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Integration of urban freight transport in city planning: Lesson learned

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ABSTRACT

The paper explores how governing bodies and planning authorities in Norway take urban freight transport into consideration in three different cities. Based on empirical studies of actors and processes relevant to city planning, the paper highlights challenges related to integrating urban freight transport considerations in city planning. The paper demonstrates how different planning approaches shape the integration of urban freight transport in city planning. The paper shows that early integration of freight considerations and stakeholder engagement in city planning is vital for developing more effective and sustainable transport and freight systems in urban environments. Political anchorage, geographical scope, and time are also three dimensions that considerably influence the way urban freight transport is integrated in city planning. Insights from this analysis may be used to develop better ways of integrating freight transport into city planning in the future.

1. Introduction

According to the International Energy Agency (IEA), effective mitigation policies are needed to curb increases in passenger and freight transport and hence reduce greenhouse gas (GHG) emissions (IEA, 2021). In recent years the challenges of transitioning to low carbon transport and more sustainable cities have been reinforced by large changes in consumer culture partially related to the progress of ICT (information and communication technologies), which have spurred people to shop more online (Comi and Nuzzolo, 2016). Since 2020, due to the COVID-19 pandemic, the use of online shopping has increased even more and the way e-commerce trends impact urban freight distribution have become even more prominent (Maltese et al., 2021).

Changes in consumption patterns do not just have major implications for the production of goods and services and the supply chain (Visser et al., 2014). They also have significant impacts on urban freight transport (MDS Transmodale, 2012) and last mile services (Bjerkan et al., 2020; Gevaers et al., 2011), the spatial organization of transportation, and sustainability. Purchases are increasingly being delivered directly to the end customer (e.g. at homes or pick-up points) (Bjørgen et al., 2019a) and such last mile deliveries to the end consumer often involves delivery tours that are not optimized and occur in more fragmented delivery systems with higher delivery frequencies of smaller orders (Henriksson et al., 2018). Furthermore, repeated deliveries, failed deliveries, and returns and waste from receivers increase urban supply and value chain activities and pressure on urban spaces (Visser et al., 2014; Wygonik and Goodchild, 2018). Thus, due to changes occurring in supply chains (e.g. just-in-time concepts, home deliveries, and online shopping), which result

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in increased numbers of deliveries and more light goods vehicles in urban and residential areas, there has been a steep growth in urban freight transportation in many cities (Russo and Comi, 2016; Larsen and Van Woensel, 2019; Rinkinen et al., 2020). This tendency is expected to continue in the future (Macharis and Kin, 2017). For example, the Commission on Travel Demand in the UK explored similar recent changes in the underlying nature of travel demand and found that people were travelling fewer hours and miles per day, while there had been a rise in light van traffic, producing traffic growth at an aggregated level (Marsden and Reardon, 2018). In this context of urban freight transport being increasingly complex and costly, several changes are observed in the last mile logistics supporting sustainable mode (as on foot or by bike) to complete deliveries within urban areas to improve sustainability and liveability's in cities as well as to increase delivery performance at lower cost by utilizing telematics in delivery optimations (Comi and Savchenko, 2021; Jaller et al., 2021; Comi, 2021).

The way urban freight transport impacts the overall mobility and quality of life in the city has become acknowledged to an increasing degree over time as challenges have grown (Cherrett et al., 2012; Macharis and Kin, 2017; Banister, 2019). Increasing numbers of light goods vehicles are unwanted because they contribute to climate gas emissions, congestion, and increased pressure on already packed urban space where they compete with pedestrians, cyclists and public transport for space and time creating conflict and safety issues (Browne et al., 2017; Petterson et al., 2018).

In cities urban freight transport is contributing to increased climate gas emissions, congestion, and challenging urban logistics. In the Norwegian capital, Oslo, freight transport is responsible for 30% of all emissions from road traffic and projections show that the activity of goods transport is likely to increase (Oslo Municipality, 2020a, 2020b). Trondheim, a medium-sized city, and Bodø, a smaller city, both face a similar situation as they are experiencing a growth in distribution vehicles' share of transport. This is problematic, as growth in road traffic (partly due to an increase in urban freight transport and deliveries) hinders these cities from achieving their ambitious climate goals. Thus, to achieve ambitious zero emission goals and to have a successful transition to more sustainable transport and mobility systems (while retaining the goal of having good cities in which to work and live), there is a need to develop new ways of governing urban freight transport.

To date, local authorities have largely ignored freight and logistics in their urban planning (Cui et al., 2015; van Duin and Quak, 2007; Bjørgen et al., 2019b). Providing a deeper understanding of the complexity of urban freight transport and how it can be integrated into city planning and urban development processes are therefore needed. Increased attention on urban freight transport may help city planners to facilitate last mile activities in the context of urban mobility, through improved design, dynamic use of infrastructure and a mix of policy tools (Bjørgen, 2021). In several European cities local authorities have been more aware of freight transport as one of the primary users of the urban space, and have implemented SULPs (Ambrosino et al., 2015; Matusiewicz, 2019; Comi et al., 2020) as part of sustainable urban mobility plans (SUMPs) (European Commission, 2013b). Hence, there is still a need for increased knowledge about policy and regulation instruments to facilitate for sustainable urban freight transport (Browne et al., 2019; Dablanc, 2019; Heitz and Dablanc, 2019).

As stated in MDS Transmodal (2012) and along Ballantyne et al. (2013) urban freight transport includes the movement of freight vehicles (both Heavy Goods Vehicles and Light Goods Vehicles) whose primary purpose is to carry goods into, out of and within urban areas. Recently changes in the last mile logistics, as described in among others e.g. Comi and Savchenko (2021) reinforce that the integration of urban freight transport in a broader context of city planning need to include shopping trips in passenger vehicles, home delivery services f.ex with taxies, in addition to environment-friendly last mile delivery modes. A framework for understanding the changes in urban mobility pattern due to these interaction between last mile distribution, home delivery solutions and consumer and travel behaviour is elaborated in Bjørgen et al. (2019a). The last mile distribution has traditionally been carried out by the logistics service providers to end receivers in form of e.g. stores, and shopping trips by the end consumer. With online shopping, the end receiver is to a large extend the end consumer and the last mile distribution is in many communities moved away from urban space and shopping areas to residential and living areas.

By studying different approaches to handling freight concerns in three Norwegian cities, we aim to highlight possible ways of better integrating urban freight transport concerns into city planning. In the next part we discuss theoretical perspectives that are relevant for understanding how to integrate urban freight transport in city planning in better ways and how to govern such a complex sector characterized by heterogeneous actors, both public and private ones (Bjørgen et al., 2019b; Marcucci et al., 2017).

In this paper we discovered different approaches on how to integrate urban freight transport in local planning processes to reallocate urban space for mobility issues. (1) A trial project in which the project is used to experiment with urban mobility and infrastructures. (2) An example that uses a more traditional approach to urban development, and (3) a hybrid approach. This classification was developed by an inductive approach based on documents and data from the three different case cities. In section 4 we elaborate on why these cases are interesting for exploring the integration of urban freight transport into city planning and how they relate to the overall planning context.

2. Theoretical perspectives

Emerging attention paid to sustainability, climate-related action, and the impact of the movement of goods due to increases in e-commerce and new delivery solutions (Visser et al., 2014; Cardenas et al., 2017) calls for increased knowledge about freight and logistics in urban mobility contexts. At the same time, we have observed that climate and environmental policies have shifted from focusing first and foremost on pushing for the implementation of more efficient or environmental technologies to focusing more on low carbon and sustainability transitions of entire socio-technical systems (Dijk et al., 2019), such as transport and mobility systems. This shift stems from the recognition that only shifting from one technological solution to another (i.e substituting fossil-fuel vehicles with electric vehicles), although contributing to emission reductions, will not be enough to provide sustainable urban transport and

mobility systems. Transitioning to more sustainable transport systems, including urban freight transport, requires the involvement of a multitude of actors operating on different levels, and alignment of policies, regulations, and practises (Geels, 2012).

