

REVIEW

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# Barriers to change in urban freight systems: a systematic literature review

Mikael Kervall\* and Henrik Pålsson

## Abstract

**Purpose:** The purpose of this systematic literature review is to contribute to the knowledge about barriers to change in urban freight systems and to support managed changes toward more sustainable urban freight systems.

**Method:** This paper is based on a systematic review covering 93 peer-reviewed journal articles. The study was designed to advance earlier research in this area by providing a system perspective on barriers to development in urban freight systems. The theoretical knowledge about these barriers was analyzed and synthesized, the relationships between barriers explored, and the insights developed into a model of understanding of managed change processes in urban freight systems.

**Findings:** From a system perspective 11 categories of barriers to change in urban freight systems were identified and characterized. The barriers are, in different ways, related both to each other and to a managed change process for sustainable development of urban freight systems. A model for understanding categories of barriers and their connection to managed change processes in urban freight systems is proposed in this paper. The model consists of three groups of barriers within the process, and two groups in the system context, which should be addressed with different priorities in a managed change process. The study identifies several future research options. Future research could support the development of sustainable urban freight systems by providing insights into change process governance, potentially by combining theory from areas like organization, systems, and networks with the system perspective on urban freight systems. Research on non-European urban freight systems could increase the scholarly insights about contextual impact on barriers and change processes. Future studies could also explore methods to mitigate identified barriers, especially in the areas of cooperation, organization, politics, knowledge, and the first mover disadvantage. Finally, future research should continue to develop the model of the managed change process for urban freight systems and its use in supporting sustainable development of these systems.

**Keywords:** Systematic literature review, Urban, Freight, Goods, Transportation, Logistics, System perspective, Barrier, Transition, Sustainable

## 1 Introduction

Urban freight activities are expected to grow as a result of increased urbanization, e-commerce, and digitalization. These activities are necessary for daily life in urban areas but also generate unsustainable externalities like noise, emissions, and congestion. A sustainable development

of urban freight systems (also called urban freight transportation systems) would require changes within these systems. Before changes can be implemented in the systems the barriers to these changes must be understood and overcome. Many barriers have been identified in literature but in different types of studies and contexts. Contexts which, for example, range from cities with some ten thousand inhabitants, in Sweden [11] to megacities in China and Brazil, with populations of several million people [9, 20, 63]. The body of knowledge is also fragmented in the sense that the studies are directed toward

\*Correspondence: [mikael.kervall@plog.lth.se](mailto:mikael.kervall@plog.lth.se)

Faculty of Engineering, Division of Packaging Logistics, Lund University, PO Box 118, 221 00 Lund, Sweden

specific parts of the urban freight system. It includes, for instance, several studies discussing barriers related to policies. Weber [111] studied large socio-technical system development and identified barriers related to policy formulation, but Weber also identifies the alignment of goals, lack of tradition and incentives as challenges in the development of city logistics. Nordtømme, Bjerkan, and Sund [80] studied policy implementation and found stakeholder knowledge, organization, cooperation, and business models to be barriers to implementation of policies. Buldeo Rai et al. [16] studied policy assessment processes and identified difficulties around stakeholders' goal alignment, knowledge, and cooperation. Van Duin et al. [107] studied stakeholder perspectives on policies and found challenges in the areas of knowledge, cooperation, traditions, and behavior. Akgün et al. [1] instead studied how cities' officials choose policy measures and found challenges in many dimensions from formulation of goals to monitoring of effects. They further identified challenges related to complexity, stakeholder management and lack of resources.

Barriers are also found in articles based on systematic literature reviews. These discuss a range of barriers but from an urban freight systems point of view also provide a fragmented picture due to their disparate focuses. For example, Macharis, and Kin [67] found balancing stakeholder interests, economic sustainability, cooperation, and context dependency to be problematic when they studied approaches in city distribution. Fossheim, and Andersen [43] studied urban logistics planning and found weaknesses in cooperation. Ranieri et al. [91] had a similar finding when they identified difficulties in coordination of stakeholders and innovations as factors complicating reduction of externalities. Bandeira et al. [9] identified a lack of models for assessment in their study of sustainable urban freight operations. He [48] identified the fragmentation of research as a barrier to more sustainable urban freight network design. Schliwa et al. [94] focused on the potential of bicycles in city logistics. They identified potential barriers to adoption related to unavailable infrastructure, in the fragmented organization of the city logistics business, in low public incentives, in insufficient cooperation, and in lack of a common language between stakeholders.

These findings are all valuable and contribute to the body of knowledge about challenges and barriers in specific parts and from certain aspects within urban freight systems. However, the need for holistic approaches, providing an overview of, and further focus on change processes has been identified [57, 103]. Overview of the total body of knowledge about barriers to change is difficult to obtain and the relationships between barriers and their impact on urban freight system level is difficult to

assess without further advancing the body of knowledge. Advancing the body of knowledge would also be valuable from a societal point of view since urban freight systems on a global scale must, in short space of time, become more sustainable to meet societal goals. Practitioners who are supposed to manage this change need to know what barriers to expect in urban freight systems and how they relate to each other. This to be able to develop effective strategies to mitigate barriers and manage the change of urban freight systems.

Altogether the examples above illustrate how the current body of knowledge about barriers to change in urban freight systems could be advanced and the benefits it would give. The purpose of this systematic literature review is twofold. First, to contribute to the knowledge about barriers to change and second, to support managed changes toward more sustainable urban freight systems. The study is focused around three research questions:

1. How can barriers to change in urban freight systems, provided by earlier research, be structured and synthesized?
2. How are barriers in urban freight systems related to each other?
3. Which needs for further research, related to change toward more sustainable urban freight systems, can be identified based on the results of the study?

## 2 Methodology

This research is based on a systematic literature review (SLR) and thereby builds on earlier research. It is split into the three main stages of planning, conducting, and reporting [104] and inspired by the six steps elaborated by Durach, Kembro, and Wieland [36] for SLRs in supply chain management. The approach of the analysis and the contribution is similar to what Snyder [97] categorizes as a semi-systematic review. The process of the SLR is described according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Two researchers were involved throughout the full research process and continually discussed the study. The process is further detailed in the following sections.

### 2.1 Planning

In the planning phase, the need of the review was identified and verified in discussions with other scholars. After verification, the study continued into the scoping phase which is further elaborated in the following paragraphs.

#### 2.1.1 Definition of research question

In the scoping phase the initial idea to study conditions and barriers to change was modified to exclusively

focus on barriers. The scoping process included several iterations of searches and discussions with peers in the field. Relevant search terms were identified in an iterative process based on the researcher's preunderstanding of the research area, searches in Merriam-Webster online thesaurus and dictionary and test searches in Google Scholar. This process continued until a majority of the top ten search results in Google Scholar were deemed relevant based on their headlines and abstracts. The search terms were then converted to a Boolean search string for use in databases. Databases for the study were selected based on coverage of relevant literature. Scopus was selected for its broad coverage of scientific literature within fields as social sciences and technology [40] and Web of Science for its coverage and publisher independency [21].

### 2.1.2 Development of inclusion and exclusion criteria

Inclusion and exclusion criteria were developed in an iterative process. The criteria were developed in iterations where the relevance of search results from Scopus were evaluated, and the search string continually modified for improved relevance. In this process, the decision was taken to narrow the search to only include results from peer review journals, to ensure the quality of data. It was also decided to only include articles in English but nevertheless to include articles from any time in the results. Finally, several subject areas were excluded in this process since they only provided irrelevant results. The resulting search string is shown in Fig. 1.

## 2.2 Execution

The execution phase of the study followed a process described in Fig. 2. The process was inspired by Page et al. [86] and the PRISMA guidelines [89], and corresponds to step 3–4 (Retrieve literature, Select literature) in the process suggested by Durach, Kembro, and Wieland [36].

### 2.2.1 Retrieval and selection

First, the search criteria were implemented in Scopus and Web of Science. The searches for articles were performed at the turn of the month between October and November 2020. Duplicate records were removed by comparison of titles, first in Excel and then manually. The remaining articles were screened manually against the inclusion criteria "Does the study discuss barriers to change?". After removal of articles which did not fulfill the inclusion criteria, 112 articles remained. Of these 112 articles 109 full text articles were successfully retrieved and assessed. Full-text assessment eliminated further 16 articles, which did not fulfill the inclusion criteria. The remaining 93 articles constitute the synthesis sample and the body of literature which is presented in this article.

