DEBATE ON THE DEFINITION OF URBAN LOGISTICS: A SYSTEMATIC LITERATURE REVIEW

Agnieszka SZMELTER-JAROSZ
Department of Logistics, Faculty of Economics, University of Gdańsk, Poland
agnieszka.szmelter-jarosz@ug.edu.pl

Beata CHMIEL
Doctoral School Of Humanities and Social Sciences, University of Gdańsk, Poland
beata.chmiel@phstud.ug.edu.pl

Dariusz WEILAND
Department of Logistics, Faculty of Economics, University of Gdańsk, Poland
dariusz.weiland@ug.edu.pl

Patryk WIERZBOWSKI
Department of Logistics, Faculty of Economics, University of Gdańsk, Poland
patryk.wierzbowski@ug.edu.pl

Leszek RESZKA
Department of Logistics, Faculty of Economics, University of Gdańsk, Poland
leszek.reszka@ug.edu.pl

Abstract
This paper addresses the problem of chaos in defining the essential elements of the urban logistics system. The extensive literature on the subject focuses on selected elements of this system, treating it as something vague and describing it selectively. The variety of definitions in the literature, their contradiction and fragmentation are not conducive to a scientific discussion. The study aims to unify the approaches to urban logistics and urban logistics system and summarise the knowledge about their elements. To achieve this goal, extensive literature was collected and analysed as of July 30, 2022 to show the scope of the urban logistics system comprehensively. The search and analysis procedures were based on a mix of a few systematic literature review approaches. The research results order the definition apparatus, clarify basic terms in urban logistics and allow for improving the quality of subsequent planned research studies on the urban logistics system to minimise research biases and misunderstandings in the future.
Keywords: logistics definition, urban logistics, city logistics, logistics system, stakeholders.

1 INTRODUCTION

Contemporary problems in cities are mainly related to logistics. Managing scarce resources, massive traffic or environmental pollution require logistics support. Moreover, cities face problems resulting from sudden events (e.g. pandemics or war) (Musgrave, 2009; Swango, 2020) and often have to respond

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quickly to massive changes in a short time(Plazier & Rauws, 2021). Therefore, usually urban resilience is presented as a goal of all the city users and managers and a remedy for all the changes according to the rule, "you cannot predict everything so be prepared for everything". In urban resilience, logistics also plays a vital role (Campbell et al., 2016) – in fact, the implemented logistics solutions help to achieve and maintain resilience(Büyüközkan et al., 2022). However, the logistics is described in many ways, and the chaos of the literature causes inconsistencies in further research. Definitely, the idea of logistics – regardless of its occurrence (houses, schools, companies, hospitals, cities, rural areas, countries etc.) should be the same for all. If so, urban logistics should be described as logistics in the city, like in the company, school etc.

Despite the extensive literature on urban logistics (Anderson et al., 2005; Chaberek-Karwacka, 2017; Gonzalez-Feliu, Jesus. Semet et al., 2014; Heeswijk et al., 2020; Lagorio et al., 2016a; Macário et al., 2011) there are few studies synthesising and systemising knowledge in this area (Lagorio et al., 2016a; Russo & Comi, 2003). However, unfortunately, those studies lack a unified and homogeneous approach to logistics. Therefore, this paper aims to present one homogeneous approach to urban logistics, urban logistics system (a part of urban logistics) and its elements.

To achieve research goal, the paper was divided into a few parts. Firstly, the general approach to logistics is presented to draw the bigger picture of the studied topic. The following section exhibits the literature search and review procedure. The next part of the paper shows the research results. Finally, the last section highlights the main conclusions and the added value of the paper, presents paper's limitations and draws future research directions.

2 THEORETICAL BACKGROUND

2.1 The scope of logistics

Defining logistics is challenging because of different approaches presented in the literature. Research practice has a trap, namely looking for the oldest or most cited one as the "true" definition. Is it a well-known problem in philosophy and, more generally – science - because the number of citations for a given source increases exponentially at some point when the number of citations exceeds a certain threshold. When a source cited once is included in an article with a large number of recipients, then there is a high probability of its further citation, even if it does not present the given issue sufficiently thoroughly and comprehensively(Swango, 2020). Even if particular definitions of logistics partially overlap then still, present the various scopes of logistics activities. Chaberek (2014) and Sweeney(2005) summarised those inconsistencies comprehensively. Working separately, they concluded that the variety of definitions blurs

the true scope and tasks of logistics. Finally, they concluded that logistics is a set of activities carried out by entities to move and store the right resources in/to the right place, in the right quantity, at the right time, and at the right cost. The same approach presented Blanchard (2007). Moreover, logistics is about rationalising relationships between the elements of a given system, in the time-space transformation of resources. Within this, the logistics must overcome the trade-off problems, so find a compromise, an optimal allocation of resources and carrying out the processes(Szmelter, 2019).

If it is clear that there is no logistics without the processes it has to support (Szmelter, 2019), then it can be observed everywhere - in homes, schools, enterprises, the army, state administration, cities, rural areas, transport, etc. (Chaberek and Mańkowski, 2018). To sum up, each purposeful human activity is associated with two parallel processes: the basic process and supporting, so the logistic process. This also applies to processes carried out in cities.

2.2 Processes and resources in the city

Basic processes in cities are to meet the needs of city users, while the resources necessary for this have to be provided. Many basic processes take place in cities; however, the literature does not explicitly indicate such a distinction (Lin et al., 2019; Rześny-Cieplińska et al., 2021). These are mainly:

- professional work of city users;
- primary, secondary and higher education, training;
- administration issues;
- leisure activities: sport, tourism, recreation and culture;
- use of health care services and products;
- shopping carried out by residents of cities and surrounding areas.