2.1. Freight in urban areas

Urban freight transport occurs between the local or the regional terminal and the final destination, the end consumer which can be both individuals, businesses or institutions (Cherrett et al., 2012). Freight transport is one of the principal users of urban areas and is a central element in the complexity of mobility and accessibility planning within in urban space. An efficient freight distribution system is required, as it plays a significant role in the competitiveness of an urban area (MDS Transmodal, 2012). Patterns of movements of people and goods across urban spaces are influenced by many factors, including population growth and aging populations, the desirability of liveable cities, the need for resilient infrastructure, and changes in land use patterns (Macharis and Keseru, 2018), some of which are interrelated. Additionally, a large group of private and public stakeholders contribute to a city's logistics system (Russo et al., 2016). Such a system involves public authorities that represent different departments ranging from the city level (i.e. local level) to the national level, as well as private stakeholders such as logistics providers, terminal operators, receivers, and end consumers (Morfoulaki et al., 2015; Morfoulaki et al., 2016). Furthermore, the fact that logistics operations use the same infrastructure as personal mobility often contributes to this complexity. New logistics network designs and consumer-based economies are challenging traffic flows, environments, and road safety (Cherret et al., 2012; Hesse, 2016). All of the above-discussed aspects contribute to increasing pressure on urban land use in areas with growing populations (Cárdenas et al., 2017; Gatta et al., 2017).

In recent years, researchers have paid increasing attention to the ways that e-commerce modifies last mile operations and how home deliveries and other delivery solutions (e.g. parcel lockers) challenge capacity, traffic flows, transport volumes, environment, road safety, and load factors (Cherrett et al., 2012; Comi, 2020). For instance, Visser et al. (2014) argue that home deliveries lead to a deeper penetration of freight activities into residential areas, and they produce large return flows. With the continued development in e-commerce, drivers of freight transport that are spending less time at central business district (CBD) hubs and more in spaces with mixed use (e.g. industry and residential) (Hopkins and McCarthy, 2016). For example, an increasing trend of atomization has been observed at city level, where smaller parcels being delivered, increasing numbers of deliveries, and deliveries are being made to more addresses (Macharis and Kin, 2017). Furthermore, increases in freight distribution in urban areas create the need for new types of vehicles for movement in different types of urban environments (Hopkins and McCarthy 2016). Hence, we see a transformation of freight movement in and around urban centres when it comes to character, destination, and quantity (Lin et al., 2018). This changing landscape both impact and are impacted by operational aspects in transportation planning decisions and should be given increasing attention in urban design policy and planning.

Increased interaction between people and goods movement is one example of the impact of e-commerce in cities. Therefore, knowledge about such interactions is necessary if both social interaction and the values that cities represent to people are to be maintained (Banister, 2011; Banister, 2019). Additionally, to integrate urban freight transport into city planning, local authorities need knowledge about the ways in which laws and regulations influence present transport systems, and knowledge about why and how people act due to new regulations and laws (Marcucci et al., 2020), as well as how to facilitate increased user participation and engagement (Bjørgen et al., 2019b). Previous research has shown that early involvement of stakeholders in the public planning processes is important (Bjørgen et al., 2021), as urban freight transport influences both physical, economic, and social aspects of the urban environment (Fainstein, 2020).

Urban freight transport impacts not only public and private stakeholders, but also citizens who use the same spaces and services, and therefore it should be treated as an important issue in the context of public planning research (Bjørgen et al., 2019a). Nevertheless, urban freight transport has for years been overlooked by city planners in Europe (Lindholm and Behrends, 2012), although they have been given more attention recently (Macharis and Kin, 2017), along with recognition of the need for increased knowledge about the way planning and regulation instruments can influence freight in urban centres (Browne et al., 2019). In order to deal with problems relating to urban freight transport and deliveries, policymakers responsible for planning in urban spaces have commonly strived to lessen negative effects created by urban freight transport (Macharis and Kin, 2017). Typically, they have imposed restrictions relating to vehicle size and weight, time windows, low emission zones, and parking arrangements.

In line with the European Union's goal of achieving CO2-free city logistics by 2030, restrictive measures concerning the movement of urban freight are likely to increase in Norway and elsewhere in Europe (European Commission, 2013a; Ministry of Transport and Communication, 2017). In this regard, we aim to meet the need for more knowledge, as we focus on how urban freight transport can be integrated into mobility planning, such as Sustainable Urban Mobility Plans (SUMPs) (Fossheim et al., 2017) and urban planning practices in general in a better way in addition to review experiences from several Living Labs where stakeholders co-create, implement, and test innovations in freight transport (Gatta et al., 2017).

2.2. Planning approaches

Space is becoming a scare resource in cities due to urbanization and increased densification. Additionally, growth in urban freight transport and increased interaction between people and goods movement demand for improved accessibility to urban space. As stated in Fainstein (2020), city planning both designs and regulates the uses of space. City planning should also incorporate the element of time to allow dynamic and flexible use of urban space, as well as the necessary sequences in a spatial planning process (Holsen, 2017; Taylor, 2010). Changing social and technological trends impact how urban space is utilized and it changes the logistics solutions and operational aspects in the final step of the supply chain (Brown et al, 2019). Consequently, planning for urban freight transport needs

to be a part of a broader context and included into mobility and city planning (Dablanc, 2019). Furthermore, future governance and policy recommendations as stated in strategic plans and regulation tools need to take into account that public policy making takes a long time, whereas entrepreneurs often are hasty in their decision making due to shorter timelines (Hull, 2008).

In normative planning theory there are two main approaches to spatial planning and detailed zoning: rational comprehensive planning and coordination of sectoral interests and plans. The *rational comprehensive planning* approach integrates environmental, social and functional aspects of spatial planning (Faludi, 2000). At the local level, comprehensive planning is a complex and extensive task that includes a wide range of considerations. Limited resources, lack of knowledge and fragmented responsibilities often reduce possibilities to plan according to this ideal model (Bjørgen et al., 2019b). The second approach to spatial planning and detailed zoning, the *coordinating sectorial interests and plans* approach, sets out to involve different municipalities through municipal planning strategies. In the case of Norway, the strategy is constituted by the municipal master plan and the land-use element of the municipal master plan (Falleth and Saglie, 2011).

Land (space) and time are often scarce resources that impact urban freight transport practices. Integrated transportation and land use planning is aimed at allocating land to different groups in society and for societal activities such as recreation, walking, cycling, and shopping. However, integrated transport and land use planning also regulate time through the distribution of access to space (e.g. roads, parking). This is accompanied with conflicting purposes and interests.[1]

In some European cities, local authorities have increasingly become aware of freight transport as one of the primary users of the urban space. For this reason, van Duin and Quak (2007) argue for a cooperative and integrated approach to a collaborative planning process in local planning, namely one that includes national government, regional government, as well as private businesses. Other researchers have argued for the commitment of all involved stakeholders, including their involvement in the early stages of planning processes (Innes and Booher, 1999; Booher and Innes, 2002; van Duin et al., 2010).

Collaborative planning implies that the development of plans is shared by local authorities and stakeholders (e.g. freight carriers and their organizations, the local business groups, and local residents), who engage in face-to-face dialogue meetings in order to seek consensus on the identifications of common problems and reach agreement on the solutions (Booher and Innes, 2002; Innes and Booher, 1999). Better collaboration between the private freight and logistics industry and governing authorities has been identified as one factor that could contribute to higher acceptance of transport regulations (Bjørgen et al., 2021).