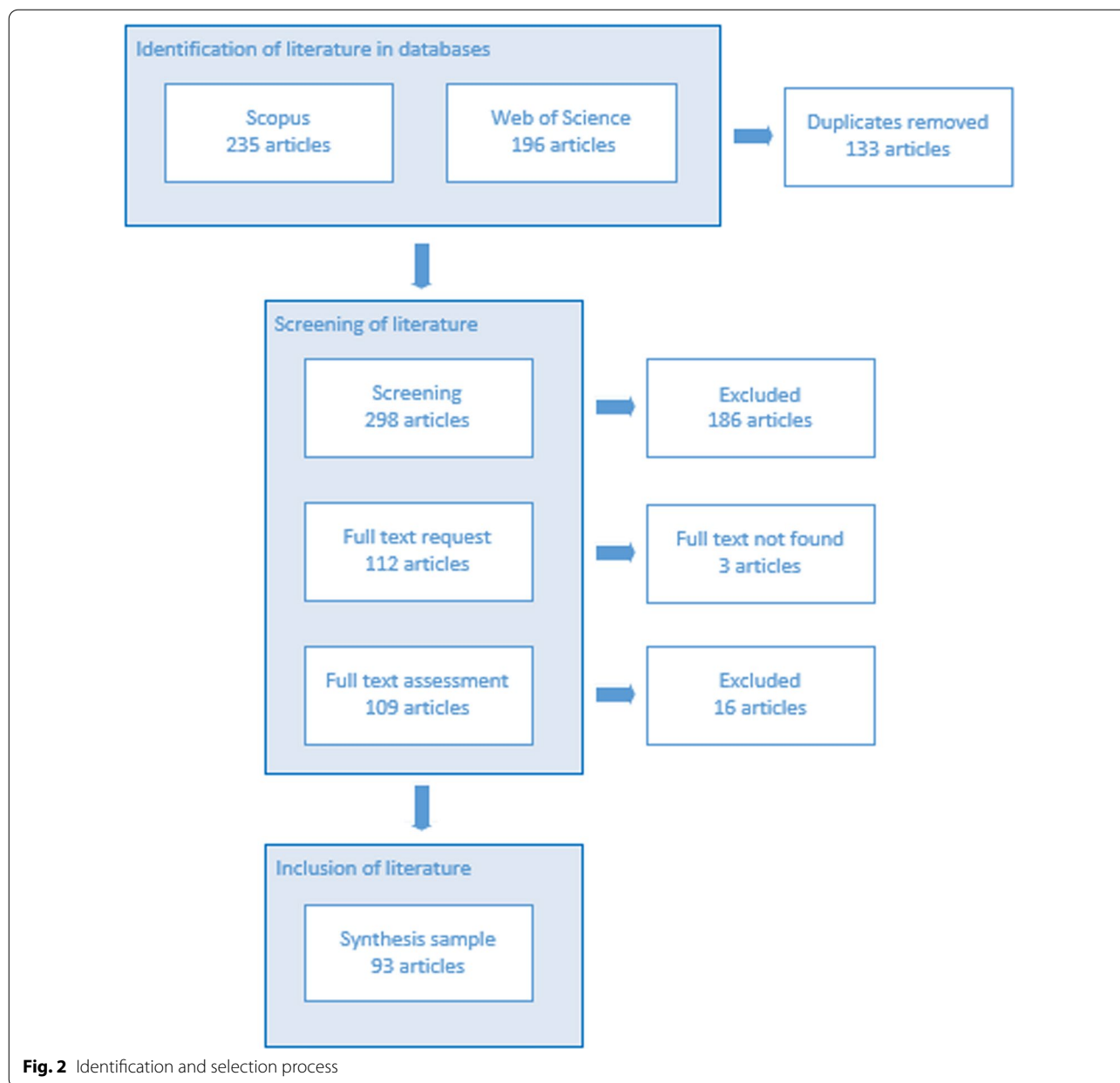
### 2.2.2 Synthetization

The literature was synthesized in multiple steps. A data extraction sheet was developed and used to collect and structure potentially relevant information from each study in the body of literature. This information was used to create both descriptive and interpretive analyzes.

The coding of the body of literature generated a mass of data which was scrutinized and questioned by the

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TITLE-ABS-KEY((barrier* OR hinder* OR hindr* OR obstruct* OR challeng* OR issue* OR
difficult* OR block* OR gap* OR miss* OR fail*) AND (change* OR transit* OR transform*
OR conver* OR develop* OR evolv* OR improve* OR increase* OR reduc* OR implement*)
AND (urban OR city OR cities OR metropoli* OR municipal* OR "last mile" OR "short
distance") AND ((freight OR goods OR cargo OR logistics OR shipping) OR (freight OR goods
OR cargo OR logistics OR shipping AND distribution))) AND Title ((urban OR city OR cities
OR metropoli* OR municipal* OR "last mile" OR "short distance") AND (freight OR goods
OR cargo OR logistics OR shipping OR distribution)) AND ( LIMIT-TO ( SRCTYPE,"j" ) )
AND ( LIMIT-TO ( LANGUAGE,"English" ) ) AND ( EXCLUDE ( SUBJAREA,"PSYC" ) )
AND ( EXCLUDE ( SUBJAREA,"MULT" ) ) AND ( EXCLUDE ( SUBJAREA,"HEAL" ) )
AND ( EXCLUDE ( SUBJAREA,"CHEM" ) ) AND ( EXCLUDE ( SUBJAREA,"PHYS" ) )
AND ( EXCLUDE ( SUBJAREA,"MEDI" ) ) AND ( EXCLUDE ( SUBJAREA,"MATE" ) )
AND ( EXCLUDE ( SUBJAREA,"AGRI" ) ) AND ( EXCLUDE ( SUBJAREA,"MATH" ) )
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**Fig. 1** Final search string



researchers in several iterations along the research process. The parameter target group was particularly hard to code. The target group is interesting to study since it can help to reveal stakeholders disregarded in literature. This parameter was coded according to broad provisional codes [75] based on the researchers’ pre-understanding about available and relevant target groups for research articles in the research area. If authors of articles have had rare or narrow target groups in mind without explicitly stating them in the article, these may have been missed. Target group thereby represents a higher degree of uncertainty than other codes presented.

The barriers to change identified in the body of literature were also coded using provisional coding. A priori codes for barrier categories were used from the start and adapted along the analysis process. The initial codes were based on findings in an unpublished empirical study performed by the authors of this article which was presented in a peer-reviewed conference article in 2020. Each barrier category was sub-coded with an inductive approach [14] using pattern codes [75]. Texts synthesizing the scholarly discussion around each barrier category together with the full list of references contributing to the category are presented in Sect. 4.

The relationships between barrier categories were examined in a process with five stages described below.

1. First, a list of the barrier categories identified in the body of literature was compiled. This original list was complemented with the number of occurrences of each barrier category code in the body of literature. The simultaneous occurrences of each of the other barrier categories were then counted.
2. In a second stage the direct impact of each of the other barrier categories on the original category was assessed. The share of articles in the other barrier category with a direct impact on the original barrier category was calculated and interpreted as an indication of the strength of the relation between the categories.
3. In the third stage a short synthetization of the direct relationship was created based on the corresponding article texts.
4. The understanding of the picture which emerged was discussed between the researchers in several iterations where models of the relations between barriers were generated, challenged, rejected, and updated until both researchers agreed on the model of understanding.
5. Finally, the model of understanding was verified against theory in the fields of strategic management and strategic planning. This process resulted into the description of barrier types and relationships presented in Sect. 5.

With this interpretive yet structured approach it was possible to both assess the strength of the relation between categories and synthesize the scholarly discussion related to each possible combination of categories. In total, 110 different relations were synthesized and aggregated before the model of the relationships between barriers was generated in the fourth stage of the process.

