GOVERNANCE OF MULTI-LEVEL AND MULTI-ACTOR SYSTEMS FOR CUSTOMS SUPERVISION

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The vessels transporting the cargo can face change in itinerary because of various factors. The ENS documents are submitted to the customs office of first entry before loading the cargo onto the vessel. The issues that the customs faced were unavailability or incomplete Entry Summary Declarations (ENS) to perform the risk assessment because of the change in itinerary of the vessels. Due to this unavailability and incomplete ENS documents, it is difficult for customs to perform their risk assessment processes. This results in an inefficient process and incurs costs.

Due to the growing amount of trade into the European Union, these issues cause a serious problem in the functioning of the customs authorities of the EU. In 2018, the PROFILE research project of the EU investigated the possibility of using blockchain technology for availability of information to the customs. The blockchain technology is a decentralized platform. In the PROFILE project it was examined whether blockchain can be used as a system to define access control to ENS data. Such a system can be seen as complementary to ICS 2.0 EU system that is currently being developed in the EU. Governance issues surrounding the blockchain-based platform arose such as who will develop the platform and be held accountable for the platform. The networked organizations around this blockchain-based platform consists of actors from the supra-national level (EU), national level (EU Member States) and business organizations (ocean carriers). Since the goals of these actors are different (carriers are interested in monetary profits and one of the interests of customs authorities is safety), a governance solution for multi-level network of actors to form a collaboration is required. Thus, the objective of this research is to look for a governance solution that enables multiple actors to join forces and form a collaboration.

Outline of the research

The research question that has been formulated for this research is: *What governance solution can enable the collaboration of multiple organizations to develop blockchain technology for EU customs supervision?*

A collective network of customs organisations comes with its own challenges like who is in charge of governance, and legal barriers specific to countries associated. Governance solution is required to ensure smooth collaboration.

The graduation project is divided in to 4 main phases. The first phase introduces the problem background, problem statement, research questions and the research methods. The second phase contains the literature study into the governance literature, and mainly look for existing governance solutions for multi-level and multi-actor governance. The second phase focuses on answering the research sub-question: *Which theoretical frameworks can help identify elements that are necessary for governing collaboration for multi-level and multi-actor networks?* The objective of this phase is to gain as much as insights into the domain of governance of global and complex network of actors. The five articles found as a result of the systematic literature review are highly cited quality papers containing governance frameworks for multi-level and multi actor networks. These models together encompass all the identified forms of horizontal governance, namely: collaborative (Ansell et al., 2008; Emerson et al., 2012), collective (Pretty, 2003) and network (Provan et al., 2008). One of the papers describes how the governance choices in collective action may be in 5 propositions (Stoker, 1998). These articles are in the domains of collaborative innovation and use of social capital and networked connectiveness. The second phase ends with answering the third sub-question: *What conceptual model could enable governance of multi-level and multi-actor networks?* The second phase ends with developing a conceptual governance model for multi-level governance in collaborative innovation. The conceptual model has elements related to dynamics of actor during and before the collaboration, dynamics of the collaboration itself, and context and drivers influencing the collaboration.

The third phase focuses on answering the research sub-question: *What governance framework can be used to aid the collaboration of multi-level actors in the context of customs supervision?* The third phase contains the contextual and the empirical study into the PROFILE project of the EU. Relevant information has been gathered from the deliverables of the PROFILE project and from interviews. These interviews have been used to gather insights into the blockchain-based platform that can serve as complementary platform to the ICS 2.0 (Import Control System 2.0) system that is currently being developed. Case study design and protocol defined by Yin (2018) were followed for this phase. From the case study analysis, it was found that the elements (from the conceptual model) that need to be included in the refined model are: Power, resource conditions, Levels of conflict/trust, Network connectedness, Policy legal frameworks, Prior history between the actors, Capacity for joint action, Mutual Understanding/consensus, Ownership/commitment, Leadership, Institutional design, Incentives, Interdependency. This phase ends with an empirically enhanced model after conducting case study analysis. Based on

the empirical context, more emphasis is made on the process of forming a collaboration for the blockchain-based platform rather than focusing on the outcomes. Due to this, the rights of the actors from the blockchain governance framework developed by Van Engelenburg et al., (2020) have been included in the model. The refined governance model can be viewed in the figure A. The elements in the model having a tracing number, Tx where x is a number, derived from the literature review and the element which is in brown colour font is derived from the case study.

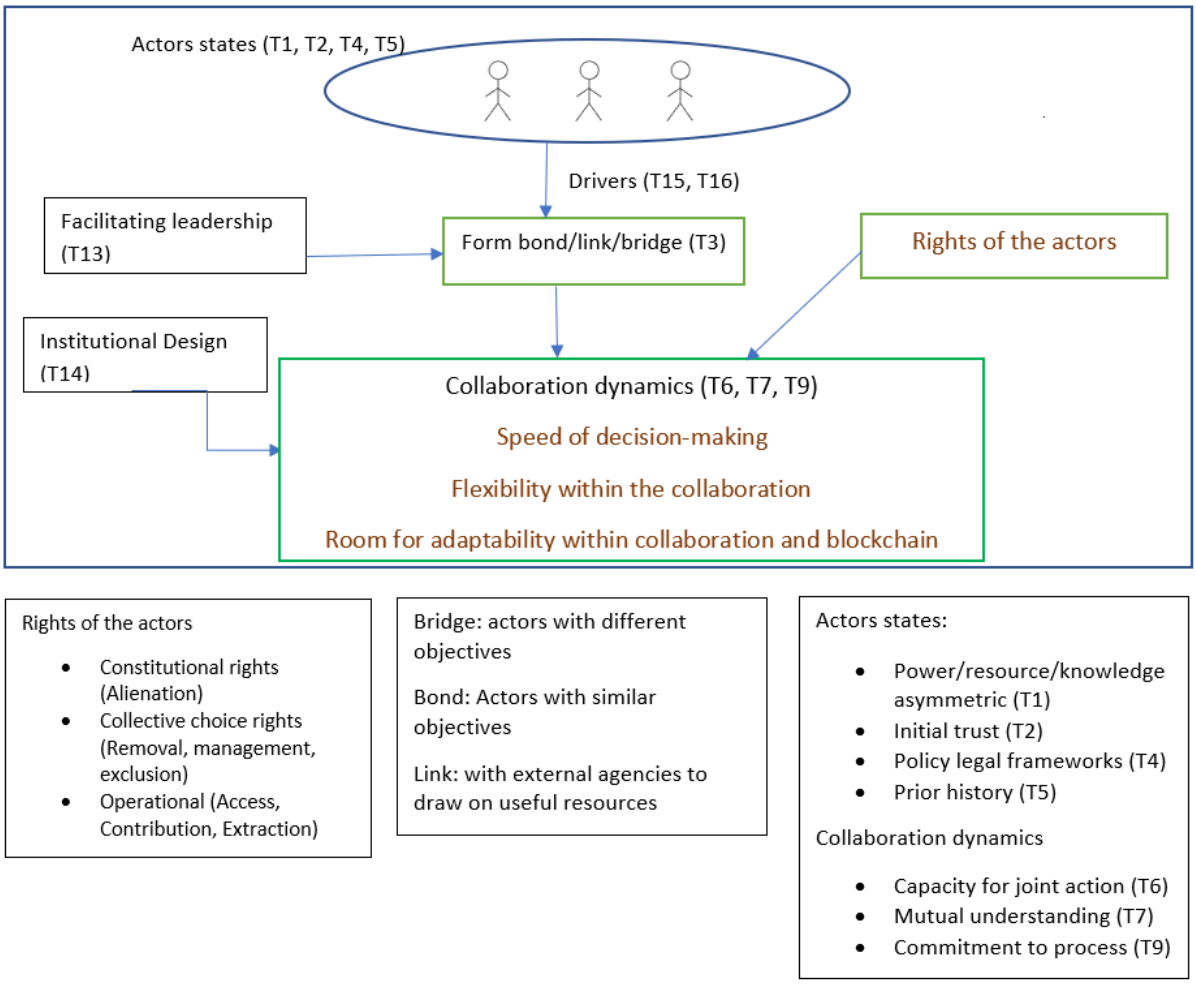

Fig. A: Refined governance model

The fourth phase is concerned with the use of the governance framework for blockchain-based platform by developing scenarios. The fourth phase focuses on answering the research sub-question: *How can the governance framework be used for governance during the development of blockchain technology for customs supervision?* The fourth phase ends with the validation and evaluation of the scenarios, and the governance model. The governance scenarios have been presented in the workshop and the feedbacks and suggestions received during the workshops have been implemented. The purpose of scenario developments is to improve the

understandings of system and stakeholder's motivation in a collaboration. There are diverse interests of the stakeholders coming to collaborate and work collectively on the platform. The scenarios can be used to create knowledge to deliberate on problems, and simultaneously demonstrate a solution that is still open-ended. Thus, various possibilities in each scenario have been explored and suggestions have been given on how to proceed with solution, like with the actor dynamics and leadership. These scenarios are developed with interviews and workshop held with experts in the field of customs domain. Lastly, some validation techniques are discussed for validating the scenarios.

