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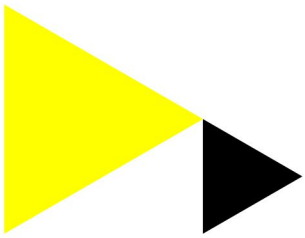

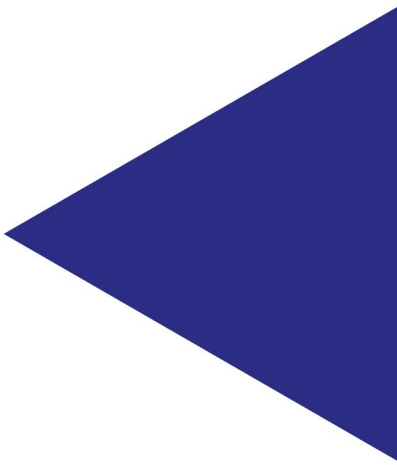

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Governance models for sustainable urban construction logistics: barriers for collaboration

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Abstract

Urban construction logistics has a big impact on cities. The topic of this paper is governance strategies for realising more sustainable urban construction logistics. Although not much research has been done in the field of governance of construction logistics, several authors have stressed the fragmented nature of the construction industry and the importance of collaboration in urban construction logistics as issues. A literature review was done to identify the barriers in collaboration. Based on these barriers the research objective was to determine which drivers for collaborative governance are needed to improve urban construction logistics. The methods for data collection were semi-structured interviews and a focus group. The collaborative governance model is applied as a strategy to overcome the barriers in collaboration and governance identified. Key findings are both formal and informal barriers hinder the governance of construction logistics. Based on a collaborative governance model we identified four for improving collaborative governance.

Keywords: construction logistics, city logistics, public procurement, tendering, governance

1. Introduction

The growth in urban population and economic upturn is leading to higher demand for construction, repair and renovation works in cities. Houses, public utilities, retail spaces, offices and infrastructure need to adapt to cope with

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the increasing number of residents and visitors, urban functions and changing construction standards (e.g. energy efficiency). Construction projects contribute to more attractive, sustainable and economically viable cities once finished. Construction logistics is often overlooked when construction activities are planned (Balm, Berden, Morel & Ploos van Amstel, 2018).

Transport activities related to construction works have negative impacts. CE Delft (Otten, Meerwaldt & Den Boer, 2016) reported that 25% of GHG emissions in Dutch city logistics is related to construction logistics and 15 to 20 percent of heavy goods vehicles is related to construction, and 30 to 40 percent of light commercial vans (excluding construction waste). Large trucks and light commercial vehicles arriving at and leaving from construction sites result in unsafety, noise and air pollution and lead to mobility problems for residents, visitors and businesses near the construction site. Material deliveries to construction sites need to be coordinated and managed in ways that reduce their impact on the urban transport system and at the same time ensuring efficient construction projects (Janné, 2018). Smarter, cleaner and safer construction solutions must be implemented for environmental, societal and economic reasons. Construction companies implementing sustainable logistics concepts show a reduction of logistic costs, less congestion around their sites and improved productivity and safety (Van Merrienboer, 2013; Janné, 2018; De Bes et al., 2018).

The goal for construction projects is to deliver the project on time, within budget to the stipulated quality. The construction industry is producing its end products (the house or infrastructure) from vast amounts of materials that must be delivered to the place of consumption (Ekeskär & Rudberg, 2016; Thunberg, Rudberg & Karrbom Gustavsson, 2017). The construction industry is greatly dependent on materials arriving to site when needed (Lindén & Josephson, 2013).

Construction logistics is defined as dealing with supplying the right materials to the correct customer and construction site to meet customers' requirements (Janné, 2018). Primary actors in this process are construction companies, suppliers, logistics service providers and clients. Construction logistics also has an impact on local schools, residents, local authorities and others. Sustainable construction logistics in urban areas faces two problems; the urban transport problem and the problem of coordinating multiple construction actors (Janné, 2018).

There are different sustainable construction logistic solutions, but they are often not implemented (SUCCESS, 2017; De Bes et al., 2018; Janné, 2018); e.g. logistics hubs, transport over water and electric vehicles. While technical solutions for sustainable construction logistics are available, the implementation is not obvious. A reason for this is that the benefits of these solutions in terms of reducing costs, emissions and time are not always evident to all actors involved (Lundesjö, 2015). In addition, actors need to decide on these solutions early in the process to plan for adequate space and resources. Collaboration between actors in the construction supply chain is essential for improving construction logistics but not easy to establish (De Bes et al., 2018; Janné, 2018).