### 3 Descriptive analysis of literature

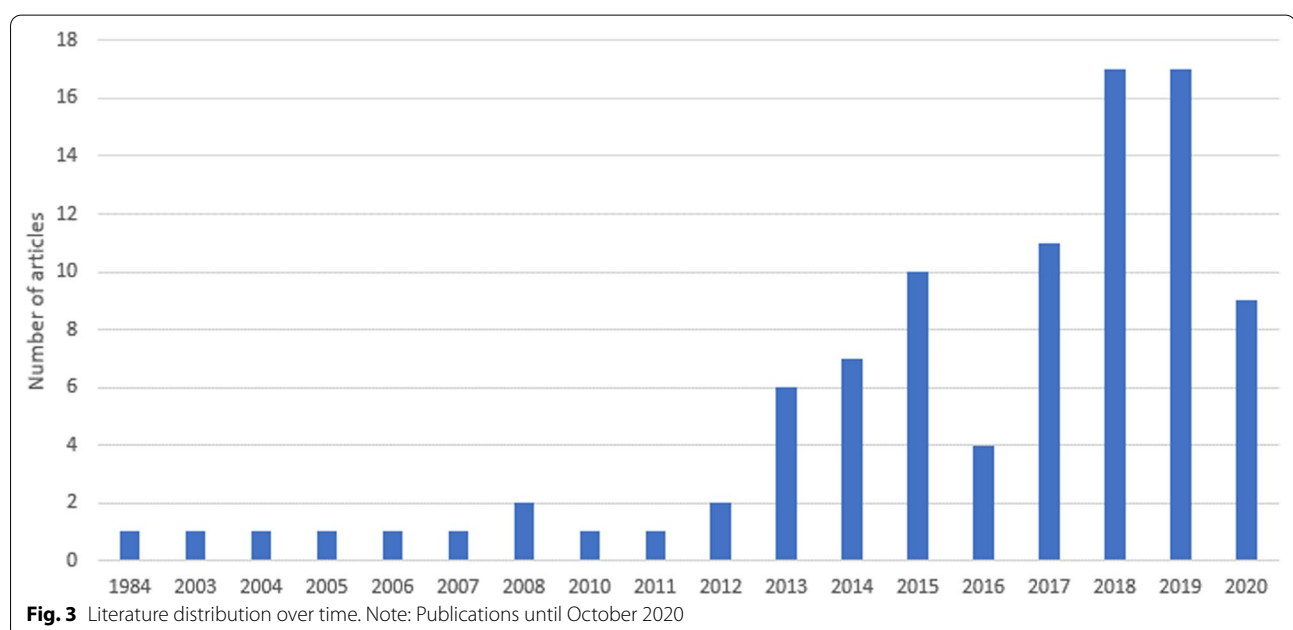
In the following subsections the body of literature is characterized from a descriptive point of view.

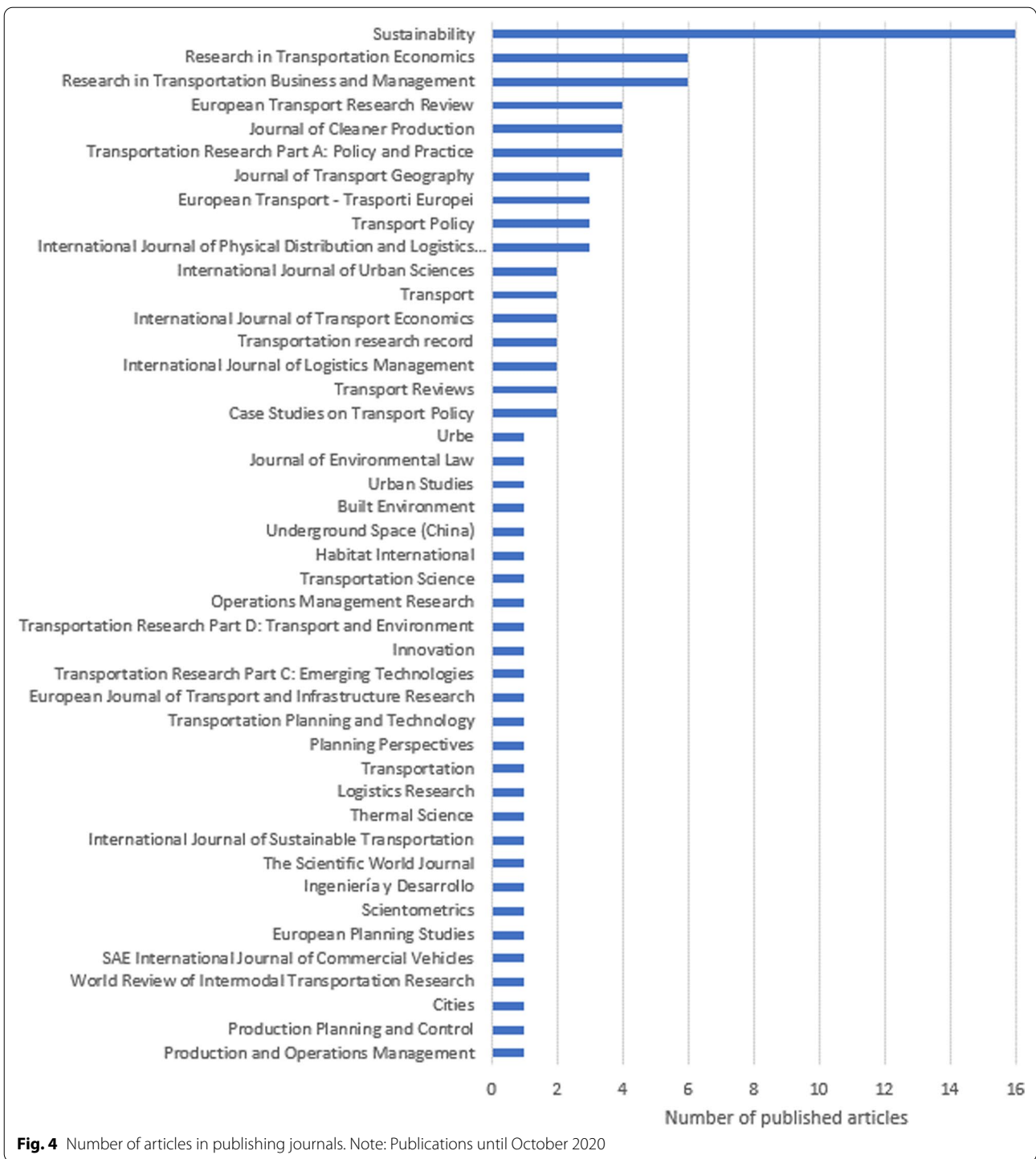
#### 3.1 Development over time and scientific context

The body of literature comprises 93 scientific journal articles (Fig. 3), published from 1984 to 2020. The number of publications until 2012 was on a level of 0–2 articles a year but has since then grown substantially. In the time period 2013–2020 4–17 articles a year were published.

Articles discussing barriers to sustainable development of urban logistics systems have been published in 44 different scientific journals (Fig. 4). Sustainability (16 articles) published the largest number of articles, followed by Research in Transportation Economics (6 articles) and Research in Transportation Business and Management (6 articles).

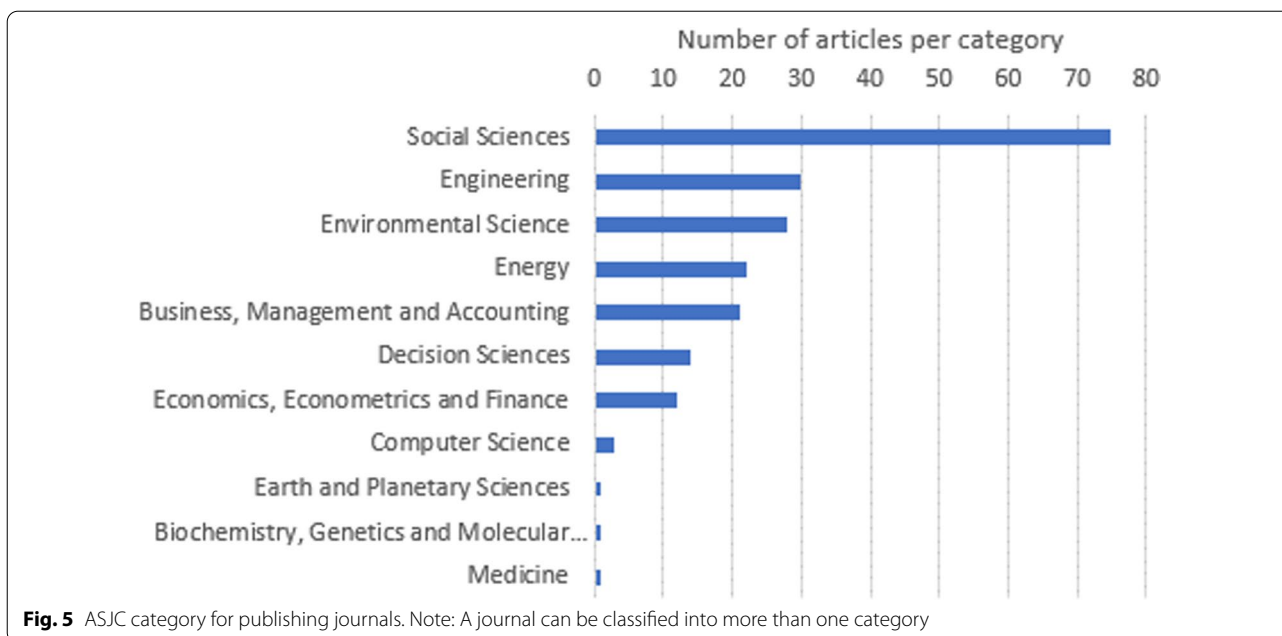
Barriers to change in urban freight systems are discussed within 11 research subjects (Fig. 5). Scopus All Scientific Journal Classification (ASJC) categorizes journals into one or more of 27 research subject areas. Articles were pre-dominantly published in Social sciences (75 of 93 articles). 30 of the articles were categorized into the





