WP4: Smart Governance

Deliverable 4.1: Evaluation of Smart Governance 1.0

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MIMIC Deliverable 4.1

Evaluation of Smart Governance Process 1.0

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Table of contents

1. Introduction

The purpose of MIMIC is to demonstrate how Smart Governance concepts can be used as an aid in the construction and city planning processes to facilitate and support logistics to, from and on urban construction sites to improve mobility and reduce congestion within cities and thereby reduce the negative impact of construction logistics on the surrounding environment and community. The MIMIC project integrates research within construction logistics, construction management, city logistics, policy framework, sustainability, and optimization of flows, with the goal of developing the Smart Governance Concept 2.0. This concept provides the implementation partners (cities and companies in the construction process and supply chain) with a set of tools organized into a supportive platform for construction logistics issues in the urban development decision and procurement processes (D4.2 and D4.3). The tools help to increase the knowledge of construction logistics (D1.3), collecting stakeholder needs and criteria of construction logistics scenarios (D1.1, D1.2 and D1.4), and to evaluate the impact of construction logistics solutions on different stakeholders (D2.2, D2.3, D3.1, D3.2 and D3.3).

The Smart Governance Concept 2.0 is based on the Smart Governance Concept 1.0 developed in the CIVIC project (Fredriksson *et al.*, 2018). The Smart Governance Concept 1.0 was a first attempt to support the inclusion of construction logistics planning in the construction project planning on a city level. The goal of this deliverable is to identify how the Smart Governance Concept 1.0, needs to be further developed to fit within the scope of the Smart Governance Concept 2.0 development under the MIMIC project.

2. Smart Governance Concept 1.0

The goal of the CIVIC project was to facilitate and support efficient, sustainable, and broadly endorsed transport to, from, on, and around urban construction sites that minimises disruption in surrounding communities, improves construction productivity, and optimises energy efficiency. The CIVIC project found that the impact of construction works on mobility in and liveability of a city was only considered to a very limited degree in the urban planning of the cities studied: Amsterdam, Vienna, Brussels, Stockholm and Gothenburg.

The CIVIC project developed a handbook for local governments, clients, developers, contractors, or any other type of actor that can influence logistics planning and the setup of construction projects. The project aimed to help local governments in collaborating with private partners to realise more sustainable and safer construction work with less inconvenience and cleaner air. In addition, it also aimed at helping clients, developers, and contractors to ensure smooth and efficient construction operations. The developed handbook provides a description of the challenges of urban construction logistics and the governance of construction logistics. It also presents the Smart Governance Concept 1.0 developed during the CIVIC project, combining different tools to improve construction logistics and its governance.

The Smart Governance Concept 1.0 (see Figure 1) can be used on two levels: the city level and the project level. On a city level, a sense of shared ownership and urgency should be created to optimise construction logistics on the project level. This is the first step of the concept. Steps 2 to 6 outline different tools and methods for the development of a construction logistics solution: in step 2, a conceptual solution is required to create a common understanding of the prerequisites for the specific construction project and possible methods for organising logistics. Step 3 entails the different instruments, policies, and guidelines that are needed for creating the formal conditions for the solution. In step 4, the specific stakeholders are involved to identify important criteria that influence the selection of the final solution. Step 5 then aims to select the final solution by providing cost calculations and traffic optimisation models. Step 6 entails the collection of data and follow-ups of KPIs. Finally, step 7 regards the evaluation of the different projects that feed back into the continuous development process of the optimisation of construction logistics at a city level. This final step is presented together with step 1 since these both concern the city level.

The Smart Governance Concept should be part of development/construction projects from the very beginning, i.e., from the planning phase.

