3. Finally, Chapter 4 shows the conclusions of the research.

2. METHOD

A systematic literature review was conducted in order to categorize the UCC concepts that are most often applied in practice.

Firstly, journals dedicated to discuss CL themes, and particularly themes regarding UCC implementation, are identified. The most influential and highly ranked scientific journals with high impact factors are considered as sources of reliable information: *Transport Reviews* ($IF^7 = 9.34$), *Transportation Research Part A: Policy and Practice* ($IF = 6.10$), *Transportation* ($IF = 4.99$), *International Journal of Sustainable Transportation* ($IF = 4.17$), *Transportation Research Procedia* ($IF = 1.85$). Also, one journal dedicated to publish proceedings of the most influential conferences (*Procedia - Social and Behavioral Sciences*) is used to cover papers published at conferences and a few Thesis [2, 6, 7] are used as a comprehensive source of useful information considering the aim and purpose of this research. The review process in this paper is not limited but rather focused to sources listed in this paragraph.

Secondly, as the different terms with similar or even the same meaning are used in the scientific literature, especially in the young research fields such as CL, the keywords to search for the useful papers are defined and listed in Table 1. The keywords were divided into three levels. The first level terms are used to identify the UCC-related papers. Second level keywords intend to focus the literature review on relationship between UCC and freight transport flows in urban areas. Finally, the

⁷ IF = Impact Factor

third level terms are used to filter the papers that describe the impacts of UCC on performance of UFT, e.g. vehicle-kilometers or GHG emission before and after UCC introduction.

Table 1. Keywords used to search for literature sources

	First level	Second level	Third level
Keywords	city/urban logistics initiative city/urban logistics measure city/urban logistics scheme city/urban consolidation centre city/urban transshipment terminal	urban freight transport city goods distribution last mile delivery	initiative impact transport externalities external effects external costs

The first level keywords singled out 4183 papers. By introduction of second and third level keywords the number of relevant papers is reduced to 1798. Further, a manual search exported 117 papers from this list to perform a content analysis. The content analysis of the research papers was conducted in order to identify initiatives used to form a UCC concept and to perform a categorization of the UCC concepts.

3. RESULTS

We analyzed all the papers collected by using first level keywords in order to identify CL initiatives planned or applied in the combination with the UCC. Further, results of the papers filtered by second and third level keywords brought information on external impact of UFT by introduction of such concepts. Consequently, the most frequently used additional CL initiatives are identified by their external impacts and grouped by their common characteristics in five classes:

- alternative means of UFT;
- delivery windows;
- restrictive and regulative measures;
- incentives and other mechanisms for funding CL initiatives, and
- other CL initiatives (reverse goods flows collection; satellite terminals; operational optimization; added-value services, application of contemporary IT solutions)

The groups of additional CL initiatives are used to define five categories of UCC concepts. Table 2 shows categorization of the identified UCC concepts significant for reduction of UFT external effects. The detailed UCC concept structure is also shown, according to specific additional CL initiative found in the literature sources. Due to limited length of this paper, from 117 analyzed sources only representatives are cited in Table 2, as the UCC concepts and the initiatives combinations repeat in other papers.

Table 2. UCC concepts categorization

UCC concept	Additional CL initiatives	Source
UCC + Alternative means of UFT	Electric delivery vehicles	[8, 9, 10, 11, 12]
	Cargo bikes and tricycles including electric	[13, 14]
	Switch to smaller road vehicles	[12, 6]
	Cargo trams	[3]
	Other alternative means of UFT	[3, 15]
UCC + Delivery windows	Off-hour delivery	[1, 8, 15, 7, 16]
	Night delivery	[6, 7]
UCC + Restrictive and regulative measures	Zone-based restrictions on access for freight vehicles	[3, 1, 8, 6, 17]
	Type-based restrictions on access for freight vehicles	[15, 17, 18, 19]
	Time-based restrictions on access for freight vehicles	[17, 18, 20]
	Access restrictions based on load factor of freight vehicles	[5]
	Regulations for loading and unloading freight vehicles	[3]
	Congestion charging	[20]
	Development of off-street loading/unloading bays	[3]
UCC + Incentives	Incentives for UCC operator	[1, 21]
	Incentives for carriers	[1, 8, 20]
	Incentives for receivers	[1]
UCC + Other CL initiatives	Reverse flows collection to improve vehicle utilization	[22]
	Satellite terminals	[10, 23]
	Operational optimization	[24]
	Added-value services	[22]
	Application of contemporary IT solutions	[3]

4. FINAL REMARKS AND CONCLUSION

The systematic literature review included 6 scientific journals from which 117 papers are identified as UCC-based papers and which discussed relationship with UFT flows and consequential effects.

Five different categories of UCC concepts were identified by content analysis (UCC + Alternative means of UFT; UCC + Delivery windows; UCC + Restrictive and regulative measures; UCC + Incentives; UCC + Other CL initiatives). The most attention in UCC concepts is given to combination of UCCs and eco-friendly (mostly electric) delivery vehicles. This is the consequence of the basic aim of the UCC to target the challenge of negative environmental and social impacts from freight delivery vehicles in urban areas. Also, the restrictions are broadly discussed because those are common measures of urban freight transport management, despite UCC application and a considerable attention is given to incentives, because a lot of UCC concepts in practice failed due to financial problems. Other initiatives are less discussed in analyzed literature. However, this does not mean that they are less important for the success of the UCC concept.

The categorization should be beneficial to researchers as well as practitioners. Researchers should gain benefits for the impact models development process because the classification makes it possible to simplify the model structure and reduce the number of variables. Practitioners may use the categorization as the guide in the decision making process related to UCC implementation.

There are some limitations in the research presented in the paper. The systematic literature review is focused on scientific journal articles on SCI list. Although such sources are the most reliable and highly valued in the scientific community, there are doubts that something is missed by the research because other sources were not considered (other journals, conference proceedings, project reports and studies, etc.). Also, the content analysis results are guided by model development motives. This means that UCC concepts categorization aims rather to facilitate the urban freight transport modelling process and indicate solutions in policy decision-making, then to provide a comprehensive and strict UCC concepts list. Policy makers and stakeholders have to include more in-depth analysis and other concepts variations to develop the most suitable and sustainable city logistics solution in particular case.

ACKNOWLEDGMENT

This research has been supported by the project "Development and application of modern tools and research methods in the field of traffic and transport".

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