PROJECTNAAM

CDM@AIRPORTS

WERKPAKKET 2A
CROSS-CHAIN-SAMENWERKING

WP2A CROSS CHAIN COLLABORATION – DELIVERABLES D2A.1-4

ORGANIZING LOGISTICS IN COMPLEX MULTI-STAKEHOLDER ENVIRONMENTS

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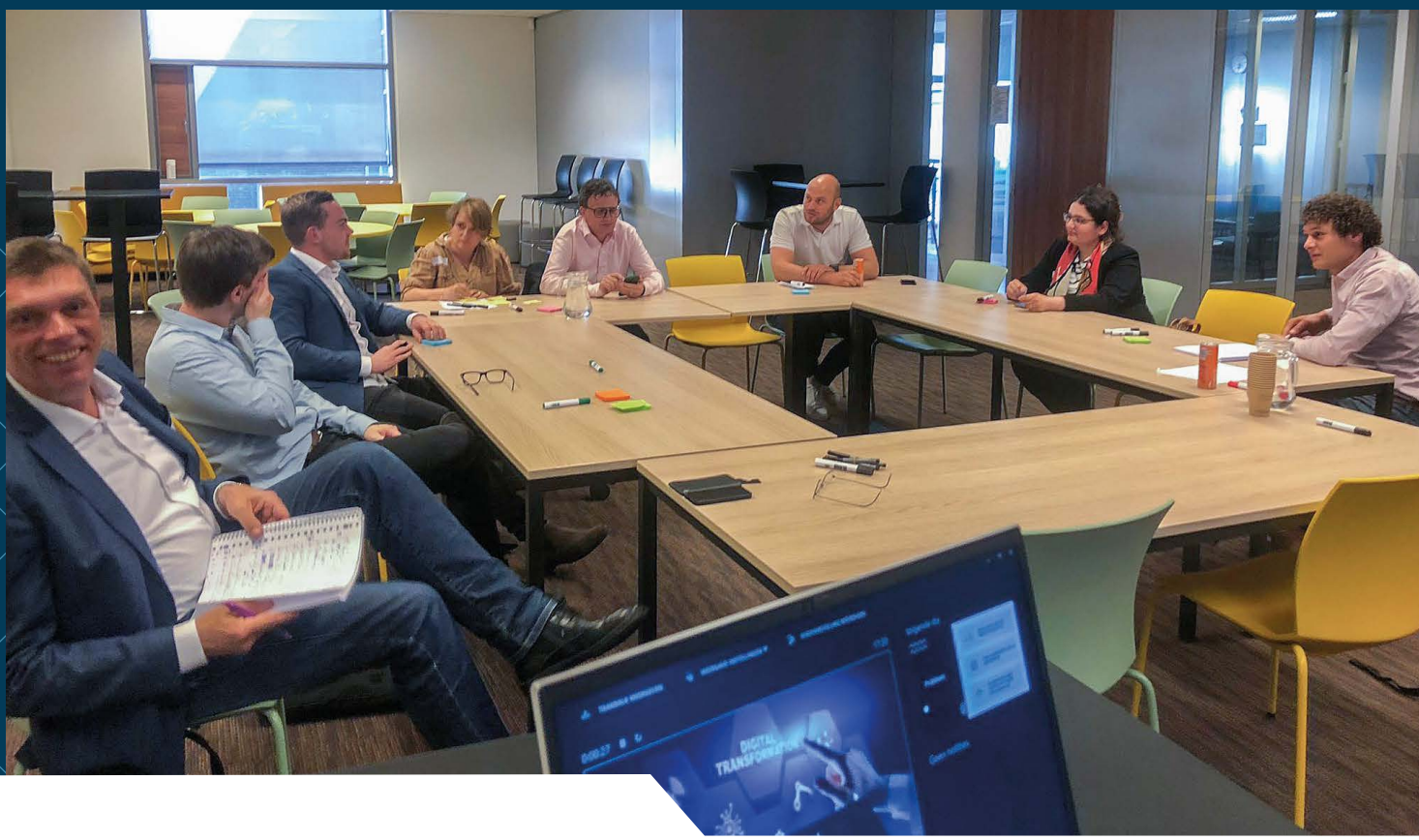

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INHOLLAND - BUSINESS RESEARCH CENTRE
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TKI DINALOG
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INHOUDSOPGAVE

MANAGEMENT SUMMARY

The research in the CDM@Airports project directly addresses the topic of organizing logistics in complex multi-stakeholder environments and falls within the field of supply chain coordination. This project contributes to the main goals of the Topsector regarding cross chain control management, data driven logistics and sustainability in the landside operation of airports.

The goal of the project was to find ways to create the conditions under which logistic firms will exchange data with each other with the goal of collaboratively working on an effective planning concept. The main question guiding the research was: How can collaborative decision making be established between air cargo stakeholders at (European) airports through neutral governance for an optimal sustainable landside operation to work digitally in order to innovate together and create system value for participating parties?

Work package 2A contributes to answering this question through research on governance issues and is guided by the following research question: What conditions must be created to assure the exchange of knowledge, skills and resources among firms in the multi-stakeholder logistic system Trucking CDM? The main objective of this work package is to develop a tested replicable methodology aimed at facilitating data sharing among partners in a logistic system. Other objectives relate to developing further knowledge around the question how governance structures can be designed that promote knowledge sharing and lower or remove barriers for collaboration in multistakeholder environments in which there is horizontal collaboration.

We used a Design Science Research approach to guide our research as it is forward-looking rather than descriptive. In a Design Science Research cycle, the first step is to theoretically develop and ground a program based on design rules found during a synthesis of research on the topic at hand. The next step is field testing, adaption of the program and finally reporting in a use case.

WP2A Deliverable D2A.1

WP2A Deliverable D2A.1 answers the research question: Is it possible to develop a planning concept based on collaborative decision making and if so, what are critical success factors? Here we studied various sources such as scientific journals, white papers, and reports - for example from TKI Dinalog. The body of the report is a theoretical framework that acts as a guide for the development of the replicable methodology.

WP2A Deliverable D2A.2

WP2A Deliverable D2A.2 has two research questions. The first is: What types of governance models can be adapted for coordinating multi-stakeholder logistic systems? and the second is What are ancillary conditions surrounding sustainability and data sharing issues for assuring knowledge exchange in multi-stakeholder logistic networks and how can these be created? Here we used both scientific and practitioner reports that look at governance of complex innovative entrepreneurial networks and ecosystems. The results of this report are a set of requirements needed for designing the replicable methodology.

WP2A Deliverable D2A.3 and D2A.4

WP2A Deliverable D2A.3 and D2A.4 are combined in one report. This report replies to the research question What does a tested methodology for adapting and implementing existing governance models to logistic networks and systems look like? To answer this question, we designed the methodology based on the research from previous deliverables. To make the results of the research more user-friendly for practitioners, we wrote the testing results and outcomes in the form of a business use case.

Note: Supporting documents can be acquired by approaching Donald.ropes@inholland.nl.

WP2A DELIVERABLE D2A.1

COLLABORATIVE DECISION MAKING IN LOGISTIC PLANNING: UNRAVELING CRITICAL SUCCESS FACTORS

MANAGEMENT SUMMARY

This report investigates the possibility of developing a logistic planning concept based on collaborative decision-making and identifies the critical success factors associated with this approach. The context is the airport node, specifically air freight stakeholders involved in the landside pickup and delivery process. By analyzing existing (scientific) literature, case studies, and industry best practices, this report provides insights into the integration of collaborative decision-making in logistic planning and offers practical recommendations for successful development of a cooperative planning concept. The question guiding the report is: *Is it possible to develop a planning concept based on collaborative decision making and if so, what are critical success factors?* The answer to the first part of the question is that is it theoretically possible, as it has been done successfully in other contexts such as the Harbor of Rotterdam.

In this project, we understand a planning concept to have a technical aspect, which is the digital platform being developed by Cargohub, as well as a social aspect. This report stems from WP2A, which is about the social aspects of developing and implementing a digital platform. Consequently, this report focusses on the latter and looks at issues such as open communication, collective idea generation, and consensus building. Furthermore, we found that all stakeholders must understand the objectives, processes, and expected outcomes of the collaborative planning effort.

1. INTRODUCTION

WHAT IS A PLANNING CONCEPT BASED ON COLLABORATIVE DECISION MAKING?

In the context of this project, a planning concept refers to the strategic and operational processes involved in organizing and optimizing the transportation of goods to and from the ground handler, specifically the processes associated with slot planning. A planning concept focused on this aspect of landside air freight operations is thus crucial for ensuring efficient and cost-effective movement of cargo to and from the ground handler. The planning concept in this project is focused on the planning of slots, which is shown below.

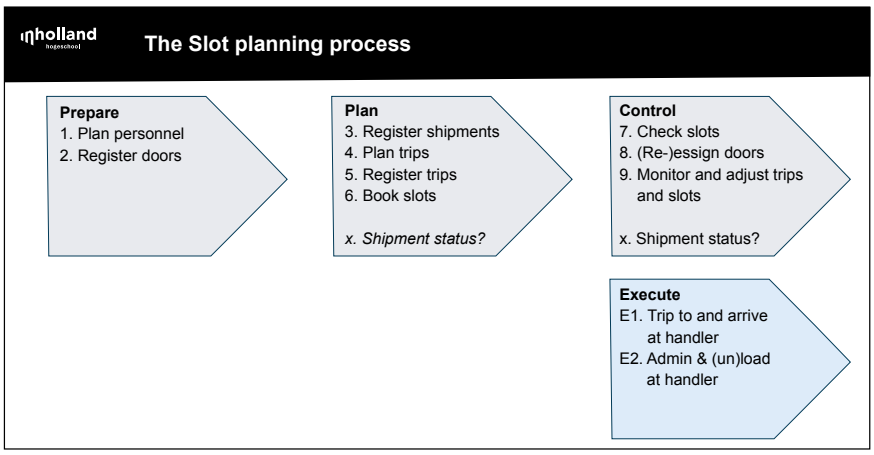

Figure 1: The slot planning process

- **Prepare**. Here the ground handler 1) plans the personnel needed for a slot, and 2) registers the doors.
- **Plan**. This is the process stakeholders follow in order to assure efficient landside pick-up and deliveries. Steps in this process are 1) shipment registration 2) trip planning 3) registering of trips and 4) booking of slots. An important element in planning is the status of the shipment.
- **Control**. This aspect of planning considers the question whether a pick-up or delivery will be made on time, or does the time need to be adjusted, requiring adjustment in the ground handler's preparation? Steps involved in this part of the slot planning process are 1) checking the slots 2) reassigning doors and 3) monitoring and adjusting both trips and/or slots. Again, shipment status is crucial for this element.
- **Execute**. While this element falls out of the planning process, it is an important part of the slot planning process in that 1) the arrival times at the ground handler need to be known and 2) administration and unloading procedures need to be followed.

A planning concept based on collaborative decision making (CDM) emphasizes the cooperation and coordination among the various stakeholders involved in the landside air freight process. An effective planning concept is important for the air freight sector where multiple entities such as truckers, forwarders, road feeders and ground service providers need to share information to ensure smooth operations, limit waiting times, and consequently reduce CO2 emissions per trip. A planning concept based on CDM aims to improve decision-making processes, enhance operational efficiency, and optimize the use of resources through active collaboration and information sharing (Mrabti et al., 2022). Key aspects of a planning concept based on CDM are (Attaran & Attaran, 2007; Audy et al., 2012; Holzwarth et al., 2022; Rosca et al., 2022; Veile et al., 2022):

- **Integrated Planning**: CDM integrates planning processes across different stakeholders. By harmonizing these plans, the entire system operates more smoothly, reducing delays and improving overall efficiency.
- **Shared Information**: CDM relies on the sharing of accurate and timely information among all stakeholders. This includes data related to relevant operational factors such as. Access to shared information allows stakeholders to make informed decisions.
- **Real-time Data Exchange**: CDM systems facilitate real-time data exchange, enabling stakeholders to receive updates instantly. This instantaneous flow of information allows for quick responses to changing conditions and helps in proactive decision-making.