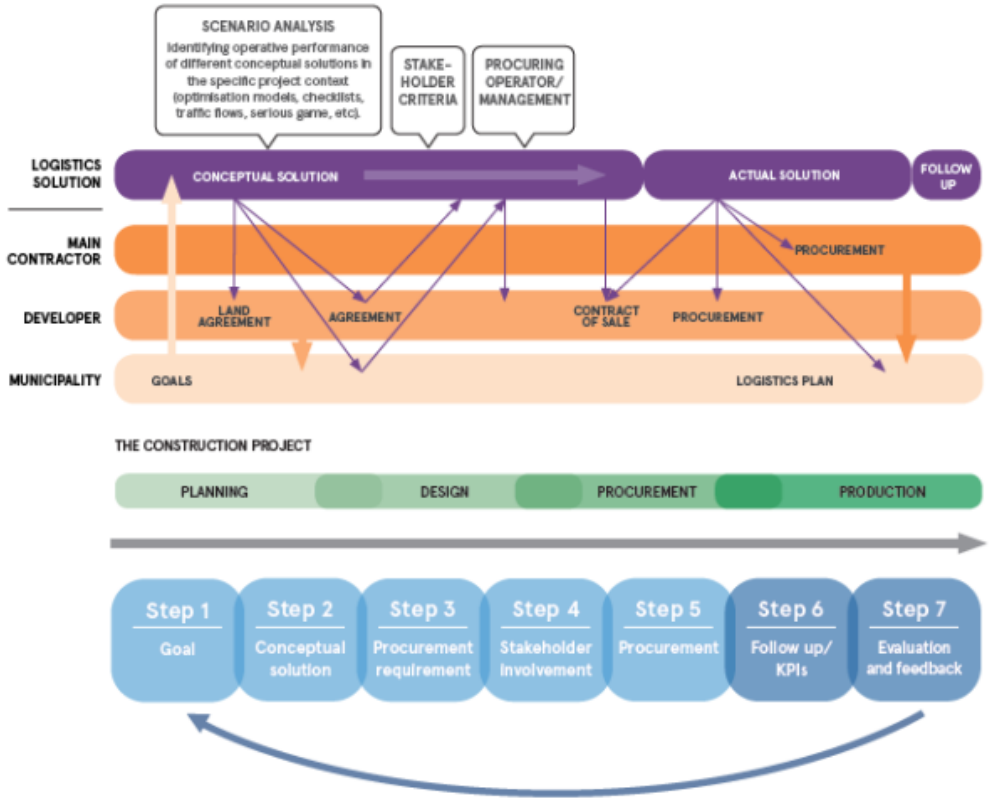

Figure 1 - Smart Governance Concept 1.0 (Fredriksson et al., 2018)

During and after the CIVIC project, the Smart Governance Concept 1.0 has been presented to possible users on several occasions. During these presentations, several difficulties relating to applying the concept have been experienced.

1. It is difficult to see which actor has the lead of the development of a construction logistics setup as the project evolves.
2. It is difficult to see decision gates, i.e. where and when decisions have been made or should be made.
3. It is difficult to see the output of applying the concept and the output is only considered on two levels; the city and the project levels.
4. It is unclear what the scenario analysis entails.
5. The steps provide a too linear process; in reality the development process is iterative.
6. The format of agreements, contracts and legal frameworks are not clarified, nor is it clear when agreements and contracts are introduced in the process.

3. Evaluation of Smart Governance Concept 1.0

Based on the uncertainties identified, an evaluation of the Smart Governance Concept 1.0 was performed in the MIMIC project. The evaluation took place at the consortium meeting in Oslo, October 2019, and has been further elaborated by Anna Fredriksson, Linköping University and Monica Billger, Chalmers University of Technology. During the consortium meeting in Oslo the Smart Governance Concept was discussed in a workshop to capture the uncertainties and challenges of implementing it. In the workshop, four main challenges were identified, marked in Figure 2 with numbers 1-4, and further explained below.