This adaptation of the model from organizational studies to the field of digital trade infrastructures and blockchain-based platforms is a way to fill the knowledge gap that has been identified in the first chapter. The model can be used to deliberate on the governance of the blockchain-based platform and the customs authorities can use the platform to have better risk rules, and ultimately better risk assessment in international trade.

Scientific and Societal relevance

The existing literature had very few researches on collaborative innovation for digital trade infrastructures. The theoretical governance frameworks that were selected for the development of conceptual model were for the governance of actors in a general context. The case study into the blockchain-based platform developed by the PROFILE project helped turn the conceptual model into an empirically enhanced model. This empirically enhanced governance model thus gave solutions for collaborative innovation and multi-level governance for blockchain-based platform. This research is ultimately an extension to the work done in the field of digital trade infrastructures as it contributes to the literature for governance solutions for blockchain-based platform.

The empirically enhanced model of governance can be used by global and complex networks of actors & organizations to derive scenarios for collaborative innovation so that they can identify the elements of governance that the stakeholders of the platform need to adopt, and to explore how these elements influence the design choices of the blockchain-based platform. The model can be used to develop the blockchain-based platform and the Customs Authorities can use the platform to have better risk rules, and ultimately better risk assessment in international trade. Better risk assessment will ultimately lead to improved security at the borders for international trade and reduction of financial losses due to fraudulent customs declarations.

Limitations

Limitations of this research are that the empirical data gathered was limited and also the time constriction (total thesis duration: 6 months) made it difficult to analyse the gathered data intensively. The conceptual governance model was formed by consulting literature were for the governance of actors in a general context. So, the limitation of the conceptual model is that the literature review was not done to find theoretical frameworks for governance of actors around blockchain-based platform or customs supervision. The refined model was obtained in the last four weeks of this research. More time could have been put into refining the model by giving justifications after consulting experts in the customs domain and stakeholders of the blockchain-based platform. Interviews could have been held with customs officers and the workers at the carriers organizations to gain insights and to refine the governance model further.

Another limitation of this research is that the empirically enhanced model is used to develop governance scenarios for blockchain-based platform for customs supervision. Whether the model can be used as a guide to implement governance in real life needs to be further researched.

Chapter 1: Problem definition and Research approach

1.1 Problem background

The European Union (EU) faces large influx of goods every minute (European Commission, 2018). The EU border control management is decentralized, and the EU member states are responsible for it. Presently, the EU border control comprises of 28 different customs authorities. The customs authorities play the most crucial role in border control because they are responsible for protecting the European mainland from threats (human, economic and environmental) and ensure safe international trading (European Commission, 2010, 2018a). They prevent incoming of hazardous or unlawful goods into the EU mainland (European Commission, 2010).

The Customs Authorities do their jobs by performing risk assessment on the incoming goods. The EU introduces new management techniques and technologies to improve their risk assessment analysis regularly. The risk connected with the entry of goods into the EU customs territory is analyzed by the customs authorities based on the information of goods provided in an electronic declaration. Every entity (a carrier or a different person acting with the knowledge of the carrier) importing goods from a third country is obliged to submit an Entry Summary Declaration (ENS) prior to the arrival of goods to the EU (DG TAXUD, 2017c). The ENS data include information such as the buyer and seller identities, description of the items, the countries of destination and origin (Hesketh, 2010). Customs declarations may be submitted by an importer, a logistics service provider or a customs broker. Control measures depend on the assessment of risks and threats. These may include checking transport documents, carrying out the customs examination of goods or inspection of means of transport.

1.1.1 Customs risk assessment process

Customs risk assessment process is a socio-technical process involving both technology and the human factor to determine whether the goods imported are hazardous or has fraudulent information. Customs declarations submitted by an importer, a logistics service provider or a customs broker are subjected to an automated risk analysis based on risk rules predefined in risk assessment software.

According to an expert in the field of customs domain working in the Delft University of Technology (TU Delft), the risk rules set apart a set of declarations that are considered as risky. This set is further investigated on by a human targeting officer. The human targeting officer

adheres to the organization's principles and guidelines coupled with his own expertise and experience and makes a final selection for inspection to be sent for physical inspection. With the current approach, customs currently know very little about how many fraudulent declarations they miss. Also, from the declarations that undergo physical inspection, only a small percentage result in actual hits, as told by the expert. Thus, the customs aim to improve by engaging in data analytics projects and add insights from data analytics algorithms to the risk assessment process.

1.1.2 Problems faced during risk assessment process

The European Commission, (2018) reports over four thousand tonnes of goods being traded in and out of Europe every minute. These trading involve numerous interactions between the customs authorities each and involve huge amounts of paperwork (IBM, 2017; Allison, 2016). These massive volume of interactions and communications pave the way for misinformation in the documents (voluntarily or involuntarily). In addition, the Import Control System (ICS) faces the problem of incomplete ENS data and unavailability of the ENS data to the Customs Authorities to perform risk assessments analysis (DG TAXUD, 2017c). The unavailability of ENS data occurs especially in maritime transport of goods (European Commission, 2013). The ENS data is sent to the Customs of First Entry (COFE) in EU 24 hours prior to the loading of goods onto the vessel. In case after loading, the itinerary of the vessel changes, and the goods arrive at a different customs office in the EU, that customs office do not have the ENS documents to perform the risk assessment (European Commission, 2013). The interactions between the Customs Authorities are extremely high (DG TAXUD, 2017c). These interactions are requests for ENS data or additional information of the goods.

Due to this, delays are often experienced throughout the risk assessment process because the customs authorities must communicate more to get information and perform inspections unnecessarily. These activities come at a financial expense to the customs authorities (Thomas and Tan, 2015). The costs for the customs are largely concentrated on duplication of information, performing redundant inspections of the goods, communicating for the missing ENS documents and lack of coordination of activities of the EU customs offices and other border agencies, also known as Coordinated Border Management (CBM) (Elmane-Helmane and Ketners, 2012; Rukanova et al., 2017). Hence, there is an urgent need to find a solution for incomplete, misrepresented and missing information of the ENS.

1.2 Previous work done in the field of customs domain to improve the risk assessment process

Digitalization is looked at as a solution to improve the risk assessment process for international trade. The EC and the Member States of the EU developed the CORE project, which aims to improve the trade security by employing secure ways of data collection and distribution (CORE, n.d.). Data fragmentation has been observed as the problem by the actors involved in the international trade and Digital Trade Infrastructures (DTI) has been proposed as the solution (Rukanova et al., 2017). Hesketh (2009) proposed the use of data pipeline because the data quality weakens along the supply chain, and hence, data should be captured at the source. These solutions enabled the organizations to share information with safe and secure methods for accessing the data (Hesketh, 2009; Thomas et al., 2015). Rukanova et al. (2017) researched how the data pipeline can provide access to data assets which will allow the customs to improve their risk assessment analysis. The transparency of data along the supply chain allows the actors involved to coordinate and take better decisions throughout the chain (Hofman et al., 2019).