The fragmented nature of the decision-making process, the governance, adds to this complexity. Governance is defined here as the set of decisions, actors, processes, institutional structures and mechanisms, including the division of authority, responsibilities, underlying norms and information-flows, involved in determining a course of action (Moser, 2009). Although not much research has been carried out in the field of governance of construction logistics, several authors have stressed the fragmented nature of the construction industry (Lundesjö, 2015; Sundquist, Gadde & Hulthén, 2018) and the importance of collaboration to achieve more efficient and sustainable urban construction logistics processes.

BIM (Building Information Model) can be used as an integrated product model for industrialized construction, to achieve collaborative work between participating units, and information sharing. BIM might improve the efficiency of the construction process, enhances the role of product information, and creates an information-based environment (Whitlock et. al. 2018). However, there is lack of collaboration and data sharing in the construction supply chain despite the implementation of BIM and standardised product data in many construction companies (Ying et. al., 2014; Kumar & Chang, 2015; Janné, 2018; Whitlock et. al. 2018; Deng, et. al., 2019). Future research work should focus on extending planning frameworks to account for varying degrees of complexity in materials and site layout management.

The research question was to determine which drivers for collaborative governance are needed to improve urban construction logistics. The challenge is to keep the community around constructions sites an attractive and safe place to work, live and visit while improving energy efficiency and productivity of construction projects at the same time.

2. CIVIC research project

The work that is presented in this paper, is part of the CIVIC project (2016-2018), funded within the JPI Urban Europe ENSCC call. The goal of the CIVIC project was to facilitate and support efficient and sustainable transport to, from and around urban construction sites that minimises inconvenience for the surrounding community, improves construction productivity and optimises energy efficiency. The consortium consists of partners from Belgium, The Netherlands, Sweden and Austria and explored cases in five cities. CIVIC found that the impact of construction works on mobility and liveability of a city was only a very limited part of the urban planning in Amsterdam, Vienna, Brussels, Stockholm and Gothenburg. This paper presents results from research in Amsterdam.

Barriers in processes of collaboration

Literature on barriers in collaboration in the construction industry is often focused on supply-chain management, supplier-contractor collaboration or partnering. Bemelmans et al. (2011) carried out a literature review of 50 articles on supplier-contractor collaboration in the construction industry. Barriers to supplier-contractor collaboration in these articles discussed were: a lack of top management commitment, poor understanding of the concept, an inappropriate organizational structure to cope with the concept and a lack of belief that there are mutual benefits (Bemelmans et al., 2011). Gadde and Dubois (2010) identified further problems with the concept of 'partnering'. Partnering is defined as: 'a long-term commitment between two or more organizations for the purposes of achieving specific business objectives by maximizing the effectiveness of each participant's resources' (Gadde and Dubois, 2010, 256). According to them this can only be achieved through a shared culture without regard to organisational boundaries, a relationship that is based on trust, a dedication to common goals and an understanding of each other's individual expectation and values. *Lack of trust, organisational boundaries* and *conflicting objectives and values* are noticeable barriers here.

Richey, Roath, Whipple & Fawcett (2010) identified several barriers and facilitators in supply chain management based on literature review. Supply chain management concerns 'the integration of business processes that span the spectrum from the raw material extractor to the end user to provide product' (Richey et al. 2010, 238). This objective of this integration is achieving operational efficiencies and strategic effectiveness in the supply chain through collaboration. According to them, supply chain integration requires both *harder* and *softer* aspects. New learning capabilities such as information technology, skills and knowledge and performance measures, i.e. positive results that motivate the continuation for change are amongst the harder aspects. Differences in social norms (cooperative versus adversarial relationships) and lack of awareness of the positive results on the change are the softer aspects (Richey et al., 2010). *Lack of awareness, differing social norms* and *lack of knowledge* are important barriers in collaboration.

These barriers are mostly limited to the processes within the supply chain, either in one firm or organization and across firms, leaving the role of the public authorities out. According to Klijn and Teisman (2003) institutional structures in public private partnerships can form barriers for collaboration. Especially the demarcations in domains challenges cross-sectoral collaborations, but also the multiplicity of actors and the different value systems among public and private actors that lead to different strategies as well (Klijn and Teisman 2003). We see here an overlap with the earlier mentioned barriers of *organisational boundaries (demarcations in domains)* and *conflicting value systems (i.e. differing social norms)*.