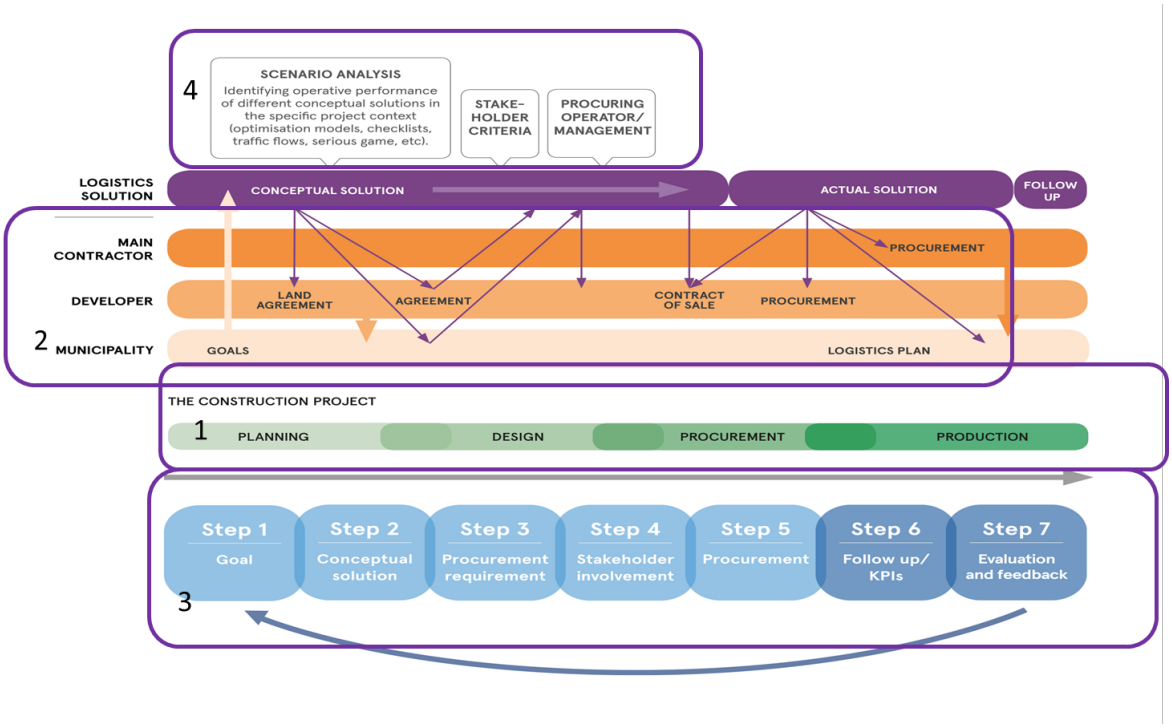

Figure 2 - Identification of the improvement areas within the Smart Governance Concept 1.0

3.1 Introduce planning levels and gates

Looking at the construction project there is a need to ensure that decisions are taken during the project. As the concept is presented now it lacks gates and it also lack a connection to the planning hiearchy introduced in D1.1. Gates have previously been used in construction planning, see Figure 4 (Mejlænder-Larsen et al., 2016). The suggestion is to add some types of gates to the Smart Governance Concept and to coordinate these with the planning levels and thereby handle the issue of only two levels (city and project level) of the Smart Governance Concept 1.0, see Figure 8.

3.1.1 Planning levels and gates in the supply process

Planning in construction logistics can be perceived as hierarchical, with processes at three planning levels: strategic, tactical and operative (Thunberg and Fredriksson, 2018). These planning levels have different horizons, planning objects and frequencies (Jonsson and Mattsson, 2009). Strategic planning has a long-term horizon and sets the boundaries for the mid-term horizon tactical planning, which, in turn, sets the boundaries for the short-term horizon operative planning. One major caveat here is that the supply process and the construction process have

different foci; the construction process focuses on finalizing the project and is seldom seen as part of the supply chain and the supply process. The supply process, on the other hand, places the material flow into a wider scope with multiple tiers of suppliers in the supply chain before the material flows reach the construction site. This is illustrated in Figure 3 where the Smart Governance Concept 1.0 is placed into the project/supply process framework of Friblick (2000). Looking at the Smart Governance Concept 1.0 in this way shows that some aspects, e.g., designing the conceptual setup, is more closely linked to the construction process, whereas the actual implemented setup affects the materials flows once the construction project enters the procurement and production phases. This implies that even though the logistics setup will affect the operations of the supply process, the scope of the setup (strategic level) and the decided setup (tactical level) has to be decided before the supply process is fully operational.