After CORE, the PROFILE project was launched in 2018. The focus of the PROFILE project (PROFILE, n.d.) was to use data analytics and data assets to improve the customs risk assessment process (PROFILE, n.d.). Along with PROFILE, the EC and the Member States, developed the Import Control System 2 (ICS2) for the purpose of developing a Common Repository for the ENS information. This repository will allow the customs authorities to access the ENS information (DG TAXUD, 2017c). The European Commission identified the prospect of blockchain technology to be used for digital initiatives and evaluation of its application within customs has been done (DG TAXUD, 2018a). Blockchain is a distributed ledger that records information openly and in a decentralized manner (Ahl et al., 2019). Every transaction within the platform is recorded as a block after getting consensus from all parties using the platform. This block then gets linked to previous blocks, thus forming a chain and gets shared across the network promoting transparency and accountability (Ahl et al., 2019). The PROFILE project is researching on the application of blockchain technology to improve the availability of information.

1.3 Issues identified with using blockchain technology to improve risk assessment process

Blockchain technology is where data can be made accessible for different actors simultaneously (Zheng et al., 2017). Blockchain makes it possible to exchange information directly while all transactions are recorded permanently (Zheng et al., 2017). Blockchain technology causes privacy concerns among the users as there can by nodes present in the blockchain that can use the sensitive information shared across the blockchain for malicious purposes. Blockchain technology is a decentralized system of technology (Chang, Iakovou and Shi, 2020). Thus, it is not clear who is developing and maintaining the platform and it needs to be defined clearly to the organizations using the platform.

In Ølnes, Ubacht and Janssen (2017) a governance of the blockchain model was introduced to define who is responsible for designing the platform and liable for it. The model introduced a transition from centralization to decentralization where a single organization first develops the platform and then the single-actor governance turns into a networked governance. There are governance related issues identified with the adoption of the blockchain technology for the risk assessment process as the organizational network that will be using the technology consists of actors from private firms (business organizations like the carriers), public authorities (Member States of the EU). The network formed is international with actors placed at various levels of power and resources

In the customs domain, countries can join forces and approach holders of external data that is valuable for them collectively. The benefits of this is shared costs and efforts (Rukanova et al., 2019). A collective network of customs organisations comes with its own challenges like who is in charge of collaboration, and legal barriers specific to countries associated. Governance of such collaborations are required to ensure smooth collaboration. The definition of governance for this thesis is taken from Bevir (2013) where governance is broadly “all processes of governing, whether undertaken by a government, market, or network, whether over an entire system, formal or informal organizations, or individuals part of such a system, and whether through laws, power, contracts, norms, language” (Bevir, 2013, p. 1).

Rukanova et al. (2020) proposed a governance framework for public and private organizations to realize the value of big data analytics in their respective organizations. The governance framework was developed by using top quality articles that the researchers seemed appropriate for their model. In their research, there was lack of an intensive literature review for governance

models that have been designed solely for multi organizations network. Nevertheless, Rukanova et al. (2020) gave insights on collective capability building for organizations by joining a network and performing collaborative processes

1.4. Identification of missing knowledge

There is lack of research on how the customs authorities and the business organizations involved in international trade can join forces to realize the blockchain technology. For collective use out of the blockchain, the idea is that organizations form a collaborative network. Research to find existing literature that answers the question of how they can form a collaboration will be conducted. Thus, the objective of this research is to look for a governance solution that enables multiple actors to join forces and form a collaboration.

1.5. Research Questions

After mentioning all the issues, the main research question needs to be formulated for having a consistent research goal. The main research question is:

> *What governance solution can enable the collaboration of multiple organizations to develop blockchain technology for EU customs supervision?*

The main goal of this research is to define a governance framework that enables the collaboration of multiple organizations from varied backgrounds. These organizations will have their own needs and values that the collaboration process must take care of. In addition, the collaboration must lead to a successful definition of developers of the blockchain platform and the actors responsible for governance of the platform.

The sub-questions derived from the main research questions are given below along with the research methods:

1. *Which theoretical frameworks can help identify elements that are necessary for governing collaboration for multi-level and multi-actor networks?*

Method used: Systematic Literature Review

This sub-question is formulated so that the researcher can gather ideas for the governance solution required for this research. To answer this question, a literature review will be conducted on the multi-level governance literature to find theoretical frameworks that can help to develop the conceptual governance framework for multiple organizations. The scope for the theoretical frameworks would be those governance frameworks that are focused on an international setting and have multi-level actors. These frameworks would then be analysed to identify elements that are deemed relevant for the formation of the conceptual model.

2. *What conceptual model could enable governance of multi-level and multi-actor networks?*

Method: Framework development from the literature review analysis.

From the previous sub-question, elements have been identified that are deemed relevant for the formation of the conceptual model. The conceptual model will be formulated as a result of the systematic literature review done in the previous sub-question. This conceptual governance model will still need to be refined to a context where it will be used. This will be done in the next sub-question.

3. *What governance framework can be used to aid the collaboration of multi-level actors in the context of customs supervision?*

Method used: Case study research.

This question is formulated so that the conceptual framework can be given contextual refinement to be used in the setting of customs supervision. Case study is conducted on the blockchain-based platform that is being developed by the PROFILE project. This case is analysed and explored to refine the model to make it suitable to be used for the blockchain technology that will be used by the customs organizations and other actors from the international trade supply chain.

4. *How can the governance framework be used for governance during the development of blockchain technology for customs supervision?*

Method: Scenario Development

This question is formulated to research how the refined model can be used. The refined model will be used to design governance scenarios. Thus, this sub-question is concerned with the use of the governance framework for blockchain-based platform by developing scenarios. The research ends with the validation and evaluation of the scenarios, and the governance model.

1.6. Research methods

The research questions developed in the previous section can be answered by the following methods:

Research Question	**Method**	**Chapter**

Which theoretical frameworks can help identify elements that are necessary for governing collaboration for multi-level and multi-actor networks?	Systematic Literature Review	Chapter 2: Literature Review (section 2.1 to 2.5)
What conceptual model could enable governance of multi-level and multi-actor networks?	Framework development from the results of the literature review analysis	Chapter 2: Literature Review (section 2.6)
What governance framework can be used to aid the collaboration of multi-level actors in the context of customs supervision?	Case study by using secondary data	Chapter 3: Context analysis and empirical study
How can the governance framework be used for governance during the development of blockchain technology for customs supervision?	Scenario development	Chapter 4: Development of scenarios

1.7. Data Collection

The method of systematic literature review used to answer the first research question will help the research by bringing various insights from existing governance models to the thesis such as collective, collaborative and networked governance. These models will be analysed and the main elements from these models will be extracted to develop a framework for this thesis. Next, the case study will be conducted by acquiring secondary data from experts in the field of customs domain working in Delft University of Technology (TU Delft), and by conducting workshop with stakeholders developing blockchain technology for customs authorities. Yin (2002) defines case as "a contemporary phenomenon within its real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context" (pp. 13). The case study will help give context to the multi-organization and multi-level governance framework. After conducting the case study, the refinement of the conceptual model will be done from the empirical data. Lastly, the

method of developing scenarios will help analyse how the refined governance framework can be made useful in the empirical context.

1.8. Structure of the thesis

The thesis will answer the research questions in subsequent chapters. The work done on the thesis have been divided into different phases. The following table gives an overview of the structure of the thesis:

Phases	**Chapters**	**Outcomes**
Problem definition	Chapter 1: Problem definition and research approach	Thesis definition
Designing	Chapter 2: Literature Review	Conceptual framework
Application to empirical context	Chapter 3: Context analysis and Empirical study Chapter 4: Development of scenarios.	Refined model Governance scenarios
Conclusion	Chapter 5: Conclusion and Recommendation	Concluding remarks

Chapter 2: Literature Review

This chapter will answer the research question: *Which theoretical frameworks can help identify elements that are necessary for governing collaboration for multi-level and multi-actor networks?* The systematic literature review approach by Kitchenham et al. (2009) is used to answer the above research question. The literature review approach is explained in the chapter in the section 2.1 and the approach has been followed step by step in the sections 2.1 to 2.5. The last section of the chapter, section 2.6, is focused on answering the research question: *What conceptual model could enable governance of multi-level and multi-actor networks?* To answer this research question, framework development will be done. Kitchenham et al. (2009) proposed the following steps to conduct the literature review: identification of studies, study selection, study quality assessment, data extraction and data synthesis.