- **Performance Monitoring:** CDM involves monitoring key performance indicators (KPIs) collaboratively. This data-driven approach allows stakeholders to assess the effectiveness of their decisions and identify areas for improvement. By analyzing performance metrics together, stakeholders can refine their planning strategies.
- **Stakeholder Collaboration**: CDM promotes collaboration and communication between stakeholders in the air freight chain. By working together, stakeholders can anticipate issues, address challenges, and collectively plan for efficient operations.
- **Performance Monitoring**: CDM involves monitoring key performance indicators (KPIs) collaboratively. This data-driven approach allows stakeholders to assess the effectiveness of their decisions and identify areas forimprovement. By analyzing performance metrics together, stakeholders can refine their planning strategies.
- **Flexibility and Adaptability**: CDM processes need to be flexible and adaptable so that stakeholders can adjust plans in real-time based on emerging situations.
- **Collaborative Problem Solving**: When issues or disruptions occur, CDM can promote collaborative problem-solving. Stakeholders work together to find solutions, whether it's rerouting trips, adjusting schedules, or managing unexpected events.
- **Clear, agreed upon governance structures**: Governance facilitates collaboration by defining standards and protocols for data exchange, communication and decision-making among stakeholders.

2. POSSIBILITIES FOR A CDM-BASED PLANNING CONCEPT

The question guiding this report is whether it is possible or not to develop a planning concept based on CDM. The section above gives a blueprint of a planning concept and considerations for its development. Based on these two things, we would argue that it is in fact possible to develop a CDM-based planning concept. The following three - of many - cases that support our answer.

Table 1: CDM in other contexts

Initiative	Background	Webpage
Collaborative Environment Management specification	Initiated by Eurocontrol, with the support of ACI Europe, the Collaborative Environmental Management (CEM) specification is designed to help airports and their operational partners coop-erate with one another and work together to identify, develop and implement effective solutions to fulfill their sustainability objectives.	Brussels South Charleroi Airport introduces Eurocontrol's Collaborative Environmental Management - Passenger Terminal Today
Cargo iQ	Cargo iQ is a system of shipment planning and performance monitoring for air cargo based on common business processes and milestones. As part of that system, the Master Operating Plan (MOP) describes the standard end-to-end process of transporting air cargo.	IATA - Cargo iQ
Portbase	Portbase, based in Rotterdam, facilitates data sharing between companies and information exchange with governments in order to work faster, more efficiently and at lower costs. Portbase manages the digital infrastructure of the Dutch ports.	Portbase-corporate-story-2020-2022.pdf

Perhaps a more important question than whether a CDM-based planning concept can be developed is *how* can such a system be developed? What are the processes involved? Again, we focus on the social processes and only look at the IT architecture in so much as it affects the social elements.

3. CRITICAL SUCCESS FACTORS AND BARRIERS TO DEVELOPING A PLANNING CONCEPT BASED ON CDM

A critical success factor (CSF) in management is a specific element or activity that is necessary for an organization or project to achieve its mission or goal. CSFs are action-based statements that can be assigned to an owner and are usually internal factors specific to the organization or project. According to Merriam-Webster, a barrier in the context of a social environment is 'something immaterial that impedes or separates.' Barriers can be internal or external factors that

hinder progress or prevent the successful achievement of desired outcomes. In this project, the process of developing a planning concept based on CDM that we will undertake depends on both assuring certain CSF's are respected and breaking down barriers.

We found the following CSF's (Biswas & Akroyd, 2016; Denolf et al., 2015; Le Pennec & Raufflet, 2018; McKellar et al., 2014; Oh & Bush, 2016; Wei et al., 2012):

- **Trust Building**: Foster a culture of trust among participants. Trust encourages open dialogue and the sharing of diverse perspectives and information, leading to better decision outcomes.
- **Clear value statement**: Whether it's financial resources, manpower, or technology, having a clear understanding of the project's value enables organizations to allocate resources judiciously.
- **Clear Communication**: Transparent and effective communication among and between all stakeholders is essential.
- **Stakeholder Involvement**: Identify and involve all relevant stakeholders from diverse backgrounds and expertise. This includes employees, customers, partners, and community members, depending on the context of the planning.
- **Shared Vision and Goals**: Establish a shared vision and common goals that align with the interests of all stakeholders. This shared understanding provides a foundation for decision-making.
- **Facilitation Skills**: Skilled facilitators are necessary to guide collaborative discussions, ensuring that everyone's opinions are heard, ideas are explored, and conflicts are resolved constructively.
- **Respect for Diversity**: Acknowledge and appreciate diverse viewpoints, experiences, and expertise. Encourage an inclusive environment where different opinions are valued.
- **Data and Information Sharing**: Provide accurate and relevant data and information to participants. Informed decision-making relies on access to reliable data and expert insights.
- **Conflict Resolution**: Develop strategies for handling conflicts that may arise during the decision-making process. Addressing conflicts promptly and constructively is crucial for maintaining the momentum of collaboration.
- **Accountability and Ownership**: Clearly define roles, responsibilities, and accountability for the decisions made. Ensure that there is ownership of the outcomes and a commitment to implementing the agreed-upon plans.
- **Flexibility and Adaptability**: Be open to adapting plans based on new information and changing circumstances. A collaborative planning process should be flexible and able to respond to emerging needs and challenges.
- **Continuous Evaluation**: Establish mechanisms for evaluating the effectiveness of the collaborative planning process. Regular feedback loops help in identifying what works well and areas that need improvement.

Barriers that could hinder progress or prevent the successful achievement of developing a collaborative planning concept can be divided into internal and external barriers. Internal barriers refer to organizational specific obstacles that are not specifically related to a collaborative situation but influence whether a firm is willing and able to participate in a collaborative project (Sternberg et al., 2022). For example, organizational competences associated with the ability to gather and process new knowledge (Cruijssen, 2020). Other examples of other internal barriers are resistance to change, lack of (internal) information sharing culture, weak technological capabilities, and lack of resources. This last barrier is greatest for small trucking firms. External barriers are factors such as legal and regulatory issues, competitive pressures, technological limitations, cultural and organizational differences among participants.

4. CONCLUSION

Based on our findings and analysis of the various sources found in our desk research, we conclude that it is indeed theoretically possible to develop a planning concept based on CDM. However, we also conclude that there are many factors to be considered when doing so. On the one hand, developing the information technology infrastructure demands much of the platform designer. On the other hand, the platform needs to be developed in a co-creative process among truckers, forwarders, and ground handlers, which requires skills in facilitating open innovation processes where there is horizontal collaboration.

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WP2A DELIVERABLES D2A.2

REPORT ON THE DESIGN REQUIREMENTS OF A REPLICABLE METHODOLOGY FOR DEVELOPING EFFECTIVE GOVERNANCE STRUCTURES IN THE TCDM COMMUNITY.

MANAGEMENT SUMMARY

This document is a report that serves as deliverable 2A.2: Desk research to answer the questions 1) 'What types of governance models can be adapted for coordinating multi-stakeholder logistic systems?' and 2) 'What are ancillary conditions surrounding sustainability and data sharing issues for assuring knowledge exchange in multi-stakeholder logistic networks and how can these be created?'

The report also lays the foundation via design propositions for deliverable D2A.3, which is the program for implementing effective governance structures in the TCM community. The CDM@Airports project is meant to develop new knowledge about how logistics firms working at the airport node can collaboratively plan via a digital platform. While many of the project partners are already involved in some form of cooperation with each other, this project hopes to develop knowledge that can promote data sharing and collaborative innovation.

The purpose of the research presented here was to develop prescriptive knowledge in the form of design propositions that can be used to guide the development and implementation of effective governance structures in Trucking CDM and other data sharing platforms. We consider effective to mean leading to the desired outcomes of the platform. We also needed to know mechanisms facilitate the outcomes and the influence and impact the context has on these outcomes.

Governance in supply chains is described in the literature as a complex issue (Clauss & Spieth, 2017) and our experience in the field underpins this. In situations where different chains intersect, such as in seaports, airports or 'logistic hotspots', the complexity of the logistic system is greater than a typical supply chain due to the need for horizontal collaboration. One of the consequences of this complexity is decreased performance of the logistic system. Coordinating the different flows of the various supply chains might boost performance of the whole logistic system and in turn mutually benefit the individual firms involved. However, our literature search shows that little is known about knowledge sharing, including the sharing of data, and innovation in these types of multi-stakeholder logistical networks. Our search on the Internet turned up several documents that can give insight into horizontal collaboration, but not specifically about implementing data sharing platforms in multi-stakeholder environments such as found at the airport node.

One of the ways that could facilitate collaboration in regard to data sharing among stakeholders is the implementation of governance structures that guide how collaborative processes are designed and maintained.

The literature discusses two main types of governance. The first is called contractual governance, which is based on legal structures that are designed to impede opportunism and exploiting other partners. This type of governance is often used at the start of collaborative activities in situations where partners have never worked together before. The other type is called relational governance and relies on trust and other forms of social structures to assure that partners work effectively together. Within relational governance is also process formalization, which gives directions for how the group works together. All three are meant to coordinate activities and assure that the group reaches its common goal.

Based on the literature, a set of design propositions was defined. These serve as the basis for a program designed to help groups collaboratively develop governance structures that help assure reaching a common goal. We call this methodology, LOGIGOV.

1. INTRODUCTION

As markets become more competitive and profit margins decrease due to costs of resources, sustainability issues and other external pressures, logistics firms are forced to look towards innovative ways to remain competitive. One way logistic firms do this is to look towards partners in their supply chain. By working and innovating together with firms from the vertical and horizontal chains, companies can optimize operational chain performance by delivering a product or service to their customers at minimal costs and at the contracted time. Furthermore, by working together in broader network structures, firms can gain access to data as well as new and unique knowledge outside the direct chain. Data is important for making better-informed decisions while new knowledge is critical for innovation of new products and processes. Also, studies show that innovation focused on sustainability is usually too complex to be dealt with by a single firm (Wiesner et al., 2018).

We know that firms seek data, information and knowledge outside their organization because of costs, resource scarcity and utilization and economies of scale (Chesbrough, 2004). Participation in open platforms, such as TCDM, is a way for firms to gain access to needed resources. However, various factors hinder collaboration in open platforms, especially in cases where competing firms participate. For example, the different types or forms of data firms use or the threat of opportunistic behaviour by other companies (Huo et al., 2016). This paper examines the latter, namely social and cognitive issues related to participation in platforms, specifically where there is horizontal collaboration. Such platforms are complex, multi-stakeholder environments where data sharing, knowledge flows and other forms of collaboration are not as a matter of course and need to be organized. Consequently, the main research question of work package 2A is: *What conditions must be created to assure the exchange of knowledge, skills, and resources such as data among logistics firms in a multi-stakeholder logistic system?* In this project, we define governance as a set of rules, procedures

and operational structures that guides the short-term and long-term actions of platform members. Effective governance should positively affect attaining both individual firm and group objectives as well as allow for monitoring.