area of Engineering and 28 as Environmental science. The dominating journal of the sample, Sustainability, with 16 articles, is categorized in the three categories of Social sciences, Environmental science, and Energy which significantly affect the weight of these research areas. Over the last five years the share of articles published

by journals categorized as Social sciences has varied between 32 and 50%. A growing share of articles have been published by journals in Energy and Environmental science. The growth in these categories can also here to a large extent be explained by the 16 articles published by Sustainability in the years 2018–2020. Journals with



the words “transport” or “transportation” in their title are found in several categories. A vast majority of these journals are categorized Social Sciences and nine out of 20 are categorized Engineering.

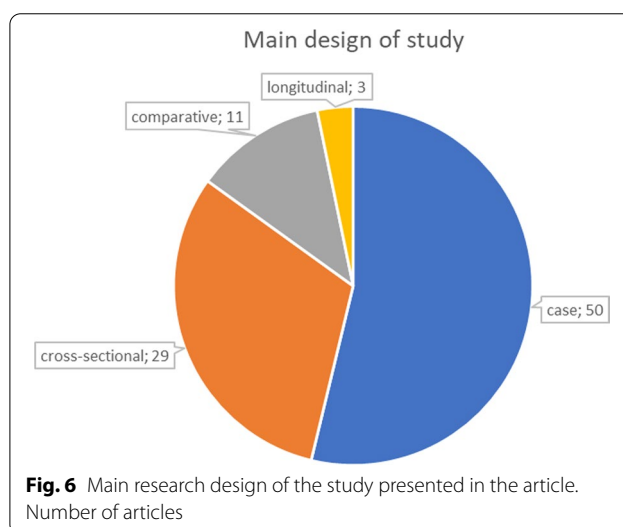
### 3.2 Methods in the literature

The corpus of literature is dominated by case studies and cross-sectional studies, including systematic literature reviews. 85% of the studies fall into these categories. Longitudinal studies are, on the other hand, rare and experimental studies nonexistent. In total, four of the five main types of research design defined by Bryman, and Bell [14] were found in the body of literature. An overview of the research designs is shown in Fig. 6.

Figure 7 illustrates the methods for data collection described in the studies. Interviews as well as surveys are widely used collection methods while studies built on data collected through participations are rarer. Studies including systematic literature reviews have been published ten times since 2015. None of them examines barriers to change in urban freight systems. Most studies do not use a defined theoretical framework for their analysis. Tennis [100] defines theory as a “set of propositions used to explain some phenomena”. Such theories could only be identified in less than 15% of the studies.

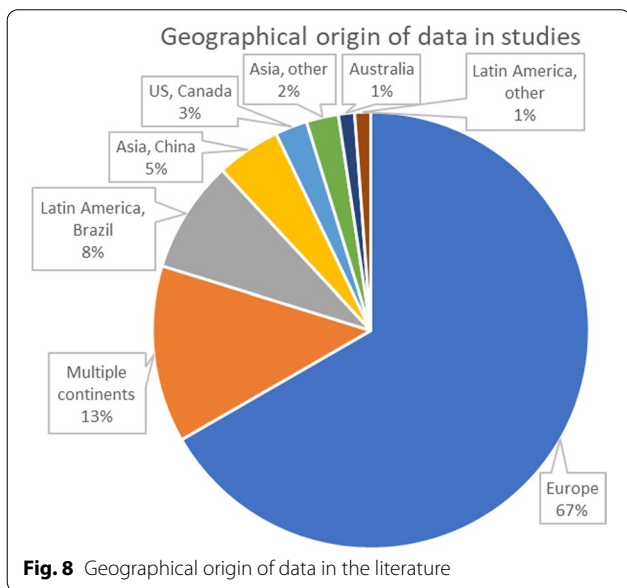
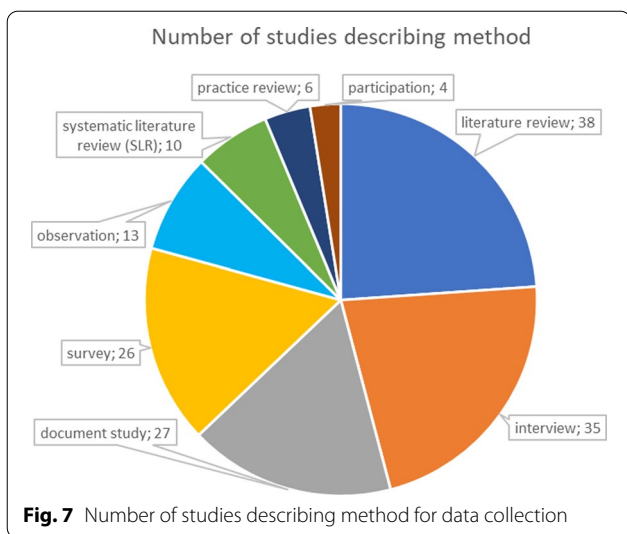
### 3.3 Focuses in the literature

The origin of the underlying data could be identified in 84 of the 93 studies. The geographical origin of data in the studies is mainly Europe. European data is explicitly used in 67% of these and further included in the 13% of studies



which are based on data from multiple continents. 9% of the data originates from Latin America where Brazil is the dominating country of origin. Notable is the low share of studies originating from both Asia (7%) and Anglo-America (3%). Further information about data origin is available in Fig. 8.

The research results in the body of literature are presented with a certain audience in mind. In some studies, the target group for the study is explicit and in others it is not. Target groups were assessed for all studies in the corpus of literature. Apart from the research community, authorities represent the main target group followed by



logistic service providers. More than 2/3 of the studies address public authorities with their results and slightly less than 1/3 address logistic service providers. Few studies address retailers and politicians with their findings. In 13 of the studies no clear target group could be identified.

#### 4 Barriers to sustainable development in the literature

Our analysis shows that barriers discussed in the corpus of literature can be split into 11 categories. An overview of the categories and the references contributing to each category is available in Table 1. The most frequently mentioned barriers are related to *cooperation*, followed by

*knowledge*. The least addressed categories are *technology* and *infrastructure*. The categories and their constituting discussions are summarized in Sects. 4.1–4.11.

##### 4.1 Technology

Technology covers two sub-categories of barriers discussed in the literature, *unproven in application* and *lack of adaptation*. The first is most discussed and includes limited types of vehicles and specifications, such as range and load capacity [38, 58, 60, 99, 106]. It also includes the need to align innovations in other areas to achieve more sustainable systems [91]. The second sub-category addresses barriers originating in unadapted routing principles [95].

##### 4.2 Infrastructure

Barriers related to infrastructure can be split into three sub-categories of which *lack of availability* is most frequently identified. This sub-category highlights insufficient space for urban freight activities [18, 32, 63, 79] and lack of charging infrastructure [19, 65]. A second sub-category is *risk of externalities* from new infrastructure, for instance, from urban consolidation centers, which can be used as argument to not change the current structure of the system [107]. The final sub-category debates the *long lead time* from investment to *benefits*, in underground logistics for example [34].