2.1 Identification of studies

The first step of this approach requires determination of the objectives and questions that the literature review will answer (Kitchenham et al., 2009). The literature review is to gain insights on the existing literature for finding different elements of governance in multi-level and multi-actor setting. The thesis research is focused on the domain of collaboration of private and public organizations. This is the reason the literature search was done in the setting of multi-actor and multi-level context. As international trade involves different types of actors (carriers, customs authorities etc., the European Commission (EC)) in various levels of administration, the literature search is done to find multi-level governance frameworks. In addition to the multi-level, the customs authorities of the EU Member States are at the same level of administrative power. Thus, horizontal governance is also of interest.

The literature review objectives are: 1) to gain insights on the different types of multi-level governance and horizontal governance, 2) to explore the existing different governance structures derived from previous literature, 3) to use the existing governance models/frameworks to make a conceptual model for collective capability building process.

For the first objective, to gain insights on the different types of horizontal governance, the following questions were raised:

- How is multi-level governance and horizontal governance defined and investigated in different contexts in previous research?
- What objectives were fulfilled by the research on multi-level governance, horizontal governance?

- What are the contributions of previous research related to horizontal governance?
- How many forms of horizontal governance has been identified by previous research?

The second objective, to explore the existing governance structures and to relate it with the domain of EU customs organisations, raises the following questions:

- How can the theories/theoretical frameworks derived from the different forms of horizontal governance literature help in shaping and understanding international and organisational governance?
- What theories and theoretical frameworks/models have been designed and used in terms of horizontal governance related to international organisations/EU context?

The third objective, to use the existing governance models/frameworks to make a conceptual model for collective capability building process in the EU customs organisations, the following question need to be answered from the literature review:

- What main elements can be used to form a conceptual model for the EU customs organisations?

To find and identify literature, Scopus was taken as the main database source. This included Elsevier, Springer, Wiley-Blackwell, Taylor & Francis, Sage, IEEE, Oxford University Press and Emerald. The following is a list of the search strings that were used in the study. These were the main searches conducted for the literature review. They were:

- (Multi-level AND governance)
- (Multi-level AND governance) AND (framework OR model)
- (horizontal AND governance)
- (horizontal AND governance) AND (framework OR model)
- (Collaborative AND governance)
- (Collaborative AND governance) AND (framework OR model) (type of horizontal/multi-level governance)
- (collective AND governance)
- (collective AND governance) AND (framework OR model) (type of horizontal/multi-level governance)
- (network AND governance)
- (network AND governance) AND (framework OR model) (type of horizontal/multi-level governance

The reason for selecting the above search strings is because the domain of the research is collective data analytics capabilities building processes. This type of processes require multiple actors to come and join forces to form a collaboration. Further, in the domain of international trade multitudes of actors are involved in the supply chain. Few of those actors are the Customs Authorities and the carriers. Private firms, national and supranational organizations (the EU) form complex bonds and interactions among each other. Various types of multi-level governance are also used in the search terms.

2.2 Study selection:

This step defines the exclusion and the inclusion criteria for the studies found in the search. Since the different forms of horizontal governance can be related to a vast range of disciplines and will result in quite a large number of results, it is important to select the studies and assess them based on the requirements. The following selection criteria were used to select papers:

- The articles were published in a scientific journal or at a scientific congress.
- The articles need to peer-reviewed to ensure the quality of the papers. Thus, the search was limited to journal articles, conference papers and book chapters.
- The search was limited to following disciplines: Multidisciplinary, decision sciences, humanities, social sciences, business, management, economics. This is because the main research question can be related mostly to these disciplines.
- Only published articles till the date April, 2020 were included. There is no bar on the starting date to include the studies because all practices of successful multi-level governance were deemed useful.
- The language was set to English for ease and familiarity.

The following exclusion criteria were used to leave out articles.

- Because of low relevance, the search results from the following disciplines were excluded: Environmental Science, Agricultural Science, Medicine, Energy. Earth and Planetary Science, Chemical Engineering, Chemistry and Immunology & Microbiology, Mathematics, Neuroscience.
- Studies of case study set at low scale geographically (for instance neighbourhoods) because the scope of the research is at the international and national level.

Using the defined inclusion and exclusion criteria, the number of results for each are listed below:

1. (Multi-level AND governance): 936 results
2. (Multi-level AND governance) AND (framework OR model): 674 results

3. (Horizontal AND governance): 499 results
4. (horizontal AND governance) AND (framework OR model): 377 results
5. (Collaborative AND governance): 1298 results
6. (Collaborative AND governance) AND (framework OR model): 1061 results
7. (Collective AND governance): 1951 results
8. (Collective AND governance) AND (framework OR model): 1256 results
9. (Network AND governance): 4498 results
10. (Network AND governance) AND (framework OR model): 3229 results

The total number of documents from the searches at this step is 15779.

2.3 Study quality assessment

This step is to assess the quality of the documents found at the previous steps. The above searches were sorted by citations (highest) to get an idea on which studies of governance structures/theoretical frameworks were highly regarded. After sorting, the abstracts and titles of the first 20 search results were considered and read. If the abstract was not clear, for few of the papers the Conclusion of that document was read. This determined whether the documents were relevant to the research and had potential for being an inspiration to the creation of the conceptual model of the governance framework in this research. This process helped narrow down the number of relevant documents to 39. These 39 papers were again sorted according to citations and the articles having >1000 citations in Scopus are selected.