We focus on governance issues that promote cooperation and collaboration in the form of data sharing and innovation while at the same time mitigate opportunistic behaviour. Based on the discussion above, questions arise concerning governance in data sharing platforms such as; which types are the most effective in eliminating undesired behaviour (such as opportunism)? which types assure transaction cost reduction and which increase mutual gain? Is there one approach to governance that accomplishes all three aspects? Or need there be a configuration of governance structures? We also look at governance to coordinate activities and assure that the group achieves its common goals. Thus, this paper contributes to answering the main question of the project: *How can collaborative decision making be established between air cargo stakeholders at (European) airports through neutral governance for an optimal sustainable landside operation to work digitally in order to innovate together and create system value for participating parties?*

We start by presenting different frameworks of governance found in the literature, followed by a discussion on governance in collaborative environments, such as TCDM.

1.1 CONTRACTUAL GOVERNANCE

Contractual governance has its theoretical basis in transaction cost economics (TCE). TCE contends that firms are exposed to opportunism and self-interested behaviours by external stakeholders that lead to higher costs. Contractual governance structures are legal frameworks based on authority and clearly defined regulations that act to monitor and reduce undesirable behaviours such as opportunism. Contracts are used to define, among other things, intellectual property rights (including patents, copyrights, trade secrets and trademarks), confidentiality, trust, conflict resolution procedures and disciplinary actions for firms not following the rules or regulations.

Contractual governance takes the form of detailed contracts and is the dominant form of governance in collaborative environments (Roehrich et al., 2020). Contracts help guide the coordination of activities aimed at achieving mutual goals and contribute to successful conflict management. Contractual governance has an element of control by obliging partner firms to follow agreed upon conditions. From a TCE perspective, without detailed contracts the risk that parties will not perform their obligated duties or abuse the other partners increases.

Contractual governance is a powerful mechanism for mitigating opportunism but is not without its problems. For example, no contract can cover all of the risks involved in open network participation considering the amount of possible contingencies and potential issues for conflict - many of them unforeseen at the beginning of collaboration. Another downside of a contract is that it limits flexibility, which is especially important in complex networks (Zobel & Hagedoorn, 2020).

Some authors are critical of TCE as a foundation for governance because it emphasizes and exaggerates the suspicion between contract partners. An important point for this project is that logistics relationships are difficult to safeguard through formal contracts because of the following concerns (Addae-Boateng et al., 2015; Cruijssen, 2020; Provan & Kenis, 2007; Schmoltzi & Wallenburg, 2012; Q. Wang et al., 2020):

- **Complexity of operations**: Logistics operations often involve numerous interconnected processes, such as transportation, warehousing, inventory management, and distribution. These complexities make it challenging to foresee all potential issues and contingencies in a contract.
- **Operational constraints**: Strict adherence to a contract might not always be feasible due to operational constraints. For example, a delay caused by bad weather might prevent a carrier from delivering goods on the agreed-upon date, even if they are contractually obligated to do so.
- **Dependency on third parties**: Logistics often involve multiple parties, such as carriers, customs agents, and suppliers. If one of these third parties fails to meet their obligations, it can affect the entire supply chain, even if the primary contracting parties respect their agreement.
- **Relational nature of logistics**: Logistics relationships often rely on trust, collaboration, and mutual dependency. Overly formal contracts might damage the trust-based nature of these relationships, leading to strained interactions and decreased efficiency.
- **Cost of enforcement**: Enforcing a formal contract can be expensive and time-consuming. In many cases, the cost of legal action might outweigh the benefits, especially for smaller-scale logistics operations.

To address these challenges, collaborative arrangements between logistics firms often use a combination of formal contracts and informal agreements, which is the basic tenant of relational governance (Raue & Wieland, 2015).

1.2 OPERATIONAL GOVERNANCE

Operational governance refers to the set of processes, activities, policies, and procedures that an organization establishes and follows to ensure effective and efficient day-to-day operations. In the context of a collaborative project such as CDM@Airports, operational governance refers to the framework, processes, and mechanisms put in place to ensure that the collaborative effort functions smoothly and achieves its intended goals. Effective operational governance in such projects is crucial for coordinating activities, resolving conflicts, managing resources, and maintaining overall project integrity. Operational governance can be broken down into formal governance and relational governance.

1.2.1 FORMAL GOVERNANCE

Formal governance refers to mutually agreed upon rules, policies and procedures that serve to guide operational processes within the collaborative activities. We follow Rau and Weiland (2015) by focusing on process formalization as an mechanism of formal governance. Process formalization in operational governance refers to the process of defining, structuring, and standardizing the operational procedures and processes within an organization. It involves creating clear, well-defined rules, regulations, policies, and protocols that guide the day-to-day activities and decision-making processes of the organization.

Several key aspects of process formalization in collaborative projects are (Aaltonen & Turkulainen, 2022; Raue & Wieland, 2015; Schmoltzi & Wallenburg, 2012):

- **Standard operating procedures**: Developing protocols for how different cargo is handled by cooperation partners.
- **Business rules**: Regulations that define or restrict actions within the system's operations. These are the basis for operational governance.
- **Performance Monitoring**: Establishing metrics and key performance indicators (KPIs) to measure the progress and success of the collaborative project. Regularly monitoring these indicators helps in evaluating the project's effectiveness and identifying areas for improvement.
- **Adaptability**: Being flexible and adaptable to changes in project requirements, goals, or external factors. Collaborative projects often require adjustments based on the evolving needs of the stakeholders or changes in the external environment.
- **Conflict Resolution**: Implementing processes for resolving conflicts and disputes that may arise among project participants. This could involve mediation, negotiation, or escalation procedures to address disagreements and ensure the project stays on course.
- **Decision-Making Processes**: Establishing decision-making protocols, including how decisions will be made, who has the authority to make specific decisions, and how disagreements or conflicts will be resolved.
- **Resource Management**: Efficiently managing shared resources, including human resources, funding, equipment, and technology. This involves allocation, tracking, and ensuring equitable use of resources across all collaborators.

1.2.2 RELATIONAL GOVERNANCE

In contrast to contractual governance, relational governance incorporates trust and commitment, relational capital, information sharing routines and informal exchange. While contractual governance is formal in nature, relying on explicit rules and procedures, relational governance relies on trust and social norms to assure compliance to agreed-upon rules for collaboration. While TCE is the lens through which contractual governance is described, Social Exchange Theory (SET) is a theoretical perspective that explains why relational governance is also effective in governance.

SET has relational interdependence, or relational contract, that develops over time as its core explanatory mechanism (Lambe et al., 2001). The basic assumption of SET is that firms enter relationships with other parties because they expect the relationships to be rewarding. For example, a firm collaborates in an inter-organizational project expecting to acquire new or unique resources from partner firms. Trust and commitment to the relationship increase over time if there is continued positive economic and social outcomes from it and if a firm is rewarded by its exchange with a partner, it will probably enter into that exchange again. SET suggests that a firm experiences rewards as both a positive economic and social outcome, meaning improved relationships or increased trust by their partners are also a positive return.

Wu et al. (2014) found that in SET the key issues of trust, commitment and reciprocity are antecedents to information sharing and collaboration in supply chains. Wang et al., (2019) support this, providing evidence that trust and relational norms are the two key mechanisms in relational governance. They define trust as 'a firm's confidence in the integrity, benevolence, and credibility of its partners', further explaining that 1) integrity is the collaborative pursuit of mutual benefits 2) benevolence, which assumes partners will not exploit another's vulnerabilities and 3) credibility, which is the ability of partners to perfume effectively and reliably.

1.3 COMPARING CONTRACTIONAL AND RELATIONAL GOVERNANCE

Contractual governance is an important part of any collaborative environment as it helps to coordinate resources, ensure compliance to agreed-upon rules and helps to mitigate opportunism. However, contractual governance structures may hinder collaboration in open innovation environments like the one our project developed. Relational governance can mitigate the challenges associated with contracts yet achieve the same goals through trust and relational norms.

Table 2 shows an overview of aspects of contractual and relational governance structures perspectives.

Table 2: Perspectives on contractual and relational governance structures

Perspective	**Contractual perspective**		**Relational perspective**	
Mechanism	**Comprehensive contracts**	**Contract application**	**Trust**	**Relational norms**
Major elements	Specified clauses and terms	Enforcement of contracts through legal power	Confidence and a trustful environment	Behavioural expectations, reciprocity
Purpose	Reduce opportunism, coordinate processes	To ensure compliance	Establishing confidence in current and future collaboration	Promoting goal congruence and socialization
Theoretical foundation	Transaction cost economics		Social exchange theory	
Characteristic	Formal, economic, instrumental, legal		Relational/social/ informal Partners are reliable	
Motivation	Future benefits and interests		Positive history and past rewards in the relationship	
Main assumption	Partners are opportunistic. Self-interest is negative and needs to be mitigated		Self-interest acceptable in relationships, if it is a driving force for the greater whole	
Criticism	Underestimates relational factors		Overestimates relational factors	

Source: Wang, et al (2019)

The literature on governance points to effective governance having elements of both a contractual and relational perspective. These complementary perspectives are combined in different ways according to the situation, the context and place in time: contractual governance is forward-looking often being used to guard future collaborative endeavours against negative payoffs, while relational governance might be considered backward-looking, relying on trustful relationships built over time (Vieira et al., 2014).

The question rising here is what effective governance in situations is such as the TCDM project, considering it has a strong element of horizontal cooperation which lends itself to opportunism among partners. Is it contractual in nature? Or is it like SET assumes, self-governance based on trust and relational norms? It seems that the literature is clear that relational governance can, like contractual governance, mitigate opportunism, but at the same time foster the enforcement of obligations and expectations.

2. GOVERNANCE IN COLLABORATIVE ENVIRONMENTS

The literature points out that for governance to be effective in collaborative environments, it must be firstly aligned with the specificities and complexity of the collaboration and secondly, flexible and adaptable enough to deal with any changes (Schmoltzi & Wallenburg, 2012). In this sense, collaborative governance is a set of core guidelines, processes, and frameworks supported by a flexible infrastructure, some of which is controlled by different alliance members and some by no one (Vagadia, 2014 p. 262).

Provan and Kenis (2007) propose three forms of governance in networks; participant-governed, lead organization governed and third-party governance. They suggest that choosing an effective form of governance is related to four key predictors: the amount and pervasiveness or density of trust in the network, the number of participants, the level of goal consensus and the competences for participation. They developed the following propositions that summarize the basis relationships between the key indicators given above (p.241).

1. Shared network governance will be most effective for achieving network-level outcomes when trust is widely shared among network participants (high-density, decentralized trust), when there are relatively few network participants, when network-level goal consensus is high, and when the need for network-level competencies is low.
2. Lead organization network governance will be most effective for achieving network level outcomes when trust is narrowly shared among network participants (low-density, highly centralized trust), when there are a relatively moderate number of network participants, when network-level goal consensus is moderately low, and when the need for network-level competencies is moderate.
3. Third party network governance will be most effective for achieving network-level outcomes when trust is moderately to widely shared among network participants (moderate density trust), when there are a moderate number to many network participants, when network-level goal consensus is moderately high, and when need for network-level competencies is high.

2.1 PERFORMANCE MONITORING AND GOVERNANCE

Inter-organizational governance guides collaboration between multiple organizations to achieve common goals. Key Performance Indicators (KPIs) play a crucial role by providing measurable metrics to assess the effectiveness and efficiency of the collaborative efforts. In this project, KPI's also have other important roles (Cruijssen et al., 2007; Jefferies et al., 2014; Langfield-Smith, 2008):

- Assure alignment of objectives KPIs can ensure that the goals and objectives of each participating organization align with the overall goals of the collaborative effort.
- **Performance Measurement**: KPIs provide a standardized way to measure the performance of each organization and the overall collaboration. This allows for objective assessments of how well each party is contributing to the shared goals.
- **Accountability**: KPIs establish accountability by clearly defining responsibilities and expectations for each participating organization. When organizations know their performance is being measured, they are more likely to meet their commitments.
- **Decision-Making**: Data from KPIs can inform decision-making processes within the inter-organizational governance model. It provides a basis for making adjustments or resolving conflicts based on quantifiable information.
- **Communication**: KPIs facilitate communication between participating organizations. They provide a common language and set of metrics that all parties can understand, making it easier to exchange information and coordinate activities.
- **Risk Management**: KPIs can be used to identify potential risks and issues early on. By monitoring KPIs, organizations can proactively address issues before they escalate and impact the collaboration negatively.