##### 4.3 Economy

Economic barriers refer to five sub-categories: *costs*, *low profitability*, *short-term focus*, *small actors*, and *low market value*. *Costs* include the investments for integrating freight into the planning process [46] and the land costs for space-consuming logistic activities [113]. *Low profitability* highlights low profits in urban consolidation and for new solutions like distribution of goods with electric vehicles [19, 24, 85, 108]. *Short-term focus*, the largest sub-category, addresses barriers coming from tensions between long-term investments in environmentally sustainable solutions, and stakeholders’ short-term economic focus [4, 80, 101]. The fourth sub-category, *small actors*, discusses the fragmentation of the urban freight system as an obstacle for professionalization and economies of scale [47, 81, 94]. Finally, in *low market value* the authors conclude that environmental concerns are not rewarded enough by the market and does not always increase customers’ willingness to pay [38, 112].

##### 4.4 Policies

Barriers related to policy can be separated into five sub-categories: *insufficient methods*, *imbalanced measures*, *resource limitations*, *complexity*, and *lack of alignment*, where the last has the highest number of references in



**Table 1** Summary of categories of barriers and references

Category	Sub-category	Reference no	Qty
Technology	Unproven in application	[31, 34, 38, 58, 60, 91, 99, 106]	8
	Lack of adaptation	[95, 102]	2
Infrastructure	Lack of availability	[18–20, 32, 63, 65, 79, 81, 94, 101]	10
	Risk of externalities	[107]	1
	Long lead time before benefits	[34]	1
Economy	Short-term focus	[4, 5, 19, 20, 24, 34, 58, 65, 67, 80, 85, 91, 101, 105, 82, 106, 111]	17
	Low profitability	[5, 19, 20, 24, 31, 38, 60, 67, 85, 92, 105, 106, 108, 109, 115]	15
	Small actors	[47, 58, 81, 94]	4
	Costs	[46, 102, 113]	3
	Low market value	[38, 112]	2
Policies	Lack of alignment	[17, 24, 25, 31, 33, 43–45, 52, 60, 65, 67, 77, 84, 90, 93, 94, 99, 111, 115]	20
	Imbalanced measures	[1, 8, 38, 41, 47, 71, 79, 81, 111, 115]	10
	Complexity	[20, 24, 25, 32, 47, 52, 96]	7
	Insufficient methods	[19, 23, 27, 81, 111]	5
	Resource limitations	[107]	1
Politics	Lack of commitment	[1, 2, 25, 32, 38, 41, 44, 47, 85, 94–96, 102]	13
	Unclear direction	[1, 43, 96]	3
Goals	Unaligned	[3, 16, 18, 29–31, 41, 43, 44, 52, 53, 59, 61, 67–70, 77, 85, 87, 111, 113]	22
	Unclear	[1, 20, 41, 96]	4
Organization	Lack of resources	[1, 4, 7, 10, 11, 23, 26, 32, 33, 43, 48, 50, 67, 74, 79, 80, 96, 97, 102, 112]	20
	Lack of intra- and inter-organizational coordination	[5, 10, 24, 26, 31, 41, 48, 67, 94, 98, 101]	11
	Focus on easy wins	[4, 5, 74, 85, 94, 96, 102, 112, 114]	9
Knowledge	Lack of dissemination	[3–8, 16, 20, 27, 29–34, 35, 47, 53, 58, 61, 65, 70–72, 74, 80, 82, 84, 87, 98, 106, 107, 110, 113]	30
	Scattered	[6, 7, 9, 11, 16, 20, 22, 27, 48, 50, 53, 54, 65, 69, 70, 81, 84, 93–95, 102, 110, 112]	23
	Unavailable	[1, 8, 10, 16, 20, 22, 27, 33, 44, 46, 50, 52, 43, 58, 63, 77, 81, 106, 112]	19
Cooperation	Complex alignment of interests	[4, 6, 8, 10, 11, 13, 16, 18, 19, 23, 26, 29, 32, 35, 41, 45, 47, 52–54, 59, 61, 65, 68–71, 82, 91, 92, 94, 101, 107, 111, 116]	35
	Unclear gains	[4, 16, 17, 19, 31–33, 35, 52, 61, 62, 65–69, 81, 82, 84, 92, 94, 101, 102, 105, 107, 111, 114–116]	29
	Untraditional	[1, 2, 5, 8, 17, 24, 35, 45, 52, 54, 66, 67, 79, 81, 84, 94, 96, 102, 103, 107, 115]	21
	Weak management support	[2, 6, 16, 17, 19, 29, 31–33, 41, 43, 45, 68–70, 81, 87, 107, 115]	19
Societal factors	Uncertain future	[11, 17, 24, 27, 35, 38, 44, 49, 63, 66, 79, 91, 115]	13
	Require flexibility	[5, 17, 24, 63, 91]	5
First mover disadvantage	Difficult to overview consequences	[7, 84, 85, 94, 105, 113]	6
	Lack of tradition	[1, 25, 80, 107, 111, 113]	6
	Optional choice	[25, 67, 85, 107, 109, 113]	6

the body of literature. *Insufficient methods*, discuss barriers in terms of importance of methods to support policy and measure development and implementation [19, 23, 81]. *Imbalanced measures* are barriers which come from the difficulties inherent in development of policies which offer stakeholders a balanced outcome from a triple bottom-line perspective [39] by combining incentives and requirements to avoid resistance to changes [1, 8, 115]. The third sub-category policy makers' *limited resources*, addresses the risk that resource

limitations push the focus to easily implemented measures rather than the most effective ones [107]. In the fourth sub-category barriers related to the *complexity* of policy development, due to external dependencies and quality requirements for acceptance, are considered [24, 52, 96]. The last sub-category addresses barriers due to *lack of alignment* of policies and goals over organizational borders and jurisdictions [17, 25, 77, 93].

#### 4.5 Politics

Barriers related to politics can be split in *unclear direction* and *lack of commitment*, where the last is most frequently addressed in the body of literature. In the first sub-category the barrier effect of *unclear directions* in politics and insufficient operationalization of these directions are recognized [1, 96]. The second sub-category addresses the barrier effect of *lack of commitment*. Several scholars are concerned that activities which would be beneficial for the industry, like long-term freight development and coordination between authorities and over jurisdictions, are hampered by the uncertain value of spending resources on these activities [2, 32, 44]. Strale [98] suggests studying the social dimensions of politics as a way to create better understanding and less uncertainty.

#### 4.6 Goals

Barriers related to goals can be split in the two sub-categories *unaligned* and *unclear societal goals*. *Unaligned* goals include most references and concerns the barrier effects created by the multitude of stakeholders with their own agendas in the urban freight system. These stakeholders may both have conflicting goals and different time horizons for the same goals which result in different priorities, and difficulties to align activities [16, 59, 111]. The second sub-category of articles concerns barriers in the form of *unclear societal goals* and emphasizes the importance of clear and unambiguous goals as crucial in enabling effective authorities [1, 20].

#### 4.7 Organization

Organizational barriers can be split in the three sub-categories *lack of resources*, which is the most comprehensive one, *focus on easy wins*, and *lack of intra- and interorganizational coordination*. *Lack of resources* comes from a lack of focus on freight and produces consequences in the form of a lack of dedicated resources within relevant public organizations and subsequent deficiencies in activities, knowledge, and methodologies [1, 33, 96]. This situation is different compared to passenger mobility which receives higher attention in public organizations [7, 43, 102]. The lack of sufficient public resources to handle freight issues hamper the knowledge development in these organizations, since no resources are available to accumulate knowledge [50, 79]. Lack of resources also hampers collaboration, the ability to discover synergies with other areas as well as to discover the good examples [4, 7, 80]. The lack of resources and capability to build and accumulate knowledge has also had an effect in the area of methodology. The lack of methodologies for organizing development, implementation and monitoring of freight are highlighted barriers in this area [1, 10, 67]. The *focus on easy wins* is closely related to the

resource scarcity described. Long-term policy development, planning, anchoring, and implementation processes are resource demanding activities and since the resources are not available focus becomes short-term, on less complex issues [96, 112]. A similar orientation toward easy wins is found on the private business side where carriers optimize low profitability distribution but show change resistance toward more long-term development [85, 94, 114]. The previously described lack of long-term successful examples of unconventionally organized urban freight can legitimate the skepticism among stakeholders [4]. The barrier *lack of intra- and interorganizational coordination* concerns the effect of independent decision-making by stakeholders which affects other stakeholders or organizations in the system. Dablanc [24] and Dablanc, Diziain, and Levifve [26] discuss barriers originating from uncoordinated policies between both authorities in same jurisdictions and between jurisdictions. De Lima Batista et al. [31], Faccio, and Gamberi [41] both discuss barriers stemming from a missed system overview. The situation is similarly described on the private business side. Numerous independent organizations have a short-term focus and organize themselves individually [5]. Altogether, this individual and uncoordinated optimization is a barrier to the success of more long-term and potentially more sustainable solutions [48, 94].