The city users carry out the basic processes mentioned above. They are a subgroup of urban logistics stakeholders (Bjørgen et al., 2019; Kunze et al., 2016; Rześny-Cieplińska & Szmelter-Jarosz, 2020) – a group of all entities interested in city functioning. Carrying out the basic processes requires appropriate human, material, information and financial resources, so providing logistics support. For example, the basic process of professional work within the city is connected with the need to provide possibilities for humans (here: human resources) to move from their place of residence to their place of work. As well of course, it needs some materials, machines, software, money to buy raw materials etc. Currently, suburbanisation trends cause an increasing number of residents to move to suburban towns, resulting in longer travel times(Calfee et al., 2001; Sun et al., 2019), congestion (Brinkman, 2016) and the need to expand the transport infrastructure (Lovelace et al., 2020). On the other hand, it is worth mentioning the

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emerging trends towards remote work in the form of the so-called home office(Engle et al., 2020), and thus replacing the physical movement of human resources with the flow of information resources (Kayikci, 2018). If so, then the basic processes are changing, and so should the logistics support. Then, the wider construct as consumer behaviour is constantly evolving (Bounie et al., 2020; Schlaile et al., 2018). This is caused by many trends visible in cities: digitisation, focus on resilience, sustainability, biodiversity, and many others. For example, the expanding process of digitisation of services is noticeable in the purchasing process, manifested mainly by the ever-growing e-commerce market. Then the element of residents' mobility related to shopping recedes into the background because courier companies take over delivering products to a home or a parcel locker.

The other perspective is about managing the resources. When analysing the resources necessary for carrying out basic processes in the city, it is impossible not to mention such resources as water, gas, electricity and finally, the Internet, i.e. the so-called media; therefore their provision should undoubtedly also be included in the logistics support.

To sum up and avoid further misunderstandings for our analysis, we present the following assumptions as valid for further analysis:

In cities, there are two types of processes from the perspective of city users: basic processes (carried out in a basic system) and supporting (logistics) processes (carried out in an urban logistics system).

Urban logistics stakeholders are a broader group than city users (e.g. local authorities do not have to be the city users but city planners, decision-makers or coordinators). City users can be divided into subgroups like residents, tourists, commuters, students, entrepreneurs, including couriers and other transportation and logistics entrepreneurs and many others. They carry out the basic processes which need logistics support.

Because we discovered the inconsistencies in the literature about the essence and scope of urban logistics and then, we confirmed it by finding the literature with a similar conclusion, we formulated the three research questions helping to achieve the research goal:

RQ1: How to define the scope of urban logistics and urban logistics system?

RQ2: What are the elements of urban logistics and urban logistics system?

RQ3: What are the measures of urban logistics and urban logistics system?

The next section presents the methods and materials used to answer the research questions and is followed by the research results answering these questions.

3 METHODS AND MATERIALS

The systematic literature review is the top method researchers use to summarise the knowledge in the chosen research area. Therefore, because of the evolving nature of logistics as a science (as stated in the Introduction) and to enable the replication of our study, we developed a procedure based on several well-known SLR approaches. In our study, following the advice of Piper (2013), the review resulted in more than one outcome. Firstly, we summarised the knowledge on the studied topic. Secondly, we built a complete picture of the basic elements of the urban logistics system and the system itself. Thirdly, we identified the theoretical gaps that the literature does not address.

A literature review should follow a robust procedure (Armitage & Keeble-Ramsay, 2009). To achieve that, we analysed the literature review methodologies used in logistics and prepared the research framework as presented in Figure 1. We have decided, as many researchers before us, to use the PRISMA diagram (Haldane et al., 2020, PRISMA Diagram, 2020) and combine it with approaches presented by Denyer, Tranfield and Smart (2003)and Denyer and Tranfield (2009). The search itself was designed based on SLR frameworks proposed in papers by Rowley and Slack (2004) and Snyder (2019). Finally, eight literature search engines were chosen to carry out the research: EBSCOhost, Emerald, Google Scholar, JSTOR, SAGE, ScienceDirect, Taylor and Francis and Wiley. The Boolean logic was used to search the literature as follows:

- First search:

urban logistics OR urban logistics system OR city logistics OR city logistics system IN ABSTRACT
AND
urban areas OR urban facility management OR systems of cities OR urban planning IN TEXT

After the search and removing duplicates, 294 papers were identified and after screening the abstracts, 66 were included in the full-text analysis.

- Second search:

stakeholder IN ABSTRACT
AND
city logistics OR urban logistics OR mobility OR urban transport OR city transport IN ABSTRACT
AND
urban areas OR urban planning OR inhabitants OR inhabitants OR residents IN TEXT

- published from 2010 to 2021;
- “in press” papers and articles allowed;
- English-language sources;

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- only full-text records (including academic subscription);
- PDF files only.

Finally, in the full-text phase the 114 papers were included. However, some papers are usually excluded at this stage if they do not meet the review requirements. In our case, we had to exclude the papers about transportation only (some papers treat transport and logistics equally, what is a mistake) or about the single elements of urban logistics, not the whole its system. Then, in the end of the analysis, only 65 papers were included.