Like governance in general, KPI's should also be directly aligned with the goals of the alliance. In this case, KPI's should reflect aspects of the planning process (see deliverable 2a.1) Furthermore, in a collaborative environment, KPI's should be defined and decided upon by the stakeholders involved (Abdirad & Pishdad-Bozorgi, 2014).

2.2 GOVERNANCE IN DATA-SHARING PLATFORMS

The airfreight community is comprised of a set of interacting actors that directly or indirectly consume, produce, or provide data and other related resources in order to improve processes and maximalise profits. Lis and Otto (2021) refer to this configuration as a 'data ecosystem'. Governance in a data ecosystem aims to create a collaborative environment, ensuring the alignment of firm interest and collective goals. Lis and Otto (2021) define ecosystem governance as "arranged institutions and structures to ensure that individuals behave in line with the collective goals, conflicts between individuals are prevented or resolved, and the effective and fair use of collective resources within the inter-organizational collaboration." (p.6068) In this sense, data ecosystem governance is governance in collaborative environments. On the one hand, data governance has technical aspects specifically related to data collaborations, but on the other hand has comparable elements of the governance frameworks presented above (Lee, 2019; Pilbeam et al., 2012).

3. DESIGN PROPOSITIONS

The first question guiding this report is: *What types of governance models can be adapted for coordinating multi-stakeholder logistic systems?* Based on the discussion above, we would argue that there is no one model that can be adapted, but that the frameworks we presented can guide the design of an approach that is aligned with the specificity of the TCDM community. The second question in this report is: W*hat are ancillary conditions surrounding sustainability and data sharing issues for assuring knowledge exchange in multi-stakeholder logistic networks and how can these be created?* The answer to this question lies in the social interaction around the TCDM platform we organized during the project. The first part of the question concerning sustainability is answered in WP2B. This report looks at the second part.

As proposed in the project plan, we use a Design Science Research approach in this project (van Aken, 2004). The first step in the process of design science research is to develop what are called design propositions. According to Denyer et al (2008), a design proposition is a general template for the creation of solutions for a particular class of field problems. It is prescriptive knowledge that takes four elements into consideration: Context, Intervention, Outcome and Mechanisms.

In this research, we propose the following overarching design proposition based on our literature review above: If in the context of the TCDM project **(C),** one wants to improve collaboration among partners **(O)**, then a series of interventions aimed at collaboratively developing governance structures **(I**) may help by developing both relational and contractual governance **(M).**

Context. In this project, firms collaborate in order to optimize landside operations at the airport node, specifically in regard to slot planning. Considering the operational level of the project, effective governance should assure knowledge and data exchange by creating positive ancillary conditions that promote collaborative processes. For example, trust, understanding and compliance. Flexibility also plays a major role as does transparency. Governance structures in this project should respect the limited scope of collaboration, and not be overly complex. Additionally, the culture of firms operating at Schiphol is important to consider. Firms have worked together in various projects in the past and so there is already some mutual trust, mitigating the need at this time for contracts.

Outcome. The crux of this project is to, through governance, assure that firms work together on reducing C02 emissions by reducing wait times at the ground handler's shipping dock. An antecedent into this is a governance model accepted and agreed upon by the TCDM community.

Intervention. Based on the desk research presented above, we propose the following governance model as a framework for working with project partners on promoting their collaboration.

- **Business rules**. These are operational agreements made by stakeholders on processes surrounding landside pick-up and delivery processes. They guide ways of working as well as explicate expectations and as such form a basis for communication.
- **Key performance indicators**. KPI's are agreed upon metrics important for monitoring how operations are functioning. They are directly linked to the business rules.
- **Dashboard**. This is a tool that displays whether parties adhere to the business rules and to what extent the defined KPIs are realized. This assures transparency among stakeholders.
- **Escalation trajectory**. This is about enforcement and supervision if one party too often does not comply with the business rules. Compliance is an important aspect of this trajectory.
- **Procedures for minor changes in governance**. This concerns decision-making processes when something needs to be changed in the dashboard or the escalation trajectory.

- **Commission of users and providers**. Decision-making processes if the platform governance needs to be amended or improved.
- **Contract with the entire community**. This is for ensuring stakeholders approve of the governance model and agree to comply with it.

Mechanisms. By approaching data sharing and collaboration as a social process in which individual actors- such as a ground handler – participate, we expect that workshops based on social interaction among the stakeholders will over time lead to better collaboration due to higher levels of trust.

4. CONCLUDING REMARKS

This report lays the foundation for developing a methodology for creating collaborative governance models. The context of the research is the air freight sector working at the airport node, specifically collaborating on a digital planning platform. While the planning process is not exceptionally complex, the environment in which it takes place is. This is due to the diversity of stakeholders' data and data needs, social factors, and contingencies such as traffic jams that delay a trucker, that cannot be easily planned for. For this reason, governance should be easily adaptable to handle the dynamic environment in which planning takes place. At the same time, considering the importance of trust in creating network governance, workshops will need to be developed based on social learning and interaction.

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WP2A DELIVERABLE D2A.3 AND D2A.4

THE LOGIGOV SYSTEM: A TESTED METHODOLOGY FOR COLLABORATIVE GOVERNANCE DEVELOPMENT

MANAGEMENT SUMMARY

This report is aimed at answering the question *What does a tested methodology for adapting and implementing existing governance models to logistic networks and systems look like?* To answer this question, we designed the methodology based on the research results of deliverables D2A.1 and D2A.2 from WP2A.

We combined the design and testing of the methodology and present the latter in a use case format that can be used as a stand-alone product. The use case serves as a set of guidelines for implementing the methodology and includes the context and boundaries in which the testing was done, the various steps taken, a comprehensive list of critical success factors, and reflections on the implementation, linked to each of the steps. The point of such a use case is to structure the results of the research in such a way so that it can serve as a guide for practitioners in the field.

1. INTRODUCTION

Creating a replicable tested methodology for adapting and implementing existing governance models to logistic networks and systems involves a systematic approach that considers; the context, including the complexity of the airport node, the need for efficient coordination and the integration of the stakeholders.

The main objective of work package 2A was to develop a tested replicable methodology aimed at facilitating data sharing among partners in a logistic system. But what do we mean by 'replicable methodology'? According to the Cambridge dictionary, *replicable* is something that can be done in the same way as before or produced again to be the same as before. For example, scientific results need to be replicable to be valid. It has to do with repeating an action in a way that the same results are achieved. Methodology is a system of ways to achieve something; it is a means to an end. Combining the two definitions leads us to define replicable methodology as a system of actions that can be replicated and lead to the same results. The challenge for us is to see how context will affect the replicability because we are aiming at testing in different settings. What we mean by 'tested' is that the prototype we develop based on theory will be implemented among the consortium members. We call the prototype the LOGIGOV System, which is a social program made up of diverse types of interventions. Testing includes efficacy of the interventions performed and their implementation.

As stated in WP2A Deliverable D2A.2, we used a Design Science Research approach in this project (Dresch et al., 2015). The first step in the process of Design Science Research is to develop what are called design propositions. According to van Aken (2005), a design proposition can be described as offering a general template for the creation of solutions for a particular class of field problems. It is prescriptive knowledge that takes four elements into consideration: Context, Intervention, Outcome and Mechanisms.

In this research, we propose the following overarching design proposition based on our literature review above: If in the context of the CDM@Airports project **(C),** one wants to improve collaboration among partners **(O)**, then a series of interventions aimed at collaboratively developing governance structures **(I**) may help by developing operational governance.

The Design Science Research cycle has an element of testing of the design propositions and an accompanying method for implementing them in some sort of program or system. In our case, we tested the LOGIGOV system using a quasi-experimental design (Cook et al., 1979). Our hypothesis is that an effectively implemented LOGIGOV system will lead to the development and adoption of effective governance structures by the stakeholders. We consider governance structures to be effective if they first lead to 1) improved cooperation and collaboration in the form of knowledge and resource exchange 2) process or product innovations and 3) higher levels of social capital. Also, effective governance structures should lead to reaching a common goal. In the case of this project, this is reduced wait times and consequently less C02 emissions.

2. DESIGNING THE LOGIGOV SYSTEM

The result of this work package is a replicable methodology we call the LOGIGOV system. This system is a program that helps interorganizational project teams collaboratively develop effective governance structures in the context of logistics firms working together in a digital platform aimed at streamlining the logistics flows around the ground handling process.

To guide the design of the LOGIGOV system, we employ a model from Andriessen (2005) and use the literature reviews and knowledge products generated during the project to fill it in.

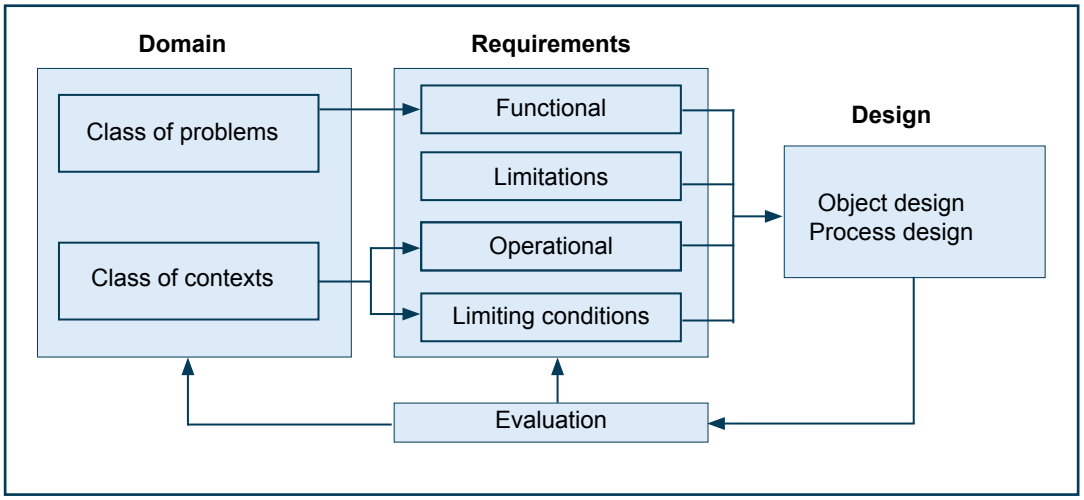

Figure WP2A-1: Model for designing social programs

The domain section of the design cycle considers the class, or type of problems that the LOGIGOV system must solve, as well as the context(s) in which the system will be implemented. Requirements are the aspects that the object design must incorporate and include 1) what it should achieve 2) parameters of its use 3) how it should be used and 4) limitations for its use.

2.1 DOMAIN

2.1.1 CLASS OF PROBLEMS: WHAT ARE WE LOOKING AT?

In the case of CDM@Airports, the class of problem is in the realm of collaboration among stakeholders involved in cross-chain situations and horizontal collaborations. As discussed above, horizontal collaboration is difficult to realize because organizations must integrate various processes such as information flows, management systems and physical flows of goods. Problems with horizontal integration and collaboration have been widely discussed in the literature. This project looks specifically at firms participating in a digital platform where data and information flows are integrated and made available to others working within the platform. For this reason, we limit ourselves to looking at problems associated with information sharing between firms, which can be approached from two perspectives. The first is a technical one and relates to for example the type and quality of information to be shared, its form, and the technical ability of firms to share their information. There is also a social perspective, which considers more 'soft issues' such as governance, organizational culture, and a firm's competence in relationship management. This report focusses on the soft issues. Work package 2C focusses on the technical ones.