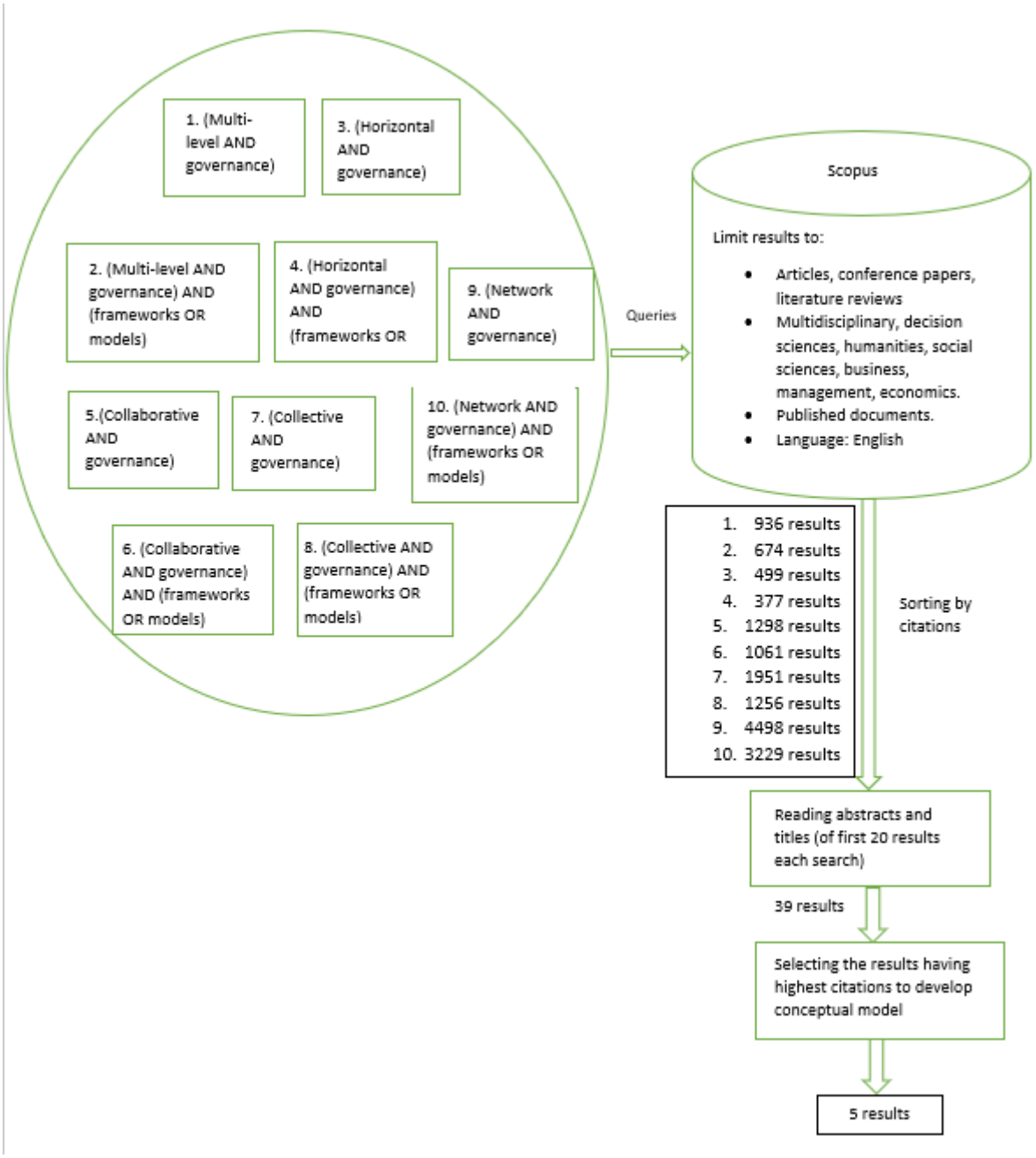

Fig. 2.1: Visualization of the systematic literature review approach conducted for this research

2.4 Results: Governance Models

This section addresses the fifth step of the systematic literature review approach namely data synthesis. The five articles found in the step 3 of the systematic literature review are highly cited quality articles containing governance frameworks for multi-level and multi actor networks. These models together encompass all the identified forms of horizontal governance, namely: collaborative (Ansell and Gash, 2008; Emerson, Nabatchi and Balogh, 2012),

collective (Pretty, 2003) and network (Provan and Kenis, 2008). One of the papers describes how the governance choices in collective action may be in five propositions (Stoker G., 1998). These articles are in the domains of collaborative innovation and use of social capital and networked connectiveness.

2.4.1 "A Model of Collaborative Governance" by Ansell et al. (2008)

Ansell et al. (2008) defined collaborative governance as "A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets" after conducting a comprehensive literature review. This definition is apposite to the research as can be seen from the section: case study. The customs organizations may be enlisting non-state stakeholders for hiring data analytics capabilities to implement an efficient data analytics framework for improving the security at the borders. This makes the situation complex from the simpler collaboration of directly related public agencies. Ansell in his later research (2011) pointed out that collaborative process of problem-solving brings the stakeholders to a position of shared uncertainty which leads to mutual learning.

The model by Ansell et al. (2008) highlights the relevance of certain starting conditions that is crucial to collaboration of state and non-state stakeholders. These include trust level because of the history between the stakeholders, respective constraints and motivations of the partaking organizations, and an important starting condition: asymmetries in power, resources and knowledge. The third condition has been deemed as an important one by the authors "*If some stakeholders do not have the capacity, organization, status, or resources to participate, or to participate on an equal footing with other stakeholders, the collaborative governance process will be prone to manipulation by stronger actors*" (Ansel et al. 2008).

The model shows how "trust", "commitment" and "shared understanding" can shape the collaboration process, not to mention the key influence of "institutional design" and "leadership". During institutional design of the collaboration, stakeholders should follow "internal inclusiveness" (which means that all relevant stakeholders are included in decision-making), "external exclusiveness" (so that no similar initiations of collaborations are present) (Ansell et al., 2008).

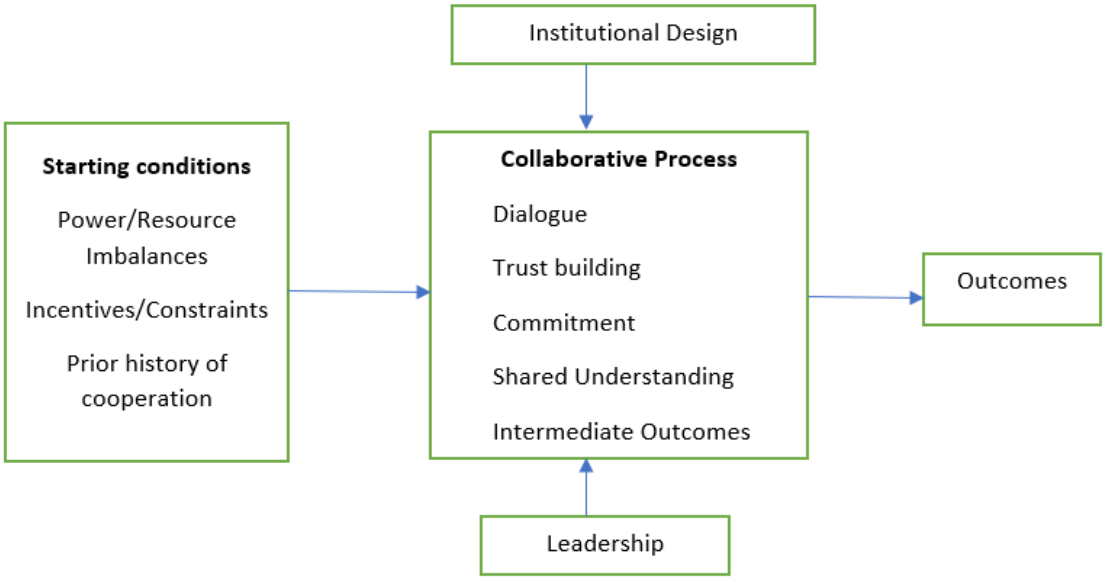

Fig. 2.2: A model of Collaborative Governance adapted from the article Ansell et al. (2008, p. 550)

2.4.2 An 'Integrative Framework' by Emerson et al. (2012)

Emerson et al. (2012) define collaborative governance as "*the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished*" (p. 2). This definition helps in strengthening the belief for a need of collaboration in the customs organizations in order to meet their goals of increased security and decrease financial loss due to frauds.

Emerson et al., (2012) synthesized a framework based on comprehensive literature study that describes how and when a collaborative governance will come together. This framework outlines three dimensions, namely: "the system context, the collaborative governance regime (CGR), and the collaboration dynamics and collaborative actions" (Emerson et al., 2012, p. 5).

The system context comprises of the external environments that the CGR influences and gets influenced by, the CGR is defined as "*a system in which cross-boundary collaboration represents the predominate mode for conduct, decision making and activity*" (Emerson et al., 2012, p. 10), and the collaboration dynamics that is composed of "principled engagement", "shared motivation" and the "capacity for joint action", which ultimately leads to collaborative

actions and produce collaborative outcomes/impacts that constitute a CGR (Emerson et al., 2012, p. 10).

The CGR is developed by four drivers which arises from the system context: "initiating leadership, consequential incentives, interdependence, and uncertainty" (Emerson et al., 2012, p. 5).

After formation of CGR, collective governance operates based on participating actors' interactions (collaborative dynamics). The CGR can undergo adaptations.