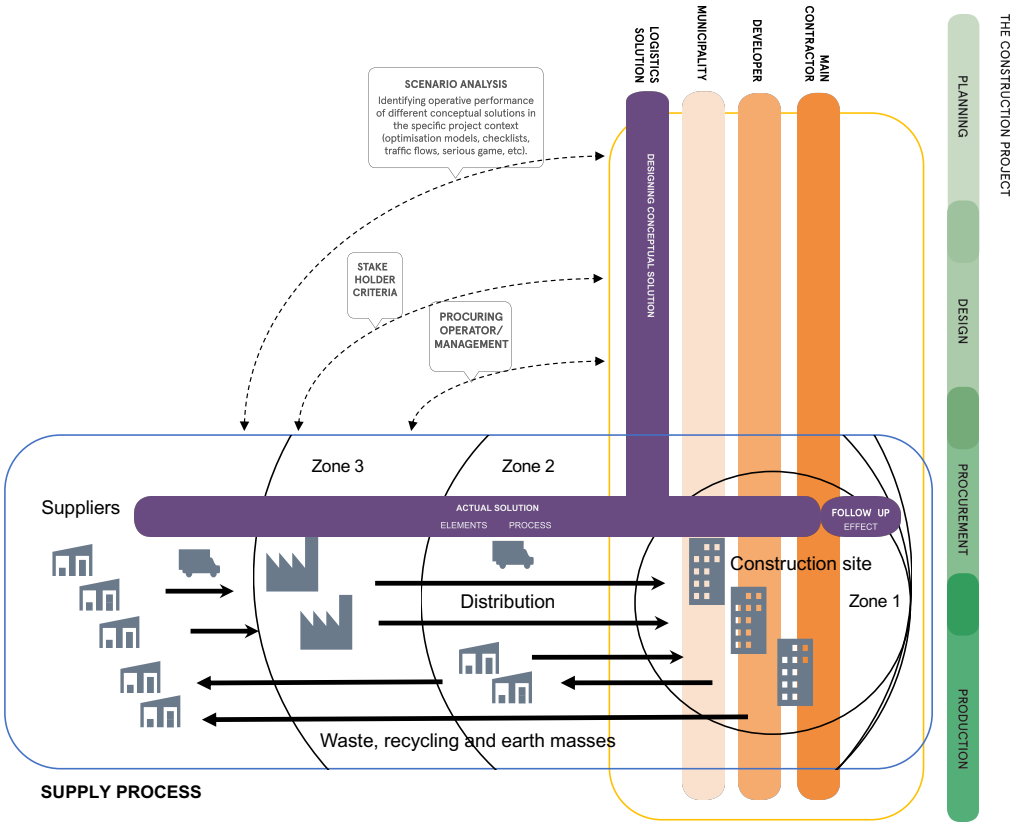

Figure 3 - Smart Governance Concept 1.0 in Friblick's framework of project/supply processes (Friblick, 2000)

3.1.2 Planning levels and gates in the construction process

In the construction industry each actor has its own execution model documenting an ideal internal workflow for project execution. These models are usually different, arranged to ensure the needs of each individual actor in a construction project. Such execution models do not necessarily incorporate Building Information Modelling (BIM) supportive measures, nor do they usually support comprehensive collaboration or common goals. This, however, is often necessary in order to meet changes in framework conditions and increased project complexity in the construction industry, especially related to an increased focus on construction supply chain management (Thunberg and Fredriksson, 2018).

The project SAMBIM (Mejlænder-Larsen et al., 2016, figure 3) developed a mutual project execution model in which the principal needs of each individual actor and the collaboration

between actors were attended to, as collaboration was seen as a major driving force for a more efficient project execution.

If both cross-level and cross-actor BIM aspects were incorporated into the models, it would most likely cover the shortcomings of present execution models. All actors would have a common understanding and work towards consensus goals. Aspects describing different execution models and related research findings are at hand, both at national and international levels. Few research results are however pointing to the specific challenges of the actors when collaborating in BIM projects, and of their approaches to the use of individual execution models.

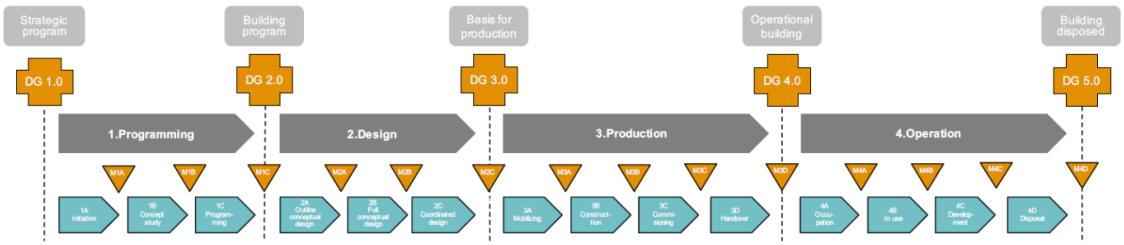

Figure 4 - Suggestion of how to use gates in construction planning (Mejlænder-Larsen et al., 2016)

The RIBA Plan of Work is a framework that organises the process of briefing, designing, delivering, maintaining, operating and using a building into eight stages. It covers all disciplines within construction projects and and is meant as guidance for the preparation of detailed professional services and building contracts. The RIBA Plan of Work is published by the Royal Institute of British Architects (RIBA). According to its home page, the RIBA Plan of Work is "split into a number of key project stages", and it "provides a shared framework for design and construction that offers both a process map and a management tool" (www.architecture.com). In the RIBA Plan of work 2020 (see figure 5), “Finalising Site Logistics” is added as a task under stage 5 “Manufacturing and construction”. Otherwise, logistics is not specifically mentioned under any of the stages and tasks. Also, emissions reductions, waste management etc are not specifically mentioned tasks. Presumably these issues sort under "sustainability", "client requirements", or "site appraisal of planning considerations". There are several different other initiatives of designing process- or execution models at an international scale, in which emission reductions, waste management, mobility and transportation etc. do not seem to have been established as individual focus areas or allocated to designated pre-existing focus areas.