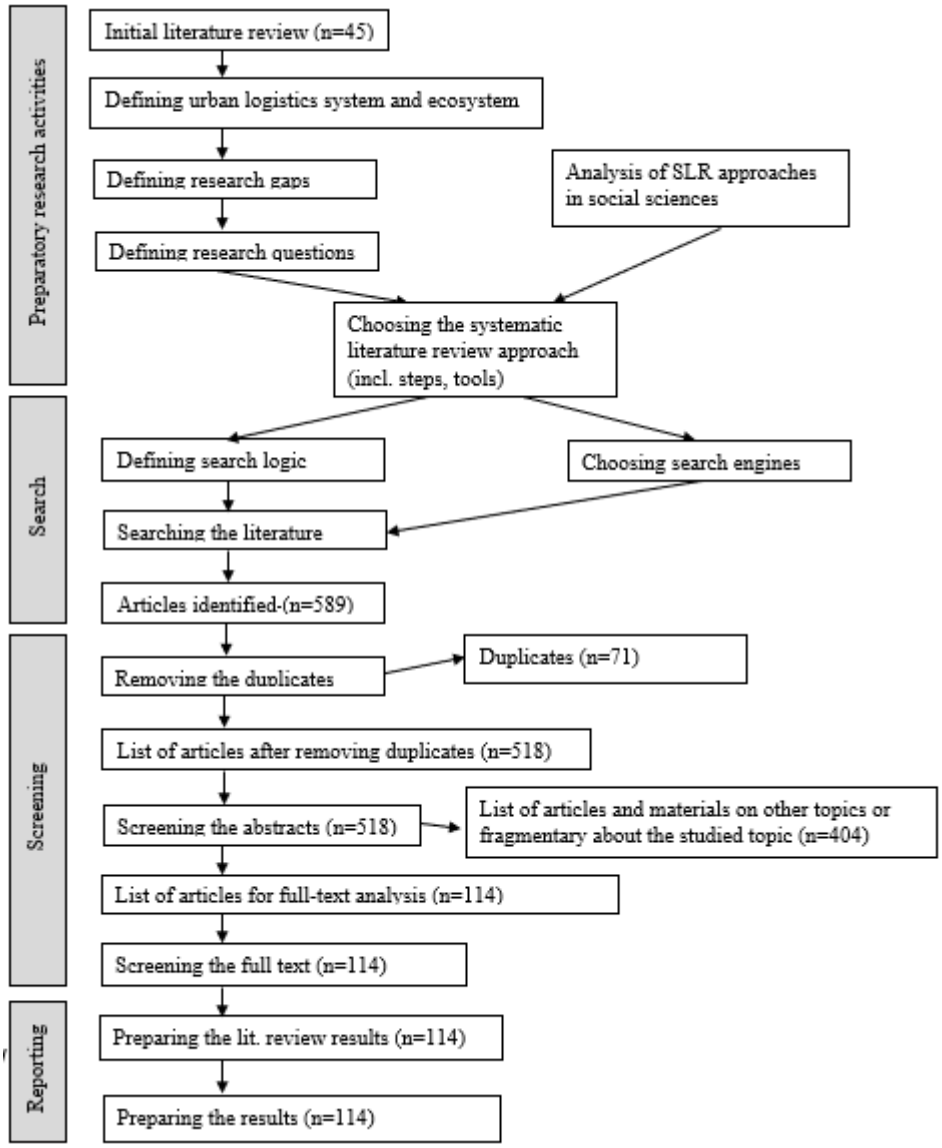

FIGURE 1. SYSTEMATIC LITERATURE REVIEW (SLR) PROCEDURE BASED ON PRISMA FLOW DIAGRAM
Source: own elaboration based on (David Denyer and Tranfield, 2009; Dragan et al., 2020; Haldane et al., 2020; Snyder, 2019)

4 FINDINGS

4.1 Defining urban logistics and urban logistics system

The literature has many definitions for urban logistics (called also city logistics) and the urban (city) logistics system. The problem with an unambiguous definition lies primarily in the difference in the interests of the parties participating in urban life. As it has already been mentioned, these interests are very often contradictory. Some authors consider only a strictly geographical area to be the scope of urban logistics (usually the area of one city)(Allen et al., 2011; Boloukian & Siegmann, 2016), or the specific area within the city, e.g. the area of the seaport (Wang & Ma, 2019) or the specific problem as a part lof urban logistics decision-making, e.g. choosing the location of the warehouse/distribution centre (Yang & Zeng, 2018; Zhao et al., 2020; Zhou et al., 2016). For some, however, the urban logistics and its system should cover many geographically connected urban agglomerations (Ducruet & Lugo, 2013; Rodrigue et al., 2017) or even urban-rural areas (Gong, 2019). From the aforementioned basic and logistic processes perspective, the first research gap can be identified at this point - the underdefinition of the geographical area to which city logistics applies. From a purely geographical perspective, it should include support for all processes carried out within the area formally belonging to the city. In turn, it will not meet city users' needs, because they often live outside the city and use the city only during some part of the day. The question raises: What about suburban zone, urban metropolitan areas? Should they be included in urban logistics, constitute a part of urban logistics, or be a separate area of logistics called "suburban logistics"? Finally, we have to accept that urban transport systems being a part of urban logistics systems perform functions not only in the city itself but within the functional area of the city. It is undefined and should be addressed in future research. In our opinion, considering the chosen approach to logistics, the logistics in suburban zones should be included in urban logistics if it still focuses on supporting the basic processes of city users.