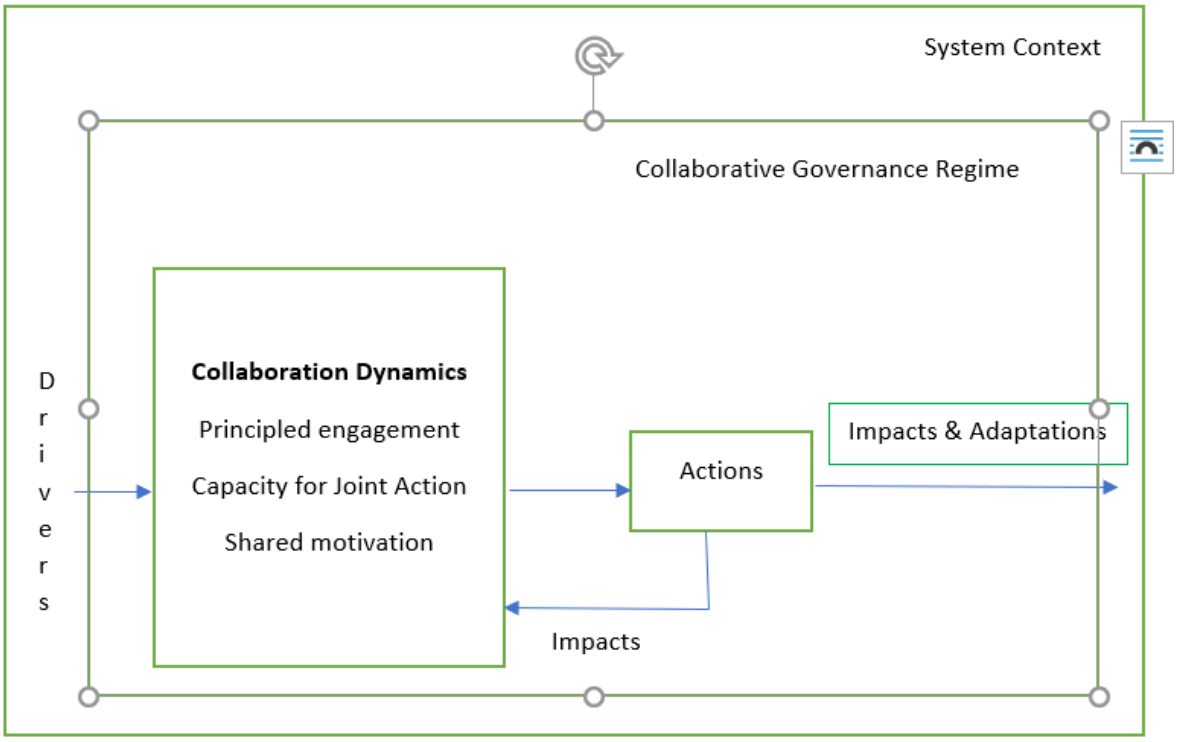

Fig. 2.3: An interactive framework adapted from Emerson et al. (2012, p. 6).

2.4.3 Framework of "Social Capital and Collective Management" by Pretty, (2013)

Pretty (2003) analysed how social capital affects the "transaction costs of stakeholders" working together leading to cooperation (p. 1913). The advantage of social capital is that actors are willing to "invest in collective activities" because of mutual trust. Actors are less likely to be involved in resource degrading activities. The author outlined four features for successful management of resources using social capital: "relations of trust"; "reciprocity and exchanges"; "common rules, norms, and sanctions"; and "connectedness in networks and groups" (Pretty, 2003, p. 1913). "Relations of trust facilitate cooperation" and "reduce transaction costs between

stakeholders" (Pretty, 2003, p. 1913). Trust between actors also decreases time invested in monitoring others. Reciprocity refers to "simultaneous exchanges of goods and knowledge of equal value, or continuing relations over time" (Pretty, 2003, p. 1913). Common rules, norms, and sanctions are the "mutually agreed upon" or "handed-down drivers of behavior" to ensure the gials of the collaboration and the actors are aligned (Pretty, 2003, p. 1913). Lastly, "three types of connectedness (bonding, bridging, and linking)" are mentioned as important for the networks (Pretty, 2003, p. 1913). "Bonding describes the links between people with similar objectives" (Pretty, 2003, p. 1913). "Bridging describes the capacity of such groups to make links with others that have different views" and "linking describes the ability of groups to engage with external agencies" to draw on useful resources (Pretty. J., 2003, p, 1913)

2.4.4 Provan's modes of network governance

The authors believed that networks are formed to obtain positive outcomes in a current problem-solving situation. They view networks as functional instruments and that "*networks are a response to failures of markets, failures of hierarchical coordination, and to societal and technological developments*" (Provan et al., 2008, p. 5). The authors defined networks to be constituted by "ties" and "entities". Based on this, the authors identified three modes of networks that are formed due to their functioning. They are "participant-governed networks", "network administrative organization (NAO)", and "lead organization-governed network" (Provan et al., 2008, p. 6).

A "participant-governed network" is one where "network actors govern themselves with no separate and unique governance entity" (Provan et al., 2008, p. 6). The network acts collectively and very decentralized. A "NAO" is described as "a network with a separate administrative entity and it is present to govern the network and its activities" (Provan et al., 2008, p. 8). In this structure the governance is centralized. A "lead organization-governed network" is characterized as having a central actor, in which "*all major network-level activities and key decisions are coordinated through and by a single participating member, acting as a lead organization*" (Provan et al., 2008, p. 7). The network governance in this case is centralized with actors having asymmetric power. This central entity in this case is a member of the network.

It was argued that strong interdependencies between the entities of the network helps in keeping the interactions going. A network can adopt any of the three modes of governance based on the

following “four contingencies: trust, number of network participants, network goal consensus, need for network-level competencies” (Provan et al., 2008, p. 9).

2.4.5 Stoker’s five propositions of governance

Stoker, G. (1998) identifies the key aspects of governance as:

- Governance is a complex set of institutions and actors derived from government, private and not-for-profit sectors. Legitimacy of power exercising by the actors is required.
- The governance perspective is increasingly shifting from just being about the government to involving various private and voluntary sectors in decision making. Blurring of responsibilities between the public and the private organizations become apparent.
- Existence of power dependencies between the actors involved in a collective initiative. These dependencies may be because the organizations depend on other actor’s resources, or because of the rules and the system context of the organizations.
- Autonomous self-organizing networks are formed between the actors. The partnership activity of the actors forms a regime which is an informal foundation for co-ordination and a largescale structure of command.
- Governance has the capacity to get things done without relying on a figure of authority. Government can use new tools to steer and guide and is a new form of governing. It involves defining the situation, identifying relevant stakeholders in the governance and then forming linkages between them. Governance is about “influencing and steering relationships” to obtain favorable outcomes (Stoker, 1998).

2.5 Analysis of the literature found during literature review

In this section, the five articles that have been summarized in the previous section will be analysed with relevance to the elements of governance that the articles contained. This analysis will help to determine the elements to be used in the conceptual model. This conceptual model will be designed in the next section with the help of this analysis. In the table 2.1, the different aspects of governance and the elements have been listed along with the sources for the same.

There are three aspects of collaboration that have been recognized after doing the literature search. They are dynamics of actor during and before the collaboration, dynamics of the collaboration itself, and context and drivers influencing the collaboration (Ansell et al., 2008; Emerson et al., 2012; Pretty, 2003; Provan et al., 2008; Stoker, 1998).

Aspects of governance from the articles	Elements related to that aspect in the articles	Tracing number for the element	Articles mentioning the elements in their models
Actor dynamics before and during collaboration	Power, resource conditions	T1	Ansell et al. 2008, Emerson et al. 2012; Stoker, 1998
	Levels of conflict/trust	T2	Ansell et al. 2008; Emerson et al. 2012; Pretty, 2003; Provan et al. 2008
	Network connectedness	T3	Emerson et al. 2012; Pretty, 2003; Provan et al. 2008; Stoker, 1998
	Policy legal frameworks	T4	Ansell et al. 2008, Emerson et al. 2012
	Prior history between actors	T5	Ansell et al. 2008, Emerson et al. 2012
Collaboration dynamics	Capacity for joint action/network-level competency/blurring of roles & responsibilities	T6	Ansell et al. 2008, Emerson et al. 2012; Provan et al. 2008; Stoker, 1998
	Mutual Understanding/consensus	T7	Ansell et al. 2008, Emerson et al. 2012; Provan et al. 2008
	Dialogue/Definition	T8	Ansell et al. 2008, Emerson et al. 2012
	Ownership/commitment	T9	Ansell et al. 2008, Emerson et al. 2012
	Principled engagement	T10	Emerson et al. 2012
	Reciprocity & exchanges	T11	Pretty, 2003
	Organization of networks	T12	Provan et al. 2008; Stoker, 1998
System Context and drivers influencing the collaboration	Leadership	T13	Ansell et al. 2008, Emerson et al. 2012
	Institutional design/rules, norms and sanctions during collaboration	T14	Ansell et al. 2008, Emerson et al. 2012, Pretty, 2003

	Incentives	T15	Ansell et al. 2008, Emerson et al. 2012
	Interdependency	T16	Pretty, 2003; Emerson et al. 2012; Stoker, 1998
	Socioeconomic/ Cultural Health & Diversity	T17	Emerson et al. 2012
	Impact to the context and dynamics	T18	Emerson et al. 2012
	Adaptation to the dynamics of actors and context	T19	Emerson et al. 2012

Table 2.1: Analysis of various aspects of collaboration and different elements listed under the aspect in the articles (own work).