In the case of freight transport, this is deemed necessary because urban freight transport policies are unlikely to succeed if they not supported by the stakeholders (Dablanc, 2011; Macharis et al., 2014). Thus, to ensure higher levels of user acceptance, the planning process should involve relevant actors from both the public sector and private sector in the development and implementation of plans (Marcucci et al., 2017b). The responsibility for urban freight transport as a topic is both strategic and operative in character but is generally fragmented and divided between a number of different agencies and departments within city-level administration, with different sectoral responsibilities, motivations, and concerns. Typically, involved departments are agencies for planning and building at municipality level, as well as other public actors such as the police and parking agencies, (Bjørgen et al., 2019b). More knowledge is needed in order to understand the complexity of urban freight transport and to improve coordination and collaboration between public and private stakeholders and to engage private stakeholders early in the public planning process (Bjørgen et al., 2021). In section 4, we investigate whether and how this has been done in the three case cities.

2.3. Planning legislations in Norway

The planning legislation in Norway comprises several tools that support the management of land in the face of individual, public, and corporate interests. The public planning process according to the Planning and Building Act of 2008 (Ministry of Local Government and Modernisation, 2008) is one such tool that ensures consistency in planning from the general level to the detailed level. It instructs the local authorities in the development of municipal master plan and action programmes that serve to update the municipal master plan every four years (Ministry of Local Government and Modernisation, 2008; Falleth and Saglie, 2011). The statutory securing of citizen participation through rules for consultations and publicity is another tool that affects all parties (Ringholm et al., 2018).

Norwegian cities have responsibility for municipal planning processes and for guaranteeing that they are in line with national planning and building legislation in order to create attractive, liveable and competitive communities with sustainable forms of urban mobility (Ministry of Local Government and Modernisation, 2008). The public authorities' position is relatively strong at the local level. Local authorities are responsible for city and mobility planning, including urban freight transport. The largest cities in Norway receive national funding to either stabilize or reduce the numbers of vehicle miles travelled by private cars. The funding is mainly used to finance infrastructure for cyclists, pedestrians, and users of public transport, and to restrain private cars use through the administration of taxes and regulations (Ministry of Transport and Communication, 2017). However, the national finding provided to cities does not seem to spur integrated mobility planning that integrates passengers and goods alike (Banister, 2008; Russo and Comi, 2016; Rai et al., 2017).

In Norway, the planning system emphasizes public participation and therefore Norwegian cities constitute an appropriate place for studying how to expand participation to better incorporate private stakeholders. Furthermore, pilot and trial projects have increasingly been used in city planning as means to experiment with policies and new methods to develop urban spaces (Bulkeley et al., 2014; Ryghaug and Skjølsvold, 2021).

[1] M. Browne, from the University of Gothenburg, lecture titled 'City Logistics and Urban Planning', held 27 March 2020, at the Norwegian University of Science and Technology, Trondheim.

3. Methods and data

In cities urban freight transport is contributing to increased climate gas emissions, congestion, and challenging urban logistics. In the Norwegian capital, Oslo, freight transport is responsible for 30% of all emissions from road traffic and projections show that the activity of goods transport is likely to increase (Oslo Municipality, 2020a; 2020b). Trondheim, a medium-sized city, and Bodø, a smaller city, both face a similar situation as they are experiencing a growth in distribution vehicles' share of transport. This is problematic, as growth in road traffic (partly due to a increase in urban freight transport and deliveries) hinders these cities from achieving their ambitious climate goals.[2] Thus, to achieve ambitious zero emission goals and to have a successful transition to more sustainable transport and mobility systems (while retaining the goal of having good cities in which to work and live), there is a need to develop new ways of governing urban freight transport.

This paper is based on an analysis of three strategic research sites (cities) that illustrate different approaches to integrating urban freight transport into city planning. All three city municipalities were identified as interesting cases for studying urban freight transport because they were partner municipalities in previous (NORSULP) and an ongoing research project (SNAPSHOT). The three cities are also interesting cases for studying integration of urban freight transport in city planning, as they represent differences regarding population size, density, and how city-level administration is set up to handle different mobility programmes with potential implications for urban freight transport. An overview of the three case cities is given in Table 1.

To gain a better understanding and gather details about the Norwegian planning process, we conducted a document study of planning and legislation at municipal level. Additionally, we mapped ongoing planning processes and relevant ongoing projects in the case cities. The main sources of data for the study were gathered in meetings with the municipal authorities and different local authorities, departments, and agencies in the three case cities. A variety of actors with different interests and responsibilities was represented in the meetings with the municipal authorities. However, common to them was that they all worked on transport and urban development matters.

In our study, the municipalities (Oslo kommune, Trondheim kommune and Bodø kommune) were represented by one or two employees in separate digital meetings in spring 2020 in each of the three cities. The purpose of the meetings was to establish a dialogue to gain insights into how urban freight transport could be integrated in city planning on different levels of government. The meetings gave us detailed insights into how municipalities in Norway deal with urban freight transport in traditional city planning settings.

We also wanted to know what happened when traditional approaches to dealing with urban freight transport were changed to incorporate more experimentation in how city planning was done. In the case of Bodø, experimentation was done to some extent (as explained in more detail in section 4.1.2). Trondheim had gone furthest ahead in taking an experimental approach to city planning. Thus, the Trondheim case warranted a broader approach to data collection and additional qualitative interviews were considered suitable for gathering experiences and information, as there was limited knowledge about the topic (Thagaard, 2009) and reflections from interviewees were considered important. Accordingly, in addition to meetings with representatives of the municipalities, interviewees were held with representatives of public and private sector stakeholders who were either involved with or impacted by the ongoing pilot projects (see Table 2 for an overview).

The interviews focused on urban freight stakeholders' participation in the trial project. Additionally, logistic operators, receivers, and urban planners representing both local planning (municipal planning authorities) and regional planning (planning authorities at county municipality level) contributed information about the pilot planning and the implementing process, as well as their experiences before, under and after the different measures. In total, 17 interviews were conducted in the Trondheim case: 5 with public stakeholders (one each from the regional municipality, department of city planning, and the 'Greener Trondheim' programme, together with two representatives from waste and public transport authorities), and 12 with private stakeholders who represented mainly commercial interests and culture institutions in the area, such as shop managers, property managers and private managers who were responsible for urban freight related tasks such as those provided by transport companies, taxies and service providers. Our interview guide focused on participation, the planning process, and several mobility issues, including those relating to urban freight transport. Due to the COVID-19 pandemic, the interviews were conducted digitally in spring 2020. The interviews were accomplished as an open dialog between the interviewees and the interviewer supervised by the structure topics in the interview guide. Each interview lasted around 1 hour. Altogether, the document studies, interviews, participant observation in meetings, and onsite observations in the three cities gave us in-depth insights into how the different approaches to city planning integrated freight and logistics in local planning processes in the three cities. The insights are discussed in more detail in section 4.

4. Results and discussion

4.1. The case cities

All three cities being studied have earlier participated in research projects regarding urban freight transport but differ in how they have addressed this policy area. The case cities took part in the national research project NORSULP (Norwegian Sustainable Urban Logistics Plans) which aimed to facilitate local strategies for urban development through a guidance to establish local urban logistics

[2] Norwegian cities have launched climate strategies with the aim of having close to zero emissions by 2030 (Oslo Municipality, 2020a; Trondheim Municipality, 2017).

Table 1
Case cities.

City	Population (2020)	Density (residents/km^2*)	Estimated population growth by 2040 (%)	City/mobility programme
Oslo	1,036,000	3840	21	Car-free city life**
Bodø	52,560	2863	17	Smart Bodø***
Trondheim	207,595	3248	14	Greener Trondheim****

*Population and land area in urban settlements (updated 6 October 2020) (Statistics Norway, 2020).
** https://pedestrianspace.org/car-free-livability-program-in-oslo/.
*** https://bodo.kommune.no/smart-bodo/category2556.html/.
**** https://miljopakken.no/.

plans (Bjørgen et al., 2019b). By attending the NORSULP projects the cities started the first stage of the process of integrating logistics and freight stakeholders in city planning (Bjørgen et al., 2021). Bodø was the first Norwegian city to have developed a "City logistics plan" (Bodø Municipality, 2020) based on the framework of Sustainable Urban Logistics Plans (SULPSs) in Morfoulaki et al. (2015). Trondheim and Oslo have recently (fall 2021) received a political mandate to draft a local SULP.