In addition, another gap in the unambiguous definition of urban logistics lies in the scope of the processes and resources it covers. Some of the definitions of urban logistics refer only to problems in transport, transhipment and storage of cargo; another ones – only to mobility. In others, however, only the information is the resource to be managed within the urban logistics system or only humans (as human resources; see Table 1). According to the approach to logistics, which we presented in the theoretical background, the most comprehensive approach and proper are those definitions that refer to both the groups mentioned above. Processes should be focused on managing all the possible resources: material, human, money and information. Additionally, within urban logistics, the processes refer to

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problems/tasks/actions in leading groups of problems, i.e. social, economic, environmental, infrastructural. The type of problem defines the resources and processes to be managed.

TABLE 1. SCOPE OF URBAN LOGISTICS

Categories/areas of urban logistics research	Source(s)
Processes and resources	
Freight transport, reloading, storage	(Boloukian & Siegmann, 2016; Crainic et al., 2012; Ferguson et al., 2012; Lagorio et al., 2016b; Nesterova & Quak, 2016; Österle et al., 2015; Quak et al., 2016; Russo & Comi, 2013; Woensel & Savelsbergh, 2016; Yang & Zeng, 2018; Zhao et al., 2020)
People's mobility	(Suryani et al., 2021)
Freight transport, mobility of people	(Allen et al., 2011; Montwiłł, 2019)
Freight transport, mobility of people, and flow of information together	(Akosua et al., 2021; Bronnikov & Savin, 2018; Kiba-Janiak & Cheba, 2019; Kubek & Więcek, 2019; Masłowski et al., 2019; Witkowski & Kiba-Janiak, 2012)
Social, economic, infrastructural and environmental problems	(Akosua et al., 2021; Fraske & Bienzeisler, 2020; Jedliński, 2014)
Resources only	
Legal regulations regarding city logistics	(van Rooijen & Quak, 2014)
Information	(Anand et al., 2016; Taniguchi et al., 2016)
Processes only	
Logistics activities (without indicating resources)	(Nesterova & Quak, 2016; Nowicka, 2014; Taniguchi, 2014; Zhao et al., 2020)
General transportation (no asset indication)	(Akosua et al., 2021; Benjelloun et al., 2010; Taniguchi, 2014; Zhao et al., 2020)

Source: Own processing

The definitions we analysed also differ in indicating the core of logistics activities. According to some of them, the processes of urban logistics begin at the time of planning logistics activities (Witkowski & Kiba-Janiak, 2012). Then, some definitions relate directly to the control of the logistics processes within the city and the potential opportunities to improve and optimise their course (Masłowski et al., 2019; Woensel & Savelsbergh, 2016), but also those specifying that the role of urban logistics is to communicate new problems to actors (stakeholders) as soon as they appear (Guimarães et al., 2020). To sum up, urban logistics should cover (as in the other areas) the whole management: planning, motivating, organising and controlling in terms of carrying out the processes using resources and meeting the needs of urban logistics stakeholders (including city users). Then, we have here processes and resources being managed altogether. They are managed in some urban environment, called urban logistics system – a system of elements in which the processes with use of resources are carried out.

To end this part of the results, it is worth noting that no definition met our assumptions made earlier, regarding basic and logistics processes. The nearest one was the definition by Witkowski and Kiba-Janiak (2012). According to them, urban logistics „focuses on planning, coordinating and controlling processes taking place within the boundary of a given urban area and is related to the physical movement of goods

(i.e. raw materials, semi-products, goods and waste, etc.), people and information in a manner that will optimise costs, minimise congestion and improve quality of life (Witkowski & Kiba-Janiak, 2012). However, we still think that a discussion is needed about including the suburban area in the scope of urban logistics. The supplementary definition of the cited one was proposed by Kulińska and Kulińska (2019) stating that city logistics is the entirety of processes streamlining and optimising the flow of people, cargo and information in cities through management in such a way as to meet the needs of residents while taking into account environmental aspects, safety and economic energy. This definition, in turn, does not include all of the resource categories (not the financial and material) and not all of the city users. So to sum up and clarify that the logistics is one and is used in many places with the same goals and tasks, we propose to define urban logistics as "the entirety of processes supporting the purposeful activities of people in cities and urban functional areas focussing on providing the right resources (material, human, information, money) in right quantity to the right places, to the right time, at the right (agreed cost)". This is a simple element of urban logistics.

Considering the multitude of approaches to urban logistics and its system, creating a closed list of elements of such a system was challenging. In order to ensure the clarity of the study, the authors divided the elements of the urban logistics system most often defined in the literature into five key categories (see Table 2). The first category, the largest one, is participants/actors/stakeholders. The most frequently mentioned in publications and definitions of elements include carriers (18 papers), local governments/public administration/road managers (16 papers), recipients/senders of shipments (13 papers), customers, consumers (12 papers), residents (9 papers) and industry in the city (8 papers). The second category, which is also equally numerous, is the elements of infrastructure generally recognised by the authors. Within this category, the publications most often mentioned: goods distribution systems, distribution centres, point logistics infrastructure, logistics real estate, logistics centers (17 papers), road networks, urban roads, transport corridors and junctions (14 papers), warehouses, landfills, storage rooms, parcel lockers, parcel lockers (10 papers). Other less common elements were: urban infrastructure, parking spaces, container and railway terminals, waterways and seaports. However, all the elements taking part in carrying out logistics processes (processes within urban logistics) should be the elements of urban logistics system.