Collaborative governance

A collaborative governance model is applied in the research as a strategy to understand barriers in improving the governance of urban construction logistics. Collaborative governance is frequently advocated because of its potential to transform the context of a complex situation or issue. While still different definitions exist, the definition given by Emerson, Nabatchi & Balogh (2012) is used here. Collaborative governance is defined as 'the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres to carry out a public purpose that could not otherwise be accomplished' (Emerson et al., 2012, 2). Emerson et al. (2012) have set out an extensive framework on collaborative governance that can be used to study collaborative governance, as a whole, or to focus on its various components and/or elements, while facilitating interdisciplinary research on complex multilevel systems (Emerson et al., 2012).

This integrative framework for collaborative governance (figure 1) consists of three dimensions; the general system context, the collaborative governance regime (CGR), and its collaborative dynamics and actions. The surrounding system context consists of political, legal, socioeconomic, environmental and other influences that affect and are

affected by the CGR. From this system context either constraints or opportunities emerge that can influence the collaboration. Drivers, such as leadership, consequential incentives, interdependence and uncertainty are needed to initiate and develop the CGR. (Emerson et al., 2012). To keep the collaboration going, collaborative dynamics are necessary to produce collaborative actions that work towards the shared objective of the collaboration. Collaborative actions can be perceived as interventions or experiments. These actions can lead to concrete results (outcomes) and the transformation of the issue (potential adaptation). Evaluation and monitoring of the actions than lead to a better understanding of the problem at hand as well as provide feedback into the potential solutions and change of the governance structures (Emerson et al., 2012). In this research, we reflect on the drivers that are needed for collaboration to start.

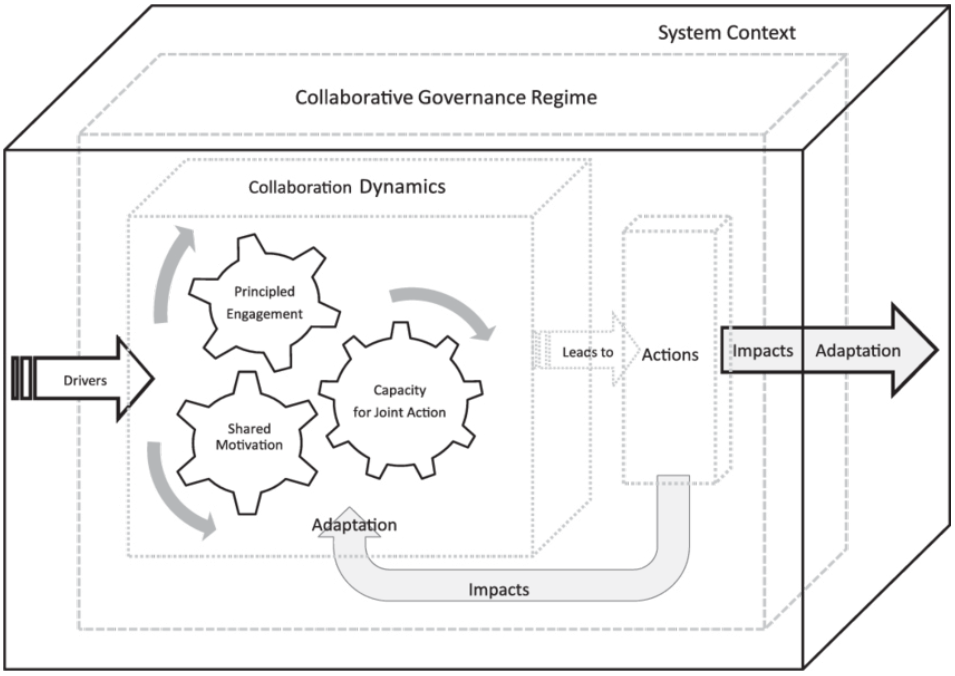

Fig. 1. The integrative framework for collaborative governance (Emerson et al. 2012).

3. Methods

This research is a qualitative explorative research and is practice-oriented. The research design is a case study. Yin (1984) defines the case study research method "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not evident; and in which multiple sources of evidence are used." The case in this research is the decision process of construction logistics in the City of Amsterdam (Balm et. al, 2018).

The research focuses on larger public construction projects. The tender value of the projects is above € 5.548K. Public tendering is obligated for these projects. European legislation for tendering requires public clients to use EMAT-criteria. Construction projects where the client is a private entity are not obligated to use EMAT-criteria due to freedom of contract. The EMAT-criteria can be used to stimulate innovation in construction logistics (Parikka-Alhola & Nissinen, 2012; Balm & Ploos van Amstel, 2017).