The three case cities governance are organized in different ways at the local level with several agencies and departments involved in transport and mobility issues. All three case cities highlight personal mobility as an important issue in city planning. Additionally, the cities have developed their mobility programs, which mainly focused on personal mobility, but with increased attention paid to urban freight transport. After looking at how governing structure influence the position of urban freight transport, we initially identified three different approaches: a traditional approach in Oslo, a hybrid approach in Bodø, and a trial project approach in Trondheim. Table 2 lists the departments in each city with overall *strategic responsibility* for implementing the most important transport and mobility issues, the involved agency at the local level, and different strategic plans and planning and regulation tools relevant for urban freight transport.

The governing structure in the three cities is partly defined by which agency or department has strategic responsibility for the urban mobility programme and how different agencies are involved. As listed in Table 2, the governance structure with several agencies and departments shows fragmentation of power and distribution of responsibility which partly explain a lack of the link to other planning functions. Additionally, the governance structure influences the possibilities to be aware of how freight transport affects other issues in city planning and the potential to transfer knowledge of freight transport across different planning functions. In the following section (4.1.1–4.1.3), we will describe in more detail how the approaches differ with regards to their relationship with the political level, strategies, and visions, and how urban freight transport is incorporated in city planning.

4.1.1. Oslo

To achieve a zero-emission city within 2030 (Oslo Municipality, 2020a) the climate strategy for Oslo highlights several target areas for achieving sustainable mobility, including increased use of soft modes, walking and cycling, overall reduction in car traffic by one-third (compared with 2015 levels), and all vans and heavy-duty transport to have zero emissions or use sustainable fuels by 2030. Planning for 'a car-free city centre' (Oslo Municipality, 2019) mainly focus on personal mobility. Less attention has been given to facilitating solutions for services and freight deliveries in the city centre, even though urban freight transport contributes 30% of all emissions from road traffic in the city (Oslo Municipality, 2020a).

When working towards meeting its climate goals, the city authorities in Oslo have mainly used traditional planning approaches and procedures in line with the Planning and Building Act of 2008 (Ministry of Local Government and Modernisation, 2008). Public participation is emphasized to a certain extent and the planning processes of the car-free Oslo initiative involve input from several municipal agencies across different sectors. The Agency for Climate has strategic responsibility for overseeing the process, and its operations have influenced decision-making processes within other local sector agencies (named in Table 2),

Table 2
Governing structure, plans and planning tools for the three case cities.

City	Oslo	Bodø	Trondheim
Strategic responsibility	Agency for climate	Dep. of Planning and Community	Greener Trondheim
Agencies and departments involved in Transport and mobility issues	Agency for Improvement and Development Agency for Urban Environment Agency for Real Estate and Urban Renewal	Dep. of Business and Development Dep. of City Planning Dep. of Technology and Operation	Dep. of City planning Dep. of Climate
Strategic plans	Municipal master plan Climate strategy	Municipal master plan Climate strategy	Municipal master plan Climate strategy
Planning and regulation tools	Car free Livability Programme Public procurements Zero Emission Zone Climate budgetCity logistics plan (to come)	City logistics plan	Greener Trondheim Programme Street Use Plan City logistics plan (to come)

Although, the Agency for Climate has a somewhat strategic and superior role in the governance structure, the other agencies and departments with legal power involved in transport and mobility issues often have their own priority areas. This challenges between strategic and operational level can be exemplified with the procurement strategy's decentralized model, with over 1000 separate procurement responsibilities and accompanying delivery addresses, while at the same time focusing on securing on zero-emission criteria in all tenders, including zero-emission vehicles, zero-emission fuels and effective logistics solutions.

The Department of Urban Development is in charge of the 'Car-free city life' action programme in cooperation with the Agency for Planning and Building Services, the Agency for Urban Environment, and the Agency for Real Estate and Urban Renewal, whereas the Agency for Urban Environment is responsible for developing a city logistics plan, highlighting freight and logistics issues in public planning in cooperation with relevant stakeholders. Thus, using public procurement, the 'Car-free city life' action program and the proposed city logistics plan can all be seen as viable examples of planning tools that will increase the attention to urban freight transport in city planning across different departments and agencies in Oslo Municipality. However, due to the planning approach, this does not seem to be the case in practice.

4.1.2. Bodø

Bodø has undergone vast changes in recent years, mainly as a consequence of the planned development of a new city area following the relocation of the city's airport, which opened up land for redevelopment (Bodø Municipality, 2019a, 2019b). Meetings with Bodø city officials revealed that the development of the city logistics plan had contributed to more awareness of urban freight transport in the city.

However, the development of the city logistics plan was challenging. The Department of Business and Development was responsible for establishing arenas that coordinated city development and logistics issues, while the Department of Technology and Operation was responsible for securing the design and regulation of space needed for freight and home deliveries.. The department of City Planning used the local SULP when planning for the new city area to allocate space for essential purposes such as mobility, parking, *and* urban freight transport (Bodø Municipality, 2021). The purpose was to gain more insights into challenges faced by suppliers such as transport companies and the demand side of the market, represented by consumer travel and shopping preferences.

When developing the new area, the Department of Planning and Community wanted Bodø to become a '10-minute walking city' (including mobility for goods and people). However, the municipal authorities needed more data about the current situation and dialogue with the stakeholders in order to be able to take the next development steps.

4.1.3. Trondheim

In the city of Trondheim, the 'Greener Trondheim' programme is responsible for projects, pilot projects, and trials to improve mobility in the city and the surrounding region (Trondheim Municipality, 2017). The aim is to plan for an active and attractive city centre, highlighting social and cultural interaction and city life, in addition to increasing the use of public transport and soft modes. The trial discussed in this paper concerned one of the main streets running through the city centre. The goal of the trial was to learn how to reallocate the use of urban space in a better way with regard to personal mobility issues. Thus, the main aim of the trial project was to gain experience by testing different solutions (on a small scale) in a real-world setting, before eventually making the changes more permanent (or upscaling them) in the longer run. This procedure is in line with the rationale behind many pilot and trial projects that are implemented in urban environments (Ryghaug and Skjølsvold, 2021).

Initially, the vision for the trial did not include urban freight transport. However, by the start of the pilot planning the municipality discovered the need to pay attention to freight transport and to incorporate urban freight transport issues. Therefore, the municipal authorities invited freight stakeholders to attend workshops in the initial phase of the project in order to acquire more knowledge about the stakeholders' needs and to learn about their views on suggested solutions. Nonetheless, it seems that urban freight transport played a minor role in the trial project. In the interviews, it was mentioned that the municipal authorities had lacked sufficient knowledge about urban freight transport before starting the project. Especially parcel deliveries seemed to have been treated in an unsatisfactory way. Although some actors, such as those representing waste and renovation, reported that communications had been good, service providers such as craftsmen, homecare and home delivery reported that the dialogue had been very limited and unclear. As a consequence, the experience among urban freight transport actors and actors involved in delivering goods and services was that deliveries took longer while the trial was ongoing.

The trial contributed to making deliveries not only more time-consuming but also more complicated and unsafe, as employees more often had to cross streets with traffic, bicycle lanes, and use the pavement when unloading and delivering goods. Interviewees, who represented different kinds of users, reported that their involvement in the process had only been limited and that there was a low degree of involvement as the trial developed over time. They received most of their information about the project from newspapers and they seldom knew about infrastructure changes (e.g. changes to the direction of traffic flow) before they happened.

Politicians became quite involved in the processes and advocated for certain solutions to be promoted or stopped. This often came as a result of pressure from either the public or certain groups of stakeholders with interests connected to the street, such as transport companies or receivers of goods (e.g. shops and businesses).