2.1.2 CLASS OF CONTEXTS: THE CASE STUDY

The context of the research is the sharing of information via an electronic platform between LSP's (Logistic Service Providers) operating at the airport node. We looked at ground handlers, road feeders, freight forwarders and trucking firms. The specific context is centered around the loading dock of the ground handler and the availability of doors for the unloading of airfreight from either road feeders or forwarders. The figure below shows the context of the relationships among the logistic service providers (LSP's) in regard to both information flows and for governance in vertical collaboration.

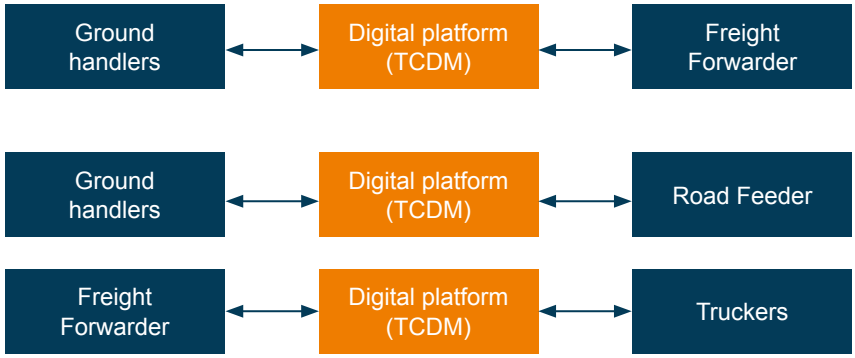

Figure WP2A-2: Information flows between project stakeholders

Figure WP2A-2 also displays the specific flows of information each of the LSP's have with each other via the digital platform within the context of the airport. We see that ground handlers need to communicate about openings at their loading dock to freight forwarders and road feeders. Both freight forwarders and road feeders need to communicate with ground handlers about arrival times at the loading dock as well as the type of load they have. Finally, freight forwarders and truckers need to communicate about times of arrival and loads as well.

Figure WP2A-3 also gives an indication of where existing governance structures might be or might be needed. In our initial meetings with the LSP's in the project we found no explicit contractual forms of governance. We could observe forms of relational governance, but these were not in any way formalized. Although the relationship between airlines and the LSP's falls outside of our research, it does have a bearing on it, which we will discuss later. We found was that agreements between an airline and an LSP were contractual but the governance between firms shown in Figure WP2A-3 relied on underdeveloped and implicit relational structures.

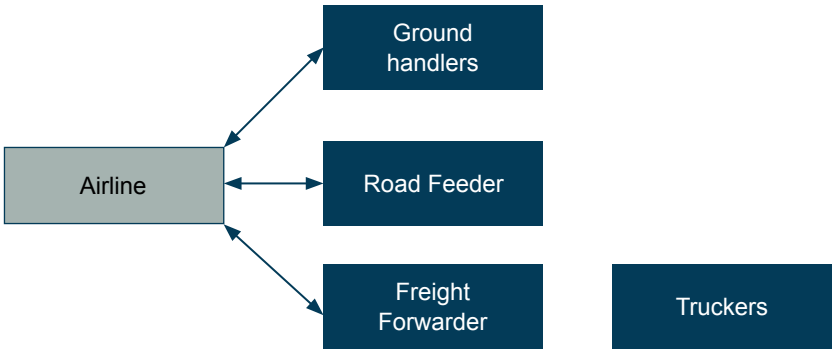

Figure WP2A-3: Relationships governed by contractual agreements.

While we started by looking at vertical collaboration, the project is specifically aimed at promoting horizontal collaboration among LSP's located at the airport node. This is a more complex situation and requires similar but more extensive types of governance (see WP2A.2). The information flows and indications of where governance structures should be needed are shown in Figure WP2A-4.

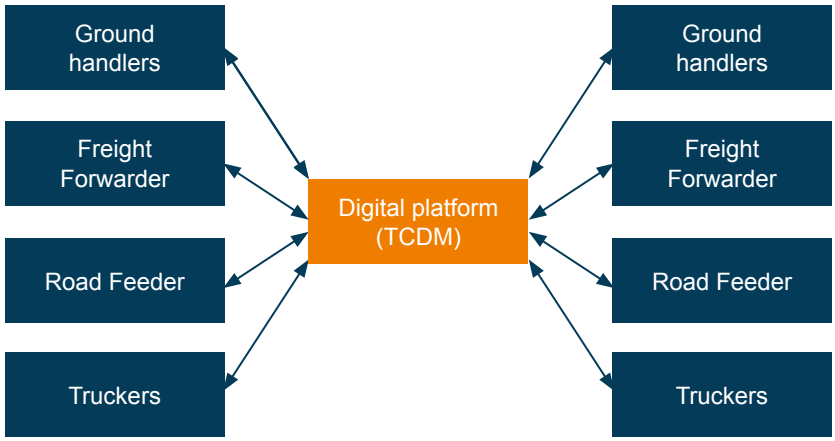

Figure WP2A-4: Horizontal collaboration among project LSP's.

The Trucking CDM IT-Platform is in essence a neutral stakeholder. However, governance issues will need to consider the role of the platform as well. In the following section we look at the design requirements of the LOGIGOV system.

2.2 REQUIREMENTS

The four types of requirements needed to design effective interventions for the LOGIGOV system are presented below. We structure this section using the model in Figure WP2A-1.

2.2.1 FUNCTIONAL REQUIREMENTS

Functional Requirements are the desired end results and are linked to the problem definition but are flexible and can be adjusted by the designer. In this case, the requirement is that the system must help inter-organizational project teams in the logistics sector to develop and adopt governance structures that help to guide decision making, coordinate activities and deter opportunism. These structures can be either relational or contractual, or a combination of both. We consider formalization of processes as part of relational governance.

As discussed previously, the mechanism behind relational governance is trust. Implementation of the LOGIGOV system should thus help develop a trustful environment where confidence in current and future collaboration is high, and partners are seen as reliable. The LOGIGOV system should also lead to formal policies and processes agreed upon by stakeholders. These processes are meant to guide the operational aspect of the platform. At the same time, the LOGIGOV system needs to help develop an awareness about contractual governance and an idea when it should be developed. For example, if a new product is developed and IP rights are needed to protect its realization. In sum, outcomes of the LOGIGOV system should lead to the following:

- Higher levels of trust
- Formalized policies and procedures
- Awareness about contractual governance issues.

2.2.2 LIMITATIONS

Limitations are the boundaries set by the designer and consider practical issues such as time for design of the intervention, its implementation, testing and reporting. The limitations for this research consider that alongside theoretical knowledge, practical knowledge needs to be developed in the context of the research while it is occurring. For example, in a pilot study, interviews with stakeholders and discussions with the other researchers. The design and implementation of the LOGIGOV will also need to take place in practice, which demands flexibility from all stakeholders. There is also a time limit to implementation and testing. Finally, a limitation to the design concerns in what context it can be effectively implemented. In this project's case, there is already a digital platform in which some stakeholders participate. Others are aware of the problems surrounding logistics around the airport nodes and are committed to working with the research team on this, which is made concrete in their signing of the project proposal.

2.2.3 OPERATIONAL REQUIREMENTS

Operational requirements consider the 'ease of use' by the end user, which in the case of the LOGIGOV could be either a manager from a lead firm, an external consultant, or even a project group working on collaboration. An important operational requirement of the LOGIGOV is that it must be user-friendly by being explicit and uncomplicated. A frequent problem with methodologies aimed at innovation is that they are too complicated and as a result less useful. "Without a set of (simple) principles and rules to communicate state-of-the-art knowledge relating to these processes, practitioners and consultants may easily take off in the wrong direction. It is the explicit nature of such -in themselves obvious- rules that makes them effective and compelling" (Romme & Damen, 2007, p. 118).

2.2.4 LIMITING CONDITIONS

The limiting conditions, which reflect the specific context in which the intervention takes place, must be taken as unchangeable and be absolutely met. In other words, the context in which the LOGIGOV will be implemented is leading for designing the interventions. Limiting conditions we found during discussions with consortium members. These conditions are linked to the form and content of the workshops. For example, that workshops should:

- Be aimed at operational level governance in the form of business rules.
- KPI's should be simultaneously developed with the business rules.
- Have representatives from truckers, forwarders, and ground handlers.
- Always be given in a combination of a trucker or a forwarder and a ground handler.

Below the actual design of the LOGIGOV system is given.

2.3 THE LOGIGOV SYSTEM DESIGN

The first part of the LOGIGOV is the object design. This is a set of individual interventions performed as part of the total LOGIGOV system. The other part of the LOGIGOV is the process design, which refers to how the system is implemented in practice. Together they form the replicable methodology. Key principles for an effective LOGIGOV distilled from Deliverable WP2A.1 and WP2A.2 are:

- **Collaboration**: Ensure active participation and collaboration among all stakeholders throughout the process.
- **Iterative Approach**: Embrace an iterative approach, making continuous improvements based on feedback and evaluation.
- **Flexibility**: Design the system to be flexible and adaptable to accommodate evolving requirements and unforeseen challenges.

2.3.1 OBJECT DESIGN: STEPS IN THE REPLICABLE METHODOLODY

We developed the LOGIGOV using existing knowledge in the form of best practices and critical success factors found in scientific books, journal articles and practitioner reports. We also developed knowledge through expert interviews and focus group sessions with the consortium members. Steps in the system are shown in Figure WP2A-5.

Figure WP2A-5: Steps in the replicable methodology (LOGIGOV)

Detailed descriptions of the LOGIGOV steps shown in Figure WP2A-5 are presented below. Other, ongoing supportive processes are:

- Assure stakeholder engagement through workshops, meetings, and surveys to understand their perspectives, challenges, and expectations.
- Define common goals that align with stakeholder interests and consider efficiency, sustainability, and cost-effectiveness.
- Establish regular feedback loops with stakeholders, allowing them to provide input on the ongoing implementation.
- Use feedback to make iterative improvements, ensuring governance remains flexible and responsive to changing needs.

Step 1: Literature review of existing governance models

Please see Deliverable 2A.1 for this.

Step 2: Stakeholder analysis

The goal of this step is to start the process of understanding the context in which the LOGIGOV system will be implemented. If executed properly, the result will be a map of the important stakeholders, their motivations for taking part in the collaboration and their role or roles in the project. It is a crucial step towards gaining management support and starting the design of the implementation of the rest of the steps.

Step 3: Process mapping

This project is focused on strategic and operational processes involved in organizing and optimizing the transportation of goods to and from the ground handler, specifically the processes associated with slot planning. The format for process mapping is based on this. The complete slot planning process is shown Figure WP2A-6.