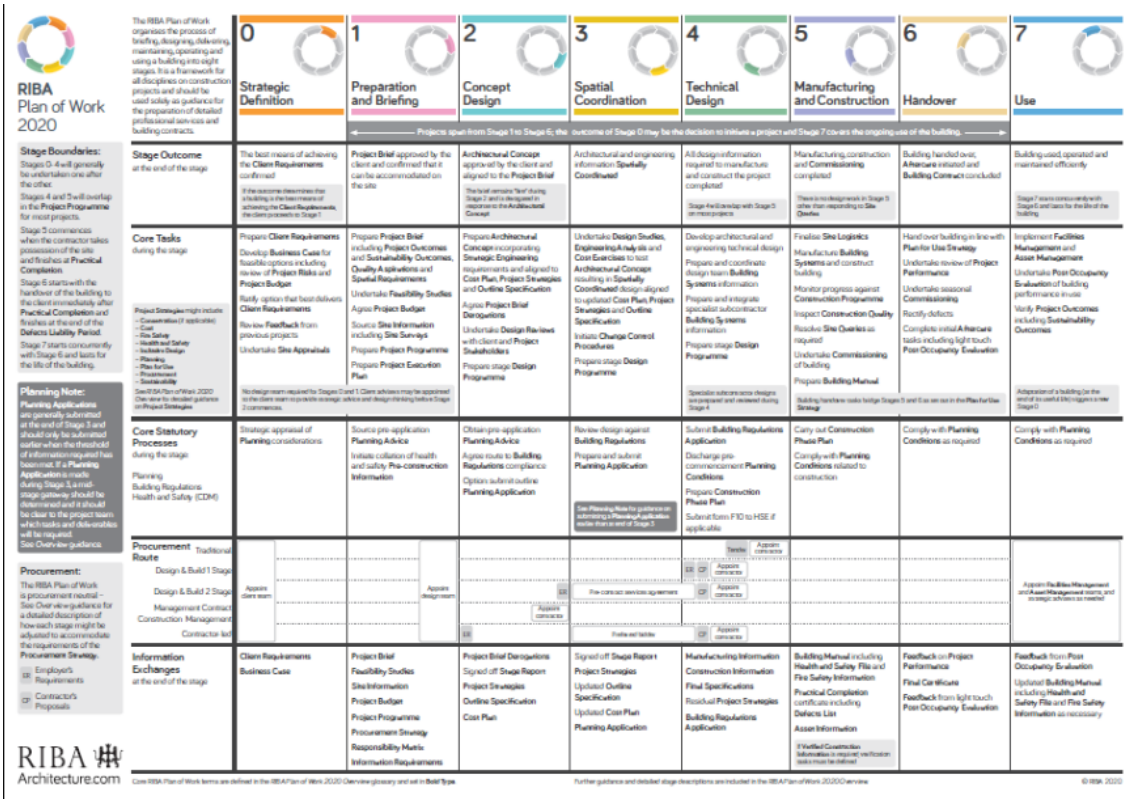

Figure 5 - The RIBA Plan of work (www.architecture.com)

3.1.3 Combining planning levels and gates in the Smart Governance concept

To summarize the above discussion, there is a need to introduce the planning levels from (1) the construction supply chain planning and management area and (2) the gates from the construction project planning and management area into the Smart Governance 2.0.

Deliverable 1.1 presented two figures on the output of the different planning levels (see Figure 6) and the link between the construction phases and the planning levels (see Figure 7).

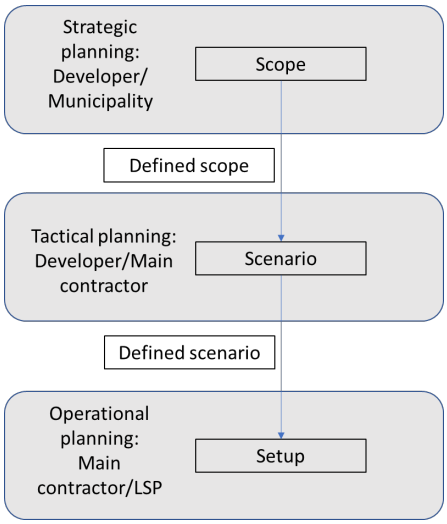

Figure 6 - Relationship between scope, scenario, and setup in the Smart Governance Concept – from D1.1