#### 4.8 Knowledge

Three sub-categories of barriers related to Knowledge were identified: *Unavailable*, *Scattered* and *Lack of dissemination* of which the last is most voluminous. *Unavailable* addresses the lack of relevant data about urban freight and logistics, this lack is considered a challenge for knowledge development [16, 22, 117]. Data is missing about use of electric vehicles [58, 106], traffic and congestion [77, 112] and about policy impacts and stakeholder preferences [1, 54]. The lack of data means that relevant analyzes cannot be performed and that knowledge development is hampered [9, 70, 84]. *Scattered* knowledge forms the second sub-category of barriers in the literature. The previously discussed lack of specialization on freight within public authorities as well as the separation of passenger and freight transportation matters in public organizations contribute to a scattered public knowledge [7, 110]. This fragmentation of knowledge is also a risk in research, where system and relational insights risk being missed [20, 48, 81]. Examples are the areas of social relations and management of changes which potentially could support development of urban freight systems [98]. The sub-category *lack of dissemination* includes barriers related to the spreading of knowledge to stakeholders in the system. A lack of methods and settings for

dissemination and learning are barriers observed in this area [53, 70, 107]. Slow information flows and unawareness of potential gains of further knowledge about freight matters among decision makers are barriers which contribute to low logistic and system knowledge as well as intuitive rather than fact-based decision making [6, 33, 113].

#### 4.9 Cooperation

There is consensus in current literature that stakeholders must collaborate to obtain sustainable freight systems. Cooperation-related barriers impede the change. More than every second article in the body of literature addresses this category of barriers in four sub-categories: *complex alignment of interests*, *unclear gains*, *weak management support* and *untraditional*. *Complex alignment of interests* is most common and deals with the complexity of aligning agendas and priorities for a large number of independent and uncoordinated stakeholders in urban freight systems [52, 65, 114]. A contributing factor to the barrier is a lack of methods for managing stakeholders and balancing their interests [69]. The second sub-category, *unclear gains*, originates from the fact that businesses balance the potential gains of sharing information against the competitive risks of losing control of information [62, 84, 105]. The third barrier in cooperation refers to *weak management support* from politics for public authorities to engage in urban freight matters [2, 32, 69]. Finally, developing urban freight systems in a new more sustainable direction requires novel and *untraditional* cooperation between several groups of stakeholders. Cooperation is however stymied since logistic service providers and carriers traditionally view peer organizations as competitors and cooperation between authorities and over jurisdictions falters [35, 67]. Furthermore, there is a lack of long-term successful examples of untraditional cooperation [8, 79, 105], which reinforces the barrier against untraditional cooperation.

#### 4.10 Societal factors

The development of the society surrounding urban freight systems affects the development of these systems and can both drive change and represent barriers to sustainable development. The body of literature discusses two sub-categories: *uncertain future*, which is the biggest one, and *require flexibility*. *Uncertain future* addresses the fact that the urban freight market is directly affected by the rapid digitalization of society and the dramatic growth of e-commerce [35, 38, 115]. This sub-category is reinforced by urbanization, which affects the freight flows [63]. *Require flexibility* comes from the combination of the predicted strong e-commerce development, high volume volatility and short lead time requirements

[5, 17]. This risk drives stakeholders in the system to try to maximize their flexibility to adapt by postponing decisions, and thereby changing toward more sustainable development.

#### 4.11 First mover disadvantage

*First mover disadvantage* includes barriers related to the *difficulty to overview consequences*, *lack of tradition* and *options* to change. The name of the category summarizes the situation, described in the body of literature, for individual stakeholders of the urban freight system who go in the forefront of sustainability initiatives. First, to consider all relevant aspects of the context in analysis and in development of solutions is complex for stakeholders of the urban freight system and it is thereby *difficult to overview the consequences* of their decisions [84, 85, 105]. One example is the consequences of combining requirements related to goods properties with geography and properties of new vehicle types. Second, the stakeholders *lack tradition* to go beyond incremental change [25, 111, 113]. Finally, it has until now been an *optional choice* for most stakeholders of urban freight systems to transform their activities in a sustainable direction. This due to social behavioral factors and low enforcement of sustainable alternatives which has offered low incentives to change and is reflected in a lack of urgency among stakeholders [25, 107, 109].

### 5 Relationships between barriers

In the previous section, 11 categories of barriers were described. These different categories are, to various extents, related to each other. Barriers in the *organizational* structure may for example affect barriers related to *knowledge*. Furthermore, the character of the barriers can be related to a scale, from *strategic barriers* to *implementation barriers*, which is an essential insight if barriers should be mitigated in a managed change process. In the analysis of interdependencies between barrier categories we applied literature from the areas of strategic planning, management, and change [15, 28, 37, 42, 56, 78]. This helped to aggregate the barrier categories to the three groups of *strategic*, *instrument* and *implementation barriers*. We also analyzed the relation between categories of barriers according to a structured procedure described in paragraph 2.2.2. Based on these analyzes it was possible to illustrate the relationship between categories of barriers as a process with interacting groups of barriers impeding the managed change of urban freight systems. Similar to the strategic planning process suggested by Bryson [15] the managed change process starts with the creation of a common understanding about the problem(s) before strategies are developed which ultimately results in implementations and results. The

suggested model of understanding is illustrated in Fig. 9. The main nine categories of barriers in urban freight systems are divided into *strategic*, *instrument*, and *implementation* barriers. These should be understood in the context of the two categories *first mover disadvantage* and *societal factors* which affect all other categories. In a managed change process the *strategic barriers* should ideally be addressed first and then followed by *instrument barriers*. Removing the barriers in these two steps would support the removal of barriers to *implementation*. All of this while the impact of barriers in the contextual *societal factors* and *first mover disadvantage* are considered. Our proposed understanding of the relation between barriers of the urban freight system is elaborated in the following paragraphs.

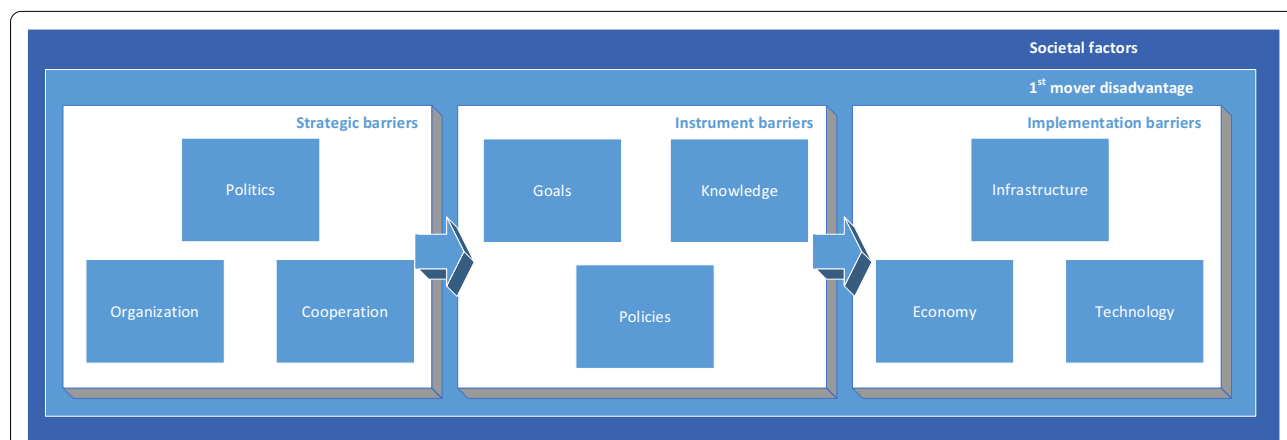
### 5.1 Societal factors and first mover disadvantage