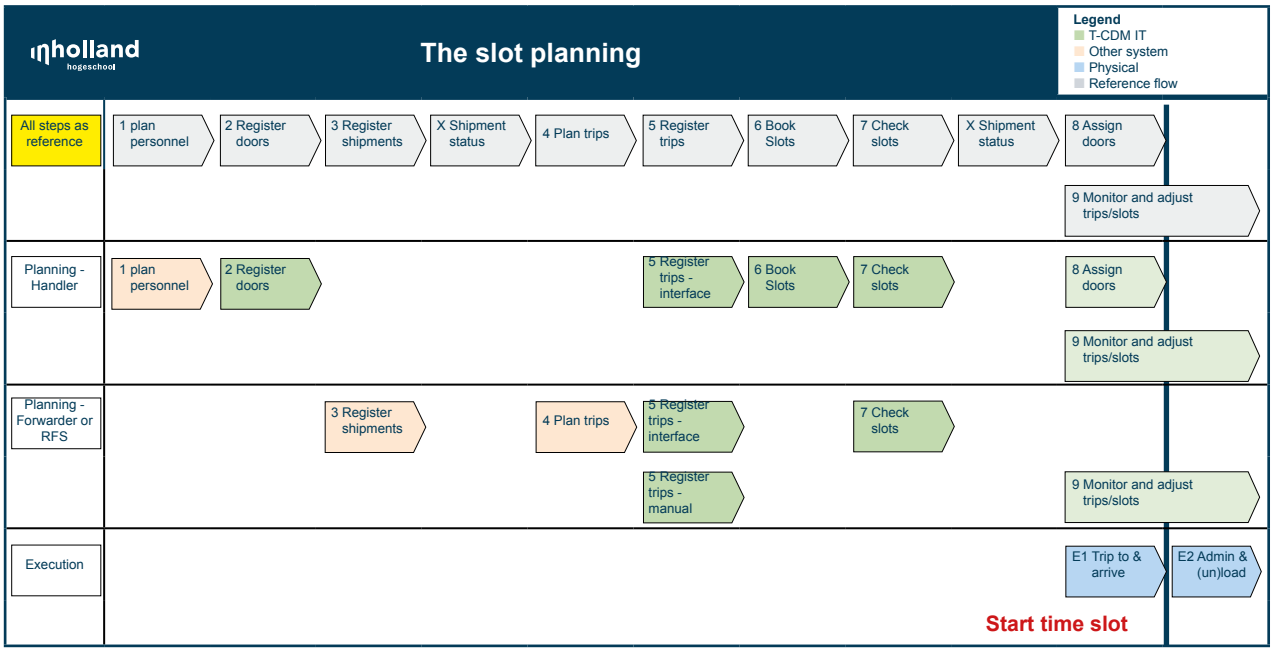

Figure WP2A-6: The slot planning process and the associated stakeholders

Step 4: Governance model determination

Determining and appropriate governance model was done through an analysis of existing models combined with an assessment of the context in which it will be implemented. See Deliverable 2A.2 for an example of the model and a discussion of how it was developed.

Step 5: Intervention (workshop) design

The design requirements for the workshops are:

- Focus on operational level governance in the form of business rules.
- Use business rules and KPI's from similar projects in similar contexts.
- KPI's should be simultaneously developed with the business rules.
- Have representatives from truckers, forwarders, and ground handlers.
- Workshop participants should always have a combination of a trucker or a forwarder and a ground handler.

3. EVALUATION

The last step in the Design Science Research cycle is the evaluation of the program developed. This we do in the form of a pilot test, presented as a use case.

3.1 PILOT STUDY

Our project is about creating conditions for collaboration among logistic service providers at the airport node so that waiting times at ground handlers loading docks are minimized, resources are maximized and in turn C02 emissions are lowered. Collaboration takes place within the Digital Twin in the form of data sharing concerning slot planning, and outside the platform where collaboration takes the form of knowledge and resources exchange.

In the pilot study we want to look at how ground handlers, freight forwarders and truckers work together in a digital platform. From a governance perspective, the pilot's goal is to come to an agreed upon model that would include a set of business rules, a list of KPI's regarding visibility and slot planning and possible ways of enforcing adherence to the rules. The project is also about understanding the characteristics of easy to adopt digital solutions in a multi-stakeholder logistic hub system enabling swift digital transition. Work package 2C looks at digitalization and how it should be developed for further development of the Trucking CDM IT-Platform as planning concept. Digital solutions, in our case in the form of the Trucking CDM IT-Platform, will not be adopted without a clear set of business rules, a list of KPI's regarding visibility and planning and a clear understanding by the stakeholders of the usefulness of the system. Thus - and we know this from theory – interventions from both WP2A and WP2C needed to be designed and tested together.

3.2 WORKSHOP DESIGN

Project researchers decided that two workshops would be needed. One to allow stakeholders to become acquainted with the digital platform's functionality and another to come to an operational governance model specifically aimed at facilitating collaborative slot planning. Functionality was also a part of the second workshop. (Note: This is discussed extensively in WP2C.)

WORKSHOP 1: DEMONSTRATION AND INSTRUCTION

The first workshop was aimed at helping the participants to become acquainted with the TCDM IT-Platform. It was a technical workshop that set the stage for the second workshop focused on adopting the platform and developing an operational governance model.

The workshop is centered around a demonstration about the functionality of the digital twin (DT), giving instructions about its use. The added value of the project and the common goals were also discussed (see Deliverable 1). The content-related goal of this workshop is to understand how the DT works specifically regarding transparency of the processes surrounding slot planning. Furthermore, we want to gain insight into the interaction between business processes, business rules (BRs) and performance measurement (KPIs).

The workshop has the following structure (for detailed descriptions of each element, please see the PowerPoint sheets, available upon request):

- Introductions between participants (name, company, position, motivation for participation).
- Workshop agenda showing goals, methodology, content.
- Introduction to case using the slot planning model shown in Figure WP2A- 6.
- Demonstration and discussion surrounding the IT functionality (regarding transparency of the planning process) and its link to KPIs and Business Rules.
- Presentation of first set of KPIs and BRs found in desk research.
- Discussion of the second workshop, including the form and content.

After the workshop a file with the KPIs, BRs and open topics divided op along the lines of the slot planning process was sent to all participants asking them to consider what works well, what doesn't work and what is missing?

WORKSHOP 2: TRIAL USE OF DE DT AND EVALUATION DESIGN OF THE SECOND WORKSHOP

The second workshop is a focus group session with representatives from ground handling firms, freight forwarders and truckers. The focal point of the workshop is on improved visibility of shipments using the system which consists of the Trucking CDM IT-Platform and the accompanying set of business rules needed to assure its implementation and running. In order to inform participants of the form and content of the workshop, a short introduction to the session's goals, its contents and a statement about privacy is sent out.

The workshop has the following structure (for detailed descriptions of each element, please see the PowerPoint sheets, available from the author upon request):

- Introductions between participants (name, company, position, motivation for participation).
- Workshop agenda showing goals, methodology, content.
- Introduction to case using the slot planning model shown in Figure WP2A- 6 and an overview of using the digital twin.

The workshop has three rounds that use the slot planning process as a reference.

- **Round one is about Business Rules**. What do we mean by business rules? What are examples of some? Are there others for this project?
- **Round two is about KPI's.** What are the KPI's needed and desired for guiding the application and evaluation of the system?
- **Round three is about usefulness of the system as a whole**. 'If there is increased visibility due to the TCDM IT-Platform, is that useful? How?'
    - Does the system (the TCDM-IT-Platform +BRs+ KPIs) work? If yes, why? If no, why not?
    - What is needed in order to make the system useful?

Expected results of the workshop are commitment to further cooperation and collaboration, higher levels of social capital, a first draft of business rules, a KPI-tree and insight into the system – its usefulness and shortcomings.

4. TESTING THE LOGIGOV SYSTEM: A BUSINESS USE CASE

This section of the report serves as both a description about testing as well as a practitioner guide to implementing the methodology developed above. A business use case is a narrative or description that outlines how a particular business process or initiative is intended to function to achieve specific objectives. Unlike technical use cases that often focus on system interactions and software functionalities, non-technical business use cases emphasize the high-level goals, processes, and outcomes within a business context. We present the case as a narrative in order to make it more approachable.

A use case typically considers the actors involved in the processes, the boundary of the system in which the processes occur, preconditions that must be met before the processes are initiated, a detailed description of the activities and interactions that took place during the case, possible alternative flows, the state of the system after completion of the case and a description of any possible errors or exceptional situations that might occur during the case.

We add to the standard use case report by adding critical success factors that came out of the testing and explanations for these based on theory. By doing this, we hope to expand the possible impact across different contexts. Also important to note here is the fact that interviews done with participants showed our approach and the system we developed to be effective. We expand upon this later in the case description.

4.1 THE CASE

The CDM@Airports project is about creating conditions for collaboration among logistic service providers (LSP's) at the airport node so that waiting times at ground handlers loading docks are minimalized and in return C02 emissions are lowered. Collaboration takes place within the Trucking CDM IT-Platform, where collaboration takes the form of data sharing, and outside the platform, where collaboration takes the form of knowledge and resources exchange. Our original plan was to involve the whole community in our testing. However, we quickly realized this was not feasible due to time and manpower constraints. For this reason, we decided to perform a pilot with one specific ground handler.

In the pilot study we looked at how a ground handler works together with freight forwarders, truckers, road feeders in the context of a digital twin of the Trucking CDM IT-Platform (DT from now on) to improve the slot planning process. From a governance perspective, the goal of the pilot was to come to an agreed upon set of business rules, a list of KPI's in regard to visibility and planning and to define the usefulness of the system. The project is also about understanding the characteristics of easy to adopt digital solutions in a multi stakeholder logistic hub system enabling swift digital transition. Work package 2C looks at digitalization and how it should be developed for further development of the Trucking CDM platform as planning concept. Digital solutions, in our case in the form of the Digital Twin, will not be adopted without a clear set of business rules, a list of KPI's in regard to visibility and planning and a clear understanding by the stakeholders of the usefulness of the system. Thus - and we know this from theory – interventions from both WP2A and WP2C need to be designed and tested together.

4.2 ACTORS IN THE USE CASE

The following actors were part of the case:

- Ground handlers
- Freight forwarders
- Truckers
- Road feeders
- A Digital platform developer
- Representatives from the sector organization Air Cargo Netherlands
- Representatives from Schiphol
- Researchers and students

CSF: Make sure the pilots are designed with the participants in mind. We were working at an operational level with partners, and as such needed to develop a governance model based on operational- level agreements, which we called Business Rules. In the project we used the following very basic definition of governance "…a set of rules, procedures and operational structures that guides the short-term and long-term actions of platform members. Effective governance should positively affect attaining both individual, firm and group objectives as well as allow for monitoring."

4.3 SYSTEM BOUNDARY

The boundary of the system in which we tested was the airport node, specifically stakeholders of the ground handlers, except for the airlines. Furthermore, we focused on the processes surrounding slot planning and more specifically on one aspect of this, namely visibility.

Reflection: While we wanted focus on both visibility and plannability in the pilot, due to technical issues including difficulties with accessing certain types of data, we could only explore the visibility aspect using the DT. However, we did discuss planning and the associated KPIs and business rules with workshop participants in a theoretical experiment.

4.4 PRECONDITIONS

The main precondition in the case was that actors were convinced of the importance for reducing waiting times for pickup and delivery at the ground handler through digitalization. Reducing congestion at the ground handler was referred to in the case as 'the golden puzzle piece', which means it is the crucial last step towards reducing emissions and increasing margins at the airport. Another precondition was that stakeholders were already working on the issue. There was considerable press from ACN and Schiphol as well (via Schiphol Cargo Main Port). This assured an existing level of urgency and understanding that collaboration was important to reach a common goal, namely reducing waiting times and consequently increasing efficiency. Finally, there was a willingness among participants to work with Inholland in the pilot program.

Reflection: These preconditions point to important critical success factors for changing any system, especially one based on informal governance. If these preconditions are not there before starting the LOGIGOV, they need to be addressed during its implementation.

4.5 MAIN FLOW OF EVENTS

This section gives a step-by-step description of the interactions and activities that occurred during the use case. The pilot took place over a six-month period and included in total seven workshops with representatives from 12 organizations. The complete group of Stakeholders is defined above. For the pilot we implemented the workshops where the ground handler was present at each one, and the other stakeholders present for different goals.