The methods for data collection have been semi-structured interviews and one focus group (workshop). The interviews were conducted in 2016 and 2017. In total 36 interviews were conducted with public authorities (18 interviews) and private actors (18 interviews). The respondents were selected following the planning and development process of construction projects (Balm et. al, 2018). Inductive analysis was performed using sensitizing concepts based on a literature review on barriers in processes of collaboration. This research is conducted to determine the nature of the problem and help in having a better understanding of the problem, to be able to make recommendations for

improving the governance of construction logistics.

The interviews were analysed in MAXQDA. MAXQDA is a software program designed for computer-assisted qualitative data and is used in academic and business institutions. The emphasis on qualitative research can be observed in the extensive attributes function and the ability of the programme to deal relatively quickly with larger numbers of interviews.

After conducting the interviews, a workshop was organized with public authorities, research institutes, contractors, supply chain actors and industry network organisations to validate and discuss the results. In contrast to the explorative character of the interviews, the goal of the workshop was to *identify* the main drivers to co-create strategies to solve the barriers. In total, 27 respondents attended this workshop.

4. Results

Based on the interviews we have identified barriers for Amsterdam. The formal barriers refer to instruments that the municipality of Amsterdam currently uses. These are regulation and legislation, land allocation, coordination framework, environmental plans (BLVC), tendering, monitoring and permits (Bork, 2018). The informal barriers refer to perceptions, awareness, behaviours and framing regarding decision making for innovative solutions in the municipality of Amsterdam. Based on the interviews and the workshop with the focus group and the collaborative governance model, we identified which drivers are apparent and which dynamics are needed for collaborative actions. This provides the first steps in creating a strategy to overcome the identified barriers and improving the governance of construction logistics for which the CIVIC-handbook created guidelines (Balm et al., 2018).

Formal barriers

Political agenda: Construction logistics is not on the political agenda in Amsterdam. A *political agenda* represents topics or problems to which government officials focus attention. Despite the further densification in urban areas little political attention focused on urban construction logistics (in 2017).

Lack of direction: Because of the absence of a strong political agenda, construction logistics is not an important policy goal (as a part of SUMP or SULP) and there is no clear direction on the strategic level of public decision making in the City of Amsterdam. Because there is not a general city program on ‘good construction logistics’, guidelines for construction logistics are only for a limited number of projects. A lack of direction is also witnessed in the private sector. The construction supply chain is characterized as fragmented and, therefore, there is no actor that is responsible for innovation in construction logistics. This lack of direction from senior or strategic level hinders innovation and cross-sectoral collaboration as public and private actors fall back on traditional working processes.

Functional silos and domain demarcation: Individual departments tend to act as a stand-alone function and formulate own strategies and work plans, in parallel with other functions. The planning process consists of actors and departments that need to function as one to implement policies for construction logistics into practice. The planning process and the construction process consists of functional silos that act autonomously and individually. Due to the variety of actors and instruments, it is difficult for public and private actors to find the right information.

Inadequate instruments and policies: A barrier is found in a separation between policy and practice. As the planning and execution of construction projects might be managed adequately in policies, the execution of these policies is characterized as chaotic. The relevant policies are not evaluated and, therefore, the lessons learned are not being integrated into new policies. A lack of understanding the effectiveness of instruments and policies are a barrier for collaboration.

Poor information systems: There is little information available regarding future construction urban freight flows in Amsterdam and the impact of innovative solutions for construction logistics. In the public sector, there are models forecasting construction logistics flows, but they are not used for traffic planning purposes. Information systems for construction logistics in the private sector are improving with 4D BIM, but an agreement about communication and sharing data is lacking. Poor information systems are a barrier for collaboration; not able to make flows and cost visible to stakerholders.

Informal barriers

Lack of sense of urgency. There is a lack of sense of urgency in the private sector regarding collaboration for innovation in construction logistics. The urgency for private actors is stimulated by physical restrictions in the area *or* possibilities for new business opportunities (new tenders). Transport of construction material is still relative cheap when it is compared to the construction budget and logistics costs are an invisible part of the duty-delivery-paid purchase costs of materials. Consequently, the costs for an innovative solution are for the contractor, the subcontractors and/or suppliers might actually benefit. To work in innovations, dialogues between contractors, subcontractors and suppliers are necessary about costs and benefits. Due to the lack of a business case, there is no urgency for the contractor to develop innovative solutions. Private actors see a role for *governance*, for example by setting clear and widely supported objectives for construction logistics on the area or city level (e.g. low emission zones).