Urban freight systems are embedded in society and thus affected by the surrounding environment. In this study, two categories of barriers were found in this environment, *societal factors* and *first mover disadvantage*. Societal factors, such as digitalization and e-commerce affect consumer behaviors and the demands for freight transportation. Other societal factors, such as urbanization and sustainability concerns also affect urban freight systems. These societal factors affect, for instance, volumes, frequency, and types of freight demands. The *first mover disadvantage* is another part of the context affecting the urban freight system on all levels. This barrier is related to the multitude of independent stakeholders who make their own decisions and through their collective actions determine the possibilities to change the system. Independent stakeholder actions affect the suggested managed change process for the system in all different phases. A more sustainable development of the system requires mutual change from independent stakeholders,

both private and public. A more sustainable development also changes the requirements on organizations, cooperation, and the need for knowledge. Additionally, it involves investments in and use of new and sometimes unproven technologies and infrastructure while the value of existing resources is put at risk. The complexity, the unclear gains, increased pains from unharmonized and unbalanced policies risk fostering change resistance and feedback into *strategic*, *instrument* and *implementation barriers*. This since change and more sustainable development, as seen in the in the period of time studied, were still optional complications for stakeholders of the system. Altogether both *societal factors* and *first mover disadvantage* constitute barriers which should be considered throughout a managed change process.

### 5.2 Strategic barriers

*Strategic barriers* are related to the ways humans in the urban freight system organize and collaborate. Political will, together with societal factors, sets the basic conditions for the system as it defines the strategic direction in society. Political focus determines resource allocation, focus, and forms of organization in the public sector. The ability to provide long-term strategic direction affects the risk of investing resources in long-term cooperation between stakeholders. Cooperation fosters insights, common problem definitions and trust between stakeholders. This create an understanding among stakeholders for needs, balanced strategies and can create the adherence to decisions which is a prerequisite for certain solutions. Moreover, cooperation over jurisdictional borders can decrease uncertainties and increase benefits of investments contributing to a more sustainable development. Resource-weak fragmented organizations without coordination, on the other hand, affect both the development of *instruments* and the process of *implementation*. These



**Fig. 9** Model of understanding of managed change processes in urban freight systems

organizations and their ability to cooperate also affect politics since organizations and cooperation between them provide politics with the basis for decisions. If input is fragmented and views disparate, the base for decisions will be unstable.

### 5.3 Instrument barriers

*Instrument barriers* are related to the formalization of strategies which enable *implementation* of these in a system. Goals in both the public and private spheres are affected by the strategic conditions created by stakeholders, which determine how goals are formulated. These formulations affect both the development of policies and the knowledge development among stakeholders. Unclear and unaligned goals increase uncertainties in planning and reduce the rationale of allocating resources to long-term or complex activities on both the private and public sides of the system. Instead, it is rational to minimize risk by continuing with business as usual and a minimum of new investments. Knowledge contributes to reducing uncertainty and provides arguments which can be used for accurate decisions. Lack of knowledge creates barriers for planning, development, understanding and acceptance of new goals and policies, since the actual needs are unknown or invisible to stakeholders. Lack of successful examples as well as methodologies to manage the complexity of changes in the freight system offer few reasons to deviate from tradition. Knowledge and goals are cornerstones for successful policy development and the formulation of policies determines the severity of barriers in *implementation*. Successful policy development balances the needs of stakeholders into a sustainable whole and stimulates development in line with societal goals while imbalanced policies paradoxically risk counteracting goal fulfilment by for example limiting actors' possibilities to focus on long-term activities. A "patchwork of policies" [25], p.266 and low levels of enforcement make sustainable development of urban freight a complication which is both complex and optional to take on for actors in the system. Even if changes are unavoidable, it can be more attractive for actors to postpone them on both the private and public sides of the system.

### 5.4 Implementation barriers

*Implementation* barriers hinder the realization of changes decided on a strategic level within/in the change process. These barriers are affected by how instruments are formed and by the contextual barriers of *societal factors* and *first mover disadvantage*. The economic reality for actors in the transportation system, their past investments and frameworks have a direct link to actors' priorities. Scarce or short-term financing of freight activities within authorities affect authorities' focus, time horizons,

ability to manage complexity and cooperation. Low profitability among private actors allows little room for long-term development. This while both technology and infrastructure investments in particular tend to be long-term decisions which are complex and require knowledge and cooperation among stakeholders to be successful. *Infrastructure* available at the right place and time determines both the functional and economic benefits of a technology or a service but is a challenge in an environment where societal factors, such as urbanization, digitalization and sustainability concerns create uncertainty. For example, electric vehicle *technology* affects the economy of its adopters. Due to limitations in vehicle specifications and higher initial investments than conventional vehicles the short-term effect can be negative. The *economic* outcome also depends on the availability of infrastructure for charging, policy support, and the capability of involved organizations to manage additional complications. Altogether, this uncertainty and short-term economic effects have made early adoption of, for example, electric vehicle technology a high-risk activity and constitute a barrier for quick adoption.

## 6 Discussion

Barriers to change in urban freight systems must be understood and mitigated to enable a managed change toward sustainability. The main contributions of this study are its system perspective on barriers to sustainable development of urban freight systems, the synthesis and categorization of these barriers, and the proposed interpretation of how barriers can be related to a process of managed change of urban freight systems. The need for holistic approaches in this research topic [57] is addressed by the system perspective which provides an overview of the fragmented research about barriers. The relationships between barriers are explored to create insights which may benefit managed change initiatives toward sustainability. Subsequent paragraphs discuss the results of the study and suggest future research directions. The discussion focuses first on the characteristics of the body of literature, then on the content of the barrier categories, and finally on links between the barriers.

### 6.1 Body of literature characteristics

The body of literature comes from 44 scientific journals, but one journal (Sustainability) stands out with 16 of 93 articles (17%); which is ten more articles than the second and third most frequent journals. This seems to reflect the total number of articles published by the journal. To assess the potential impact on the results by articles from this journal we analyzed how the articles from this journal were distributed over the barrier categories. The results showed no decisive impact on the definition

of barrier categories. Articles in the journal make up a minor share in each category of barriers, and the articles are distributed over all categories.

The body of literature incorporates a large number of case studies but few longitudinal studies. Adopting less frequent research designs in urban freight research could provide insights which are hard to find through the most common research designs, i.e., case studies and cross-sectional studies. Longitudinal studies could, for example, provide knowledge about the development process over time for early adopters of new technology, work methods or ways to organize urban freight systems, or address barriers.

Another characteristic of the body of literature is the low number of articles applying theoretical frameworks. Theoretical frameworks can, according to Tennis [100], be used to explain a variety of phenomena. This is an underused potential in the body of literature. Lagorio, Pinto, and Golini [57] found that research on urban logistics often identified challenges in the socio-technical area, where people meet technology. Future research could, for instance, use frameworks from organizational theory, network theory, system theory or governance theory to provide further insights into urban freight systems and their components. Such frameworks could also support strategy development for sustainable transformation of urban freight systems among practitioners.

Previous studies are, mainly based on European data, while the number of studies based solely on Asian, Anglo-American or Latin-American data for each constitutes less than 10% of the total amount of studies. This means a geographical limitation of available knowledge, despite the assumed global challenge of developing sustainable urban freight systems. Essential aspects of barriers related to local circumstances risk being underdeveloped. Some studies covering under-represented geographical areas may be published in other languages than English, and are thus excluded from this review; they should be covered in future research. However, it is likely that European dominance reflects an early interest in urban freight in Europe due to a combination of urbanization, high economic activity, available research funding, and the need to handle the externalities of freight activities [12, 55], all of which has not been as visible in other economies. The under-representation of regions outside Europe indicates opportunities for research. Knowledge about barriers and their significance in non-European urban freight contexts could be developed to explore all different aspects of barriers to sustainable development found in current data, such as the organization of freight systems, their governance, and stakeholder cooperation. Furthermore, if development of measures to enhance transition processes to more sustainable freight systems

builds only on European data, measures for mitigation of barriers risk being ineffective and lower citizens' trust in authorities' ability to govern sustainable transitions in other contexts.