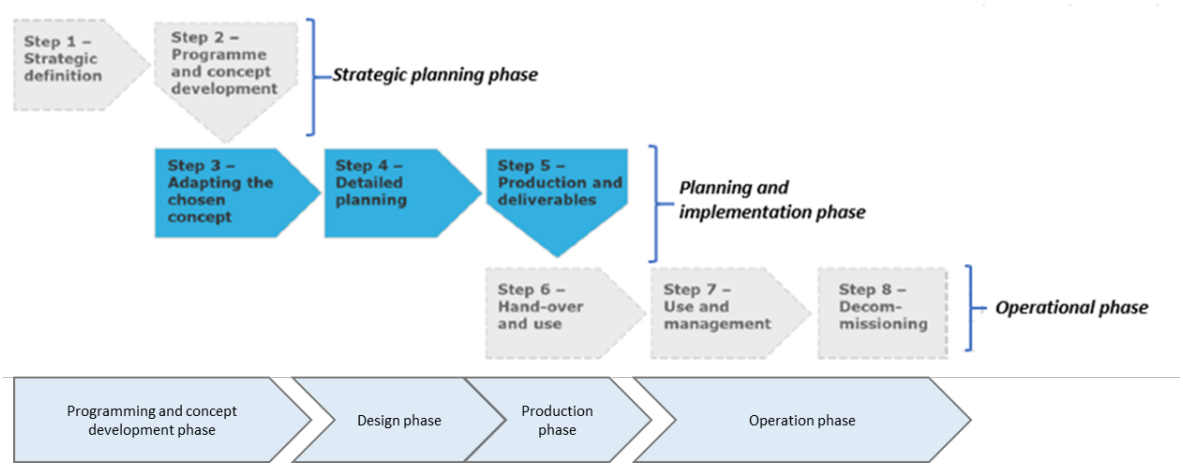

Figure 7 - Linear demonstration of the building process imposed on the hierarchical planning levels of construction logistics in figure 2 (SINTEF/Flyen 2020, based on DNV.GL, 2018) – from D1.1.

Synthesising the input from chapters 3.1.1and 3.1.2 in conjunction with the planning levels and phases in Figure 6 and Figure 7, the following points are seen as necessary to include in the introduction of planning levels and gates in the Smart Governance Concept 1.0.

- On the **strategic** level, in the strategic planning phases of the project, we need to identify the scope and goals of logistics in a construction project. The scope is related to geographical boundaries and the goal to the stakeholders involved.
- On the **tactical** level, in the planning phase of the project, we identify several scenarios of construction logistics. These scenarios are to include contextual and logistics considerations.
- On the **operational** level, in the implementation phase of the project, we identify and implement a specific construction logistics setup.

Figure 8 suggests how planning levels and gates are introduced into the Smart Governance Concept 1.0.

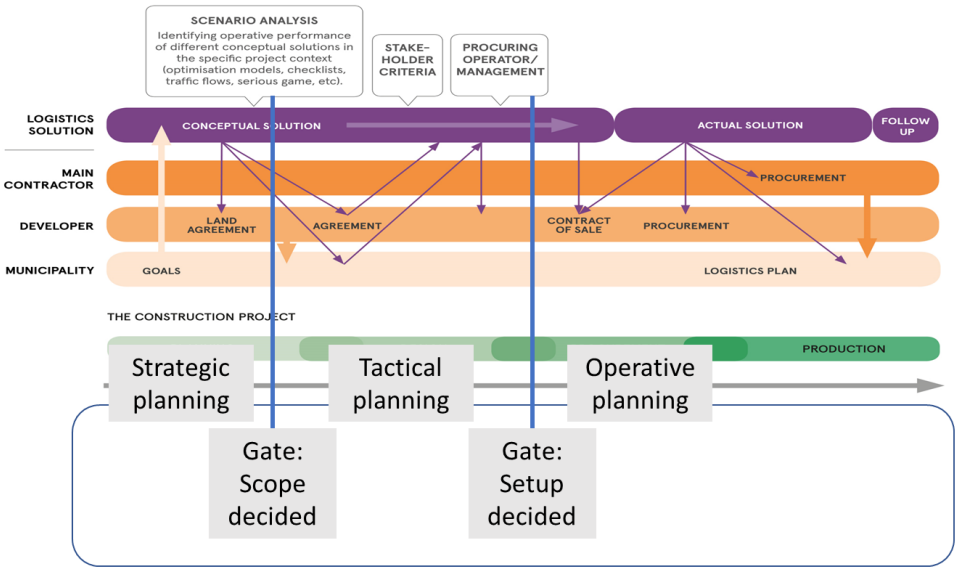

Figure 8 - Suggestion of how to add the planning levels and the gates to the Smart Governance Concept

3.2 Clarify the actors' involvement and output

In the Smart Governance Concept 1.0 the main actors (main contractor, developer and municipality) seem to be equally involved during the whole construction process. However this is not true. There is a need to better show how and when the different actors are to be involved. A suggestion of how this could be done is presented in Figure 9. Though, the inclusion of logistics in the construction planning will require new roles and a new distribution of roles and responsibilities between actors. Thus, it will affect the project organisation and one question is where the logistics organisation should be included. Previous studies (cf. Fredriksson *et al.*, 2021; Janné and Fredriksson, 2019; Janné *et al.*, 2019; Ekeskär and Rudberg, 2016) have shown that the logistics organisation needs to be included on a project hierarchical level where they have enough mandate to develop the logistics setup as well as stipulate and enforce regulations. However, what hierarchical level that is, is dependent on the project setting and the complexity of the organisation (Janné, 2020) and should be part of clarifying the actors' involvement and ouput.

Figure 9 - An example of how to show the involvement of different actors during the construction process (source SINTEF)

Furthermore, it is not clear from Figure 2 which actors are involved in the different steps or whom is responsible for which steps. Additionally, is the process to be applied for one project, one company, one urban area or a city? An issue that was identfied also in D1.1 was the need to transfer construction logistics from an operational issue within one project to a strategic issue of more than one project. To make it part of a program, company strategy, or a city SULP (Sustainainable Urban Logistics Plan) or SUMP (Sustainability Urban Mobility Plan) construction logistics has to be considered as a multi-actor concern. This leads us to present Table 1illustrating different stakeholders and different geographical boundaries.