4.2. Important dimensions for the integration of urban freight transport

The analysis revealed different ways of handling urban freight transport in relation to city planning. The differences particularly related to how the city planning process was anchored in political processes, the way stakeholder participation was orchestrated, the geographical scope, and issues related to timing with consequences for how urban freight transport would be integrated in city

planning. Collaboration among stakeholders competing for access to common infrastructure and space could increase their opportunities without compromising their interests in being part of a collaborative planning approach. The desire to move planning process forward could be achieved more easily by seeking consensus though collaborative planning, as also stated in Bjørgen et al. (2021) where the case cities were a part of the study.

The traditional planning approach seemed to result in urban freight transport becoming a concern that was given little focus compared with other issues. First, as mentioned in section 4.1.1 the planning authorities have mainly planned for person mobility. Second, in Oslo, the Agency for Climate used the yearly climate budget as a tool to plan for 'Zero Emission Zones' (Oslo Municipality, 2020c) and 'Car-free city life' programme when prioritizing the use of urban space, without paying much attention to urban freight transport.

The traditional planning approach used in Oslo called for alignment with the Planning and Building Act, which highlights the importance of participation by different actors and stakeholders in the planning process. Nonetheless, urban freight stakeholders were insufficiently identified as relevant actors and were to a limited extent included in the planning process of either the 'Zero Emission Zones' or the 'Car-free city life' programmes in Oslo. This could be due to the overarching role of the Agency for Climate, which placed much emphasis on personal mobility, the implementation of low emission vehicles and limiting motorized transport in certain areas of the city, while focusing less on the role of urban freight transport in creating an active and attractive city centre. In addition, we found that efforts to achieve these ambitious goals by trying to embed them and make them actionable as part of the strategies of other operational municipal agencies was a quite demanding task and one that was likely to marginalize concerns related to urban freight transport.

Furthermore, the use of a quite traditional planning approach in Oslo had consequences with regard to time. Traditional planning approaches are often relatively time-consuming processes, as they demand the organization of correct procedural steps, as in the Oslo case, several agencies and departments. The fact that the traditional planning approach already builds on well-founded participatory mechanisms that allow for elaboration and longer processes could be seen as a good base for involving more stakeholders in the planning process, such as urban freight actors. However, this opportunity was not recognized in the period of 2019–2021, when we studied the Oslo case, although there is evidence that Oslo has recently become more attentive towards urban logistics, as the recent approval for developing a local SULP.

The Bodø case revealed the strength of taking a hybrid approach to planning, as issues in the tactical city logistics plan were integrated as part of the strategic municipal master plan. There was also a more formalized political anchoring of the city logistics plan than in Oslo. Furthermore, integration of the city logistics plan with the municipal master plan prepared the ground for a broader stakeholder engagement as part of the local planning process. Supported by the politically approved city logistics plan, the Bodø case demonstrated that attention to logistics issues should be taken early in the planning process, as this allows for more flexible adjustments and adaptations throughout different stages of the process as the project proceeds and experience is acquired.

In the trial approach, a divided user segment perspective seemed to characterize the planning process at the expense of an overall perspective. The focus was rather on one sector or user group after the other (e.g. public transport or cycling) and there was initially little focus on urban freight transport, all of which are areas in which the municipal authorities lacked competence. This resulted in the planning of the trial project being rather fragmented and paying less attention to planning for comprehensive solutions. Ad hoc solutions and many changes that did not take into account the bigger picture caused some of the stakeholders to lose confidence in the trial project.

In Trondheim, the planning process included measures that seemed quite drastic to many of the actors, especially given that measures and changes seemed to be introduced rather rapidly, with little information and involvement of implicated actors, such as business and services that needed predictability regarding both own operations and their customers' needs. During the trial, no quantitative data were gathered to improve the decision-making process or to evaluate the solutions tested in the pilot. A prevailing interpretation was that changes were merely taken on the basis of little available data. The Street Use Plan (Gatebruksplan), a plan for street use for the city centre, was not used before or as part of the process but was developed in the later phases of the trial.

The different approaches to planning traditions gave insights into several dimensions that seem important for the integration of urban freight into city planning. The ways in which the planning approaches shaped these dynamics with regard to several dimensions are listed in Table 3.

We identified that issues concerning geographical scope (land use and the geographical framing of the project), participation, and time were parameters of particular importance to the integration of urban freight in city planning in the three case cities. Additionally, the degree of political anchoring of the planning process seemed pivotal.

Table 3
Important dimensions for the integration and consequences for urban freight transport.

	Political anchorage	Geographical scope	Participation	Time	Consequences for urban freight transport
Traditional	Strategic level	Zero-emission zone Car-free city life	Less stakeholder engagement	Time-consuming	Less focus on freight. Focus on climate and zero emissions
Hybrid	Politically approved city logistics plan	Integrated part of new city area	Broad stakeholder engagement	Flexible timing and local adjustment	Urban freight is a part of city planning
Trial	Ad hoc political anchoring	Street focus	Sporadic stakeholder engagement	Short time frame, rapid implementation	Focus on urban freight but fragmented and suboptimized

4.3. Lesson learned for how to integrate freight transport into city planning

Each case represents a unique way of approaching city planning and urban freight transport. The first case, Oslo, which in administrative terms is a city, a municipality (kommune) and a county municipality (fylkeskommune), represents the traditional way that municipalities have dealt with urban freight transport until recently, namely through formal public planning procedures. The second case, Bodø, which is similarly both a city and a municipality, may be seen a hybrid solution whereby attempts are made to implement logistics as part of more traditional planning procedures. The third case, Trondheim, which is both a city and a municipality, represents a new and more experimental approach to developing urban space. As shown in Table 3 all three approaches have benefits and shortcomings.

To overcome the potential for conflicting goals across different agencies due to own priority areas and fragmentation of responsibilities, *a city logistics plan* seems an effective planning tool to create a stronger link between urban freight transport and the established planning hierarchy. Departments involved in developing the city logistics plan expressed that the process of developing the plan had strengthened their attention to logistics issues when planning for areas and properties development. Also, the initiative to improve processes around public procurement of goods and products is an appropriate planning tool in order to achieve the climate goals.

The need to *involve relevant stakeholders* early in the planning process when developing spatial plans was seen by city officials as being of major importance. In addition to the traditional stakeholders in urban freight also new stakeholders representing waste handling, home-care services, real estate developments, city operations and maintenance and vehicle manufacturers should be involved. The *degree* of stakeholder engagement in the planning process seems crucial to secure embedding freight and logistics concerns in city planning. Through collaborative planning involving stakeholders, levels of possibilities can increase, and conflicts can be reduced. Thus, collaborative planning, such as in hybrid approaches and trial approaches, may be more productive compared with traditional planning processes that to a large degree depend upon expert decision-making with limited public engagement. However, to achieve an efficient planning process, it is important to ensure that design and management is a collaborative process.

Data on local level on mobility trends, travel behaviour and changed shopping patterns were identified as important in order to be able to design, regulate, and allocate urban spaces properly to secure their use for the future. Data relating to which vehicles, what modes, and what spaces were used in the city were seen as particularly crucial, as was information about travel and shopping activities with combined purposes at the individual level, time use and frequency of deliveries, and consumer preferences and willingness to pay for different delivery solutions. Gaining better knowledge about these aspects at a very detailed level is seen as necessary to be able to develop and facilitate a sustainable and attractive new city area.

Planning for one street at a time did not allow for incorporating the impacts of and on neighbouring streets although many large adjustments and changes at street level were made during the project. For instance, at different times i, cycle lanes and outdoor furniture were either included or excluded from the street, access by ordinary cars was restricted, and driving patterns and routes were changed quite frequently. Several users experienced negative impacts on the flow of traffic in the city centre, with poor mobility for certain transport modes such as taxis in search of parking and confusion for visitors. The *changing priorities* within a single street seemed in many instances to be closely related to diverging interests and priorities within the municipality, sometimes as a result of political pressures and to a limited extent based on professional and established planning procedures.