The system perspective further revealed that public authorities followed by logistic service providers, apart from the research community, constitute the main target groups addressed by studies. Only a few of 93 studies [5, 6, 116] seem to address retailers with their results. The absence of retailers, despite their roles as both senders and recipients of goods in urban freight systems, indicate a value of exploring their possible roles in change processes in urban freight systems.

## 6.2 Barriers in the body of literature

The research about barriers to change in urban freight systems is fragmented, as it originates from different research subjects, and has been studied for several years with different system boundaries and purposes. In this study a system perspective was used to synthesize valuable knowledge from individual studies. This resulted in identification and characterization of 11 categories of barriers as well as a proposed model for managing sustainable change of urban freight systems. The proposed model groups the barrier categories into strategic, instrumental, and implementation barriers. The literature review shows that the barriers in the strategic group (*cooperation, organization, and politics*) need further research. The suggestions in literature about how to understand and overcome instrumental and implementation barrier groups are more developed. An exception is *knowledge* which, together with *first mover disadvantage*, was identified because of the system perspective applied in this review. This section thus discusses these two categories of barriers as well as the three barrier categories in the strategic group.

*Cooperation* is the most frequently highlighted barrier in the literature. The number of articles addressing insufficient cooperation indicate a difficulty to find solutions to this barrier. Its strategic character means that it should be addressed early in a managed change process. Future research should explore which insights cross-fertilization between urban freight transportation and other theoretical areas, like stakeholder management, change management, and governance theory could offer in understanding cooperation between stakeholders. The importance of governance approaches as a measure to stimulate cooperation is, for example, emphasized by Kemp, and Loorbach [51], and Loorbach [64].

*Organizational* barriers are also in the strategic group. The lack of dedicated resources in public organizations results in far-reaching consequences for the possibilities to manage the development of urban freight

systems. Future research could help to uncover the reasons behind, and solutions to, the low focus on urban freight compared to passenger transportation within public organizations. Future research could also provide insight into how an organization could support focus on long-term goals for urban freight systems and about how progress in a long-term change process could be assessed and monitored over time. Furthermore, future research could explore the potential offered by transferring best practice from the area of passenger transports to urban freight.

*Politics* is the least discussed strategic barrier, despite its strategic management function for public organizations. Future research should be directed at how politics can support managed change of urban freight systems in line with societal goals. Governance models for the change process and reduction of uncertainty for stakeholders seem to be key research areas.

Sufficient *knowledge* about urban freight systems among stakeholders is an instrument to ensure the quality of decisions and emerged as the second most discussed barrier in the body of literature. Lack of such knowledge among stakeholders is related to insufficient public organization around freight matters. This in prevents data collection, knowledge accumulation, and thereby dissemination. Future research could address the matter of insufficient data availability by exploring new methods to generate, accumulate, and mine urban freight system data. Insights are also needed about effective methods to disseminate new knowledge to stakeholders throughout urban freight systems.

In this study we found a contextual barrier named the *first mover disadvantage*. This barrier encompasses uncertainty about consequences, lack of tradition of radical change, and the possibility to choose other options than to change in a sustainable direction. To address this uncertainty, future research should explore the consequences, in several dimensions, for stakeholders of adopting more sustainable approaches. It should also explore ways to develop, collaborate on, and govern new business models which are aligned with societal sustainability goals.

Finally, since previous research is fragmented, it lacks a common language to describe the barriers preventing sustainable development in urban freight systems. Language is, however, important to create common understanding of a phenomenon and reduce the perceived complexity of it [83, 94]. The categories of barriers presented in this study could form the basis for common language about the barriers, hinders, and challenges for sustainable development which exist in urban freight systems.

### 6.3 Relationships between barriers and managed change

The model we propose to understand relations between barriers in the urban freight system is inspired by theory within strategic planning [15], its relation to change [37], and strategic management and change [28, 42, 56]. As a result, barriers could be aggregated and discussed in terms of their character (strategic, instrument, implementation) in the system. This aggregation has practical implications. The suggested model of understanding showing barriers and relationships implies that certain types of barriers (e.g., *strategic* and *instruments*) will have a more thorough effect on the system since they affect subsequent barriers in a change process. Thereby, the suggested model provides a proposed order of priority for initiatives to mitigate barriers in an urban freight system. If managed change initiatives initially focus on the mitigation of strategic barriers and the *first mover disadvantage*, they will build a solid foundation for a continued change process. The model visualizes the importance of understanding the context of the system. This context must be continually considered in a managed change process since it is related to all identified barriers. Given the numerous stakeholders of urban freight systems and their independent decision-making we suggest putting a certain focus on mitigating the *first mover disadvantage* in managed change efforts. This, since the *first mover disadvantage* affects all other barriers in the proposed managed change process. The proposed model opens for further research within different areas. First, the proposed relationships between groups of barriers could be tested and modified by applying the model to other empirical settings. This could be done in other case studies and further clarify the links between the components of the model. It could also be done via surveys and statistical examination of proposed relationships. The management of stakeholders in relation to different barriers is an interesting area for future research. Further research could also be devoted to quantification of the impacts of different barriers in the urban freight system. Finally, we suggest research to understand how the proposed model can be used by practitioners to support managed changes of urban freight systems in the direction of sustainability.

## 7 Conclusions

This article synthesizes and develops theoretical knowledge about barriers to change in urban freight systems based on a systematic literature review and a system perspective. It characterizes barriers and proposes a model for understanding the relationship between barriers and managed change processes in urban freight systems. The insights of the study are used to identify areas of interest for further research.

Barriers to change in urban freight systems can be grouped into 11 categories, each supported by several articles, according to Table 1. The content of the categories is synthesized in Sects. 4.1–4.11. The barriers are related to each other in a variety of ways. We propose a model (Fig. 9) for understanding categories of barriers and their relation to managed change processes in urban freight systems. The model implies that barriers affecting the *strategic* conditions of the system should ideally be addressed before barriers in the groups of *instruments* and *implementation*. Barriers in the strategic group are related to *politics*, *organization*, and *cooperation*. Barriers in the surrounding environment of the system, *societal factors*, and *first mover disadvantage*, affect all stages of a managed change process. Addressing the *first mover disadvantage* should also be a priority in a process of change.

Future research could support the development of more sustainable urban freight systems by providing further insights about the governance of change processes, potentially by combining theory from areas like organization, systems, and networks with the system perspective on urban freight systems. Research on non-European urban freight systems could increase the scholarly knowledge about the contextual impact on barriers and change processes. Future research could also explore ways to mitigate identified barriers to sustainable development, especially in the areas of cooperation, organization, politics, knowledge, and the first mover disadvantage. Finally, future research could continue to develop the model of a managed change process for urban freight systems and explore its use in supporting sustainable development of the systems.

As in all research, this study has limitations. This study is based on research found in two databases based on a specific search string. Despite a rigorous process to ensure the quality of the study, limitations in both the databases and in the search-string might have excluded articles from it. The decision to include only peer-reviewed articles for quality reasons risks having excluded potentially insightful results from books and conferences. The decision just to include articles in English risks having excluded potentially interesting results in other languages. Further, the results of this systematic literature review are based on available research and this study is thereby affected by the previously discussed dominance of data from Europe in the underlying research. A broader set of underlying data could potentially affect the study results. Moreover, the insights in this study are qualitative and based on coding and interpretations by the researchers. Even if measures were taken to secure the reliability of the results, the type of qualitative coding used in this study has limitations since

it is dependent on the coders' individual associations and frames of references. Finally, the proposed model for understanding barriers and their relations is an initial model. We encourage researchers to contribute to, and continue to develop this model into a broad framework for change processes in urban freight systems. This framework can then be used by practitioners managing the development of these systems toward sustainability.

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#### Author contributions

Conception, MK and HP; Design, MK and HP; Acquisition, MK and HP; Analysis and interpretation of data, MK and HP; Draft, MK and HP; Review, MK and HP. All authors read and approved the final manuscript.

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#### Availability of data and materials

The data supporting the conclusions in this study are available at [www.scopus.com](http://www.scopus.com) and [www.webofscience.com](http://www.webofscience.com). The search string used for retrieval of data is available in Fig. 1.

#### Declarations

##### Ethics approval and consent to participate

Not applicable.

##### Consent for publication

Not applicable.

##### Competing interests

The authors declare that they have no competing interests.

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