According to the authors, the third category of elements of the city's logistics system are flows, being parts of processes carried out between the system's elements. They in fact are the integrators (connectors) between the elements indicated in the first two categories. The leading integrator within the city's logistics systems and, at the same time, an element within the flows are, generally speaking, information flows (9 papers), next, in terms of the number of papers, are: financial/capital flows and material flows (3 papers).

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The fourth separate category is related to physical vehicles. The elements of the city's logistics system appearing in the literature are cargo vehicles (11 papers), individual transport vehicles (2 papers), bicycles (3 papers), and various types of electric vehicles (3 papers).

The last category, a mix of other systems elements, contains mostly the information. Within this category, the following were indicated: legal conditions/regulations (4 papers), relations between the public and private sector (3 papers), the sharing economy (1 paper) and geographical coverage (2 papers).

4.2 Urban logistics measures

The functioning of the urban logistics system and carrying out the processes have to be measured to assess the effects of implemented concepts. Table 3 shows many measures in a few categories covering the dimensions of sustainable development (economic, social, environmental). As part of the categorisation of measures of urban logistics, the authors of the study distinguished 8 main categories of measures found in the analysed literature. The key categories, taking into account the number of measures separated within the category and the number of papers within the measure, are: social measures - in this group of measures some relate to society, its well-being, security or needs - the measures distinguished by the authors occurred in 25 papers. The next category is economic measures - in this group, the authors included the vast majority of typically cost measures - they were distinguished in 32 publications. Another defined group of measures are time measures referring directly to time units - they occurred in 12 analysed sources. The next group is environmental measures. Within this group, we are dealing with measures concerning the nuisance and harmfulness of urban logistics systems from the point of view of the broadly understood environment - this type of measures was indicated 23 times, which makes it the third most numerous category. It can therefore be concluded that the impact of logistics systems on the environment is being measured more and more often.

TABLE 2 - ELEMENTS OF URBAN LOGISTICS

Category	Urban logistics element	Sources
Actors / participants / stakeholders	Carriers	(Akosua et al., 2021; Allen et al., 2011; Anand et al., 2016; Benjelloun et al., 2010; Kiba-Janiak, 2016; Kiba-Janiak & Cheba, 2019; Kubek & Więcek, 2019; Lagorio et al., 2016b; Montwiłł, 2019; Österle et al., 2015; Parezanović et al., 2014; Russo & Comi, 2010a; Tamagawa et al., 2010; Taniguchi, 2014; van Rooijen & Quak, 2014; Verlinde et al., 2012; Witkowski & Kiba-Janiak, 2014; Zhao et al., 2020)
	Local government, public administration, road administrators	(Akosua et al., 2021; Allen et al., 2011; Anand et al., 2016; De Oliveira & De Oliveira, 2016; Kiba-Janiak, 2016; Lagorio et al., 2016b; Morana & Gonzalez-Feliu, 2015; Österle et al., 2015; Papoutsis & Nathanail, 2016a; Parezanović et al., 2014; Rose et al., 2016; Russo & Comi, 2010a; Tamagawa et al., 2010; Taniguchi, 2014; Verlinde et al., 2012; Witkowski & Kiba-Janiak, 2014)
	Forwarders, CEP – Courier Exress Services	(Allen et al., 2011; Behrends, 2016; Kiba-Janiak, 2016; Kiba-Janiak & Cheba, 2019; Kubek & Więcek, 2019; Tamagawa et al., 2010)