These aspects of collaboration align with the context of the research question. All the three aspects that have been identified from the literature will be included in the conceptual model. This is because these aspects give way for understanding the need for the actors to join the collaboration, the factors associated with a successful collaboration and the complexities of having a network of multi-level international actors deciding to collaborate on a joint project.

From the research question, it can be deduced that the collaboration will take place so that the actors can use each other's resources and competencies. These actors can either be of public or private nature. This means that the actors will have different levels of powers and influences and varied resources. The rules and norms for the actors will also differ from each other since the actors come from different nations with different law systems. That is why the elements Power, resource conditions (T1), Levels of conflict/trust (T2), Network connectedness (T3), Policy legal frameworks (T4), Prior history between actors (T5), Capacity for joint action (T6), Mutual Understanding (T7), Dialogue/Definition (T8), Ownership/commitment (T9), Principled engagement (T10), Organization of networks (T12), Leadership (T13), Institutional design/rules (T14), Incentives (T15), Interdependency (T16), Impact (T18) and Adaptation (T19) are chosen to be relevant for the conceptual model.

The elements Reciprocity & exchanges (T11) and Socio-economic/Cultural Health & Diversity (T17) are not selected because these elements are considered out of scope for the project.

Reciprocity is relevant when the parties must exchange things or privileges between each other for mutual benefit. In the framework, access to assets is more focused on rather than exchanges. Similarly, diversity of socio-economic conditions even though are present between the actors, the conceptual framework takes care of diversity by analysing the power and resources imbalances between the actors. Thus, this element is also omitted for the conceptual framework.

2.6. Conceptual model for Governance

This section will answer the second research question: *What conceptual model could enable governance of multi-level and multi-actor networks?* In this section, the governance framework is designed. The framework aims to capture the complexity of collaboration of national and supranational organizations with each other. This framework explores the initiatives that these individual organizations must take to partake in a multi-level and multi-actor collaboration and to draw value from it.

The governance model in figure 2.2 has been designed by using the elements of governance found in the literature review. This model accommodates different levels of actors to join forces to collaborate. These actors will have their own states which will define the starting conditions of collaboration as defined in Ansell et al. (2008). These states are power/resource/knowledge (social capital) imbalance (T1) with other actors, history of cooperation or conflicts (T5), initial trust level (T2) and existence of legal frameworks (T4) for participating in the collaboration. Social capital is an important precursor to ensure relations of trust and connectedness in networks and groups (Pretty, 2003). Taking these into account, leadership (T13) needs to be initiated and facilitated to ensure empowerment of actors in the collaboration. The actors can come together to collaborate and form a bond, bridge or a link (T3) (Pretty, 2003). This type of connection is important to identify the different needs and goals of the actors while collaborating.

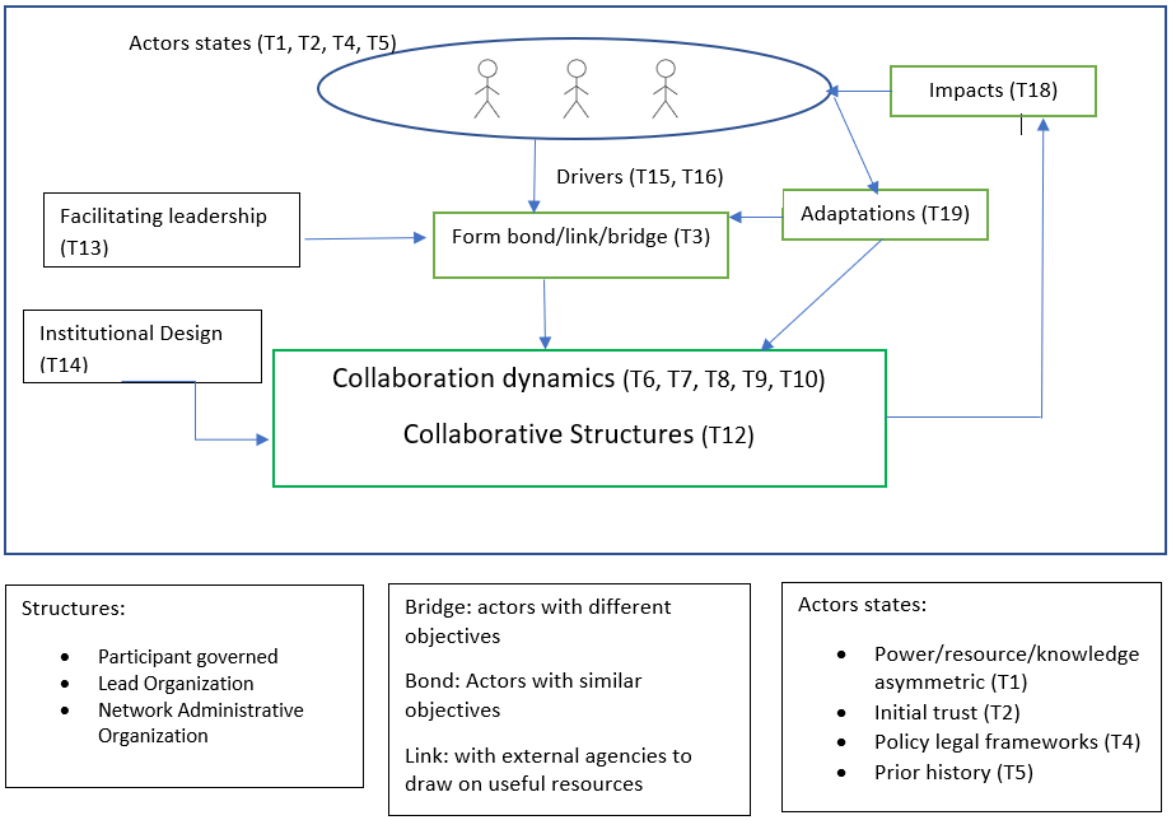

Fig 2.2: Conceptual Governance model designed from the results of the literature review analysis

After forming a connection, the actors in a collective engagement will contribute to the dynamics of the collaboration. This collaboration dynamics defines the various processes that an actor finds themselves in while in a collaboration. The processes consist of face-to-face dialogues (T8), commitment (T9), mutual understanding (T7), capacity for joint action (T6) and principled engagement (T10). Dialogues is necessary to explore the mutual gains and to break down barriers to communication. The structures of collaboration (T12) are inspired by the framework of Provan et al., (2008). The structures are effective in different conditions, and adoption of a particular structure should be based on trust, size (number of participants), goal consensus, and the nature of the task/competencies.

The actors, the link they form, and the collaboration process are all influenced by the drivers and the system context (T14, T15, T16). The system context represents the host of political, legal, socioeconomic, environmental and other influences that affect and are affected by the collaboration (Emerson et al., 2012). This is important to consider as it sets the institutional design for the collaboration. Institutional design (T14) contains the ground rules that are critical for the procedural legitimacy of the collaborative process (Ansell et al., 2008).

The institutional design is important to ensure that the actors participate and do not seek out alternative options. Institutional design should aim for process transparency and clear definition of roles (Ansell et al., 2008).

The elements 'impact' (T18) and 'adaptation' (T19) from the model of Emerson et al. (2012) is used as a feedback loop in the model. The actors will deploy the outcomes of the collaboration in their own individual organizations to draw value from the collaboration. The impact of the outcomes is felt when the outcomes of the collaborative effort will be used by the actors. These impacts will lead to learnings and will stimulate adaptations for new or same collective initiatives.