5. Conclusions

Urban freight transport and last mile deliveries are some of the most challenging areas when striving to transition towards sustainable transport and mobility systems (Wygonik and Goodchild, 2018; Wygonik et al., 2015). Compared with private car use, these areas are changing fast, spurred by recent increases in online shopping and changes in consumer patterns. Thus, in this paper we have explored how urban freight transport can be better integrated into city planning. The paper contributes to the literature on the integration of urban freight transport in city planning by examining different planning approaches to handling freight transport concerns in three Norwegian cities, none of which fits easily into previously discussed spatial planning approaches in Norway, such as the *rational comprehensive planning* approach (Faludi, 2000) and the *coordinating sectorial interests and plans* approach.

By studying the three empirical cases that illustrate different approaches to city planning, the analysis has pointed to the way governance structures at the municipality level and adopted planning approaches influence the integration of urban freight transport issues in city planning. The *traditional planning approach* allows for little focus on urban freight transport and is less concerned about freight delivery practices and the importance of this for achieving goals, such as obtaining an active and attractive city centre, partly due to other strategic goals such as the prioritizing the use of low emission vehicles. In the case of Oslo, we found that personal mobility and climate issues were given priority at the expense of urban freight transport concerns that were not clearly rooted in political objectives and goals. In contrast to the traditional approach, the *trial approach* in Trondheim was very flexible. However, this planning approach had a very different dynamic compared with traditional planning approaches, both regarding timing and stakeholder engagement. The trial approach allowed for little time to prepare for changes and the studied trial was characterized by being too narrow in scope, including geographical scope, and therefore fraught with ad hoc political anchoring and sporadic stakeholder engagement that resulted in a fragmented process with suboptimal solutions.

The studied *hybrid approach* in Bodø seemed to represent a middle ground compared with the two other approaches, as it combined more traditional elements with experimental elements: early integration of urban freight transport concerns and broad stakeholder engagement in the planning process were prioritized and supported by flexible timing and the possibilities to make local adjustments along the way. Having a politically approved city logistics plan, and a process in which urban freight transport was integrated at

different level in spatial planning and incorporated into the municipal master plan contributed to make urban freight transport concerns a central element of the city planning in Bodø.

In sum, our analysis revealed the importance of early integration of urban freight transport in city planning and stakeholder involvement in the public planning to improve the decision process and to evaluate the solutions and consequences for urban freight transport in city planning. Lack of knowledge about such issues and little involvement of stakeholders within urban freight transport, as well as lack of planning tools that target freight (including quantitative data) seems to negatively impact the position of urban freight in public planning processes. The analysis also revealed the way different planning approaches gave varying weight to political versus professional considerations with implications for urban freight transport.

The lesson learned from the three different strategic research sites demonstrates the way that different planning approaches contribute to shaping the integration of urban freight transport. Some of the dimensions that seem to shape how freight and logistics are integrated into city planning processes are; political anchorage, geographical scope, participation, and time. The context of the study area as size of the city and the scope for wide- scale planning may also influence and shape the integration of urban freight transport. Possibilities for participation, the experience of a time-consuming processes, complexities in stakeholder landscape and challenges to involve municipalities across departments and agencies and to include relevant private stakeholder may influence the integration and should be paid more attention to in further studies.

Previous research has indicated that private and public stakeholders need to work together to explore measures that suit the local context regarding urban freight transport concerns (Macharis and Kin, 2017; Bjørgen et al., 2019b; Bjørgen et al., 2021). The findings presented in this paper support such claims and demonstrate the importance of each city mapping local challenges to goods movement, while at the same time giving more careful consideration as to which planning approach is best suited for integrating freight and urban logistics. The study highlights the importance of not merely focusing on vehicle technology solutions and imposing restrictions on vehicle weight and size. In order to achieve CO2-free city logistics by 2030, in line with the goals of the EU (European Commission, 2013a; Ministry of Transport and Communication, 2017), integrating urban freight transport into city planning practices may be equally important. Finally, the interaction between urban freight transport and individual travel and consuming behaviour needs to be included in further studies to move the city planning profession forward. Among others to get knowledge about how to handle impacts of e-commerce with increasing last mile activities and to get a broader picture of the mobility patterns transitions in cities.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Ambrosino, G., Liberato, A., Bellini, R., Pettinelli, I., Guerra, S., & Pacini, G., 2015. Guidelines: Developing and implementing a sustainable urban logistics plan. Deliverable in ENCLOSE IEE Project. Available online at: https://www.eltis.org/sites/default/files/trainingmaterials/enclose_d5_2_sulp_methodology_final_version_0.pdf (accessed 10 November, 2020).

Banister, D., 2008. The sustainable mobility paradigm. Transp. Policy 15 (2), 73–80. https://doi.org/10.1016/j.tranpol.2007.10.005.

Banister, D., 2011. Cities, mobility and climate change. J. Transp. Geogr. 19 (6), 1538–1546. https://doi.org/10.1016/j.jtrangeo.2011.03.009.

Banister, D., 2019. City mobility in 2019 - sustainable and smart? In: van Den Berg, L.D., Polak, J.B. (Eds.), Road Pricing in Benelux: Towards an Efficient and Sustainable Use of Road Infrastructure. Theory, Application and Policy, (2nd ed.). BIVEC-GIBET, Brussels, pp. 132–135.

Bjerkan, K.Y., Bjørgen, A., Hjelkrem, O.A., 2020. E-commerce and prevalence of last mile practices. Transp. Res. Procedia 46, 293–300. https://doi.org/10.1016/j.trpro.2020.03.193.

Bjørgen, A., Bjerkan, K.Y., Hjelkrem, O.A., 2019a. E-groceries: Sustainable last mile distribution in city planning. Res. Transp. Econ. 87, 100805 https://doi.org/10.1016/j.retrec.2019.100805.

Bjørgen, A., Seter, H., Kristiansen, T., Pitera, K., 2019b. The potential for coordinated logistics planning at the local level: A Norwegian in-depth study of public and private stakeholders. J. Transp. Geogr. 76 (4), 34–41. https://doi.org/10.1016/j.jtrangeo.2019.02.010.

Bjørgen, A., Fossheim, K., Macharis, C., 2021. How to build stakeholder participation in collaborative urban freight planning. Cities 112, 103149. https://doi.org/10.1016/j.cities.2021.103149.

Bodø Municipality, 2019a. Klima- of Energiplan 2019-2031. https://bodo.kommune.no/sokeresultater/category1045.html?q=klima%20og%20energiplan (last accessed 29 June 2021).

Bodø Municipality, 2019b. Kommunedelplan for ny bydel, Planprogram. https://bodo.kommune.no/kommunedelplan-for-ny-bydel/category2814.html (last accessed 29 June 2021).

Bodø Municipality, 2020. Bylogistikkplan 2020 – 2024. https://bodo.kommune.no/sokeresultater/category1045.html?q=bylogistikkplan (last accessed 29 June 2021).