Category	Urban logistics element	Sources
	The inhabitants	(Anand et al., 2016; de Oliveira & de Oliveira, 2016; Kiba-Janiak, 2016; Kubek & Więcek, 2019; Morfoulaki et al., 2016a; Nourian et al., 2018; Nowicka, 2014; Russo & Comi, 2010a; Tamagawa et al., 2010)
	Recipients and senders of shipments	(Allen et al., 2011; Behrends, 2016; Benjelloun et al., 2010; Boloukian & Siegmann, 2016; de Oliveira & de Oliveira, 2016; Kiba-Janiak, 2016; Kiba-Janiak & Cheba, 2019; Kubek & Więcek, 2019; Österle et al., 2015; Papoutsis & Nathanail, 2016a; Parezanović et al., 2014; van Rooijen & Quak, 2014; Zhao et al., 2020)
	Customers, consumers	(Allen et al., 2011; Amaya et al., 2021; Anand et al., 2016; Benjelloun et al., 2010; Boloukian & Siegmann, 2016; Kiba-Janiak, 2016; Kiba-Janiak & Cheba, 2019; Naumov, 2021; Rose et al., 2016; Russo & Comi, 2010b; Witkowski & Kiba-Janiak, 2014; Woensel & Savelsbergh, 2016; Yang & Zeng, 2018)
	Industry in the city	(Behrends, 2016; Boloukian & Siegmann, 2016; Kubek & Więcek, 2019; Montwiłł, 2019; Morana & Gonzalez-Feliu, 2015; Nowicka, 2014; Wang & Ma, 2019; Witkowski & Kiba-Janiak, 2014)
	Bikes	(Nathanail et al., 2017; Naumov, 2021; Nourian et al., 2018)
	Public transport	(Kiba-Janiak & Cheba, 2019; Witkowski & Kiba-Janiak, 2012, 2014)
	Commercial areas, retailers	(de Oliveira & de Oliveira, 2016; Kubek & Więcek, 2019; Lagorio et al., 2016b; Russo & Comi, 2010a; Witkowski & Kiba-Janiak, 2012)
	Waste management system	(Boloukian & Siegmann, 2016; Witkowski & Kiba-Janiak, 2012)
	HoReCa - Hotel, Restaurant, Catering/Cafe	(Behrends, 2016)
Infrastructure elements	Road network, urban roads, corridors and transport hubs	(Aiello et al., 2021; Bronnikov & Savin, 2018; Kuse et al., 2010; Montwiłł, 2019; Morfoulaki et al., 2016a; Nathanail et al., 2017; Naumov, 2021; Nourian et al., 2018; Rose et al., 2016; Suryani et al., 2021; van Rooijen & Quak, 2014; Verlinde et al., 2012; Woensel & Savelsbergh, 2016; Yang & Zeng, 2018)
	Warehouses, landfills, storage rooms, parcel lockers, parcel lockers	(Boloukian & Siegmann, 2016; Freichel et al., 2019; He, 2020; Kauf, 2019; Kubek & Więcek, 2019; Naumov, 2021; Rose et al., 2016; van Rooijen & Quak, 2014; Witkowski & Kiba-Janiak, 2012; Zhao et al., 2020)
	City infrastructure	(He, 2020; Nowicka, 2014; Papoutsis & Nathanail, 2016b; Witkowski & Kiba-Janiak, 2012)
	Waterways	(He, 2020; Montwiłł, 2014; van Rooijen & Quak, 2014)
	Goods distribution systems, distribution centres, point logistics infrastructure	(Aiello et al., 2021; Boloukian & Siegmann, 2016; Freichel et al., 2019; Kuse et al., 2010; Montwiłł, 2019; Morana & Gonzalez-Feliu, 2015; Morfoulaki et al., 2016b; Naumov, 2021; Österle et al., 2015; Rodrigue et al., 2017; Russo & Comi, 2010a; Taniguchi, 2014; Wang & Ma, 2019; Woensel & Savelsbergh, 2016; Yang & Zeng, 2018; Zhao et al., 2020; Zhou et al., 2016)
	Parking place	(Morfoulaki et al., 2016a; Papoutsis & Nathanail, 2016a; Rose et al., 2016; Yang & Zeng, 2018)
	Container and railway terminals	(Behrends, 2016; Montwiłł, 2019; Naumov, 2021; Papoutsis & Nathanail, 2016a; Rodrigue et al., 2017)
	Seaports	(Montwiłł, 2019; Wang & Ma, 2019)
Flows	Information flows, communication, IT, ITS	(Benjelloun et al., 2010; Boloukian & Siegmann, 2016; Bronnikov & Savin, 2018; Gong, 2019; Kauf, 2019; Kiba-Janiak & Cheba, 2019; Kubek & Więcek, 2019; Papoutsis & Nathanail, 2016b; Thaller & Clausen, 2017)
	Cash/capital flows	(Boloukian & Siegmann, 2016; Gong, 2019; Kubek & Więcek, 2019)
	Material flows	(Gong, 2019; Kiba-Janiak & Cheba, 2019; Kubek & Więcek, 2019)
Vehicles	Individual transport vehicles	(He, 2020; Witkowski & Kiba-Janiak, 2012)
	Transport vehicles (cargo)	(He, 2020; Morfoulaki et al., 2016a; Nathanail et al., 2017; Nowicka, 2014; Papoutsis & Nathanail, 2016a; Rose et al., 2016; Tamagawa et al., 2010; Taniguchi, 2014; Verlinde et al., 2012; Woensel & Savelsbergh, 2016; Yang & Zeng, 2018)
	Bikes	(Nathanail et al., 2017; Naumov, 2021; Nourian et al., 2018)

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Category	Urban logistics element	Sources
	Electric vehicles (also drones, cargo-robots)	(Nathanail et al., 2017; Naumov, 2021; Nourian et al., 2018)
Other	Legal conditions / regulations	(Akosua et al., 2021; Kiba-Janiak, 2016; Kuse et al., 2010; Rose et al., 2016)
	Relations between the public and private sectors	(Kuse et al., 2010; Taniguchi, 2014; Woensel & Savelsbergh, 2016)
	Sharing economy	(Woensel & Savelsbergh, 2016)
	Geographical scope	(Benjelloun et al., 2010; Bronnikov & Savin, 2018)