4.5.1 MOBILIZATION OF STAKEHOLDERS

This occurred to a certain degree in the project itself, where the whole community gave commitment in the form of in-kind contribution to the project. However, in order to mobilize specific actors, the program manager visited each of the stakeholders who had committed specifically to the pilot.

CSF. Build social capital through a personal approach. We know that social capital plays a large part in developing trust. Going personally by each of the stakeholders and explaining what the project was about and how their role was important – also for their own organization's development – was an important way for motivating participation.

Topics discussed were about the project, the research that was to be done and specific needs and expectations of the stakeholders. A short report summarizing the points spoken about was sent after the visits.

Furthermore, mobilization occurred through interns working with us who were placed in the stakeholders' organizations. We also organized a world café session with community members, gave a general symposium about the project's first results and finally interviewed stakeholders about their interest in doing a pilot session with us, and what expectations of the pilot they had.

4.5.2 WORKSHOP 1: DEMONSTRATION AND INSTRUCTION

This workshop was a demonstration about the functionality of the digital twin (DT) of the TCDM IT-Platform and instruction in its use. The content-related goal of this workshop was to understand how the DT works in regard to transparency for slot planning. Furthermore, we needed to gain insight into the interaction between business processes, business rules and performance measurement (KPIs).

In contrast to the rest of the workshops, this was given to each firm in the pilot individually. The point of this workshop was to make sure that participants were familiar enough with the DT so that the following workshops could focus solely on collaborating on the slot planning process using the DT. For a detailed explanation of this workshop, see 3.2 above. For the slides used (in Dutch), please contact the author.

CSF: Make sure hands-on training is possible. Our technology partner had developed the DT for both research and educational purposes. We found that having a working DT was crucial for participants to understand how each aspect of collaboration around the slot planning process could be digitalized and the consequences for this regarding complexity.

In work package 2C, a list of Business Rules (BRs) and a list of Key Performance Indicators (KPIs) were developed based on desk research and interviews with stakeholders (for a complete set of these, please contact the author at Donald.ropes@inholland.nl) The project group Schiphol Cargo Main Port also delivered BRs and KPIs linked to slot planning. Additionally, there was a list of open topics based on interviews with firms during the mobilization phase. During the workshops each of the topics was discussed in relation to the functions of the DT.

CSF: From the interviews after the pilots, we know that KPIs, BRs and functionality of the DT are inextricably intertwined with governance and need to be presented as such during the workshops. For example, the KPI 'Arrival on time for booked slot' is directly linked to the BR *'At least xx% of the trips arrive on time for the booked slot'*. Concerning governance, if a firm is not on time for their booked slot, they must wait until the next free slot.

After the workshop, a handout comprising business processes, goals, BR's, KPIs, open topics and screen dumps of the DT for each part of the planning process was sent to workshop participants beforehand as way to prepare and for maintaining top-of-mind awareness. Also included was a feedback form about the BRs, KPIs and open topics structured using three questions; 'what works well?', 'what does not work?', and 'what is missing?' We asked participants to consider these as preparation for the second workshop.

4.5.3 WORKSHOP 2: TRIAL USE AND EVALUATION

The second workshop we implemented in three different rounds, each focused on the processes of slot planning around the ground handler (for a detailed explanation of this workshop contact the author). Figure WP2A-7 shows the set-up of the series of workshops.

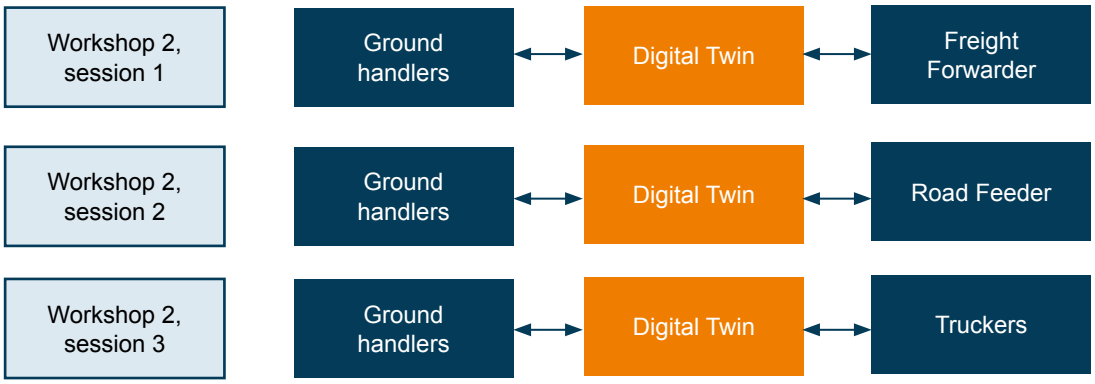

Figure WP2A-7: Stakeholders per workshop

The purpose of workshop 2 was to gain further insight into the usability of the digital twin in regard to transparency and visibility for slot planning, further exploration of important KPIs, BRs and open topics and feedback on the above. This was structured using three questions; 1) what works well 2) what does not work and 3) wat is missing? The workshop structure was based on the following points:

- Trial use: Simulation of trips to and from handler using the digital twin.
- Example of 'happy flow' => how does the system work?
- Gathering feedback on the functionality of the DT, KPIs and BRs.

CFS: having the different firms together is important because it widens a firm's perspective on the slot planning process and allows for different needs and expectations to be discussed.

Three rounds of discussion took place. Each round considered KPIs, BRs and open topics centered around an aspect of the slot planning process shown in Figure WP2A-8.

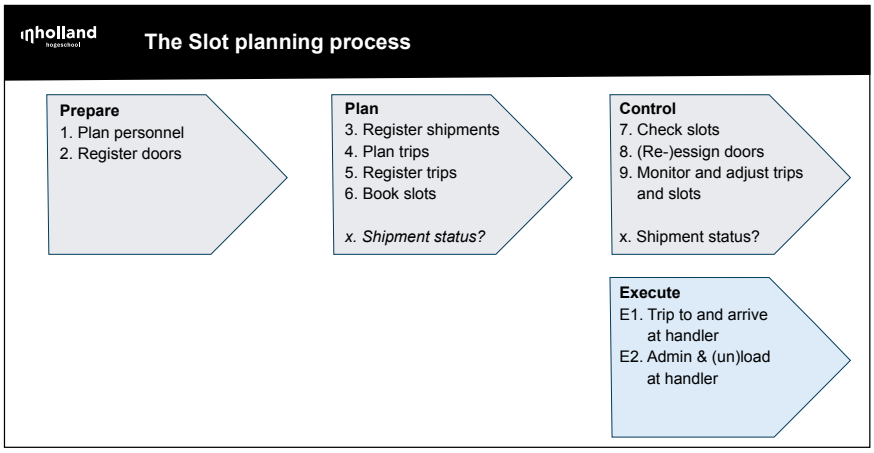

Figure WP2A-8: Sheet for guiding workshop rounds

Round one concerned visibility, which is about the planning and registering of trips. Round two was focused on plannability and looked specifically at personnel planning, slot registration and booking. Round three was about control as an aspect of plannability and included monitoring of the trip/slot and execution.

Reflection: We wanted to do an 'unhappy flow' in which visibility was made more difficult do to issues such as late arrivals, congestion, etc., but the IT provider was not able to do this at the time of the workshops. This decreased the quality and value of the results as the unhappy flow is a situation where governance is crucial.

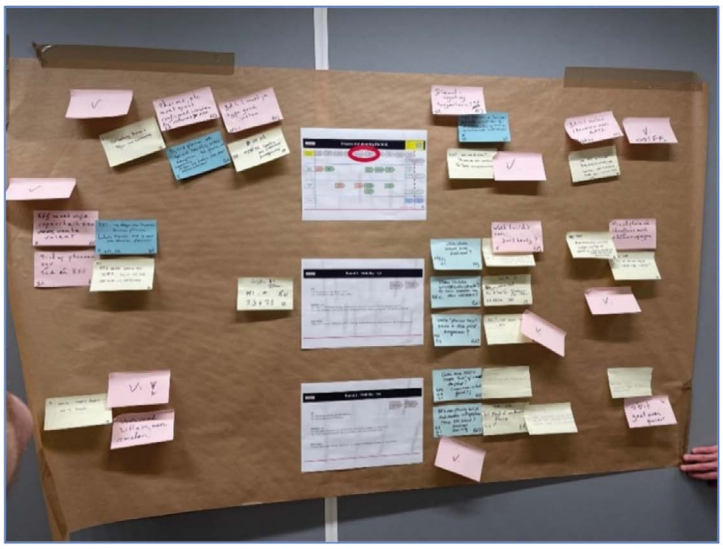

Figure WP2A-9: Photo of brown paper worksheet

A 'brown paper session' format was used for each of the sessions, which facilitated discussion and interaction among each of the participants.

After each workshop a short report highlighting the most important topics discussed was sent to all participants.

4.5.4 INTERVIEWS

The last event of the case was an interview with each of the workshop participants after the pilot was finished. Interviews were centered on the slot planning process and were intended to gain insight into different aspects of the workshops; data driven logistics, governance, and the effectiveness of the workshop design. For a copy of the complete interview protocol please contact the author. Results of the interviews are presented below in the section on postconditions.

4.6 POSTCONDITIONS (RESULTS)

In use case terminology, 'postconditions' refer to the state of the system after the successful completion of the use case. In WP2A we were not trying to impact the system so much as developing a validated methodology (LOGIGOV) for actually achieve this. Consequently, we use the term 'results', of which there are two main ones. The first is a validated methodology for establishing collaborative governance, i.e. LOGIGOV. The second one is a validated model for governance in this specific context that can be used as a building block for assuring collaboration.

4.6.1 VALIDATION OF THE LOGIGOV SYSTEM

In the interviews we asked respondents about the processes we implemented for developing a collaborative governance model: in essence if the LOGIGOV system is effective. Results point towards a positive answer. We elaborate further below.

The first question we asked was a general one; '*Is our approach – workshops with feedback in the community itself– effective for developing the foundation of a governance system?*'

Responses were in general positive, pointing out that:

- "The integral approach was good." (R8) Here the respondent is referring to the fact that we discussed the different aspects of the workshop as an integrated whole. In other words, we presented the KPI's, the business rules and the usability as being mutually dependent.
- "The workshops were effective as given because during them the community comes together." (R7)
- "That the workshops were face to face was crucial." (R5) having face to face workshops was an important aspect

of the workshop implementation that was mentioned by many of the respondents. This is an important point for practitioners who might think online workshops are as effective as F2F ones.

There were, however, some critical responses. For example:

- "I was not used to the workshop processes – there needed to be more discussion." (R5) Some of the participants were taking part in other, similar workshops, where more fundamental discussions about were taking place.
- "Theoretically the workshops were good, but a deep discussion was missing." (R6) We decided to cover each aspect of the planning process in regard to visibility and used a shortened list of business rules and KPI's that we had found in the literature. However, time was always an issue because agendas were full.
- "The workshops were good, but there was too much time between them." (R10) There was typically four weeks between the workshops, and we tried to keep top of mind by sending participants a short report in between.

The second interview question was '*Was the set-up of the workshops effective in regard to bringing together the various stakeholders?*'

Bringing together the community members was seen as a critical success factor. The following quotes illustrate this point:

- "The diversity of the stakeholders who were present absolutely lent added value because one heard different stories from different perspectives." (R10)
- "The set-up was absolutely valuable, with different stakeholders coming together and thinking about the KPI's, business rules and so on." (R13) Here two positive aspects of the LOGIGOV are illustrated. The first is related to the added value of bringing the important stakeholders together in a safe setting focused on an operational level question. The second has to do with the diversity and wide range of insights brought forth during the discussions.