Table 1: Matrix combining project phases, geographical boundaries and actors (source SINTEF)

Project phases	Geographical boundary	Stakeholders (R - Responsible; E - Executes; C - to be consulted; I - to be informed; D - Decides)								
		Architect/Landscape architect	Building owner (Public)	Building owner (Private)	Contractor	Consultants /subcontractor	Citizens/ neighbourhood	Manufacturers/ suppliers	Logistic service provider (LSP)	Construction merchants/Retail
Strategic long term planning	*Building level*									
	Neighbourhood level									
	City level									
Tactical, mid-term planning and implementation	*Building level*									
	Neighbourhood level									
	City level									
Operational phase	*Building level*									
	Neighbourhood level									
	City level									

It is also unclear which documents are to be produced during the process and by whom. All three main actors can, at a strategic level, present a strategy of construction logistics including goals and scope of the project. On a tactical level focus should be more on presenting a logistics plan including both the contextual and logistics scenarios identified (see Figure 10 from D1.1.) and on the operational level the specific construction logistics setup needs to be presented including a business model and governance structure (Janné, 2020). However, there is a need to develop checklists and drafts of these plans early on at an early stage in the process.

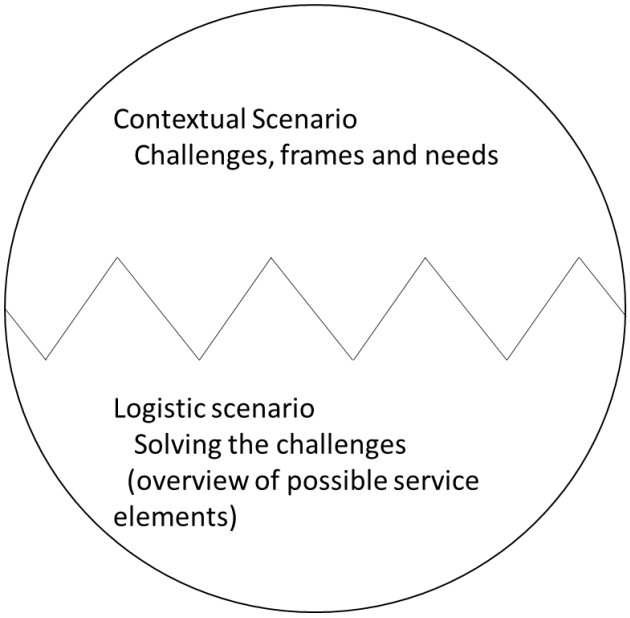

Figure 10 - The relationship between contextual scenario and logistics scenario. The combination becomes a construction logistics scenario – from D1.1.

3.3 The process of activities

The process of activities is not as linear as shown in Figure 2. An analysis of how the activities relate to each other was made and is presented in Figure 11. The analysis showed that the Smart Governance process has to be iterative to allow for changes in the governance structure. As can

be seen in Figure 11, there are multiple feedback loops and iterations in the process of activities and the process is also dependent on the actors and stakeholders involved. This allows for flexibility in the development and implementation of construction logitistics and a chance to streamline the process when new conditions are presented or lessons have been learned from previous governance structures.

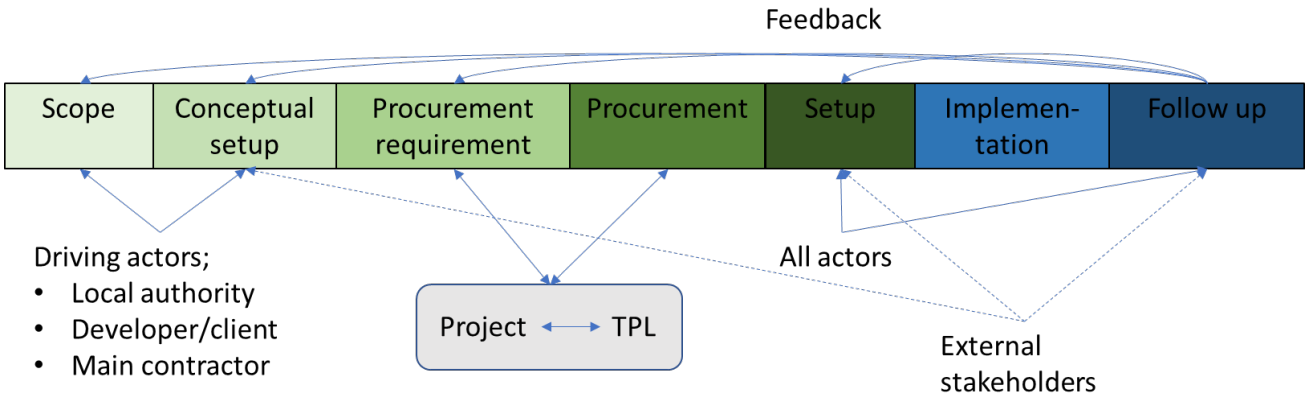

Figure 11 - An analysis of the process that need to be implemented in the Smart Governance Concept 2.0