Bodø Municipality, 2021. Kommuneplanens arealdel 2022–2034. (last accessed 29 June 2021).
Booher, D.E., Innes, J.E., 2002. Network power in collaborative planning. J. Planning Educ. Res. 21 (3), 221–236.
Browne, M., Macharis, C., Sanchez-Diaz, I., Brolinson, M., Billsjö, R., 2017. Urban traffic congestion and freight transport: A comparative assessment of three European cities. Proceedings of the Interdisciplinary Conference on Production, Logistics and Traffic, Darmstadt, Germany.
Browne, M., Behrends, S., Woxenius, J., 2019. Introduction to urban logistics. In: Browne, M., Behrends, S., Woxenius, J., Giuliano, G., Holguin-Veras, J. (Eds.), Urban Logistics: Management, Policy and Innovation in a Rapidly Changing Environment. Kogan Page, London, pp. 3–18.
Bulkeley, H.A., Broto, V.C., Edwards, G.A., 2014. An Urban Politics of Climate Change: Experimentation and the Governing of Socio-technical Transitions. Routledge, Abingdon.
Cárdenas, I., Beckers, J., Vanelslander, T., 2017. E-commerce last-mile in Belgium: Developing an external cost delivery index. Res. Transp. Business & Manage. 24, 123–129. https://doi.org/10.1016/j.rtbm.2017.07.006.
Cherrett, T., Allen, J., McLeod, F., Maynard, S., Hickford, A., Browne, M., 2012. Understanding urban freight activity – key issues for freight planning. Journal of Transport Geography, 24, Supplement C, 22-32. https://doi.org/10.1016/j.jtrangeo.2012.05.008.
Gevaers, R., Van de Voorde, E., Vanelsander, T., 2011a. Characteristics and typology of last-mile logistics from an innovative perspectives in an urban context. In: Macharis, C., Melo, S. (Eds.), City Distribution and Urban Freight Transport: Multiple perspectives. Edward Elgar, Northampton, MA.
Comi, A., Nuzzolo, A., 2016. Exploring the relationships between e-shopping attitudes and urban freight transport. Transp. Res. Procedia 12, 399–412. https://doi.org/10.1016/j.trpro.2016.02.075.
Comi, A., 2020. A modelling framework to forecast urban goods flows. Res. Transp. Econ. 80, 100827 https://doi.org/10.1016/j.retrec.2020.100827.
Comi, A., Savchenko, L., 2021. Last-mile delivering: Analysis of environment-friendly transport. Sustain. Cities Soc. 74, 103213 https://doi.org/10.1016/j.scs.2021.103213.
Cui, J., Dodson, J., Hall, P.V., 2015. Planning for urban freight transport: An overview. Transport Rev. 35 (5), 583–598.
Dablanc, L., 2011. City distribution, a key element of the urban economy: Guidelines for practitioners. In: Macharis, C., Melo, S. (Eds.), City Distribution and Urban Freight Transport: Multiple Perspectives. Edward Elgar, Northampton, MA, pp. 13–36.
Dablanc, L., 2019. E-commerce trends and implications for urban logistics. In: Browne, M., Behrends, S., Woxenius, J., Giuliano, G., Holguin-Veras, J. (Eds.), Urban Logistics. Management, policy and innovation in a rapidly changing environment. Kogan Page, London, pp. 167–195.
Dijk, M., Backhaus, J., Wieser, H., Kemp, R., 2019. Policies tackling the 'web of constraints' on resource efficient practices: The case of mobility. Sustain.: Sci., Practice and Policy 15 (1), 62–81.
European Commission. 2013a. A Call to Action on Urban Logistics. https://smartcities.at/wp-content/uploads/sites/3/A-call-to-action-on-urban-logistics.pdf (accessed 6 June 2021).
European Commission. 2013b. A concept for sustainable urban mobility plans, Annex to the Communication to the European Parliament, the Council, the European Economic and Social Committee of the Regions. COM 913 final.
Fainstein, S.S., 2020. Urban Planning. Encyclopedia Britannica. https://www.britannica.com/topic/urban-planning (accessed 8 March 2021).
Falleth, E., Saglie, I.-L., 2011. Democracy or efficiency: Contradictory national guidelines in urban planning in Norway. Urban Res. & Practice 4 (1), 58–71. https://doi.org/10.1080/17535069.2011.550541.
Faludi, A., 2000. The performance of spatial planning. Planning Practice & Res. 15 (4), 299–318. https://doi.org/10.1080/713691907.
Fossheim, K., Andersen, J., 2017. Plan for sustainable urban logistics–comparing between Scandinavian and UK practices. Eur. Transport Res. Rev. 9 (4), 1–13.
Gatta, V., Marcucci, E., Le Pira, M., 2017. Smart urban freight planning process: Integrating desk, living lab and modelling approaches in decision-making. Eur. Transport Res. Rev. 9, Article 32. https://doi.org/10.1007/s12544-017-0245-9.
Gevaers, R., Van de Voorde, E., Vanelsander, T., 2011b. Characteristics and typology of last-mile logistics from an innovative perspective in an urban context. In: Macharis, C., Melo, S. (Eds.), City Distribution and Urban Freight Transport: Multiple perspectives. Edward Elgar, Northampton, MA.
Geels, Frank W., 2012. A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. J. Transport Geography, 24, 471-482. https://doi.org/10.1016/j.jtrangeo.2012.01.021.
Heitz, A., Dablanc, L., 2019. Freight in urban planning and local policies: results from a new survey in twenty French cities. In: In City Logistics 2019, 11th International Conference on City Logistics, p. 10.
Henriksson, M., Berg, J., Karlsson, J., Rogerson, S., Winslott Hiselius, L., 2018. Köpa mat online? Effekter av ökad e-handel för person-och godstransporter i ett växande e-handelssamhälle. VTI report 977. Statens väg-och transportforskningsinstitut, Linköping.
Hesse, M., 2016. The City as a Terminal: The Urban Context of Logistics and Freight Transport. Transport and Mobility Series, Routledge, Abingdon.
Holsen, T., 2017. Samfunnsplanlegging, arealplanlegging og plangjennomføring. Kart og plan 77 (3), 237–249.
Hopkins, D., McCarthy, A., 2016. Change trends in urban freight delivery: A qualitative inquiry. Geoforum 74, 158–170. https://doi.org/10.1016/j.geoforum.2016.06.006.
Hull, A., 2008. Policy integration: What will it take to achieve more sustainable transport solutions in cities? Transp. Policy 15 (2), 94–103.
IEA, 2021. Net Zero by 2050 Hinges on a Global Push to Increase Energy Efficiency. https://www.iea.org/articles/net-zero-by-2050-hinges-on-a-global-push-to-increase-energy-efficiency (accessed 29 June 2021).
Innes, J.E., Booher, D.E., 1999. Consensus building and complex adaptive systems: A framework for evaluating collaborative planning. J. Am. Planning Assoc. 65 (4), 412–423.
Jaller, M., Pineda, L., Ambrose, H., Kendall, A., 2021. Empirical analysis of the role of incentives in zero-emission last-mile deliveries in California. J. Cleaner Prod. 317, 128353 https://doi.org/10.1016/j.jclepro.2021.128353.
Larsen, A., Van Woensel, T., 2019. Freight, logistics and the delivery of goods in cities. In: Jørgensen, B.H., Andersen, K.K., Nielsen, O.A. (Eds.), Transforming Urban Mobility. DTU International Energy Report 2019. Danmarks Tekniske Universit, Lyngby, pp. 62–71.
Lin, J., Zhou, W., Du, L., 2018. Is on-demand same day package delivery service green? Transp. Res. Part D: Transport Environ. 61, 118–139.
Lindholm, M., Behrends, S., 2012. Challenges in urban freight transport planning – a review in the Baltic Sea Region. J. Transp. Geogr. 22, 129–136. https://doi.org/10.1016/j.jtrangeo.2012.01.001.
Macharis, C., Kin, B., 2017. The 4 A's of sustainable city distribution: Innovative solutions and challenges ahead. Int. J. Sustain. Transp. 11 (2), 59–71.
Macharis, C., Keseru, I., 2018. Rethinking mobility for a human city. Transport Rev. 38 (3), 275–278.
Macharis, C., Milan, L., Verlinde, S., 2014. A stakeholder-based multicriteria evaluation framework for city distribution. Res. Transp. Business & Manage. 11, 75–84.
Maltese, I., Le Pira, M., Marcucci, E., Gatta, V., Evangelinos, C., 2021. Grocery or@ grocery: A stated preference investigation in Rome and Milan. Res. Transp. Econ. https://doi.org/10.1016/j.retrec.2021.101096.
Marcucci, E., Gatta, V., Marciani, M., Cossu, P., 2017a. marcucciMeasuring the effects of an urban freight policy package defined via a collaborative governance model Research in Transportation Economics, 65, pp. 3-9. https://doi.org/10.1016/j.retrec.2017.09.001.
Marcucci, E., Le Pira, M., Gatta, V., Inturri, G., Ignaccolo, M., Pluchino, A., 2017. Simulating participatory urban freight transport policy-making: Accounting for heterogeneous stakeholders' preferences and interaction effects. Transp. Res. Part E: Logistics and Transp. Rev., 103, pp. 69-86.
Marcucci, E., Gatta, V., Le Pira, M., Hansson, L., Bråthen, S., 2020. Digital Twins: A Critical Discussion on Their Potential for Supporting Policy-Making and Planning in Urban Logistics. Sustainability 12.24 (2020): 10623. https://doi.org/10.3390/su122410623.
Marsden, G., Reardon, L. (Eds.), 2018. Governance of the Smart Mobility Transition. Emerald Group, London.
Matusiewicz, M., 2019. SULP (Sustainable Urban Logistics Plan) as a tool for shaping sustainable urban logistics: a review of european projects supporting the creation of sulp. Transport Econ. Logistics 84. https://doi.org/10.26881/etil.2019.84.06.
MDS Transmodal, 2012. DG MOVE European Commission: Study on urban freight transport. Final report https://ec.europa.eu/transport/sites/transport/files/themes/urban/studies/doc/2012-04-urban-freight-transport.pdf.
Ministry of Transport and Communication, 2017. The National Transport Plan (2018-2029). Meld.St. Nr.33, Norway, pp 156. https://www.regjeringen.no/contentassets/7c52fd2938ca42209e4286fe86bb28bd/no/pdfs/stm201620170033000dddpdfs.pdf.