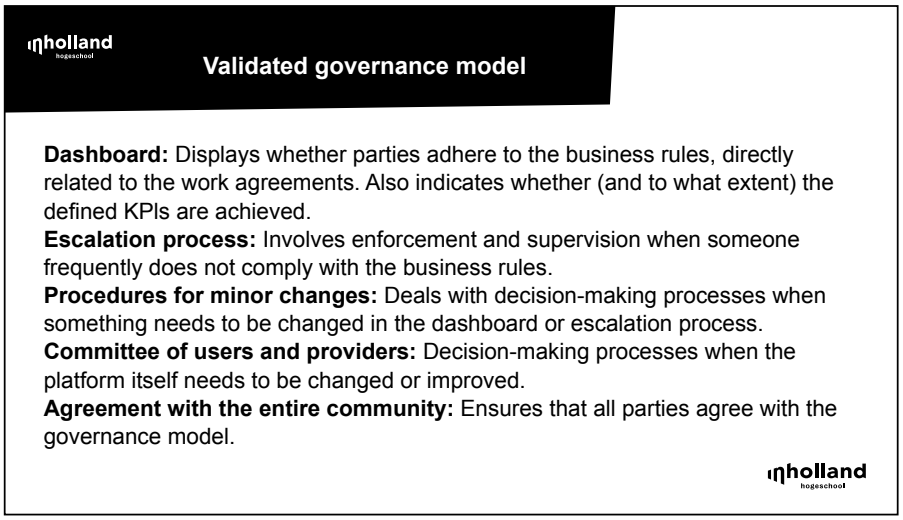

Figure WP2A-10: Validated governance model

4.6.2 VALIDATED MODEL FOR GOVERNANCE

The second result of WP2A is a validated governance model. We developed the model based on theory and tested this model in a symposium for community members. Based on the feedback collected in the symposium together with information and insights gained during the workshops, we amended the model, consequently validating it through by interviewing each of the workshop participants as well as other stakeholders in the airfreight community such as SCMP, ACN, Royal Flora and ABC. In total we interviewed 18 people representing 12 different organizations.

According to respondents governance is the key to collaboration, as a governance model helps stakeholders to understand their place in the supply chain and how they relate to others in their environment. Literally each of the stakeholders interviewed stressed the importance of governance: *"Governance is everything for collaboration*." (R8)

Dashboard for monitoring and control

We found that the dashboard element of the model is the keystone to an effective governance system, especially in a community that is highly operational.

Our first interview question was: *How important is a dashboard with KPIs and BRs for governance within the community?* All but one respondent answered that it is the foundation for governance in the community as it assures transparency in the system, which is important for monitoring whether stakeholders adhere to the agreed upon business rules. It also shows where there are problems in the system that might not be related to stakeholders' actions; *"One must be ABLE to adhere to the BR's. For example, constraints due to the physical infrastructure."* (R2*)* But transparency works both ways. If a firm is confronted with non-compliance to the BRs, then a dashboard allows them to actually check this for themselves.

Additionally, a dashboard helps stakeholders to monitor their own activities for efficiency and effectiveness, giving possible insight into process improvements. This requires that both BRs and KPIs are kept up to date and that the governance has built in possibilities for adaptation and improvements.

This quote from a respondent (R17) sums up the function and value of the dashboard: *"It serves as a mechanism to offer transparency, instill confidence, to return responsibility to the user. Furthermore, it helps ensure more efficient operations."*

Escalation and non-compliance procedures

By escalation we mean the processes that are set in motion for resolution of non-compliance to the BRs. We asked respondents about their ideas on escalation, specifically about what measures are necessary to ensure that people adhere to the BRs. On the one hand respondents were unanimous in their view that there needs to be an element of control in the governance system, but at the same time were reluctant about implementing any form of hard sanctions such as a monetary fine. In fact, several respondents discussed how rewarding firms who performed exceptionally well would work better than disciplining non-compliers because as R18 put it "*hard sanctions don't promote collaboration.*"

The following is a list of consequences for non-compliance mentioned during the interviews below, ranked in order of ascending severity.

1. No action, work on improving the system together.
2. Educate non-compliers to better deal with the BRs.
3. Naming and shaming via the dashboard.
4. Lose place in line at ground handlers.
5. Forfeit participation in collaborative system.
6. Financial sanctions.

Going to the back of the line was the most common sanction given. One respondent gave an example of what this sanction could look like: *"If you don't adhere to the business rules and consequently are regularly late for your slot time, then you are sent to a buffer zone and lose your place at the loading dock. Only once a spot comes available would you be allowed to proceed. If you do keep to the business rules, then you are allowed to proceed directly to the loading dock."* (R9)

Indirect consequences were also mentioned. For example, that the positive effects of collaboration and adhering to the BRs far outweigh the negative ones and that communication within the community should focus on this. Instead of sanctions, communicate the message that *"If you want to make use of a fast and efficient ground handling system, with all the advantages it has, then you need to adhere to the BRs."* (R11)

Respondents also spoke about the need for flexibility in the governance system due to the complexity of the slot planning process and the varied stakeholders. Again, there is a sort of trade-off talked about between flexibility and compliance. A certain amount of flexibility is important for any type of freight, but for some more than others. For example, pharmaceutical shipments.

Changes in dashboard or escalation procedures

Any governance structure, but perhaps especially one not based on formal contracts, needs to be able to adapt to changing circumstances and be flexible in the sense that stakeholders in the system are leading. If a BR or KPI is experienced by stakeholders as hindering the operational processes, then there should be built-in mechanisms for amending the governance structures. Flexibility of the governance system, especially the dashboard and escalation processes, was discussed in the interviews as a critical success factor for assuring stakeholders would adhere to it. *"If a business rule doesn't work, then we probably didn't think about it well enough, which means it can't be set in stone."* (R14)

We asked about processes and structures that should be in place in case of changes needed to be made in the dashboard or escalation process. Respondents were clear in their answers that there should be a committee responsible for

any amendments to the operational governance. They were also clear that the committee should be representative of the stakeholder group, but also be able to work independently. The idea of collaboratively working on the governance system was stressed: *"You require support for change with each transition. Simply implementing changes without a structured approach won't be effective, especially if there is a designated leader. Therefore, it is beneficial to establish a process where all parties can voice their opinions during every change. This is the first key element. Initially, there should be a consultation phase to gather input, followed by a smaller, select group that, having considered all perspectives, delivers the final verdict. These two components are essential for successful implementation."* (R2)

The 'select group' that R2 mentions would be responsible for working closely with operations and should regularly evaluate the dashboard and the escalation procedures. There were different views about who should be in the group and where it should be positioned, but most thought that the committee should be made up of representatives of the different sector councils.

Committee of users and providers

We also asked about what type of board or committee is needed to affect any changes in the collaborative system itself: 'Who discusses these processes regarding changes and improvements to the planning solution itself?' Most responses pointed towards either a third party such as Air Cargo Nederland or the whole community in the form of the sector council representatives.

Agreement with the entire community

The importance of this aspect of the governance concerns the informal nature of it. It's all about commitment to a common higher goal and assuring that parties maintain this commitment and continue to collaborate. We heard throughout each of the interviews how important governance is for successful collaboration and were looking for ways to assure commitment to the governance structures. Our question was 'What are the next steps in assuring the governance model is embraced by the whole community?' Answers were diverse, but we found several themes.

One theme was that the governance model needs to respect the dynamics of the environment in which it is implemented. This is related to the flexibility aspect we discussed above. Another theme was the key role ACN together with Schiphol has. "*I think you have to follow two routes. On the one hand, you will do that through the ACN sector councils and through the ACN board, but not everyone at Schiphol is a member of ACN, so you will also have to do something via the Schiphol line, which, in parallel, approaches parties and alerts them to what is happening. Where we often draw the line is, Schiphol informs that something is happening, and if you want to be involved, you have to do it through our line. There is a weakness in that because not everyone is a member of ours- a majority, but not everyone."* (R9)

The third theme was about communication and how important that is for continued buy-in and commitment. Messaging should point towards how collaboration is to everyone's benefit and that the governance system facilitating it is also the result of a collaborative effort. Communication should also be aimed at CEO's in order to assure top-level commitment that consequently could increase adoption.

4.7 EXCEPTIONAL CONDITIONS

The following might have occurred during the execution of the use case that influenced the results.

- Airline representatives did not participate in the workshops yet are a key player at the airport node. In many ways airlines have the power to determine the planning of ground handlers due to their flight scheduling.
- We wanted to test with different ground handlers, but time restraints limited us to just one. We might have had different insights from the interview data if this had been the case.
- While the TCDM IT-Platform DT was developed to the level where we could discuss planning, we could not test in real life. We basically tested with a demo without full functionality. Other governance issues might have come about if we had.
- We were not able to work with real-life, real-time data, which also may have influenced what was discussed in the workshops.
- Another project on a similar topic was running parallel to ours in which several respondents were participating. This which might have colored workshop participants' experiences and consequently their responses to the interview questions.

4.8 CONCLUSIONS

Our hypothesis was that if implemented properly, the LOGIGOV system would lead to the development and adoption of effective governance structures by the stakeholders. We consider governance structures to be effective if they lead to 1) improved cooperation and collaboration in the form of knowledge and resource exchange 2) process or product innovations and 3) higher levels of social capital. Effective governance structures should ultimately lead to reaching a common goal. In our case this was a reduction in wait times and consequently less C02 emissions. On the basis of our research, we believe that the governance model developed in the project, if actually implemented in the community, would lead to the desired outcomes. This because we found during the workshops and the interviews later, that governance is the cornerstone of collaboration.

We also hypothesized that the LOGIGOV system would help develop an awareness about contractual governance and an idea when it should be developed. This was true to a slight extent. We heard from several respondents that governance should start 'soft' and get 'harder' as time goes on. Elements of contractual governance were also seen in the consequences for non-compliance that were mentioned.

We couldn't find any specific themes related to the organization the respondents worked for. For example, both truckers and ground handlers had similar responses to the questions about the dashboard.

4.9 MANAGEMENT IMPLICATIONS AND FUTURE RESEARCH

The use case showing the implementation of the LOGIGOV system can be used by managers involved in cross chain collaboration projects taking place at the airport node as a way to understand the role of governance in developing relationships between the different stakeholders. Governance in this respect is a way to assure the smooth operation of slot planning as well as to develop a common goal and understanding among stakeholders, ultimately increasing social capital. Project managers in logistics, or even other sectors, can use the knowledge generated here as a framework for designing projects that enable collaboration. While the context of the use case is the airport node, and the stakeholders logistic service providers, many of the critical success factors for open innovation and collaboration are the same for other sectors.

Next steps related to the application of the governance model would be to introduce it at a sector level meeting and further develop it for application, especially regarding how to assure that the model is both flexible and enforceable. This will probably require a strong third party such as the airport itself, or ACN. Furthermore, there needs to be more applied research with stakeholders outside of the project's community, especially the airport and the airlines. Another next step could be to implement the LOGIGOV in another airport to better understand contextual issues of governance.

Future research in the vein of this project could look at to what degree social capital is actually developed in such a process as the LOGIGOV, and how this social capital affects collaboration in real life. The workshops were done to gain insight and information about the governance needed in collaborative situations, but testing the model in a real-life situation would be invaluable for both theory and practice. More research also needs to be done on the question of when and how governance shifts from informal to formal. And if this is in fact possible, considering the dynamics of the airport node, the wide diversity of the stakeholders and other problems associated with contractual governance.

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