Source: Own processing

TABLE 3 - MEASURES IN URBAN LOGISTICS

Category	Measures groups	Sources
Social/ behavioral	Threats to public safety, e.g. number of events (collisions, fires, burglaries, deaths) per million residents	(Akosua et al., 2021; Cheba & Saniuk, 2016; Kiba-Janiak, 2016; Naumov, 2021; Österle et al., 2015; Parezanović et al., 2014; Taniguchi, 2014; Woensel & Savelsbergh, 2016; Zhou et al., 2016)
	City population, population density	(Chen et al., 2021; Nathanail et al., 2017; Rodrigue et al., 2017; Thaller & Clausen, 2017)
	Number of visitors (tourism)	(Montwiłł, 2019; Nathanail et al., 2017)
	Resident satisfaction level, quality of life measures	(Cheba & Saniuk, 2016)
Economic	Demand for freight transport (customer - demand)	(Suryani et al., 2021; Yang & Zeng, 2018)
	Demand for private transport - number of vehicles	(Österle et al., 2015; Suryani et al., 2021; Thaller & Clausen, 2017)
	Percentage of people using public transport	(Kiba-Janiak, 2016; Witkowski & Kiba-Janiak, 2014)
	Number of people traveling by individual transport	(Witkowski & Kiba-Janiak, 2014)
	Urban transport costs	(Anand et al., 2016; Taniguchi et al., 2016; Witkowski & Kiba-Janiak, 2012)
	Negative effects of congestion - costs of congestion	(Akosua et al., 2021; Anand et al., 2016; Morana & Gonzalez-Feliu, 2015; Österle et al., 2015; Parezanović et al., 2014; Suryani et al., 2021; Taniguchi, 2014; Taniguchi et al., 2016; Witkowski & Kiba-Janiak, 2014; Woensel & Savelsbergh, 2016)
	Transport costs (variable per km, fixed per truck, as well as depending on time or fuel consumption, road connections)	(Chen et al., 2021; Masłowski et al., 2019; Morana & Gonzalez-Feliu, 2015; Morfoulaki et al., 2016b; Russo & Comi, 2010a; Taniguchi et al., 2014, 2016; Teo et al., 2012; Thaller & Clausen, 2017)
	Consumption of energy, resources	(Anand et al., 2016; Montwiłł, 2019; Parezanović et al., 2014; Taniguchi, 2014)
	Functioning of industrial activity (e.g. number of entreprises, density)	(Nathanail et al., 2017)
	Infrastructure maintenance costs	(Aiello et al., 2021; Akosua et al., 2021; Chen et al., 2021)
	Economic competitiveness of cities (e.g. cost of life)	(Anand et al., 2016; Gong, 2019)
	Income level of urban residents (e.g. global and per capita)	(Gong, 2019)
Time-based	Public transport delays	(Kiba-Janiak, 2016; Suryani et al., 2021)
	Timely deliveries by courriers	(Anand et al., 2016)
	Average parking time of vehicles	(Thaller & Clausen, 2017)
	Time of transport/delivery, travel, reloading	(Chen et al., 2021; Kiba-Janiak, 2016; Montwiłł, 2019; Morana & Gonzalez-Feliu, 2015; Morfoulaki et al., 2016b; Naumov, 2021; Suryani et al., 2021; Yang & Zeng, 2018)
Reliability	Reliability of public transport	(Akosua et al., 2021)

Category	Measures groups	Sources
	Distribution reliability	(Akosua et al., 2021; Chen et al., 2021)
Environmental	Land use, the area used for the implementation of logistics activities	(Parezanović et al., 2014; Rose et al., 2016)
	Fulfillment of assumptions relating to sustainable development	(van Rooijen & Quak, 2014)
	Noise pollution	(Cheba & Saniuk, 2016; Morana & Gonzalez-Feliu, 2015; Österle et al., 2015; Parezanović et al., 2014; Taniguchi, 2014; van Rooijen & Quak, 2014; Witkowski & Kiba-Janiak, 2014)
	Air pollution, e.g. CO2, NOx, SPM emissions	(Akosua et al., 2021; Anand et al., 2016; Cheba & Saniuk, 2016; Kiba-Janiak, 2016; Morana & Gonzalez-Feliu, 2015; Österle et al., 2015; Parezanović et al., 2014; Quak et al., 2016; Taniguchi, 2014; Teo et al., 2012; Thaller & Clausen, 2017; van Rooijen & Quak, 2014; Witkowski & Kiba-Janiak, 2014)
	Emitted vibrations	(Cheba & Saniuk, 2016; Witkowski & Kiba-Janiak, 2014)
Infrastructural	Level of urban (linear) infrastructure degradation, road destruction	(van Rooijen & Quak, 2014)
	Distances between points	(Aiello et al., 2021)
	Length of roads (including length of environmentally friendly transport / city area (in km2), density of roads	(Cheba & Saniuk, 2016; Chen et al., 2021; Nathanail et al., 2017; Suryani et al., 2021)
	Communication links with the marine network	(Nathanail et al., 2017)
	Number of parking permits issued	(Österle et al., 2015)
	Number of logistics centers / consolidation / distribution / presence of forwarding services	(Montwiłł, 2019; Nathanail et al., 2016; Papoutsis & Nathanail, 2016b; Russo & Comi, 2010a)
	Infrastructure availability	(Anand et al., 2016; Chen et al., 2021)
Regarding vehicles	Exceeding limits / load level of vehicles	(Morana & Gonzalez-Feliu, 2015; Yang & Zeng, 2018)
	Number and type of means of transport/vehicles used	(Cheba & Saniuk, 2016; Nathanail et al., 2017; Naumov, 2021; Österle et al., 2015; Russo & Comi, 2010b; Suryani et al., 2021; Thaller & Clausen, 2017; Witkowski & Kiba-Janiak, 2012)
	Average vehicle speed	(Naumov, 2021; Thaller & Clausen, 2017)
	Kilometers traveled/distance traveled	(Morana & Gonzalez-Feliu, 2015; Naumov, 2021)
Regarding logistics activities	Weight of the transported goods	(Yang & Zeng, 2018)
	Distribution center utilisation level	(Yang & Zeng, 2018)
	Exceeding limits / load level of distribution centers	(Morana & Gonzalez-Feliu, 2015; Yang & Zeng, 2018)
	One-pass transport distance	(Parezanović et al., 2014; Thaller & Clausen, 2017)
	Number of deliveries per trip	(Thaller & Clausen, 2017)
	Number of completed deliveries	(Rodrigue et al., 2017; Thaller & Clausen, 2017)
	Weight of the means of transport	(Chen et al., 2021; Papoutsis & Nathanail, 2016b)
	Number of projects related to city logistics	(Kiba-Janiak, 2016)

Source: Own processing

Another group of measures are those related to infrastructure - its use, capacity, availability, quantity, etc. Such measures were indicated in 14 publications. Another group of measures are those relating to vehicles used as part of urban logistics systems - these measures relate primarily to speed, distance, type of means of transport and its technical properties - these types of measures were indicated 14 times. The last group of measures distinguished by the authors are measures relating to logistics activities, e.g. the level of use of elements of logistics infrastructure, the number of completed deliveries, etc. Measures of this type appeared 12 times in the analysed literature.