Ministry of Local Government and Modernisation, 2008. Planning and Building Act 2008. https://www.regjeringen.no/en/dokumenter/planning-building-act/id570450/ (accessed 29 June 2021).
Morfoulaki, M., Mikiki, F., Kotoula, N., Myrovali, G., 2015. Integrating city logistics into urban mobility policies. In: 7th International Congress on Transportation Research, pp. 1–14.
Morfoulaki, M., Kotoula, K., Stathacopoulos, A., Mikiki, F., Aifadopoulou, G., 2016. Evaluation of specific policy measures to promote sustainable urban logistics in small-medium sized cities: The case of Serres, Greece. Transp. Res. Procedia 12, 667–678.
Oslo Municipality, 2019. The Car-free Liveability Programme 2019. https://www.oslo.kommune.no/getfile.php/13319592-1553857948/Content/Politics%20and%20administration/City%20development/Car%20free%20city/The%20Car-free%20Livability%20Programme%202019.pdf (accessed 29 June 2021).
Oslo Municipality, 2020a. Climate Strategy for Oslo towards 2030. https://www.klimaoslo.no/wp-content/uploads/sites/88/2020/09/Klimastrategi2030-Kortversjon-ENG_2608_enkeltside.pdf (accessed 29 June 2021).
Oslo Municipality, 2020b. Mer effektiv og klimavennlig vare- og nyttetransport Tiltakspakke 2. https://www.klimaoslo.no/wp-content/uploads/sites/88/2018/09/Mer-effektiv-og-klimavennlig-vare-og-nyttetransport.pdf (accessed 29 June 2021).
Oslo Municipality, 2020c. Utredning nullutslipsoner: Faglig grunnlag for videre arbeid med bestilling. (accessed 29 June 2021).
Pettersson, F., Winslott-Hiselius, L., Koglin, T., 2018. E-commerce and urban planning – comparing knowledge claims in research and planning practice. Urban, Planning and Transport Research 6 (1), 1–21.
Rai, H.B., Verlinde, S., Merckx, J., Macharis, C., 2017. Crowd logistics: An opportunity for more sustainable urban freight transport? Eur. Transport Res. Rev. 9 (3), Article 39.
Ringholm, T., Nyseth, T., Gro, S.H., 2018. Participation according to the law? The research-based knowledge on citizen participation in Norwegian municipal planning. Eur. J. Spatial Dev. 67, 1–20.
Rinkinen, J., Shove, E., Marsden, G., 2020. Conceptualising Demand: A Distinctive Approach to Consumption and Practice. Routledge, Abingdon.
Ryghaug, M., Skjølsvold, T.M., 2021. Pilot Society and the Energy Transition: The Co-shaping of Innovation, Participation and Politics. Springer. eBook. ISBN 978-3-030-61184-2.
Russo, F., Comi, A., 2016. Urban freight transport planning towards green goals: Synthetic environmental evidence from tested results. Sustainability 8 (4). Article 381.
Russo, F., Rindone, C., Panuccio, P., 2016. European plans for the smart city: from theories and rules to logistics test case. Eur. Planning Stud. 24 (9), 1709–1726. https://doi.org/10.1080/09654313.2016.1182120.
Statistics Norway, 2020. Land Use in Urban Settlements. 08459: Area and population of urban settlement (US) 2000 - 2020. https://www.ssb.no/en/statbank/table/04859 (accessed 29 June 2021).
Taylor, N., 2010. What is this thing called spatial planning? An analysis of the British government's view. The Town Planning Review 193–208.
Thagaard, T., 2009. Systematikk og innlevelse: en innføring i kvalitativ metode, Vol. 3. Fagbokforlaget, Bergen.
Trondheim kommune, 2017.Kommunedelplan: Energi og klima 2017-2030. https://www.trondheim.kommune.no/globalassets/10-bilder-og-filer/10-byutvikling/miljoenheten/klima-og-energi/kommunedelplan-energi-og-klima130618.pdf (accessed 29 June 2021).
van Duin, J., Quak, H., 2007. City logistics: A chaos between research and policy making? A review. In: Brebbia C.A. (Ed.), Urban Transport XIII. WIT Transactions on the Built Environment 96. WiT Press, Ashurst, pp. 135-146.
van Duin, J.H.R., Quak, H., Muñuzuri, J. 2010. New challenges for urban consolidation centres: A case study in The Hague. The Sixth International Conference on City Logistics. Procedia - Social and Behav. Sci. 2(3), 6177-6188.
Visser, J., Nemoto, T., Browne, M., 2014. Home delivery and the impacts on urban freight transport: A review. Procedia - Social and Behav. Sci. 125, 15–27. https://doi.org/10.1016/j.sbspro.2014.01.1452.
Wygonik, E., Goodchild, A.V., 2018. Urban form and last-mile goods movement: Factors affecting vehicle miles travelled and emissions. Transp. Res. Part D: Transport and Environ. 61, 217–229.
Wygonik, E., Bassok, A., Goodchild, A., McCormack, E., Carlson, D., 2015. Smart growth and goods movement: Emerging research agendas. J. Urbanism 8 (2), 115–132.

Further reading

Goodchild, A., Ivanov, B., 2017. The Final 50 feet of the urban goods delivery system. https://trid.trb.org/view/1495883.
Maat, K., Konings, R., 2018. Accessibility or innovation? Store shopping trips versus online shopping. Transp. Res. Rec. 2672 (50), 1–10. https://doi.org/10.1177/0361198118794044.
Milbourne, P., Kitchen, L., 2014. Rural mobilities: Connecting movement and fixity in rural places. J. Rural Stud. 34, 326–336. https://doi.org/10.1016/j.jrurstud.2014.01.004.
Ministry of Local Government and Modernisation, 2012. Kommuneplanens arealdel. Utarbeiding og innhold. Veileder T-1491. Oslo.
Rummelhoff, V., 2021. Utvikling innen B2C og B2B netthandel. https://www.postnord.no/globalassets/norge/3.-tips-og-rad/3.2-netthandelsbarometeret/netthandel-2020-og-fremover—rapport/netthandel–2020-og-fremover.pdf (accessed 29 June 2021).
Schwanen, T., 2016. Geographies of transport I: Reinventing a field? Prog. Hum. Geogr. 40 (1), 126–137.