In the Smart Governance Concept 1.0 we could see that the first phase was to create a sense of urgency and the rest of the phases where to develop a construction logsitics setup. Though, is it enough with one phase to clarify the problem? Should there be two separate processes or should they be interlinked? Furthermore, who should own the process and/or initiate it? The ownership of the process should be determinded with the aid of chapter 3.2.

In each process step there needs to be some input, output and mechanisms/tools to make things happen. However, what the input or the output is from the different steps as well as what mechanisms/tools are used in the different steps are is a crucial question. **Input** is such things as data from previous projects, the project context, the type of project, agendas for meetings and questions to be answered during meetings. **Mechanisms** are here defined as the tools we develop in the MIMIC project, such as the impact assesment framework, the game and the megagame, the MAMCA, and the scenario analysis. **Output** is the identified scope and goals on the strategic level, the scenario analysis on the tactical level and the actual setup and its evaluation on the operational level. These input, output and mechanisms/tools are also going to be different if the process aim to create a sense of urgency versus to develop a construction logistics setup for a specific project.

What these input, output and mechanisms are will depend on the purpose of the process. Is the purpose of the process to create awareness and learning among actors or to identify and implement a project specific construction logistics setup? There is also a need to clarify the scope of activities and feasible services. Is the focus solely on logistics to, from and on the construction site, or should other aspects such as waste management, climate neutrality and emission and fossil free fuels be included in the process of activities? On what planning levels and at what time in the process should these aspects be introduced and considered? To allow for these multiple aspects to be considered in the process of activities, the process has to be iterative as depicted in Figure 11.

3.4 Clarify scenario analysis

As can be seen in Figure 2 and Figure 6, scenario analysis needs to be given more attention. Furthermore, we see the potential of doing scenario analysis at two levels. First, a more

qualtitative scenario analysis with the help of MAMCA at the tactical planning level is proposed. This aims to identify the importance of different logistics elements (see D1.1 for more details regarding logistics service elements) to find the most suitable scenarios for LSPs (logistics service providers) considering offerings procurement criteria to contractors. Second, these offerings/procurement criteria are thereafter the starting point for the operational level, where these are analysed as scenarios with the help of more quantitiative methods such as optimization tools (from WP3 in MIMIC) and the impact assesment framework (from WP2 in MIMIC).

The purpose of the scenario analysis on the operational level is to allow the LSP to dimension the logistics setup based on e.g. transport, material, and waste forecasts. By doing so, the logistics setup can be matched to the program, portfolio, or project that it will serve. This operational scenario analysis can also allow for a logistics setup more suited for the stakeholders' needs.

3.5 Need to include policies and legal framework

As was found in the Smart Governance Concept 1.0, municipalities play a large role in what is governed and how it is governend when it comes to construction projects and urban construction transport and logistics activities. They are the ones who set the local regulations directly affecting the construction activities. However, their policies and regulations are directly impacted by local, regional, national, and international political ambitions and regulations. With the focus on reduced environmental impact and increased livability in cities, these regulations and legal requirements are turning towards construction projects and construction logistics to reduce impact and follow up e.g. environmental data. These policies and regualtions translate into requirements from developers, stipulated in the agreement between developer and main contractor. However, main contractors can have their own strategic goals and policies and it is not always that the ambitions, regulations, and requirements fit together. To increase the likelihood of a governance approach that reduces friction between the different stakeholders, there is a need to include the policies and legal frameworks which are addressed in D4.3, highlighting important aspects to include in the Smart Governance Concept 2.0.

4. Conclusions

The goal of this deliverable is to identify how the Smart Governance Concept 1.0 needs to be further elaborated to fit within the scope of the MIMIC project, and thereby the construction logistics sector. Based on the discussion in chapter 3 we identify that the Smart Governance Concept 2.0 needs to include the following updates:

- planning levels and gates,
- clarify which actors are involved during the various phases of the process and what their respective inputs to and outputs of the process are,
- show that the process is iterative and provide mechanisms to use during the different phases,
- clarify the role of the scenario analysis in relation to the development and implementation phases of the construction logistics setup,
- include policies and legal frameworks.

These updates will be included into the Smart Governance Concept 2.0 to be presented in D4.2.

5. Acknowledgements

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