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While analysing this set of measures, it is easy to notice that this set is chaotic and incomplete, despite its complex nature and including different aspects and dimensions of urban logistics. The comprehensive set of identified measures is primarily focused on cargo transport and logistics activities (measures regarding vehicles and logistics activities). Also, transport dominates what is natural in this regard. However, too few elements are related to mobility.

There are also two other limitations of this set. Firstly, the groups of measures are not precise, e.g. the reliability is not sharp in its nature because does not specify e.g. what distribution reliability is – does it refer to last-mile logistics, only freight, only business-to-business relations or only the final customer? There are similar cases in the studied literature. Some level of generalisation causes this set does not help assess the urban logistics and compare different cities in this regard. Secondly, the scope of the measures does not include the basic measures which should be assigned e.g. to the social dimension. Of course, it does not mean that the current literature does not address the issues we propose below. The papers usually address only one focusing on the chosen case or cases.

According to the assumptions made in this paper, and the research results, the following measures should be added (as a minimum) in the following areas:

- in social category: measures regarding social inclusion and exclusion, social care, social services, depending on needs and age (e.g. for the elderly, for people with disabilities), education services, access to entertainment and culture services, healthcare services, measures regarding the overall status of living conditions, the access to transportation services, shops, parcel lockers, post etc.; measures according to health status and state of the residents and other city users if necessary,
- in time-based category: congestion-related measures according to e.g. number of vehicles in particular places in urban and suburban areas in particular time zones during the day, measures regarding the average time of travel from the point of origin to the point of destination during the workdays and during the weekends,
- in the infrastructure category: park and ride, kiss and ride infrastructure; infrastructure for micromobility (e.g. stations, their capacities); infrastructure for people with disabilities,
- in the vehicles category: number of electric vehicles or cars; all of the measures regarding micromobility;
- in reliability category: reliability of safety and security systems, alert and crisis management,

- in the economic category: modal split, the use of underground areas; water pollution; access to air transport, rail transport, water transport, seaport (e.g. the distance to those elements or travel time);
- in the environmental category: these regarding access to scarce resources, e.g. water or biodiversity, also water pollution, recycling, waste management etc.

As well, as the information is the resource being a subject of urban logistics (e.g. timetables, real-time alert management), a new category should appear, namely the digital one. It should include access to a computer or mobile devices, access to broadband Internet, access to MaaS services, access to e-health and e-administration services and many others.

5 CONCLUSIONS

The need for undertaking a review of the literature on the basics of urban logistics was our experience related to the inability to find a comprehensive, uniform approach to this topic during research in another field. We found this may be an obstacle in the discussion between scientists, the scientific community, local governments, and practitioners. With this in mind, we found literature that confirms the ambiguity of defining logistics, and thus also the urban logistics system. In addition, during the initial literature review, we encountered difficulties in defining their scope because the approaches in various literature items overlapped and partially excluded each other. Therefore, this study summarises and unifies the views on urban logistics and helps organise knowledge once and reliably so that further research can be based on a universal approach.

The strengths of this paper are many. First, the paper gathers the definitions, approaches and views on urban logistics, its system with all the elements and presents them all in one place. Then, the research is up-to-date and covers today's knowledge state. Additionally, it presents one view on logistics and its subareas, including urban logistics. Moreover, it highlights the shortcomings of the current literature about the general view on urban logistics and proposes the research areas to be filled by future research. Finally, it is worth noting that the views included in this paper can help the researchers to anchor their research in a robust and unified approach to urban logistics based on an extensive literature review. The impact on the research field might be substantial, and we hope it will add value to developing future research on urban logistics. If we know how to define it, we will know how to study it and discuss its future.

There are also a few limitations causing our research to be imperfect and requiring significant deepening by further research. Firstly, the main limitation of our research results is the complexity of the discussed topic. We could not include all of the findings in one paper but tried to present them in the appendix.

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Secondly, as always in the literature reviews, our study has a risk of obsolescence. Thirdly, probably not all search engines were used while the literature search and some risk of omitting the valuable literature could appear in our research procedure. Nevertheless, we identified many duplicates in the screening process, proving the literature base we built was complete. Despite those risks, especially the risk of outdating our findings, the logistics, as we mentioned, is one and its goals are eternal and will be the same in the long run. Only the scope of logistics activities can change, or solutions helping to achieve logistics goals. Soon, new literature items will appear presenting the knowledge about urban resilience and flexibility regarding sudden events (e.g. pandemics and wars), which will surely enhance and enrich the current logistics theory and practice state. Nevertheless, we hope the content of this study will be accurate for a more extended period.

Unfortunately, not all of the terms and definitions are possible to be described in one paper. We hope we have started the scientific discussion on this topic which will result in many new research results helping to unify the definitions of urban logistics and its elements. Therefore, future research directions should include the complex analysis of urban logistics measures as a whole set, including subsets regarding different dimensions of urban logistics. Our proposed enhancements are imperfect and require significant additions, as indicated above. Due to the level of complexity and multidimensionality, they should be the subject of a separate research paper.

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