Conflicting goals and values. Conflicting goals between the public and private actors are identified. As the public actors strive to maximize the profits on building lots and private actors strive to build the project at the lowest costs. Issues arise when legislation is developed regarding construction logistics. Construction logistics solutions require an initial investment by contractors, and this increases the price of the construction project and, therefore, decreases the price of the building lot. Goals and values are contradicting between departments of public actors. The land allocation department strives to maximize the value of the building lot, and due to this, issues arise regarding legislation for e.g. safety during the tender phase. Contradicting goals and values are also present in departments of private actors. As the goal of the biding department is to produce a competitive bid, the procurement and preparation department is focused on arranging the material needs for the construction process at the lowest price. Innovation in construction logistics will might result into efficiency (e.g. due to standardization of processes) but will also result in complexity due to new risks, responsibilities, and tasks. As private actors can be risk-averse, innovations are not valued as beneficial. This is a barrier, because goals and values need to be aligned to create integrated solutions.

Lack of trust among direct actors involved. There is a lack of trust between the public and private actors. New actors need to be involved early in the process because innovative solutions require a new arrangement of risks, responsibilities, costs, and benefits. Because the impact of innovative construction is not proven, trust is a necessity for collaborations. There is a lack of trust due to the conservative mindset of private and public actors. In the private sector, there is a fear in showing business models of contractors, subcontractors, wholesaler, and suppliers. This might result in problems when innovation solutions are developed.

Lack of communication and sharing information. The lack of communication is a barrier, when agreements need to be made about risks, responsibilities, costs, and benefits for the innovative solution. There is a lack of communication between different departments within the municipality and, therefore, relevant information is not shared. Reasons for a lack of communication and data sharing are functional silos, the presence of temporary project consultants, and even the geographical locations of departments. A lack of communication between public and private actors is observed due to EMAT- legislation, as it is not possible for the public client to have multiple dialogues with contractors. A lack of communication is also observed between contractors and suppliers. Collaboration depends on the level of engagement, and communication is needed to validate the accuracy of the innovation.

Insufficient knowledge of the other function. A lack of communication result in a lack in knowledge of other functions. Knowledge of various actors and departments is necessary for establishing collaboration for construction logistics solutions. Knowledge about working processes of the different public- private actors (and their departments) are needed because innovations result into different risks, responsibilities, and tasks. Knowledge about why initiatives do not come in practice is missing. A barrier is observed due to a separation between public policy making and construction processes.

5. Conclusion

To provide an answer on the main question ‘how can governance strategies be improved to better cope with the current barriers in collaboration for innovation in construction logistics?’ we reflect on the four drivers from the collaborative governance model (Emerson et.al. 2012). According to the collaborative governance model, one or more of the drivers

are necessary for a collaboration to start as seems to be the case in our research.

Leadership. The lack of direction and sense of urgency results in the absence of a 'leader'. Leadership can be a leading authority or instrument that guides public and private actors in executing innovation in construction logistics. Due to the multiplicity of internal and external actors and construction projects, there is a need for a leading authority or instrument to whom these actors can refer to when innovative solutions are created. Local authorities can authorize an independent authority to facilitate the collaboration process.

Consequential incentives refer to either internal (problems, resource needs, interests or opportunities) or external (situational or institutional crises, threats or opportunities) drivers for collaborative action. Such incentives are consequential in that the presenting issues are salient to participants, the timing or pressure for solutions is ripe and the absence of attention to the incentives may have negative impacts. These incentives are there but have not yet been acknowledged by all actors involved.

Interdependence between public and private actors - but mostly the acknowledgment of – is crucial for collaboration. This interdependence results in a collaboration between departments within the multiplicity of public actors, private actors and between public and private actors. Although the interdependence is high, it is not always acknowledged as such. Instruments are frequently non-participatory and are focused on managing the specific phase of the project on department goals (time, costs and risks). A holistic view, from city planning to the construction site, is a necessity.

Uncertainty about the problem and its possible solutions. Knowing that one party cannot solve the problem on its own drives different actors to work together. One of the identified barriers in the governance shows the need for different actors to start sharing knowledge and data between public and private actors. A collaboration ethic of sharing data regarding costs, benefits, and risks of innovative solutions is needed to create innovative solutions. Constructive communication between public and private actors, public authority, and private actors within the supply chain is a necessity.

After conducting this research, several research recommendations can be made. The first recommendation is to create living labs to test construction logistics solutions for a longer period. The focus needs to be on the benefits of these solutions (e.g. CO_2 reduction, safety, costs) and to create more awareness on the issue of construction logistics and the necessity for more collaboration. Second, more research is needed regarding procurement possibilities and EMAT-criteria to stimulate innovations in construction logistics and monitor these solutions in practice.

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