2.7 Conclusion

This chapter concludes with the definition of the conceptual model for governance. This chapter contains the answers of two research questions. The first research question: *Which theoretical frameworks can help identify elements that are necessary for governing collaboration for multi-level and multi-actor networks?* was answered by conducting a systematic literature review. The elements of the conceptual governance model have been obtained from a literature review done for the governance frameworks of multi-level and multi-actor setting. While conducting the literature review, it was found that there are different types of governance in the setting of multi-level and horizontal governance, namely collaborative governance, collective governance and networked governance. These three forms of governance have been found suitable to be used for the formation of the conceptual model. The results of the literature search ended with obtaining five articles that have been highly cited and well-recognized in organizational studies.

The second research question: *What conceptual model could enable governance of multi-level and multi-actor networks?* was answered by analysing the theoretical frameworks obtained in the literature review. The theoretical frameworks mostly had elements that talked about the dynamics of actor during and before the collaboration, dynamics of the collaboration itself, and the system context and drivers influencing the collaboration. Thus, the conceptual model has elements from these domains. These elements are analysed and found to be effective on a potential collaboration and these effects could shape the collaboration outcome. In the next chapter, the conceptual model will be refined according to empirical context. Case study research will be conducted in the next chapter to obtain an empirically enhanced model.

3. Context Analysis and Empirical Study

In this chapter, the third research question: *What governance framework can be used to aid the collaboration of multi-level actors in the context of customs supervision?* is answered. The main motive for this chapter is to conceive what elements of the conceptual model derived from the literature in the previous chapter (chapter 2) are suitable in the context of customs supervision for the following case. The case study will be conducted with the help of guidelines provided by Yin (2018). The following section describes the case study protocol used in this study.

3.1 Case study research approach

Yin (2002) defines case as "a contemporary phenomenon within its real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context" (pp. 13). The phenomenon in this case being the collective efforts of multiple parties coming together to design a platform that solves an international, complex problem. A single-case study will be conducted to have an in-depth study on the designing of the blockchain-cased platform and "to retain a holistic and real-world perspective— such as in studying organizational and managerial processes, international relations" (Yin, 2018 pp. 34). A single-case study will be helpful as it is useful in developing "a deeper understanding of the subject" and helps to describe the existence of phenomenon extensively (Gustafsson, 2017 pp. 4). It allows the space to question old theoretical relationships and explore new ones between the actors. This study will be useful to design scenarios with the governance model in the next chapter (Chapter 6). A disadvantage of single-case study is the lack of generalization which may not be a disadvantage if generalization is not the goal of the researcher.

3.1.1 Case Study Selection

Following Yin (2018), we defined our case study selection criteria. We used the following criteria:

1. The case required actors from supranational, national and business organizations to collaborate in a blockchain-based platform together. This collaboration is necessary because of existing interdependencies within the actors. This interdependency is identified in terms of access to information which will help the actors to fulfil their responsibilities.
2. The case is in the domain of customs supervision and collaborative innovation.

3. The case selected is a blockchain-based platform designed to promote data accessibility to the customs authorities of the EU. The reason for selecting this case matches with the problem definition in chapter one.
4. Sufficient information about the case is available to answer our research question.

To really understand the elements of governance found in the conceptualized model, the case seemed fitting because of the above criteria. The conceptualized model gives the idea of actors coming together and describes the hurdles and catalysts while joining and working in the collaboration (chapter two).

3.1.2 Case study design and protocol

The case study design and protocol is presented in the following sub-sections after consulting (Yin, 2018). The case study design and protocol is essential in order to have a precise and unfailing case study. From the literature of Yin (2002 pp. 20), a case study design is "the logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions." In this case study design according to Yin (2018) consists of five components: 1. case study questions, 2. case study propositions, 3. the unit of analysis, 4. the logic linking the data and the propositions & 5. criteria to interpret findings. Below, we will discuss each of these case study design components.

Component 1: Case study question

The first step in designing a case study is to ask the appropriate questions that will aim to define the type of answers and the direction of the case study. This case study is conducted to get the answer of the third research question: *What governance framework can be used to instigate collective joint action in a collaborative network of actor in the context of customs supervision?* In support of this research question, the following case-study questions have been designed:

Case study question 1: What actors are involved in the case and what are their different levels of power and resources?

Case study question 2: What is the interdependency between the actors?

Case study question 3: What are the drivers that are influencing the collaboration (from table 2.1) in this case initiative?

Case study question 4: How is the collaboration affected by the elements of the conceptual model listed under actor dynamics in table 2.1 (trust, power/resource conditions, prior history, network connectedness etc.)?

Case study question 5: What elements need to be included from the conceptual model based on the empirical refinement in the customs domain?

Case study question 6: What additional elements need to be added to the conceptual model based on the empirical refinement in the customs domain?

Component 2: Case study proposition

The case study proposition helps in directing the attention to essential elements in the case that should not be missed within the scope of the case (Yin, 2018). In this case, the stakeholders involved in designing and owning the blockchain-based platform is a variety of business and governmental organizations (Van Engelenburg et al., 2020). Through the blockchain-based platform information sharing among the stakeholders will take place. The stakeholders can have diversified roles within the platform (Van Engelenburg et al., 2020) and due to this they will inculcate different relationships with each other.

Van Engelenburg et al. (2020) identified that blockchain-based platforms involving business and governmental organizations will lead to a complicated system where the technical design choices of the platform and the actors interests are dependent on each other. They designed a framework where the relationship between technical design choices and the business and government information sharing is depicted. They identified governance of the actors as a requirement stemming from their framework.

With this knowledge, the propositions are:

- Governance of the stakeholders during collaborative innovation is essential as it influences the design choices of the blockchain-based platform.
- The stakeholder relationships affect the dynamics of collaboration (see table 2.1).
- Proper governance of the collaborative network of actors will lead to the successful design of blockchain-based platform.

Component 3: Unit of Analysis

The unit of analysis sheds light on the phenomenon that is being analysed during the case study. In this case, the main unit of analysis is the process of collaboration of the actors to have collective joint action while developing the blockchain-based platform. Thus, the interest of this case study is the process of forming a collaboration rather than the product of collaboration. The elements of the conceptual model will be analyzed in the context of the case study in order

to identify the relevant factors of collaboration that will help in the development of the platform.

Component 4: Linking data to propositions

The data gathered from the data sources (section 3.2) will be helpful in answering the case study questions designed in the case study protocol. It will allow insight into the design of the blockchain platform, the stakeholder needs, their relationship with each other and the design requirements of the platform.

Component 5: Criteria to interpret findings

It is imperative to determine under what circumstances results of the case study are analysed (Yin, 2018). The case study findings can have rival explanations. The case study analysis and the case study proposition together will be a guide to interpret the findings.

3.2 Data Sources

Table 3.1 depicts the main data sources used for conducting the case study.

Information sources	**Number of sources consulted**
Deliverable documents of PROFILE project	Three documents
Research articles	Five research articles
Workshop	One workshop
Interviews	One open interview with the same members present in the workshop. Three interviews with one interviewee along the course of data gathering.
Websites	Two websites

Table 3.1: Number of information sources used for conducting the case study.

Confidential deliverable documents of PROFILE project: The main deliverables used are from the deliverable D7.2 (draft), D7.1. These deliverables are from Work Package 7 of the PROFILE project and they are reports on the Governance issues related to the EU-wide Risk Data Sharing Architecture. The PROFILE project brochure also contained information about their projects.

Research articles on the customs domain and the blockchain governance: These research articles were made available for this research by an expert in the field of customs domain present in TU Delft. The articles are Van Engelenburg et al. (2020) and a graduate research on

the blockchain-based platform for customs domain (Di Benedetto, 2020). Research articles on the blockchain technology were also consulted to gather knowledge about the design of the platform.

Workshop: A workshop was help via skype where an employee from TNO (an independent organization that conducts researches on applied science (TNO, n.d.)) was present. The employee had knowledge of the technical design choices that needed to be made for the development of the blockchain-based platform for the customs authorities. The other members present in the workshop are experts in the field of customs domain working in TU Delft. They are respectively a researcher and a professor of TU Delft. During the workshop, the scenarios from the case study were revealed to them and the participants gave feedback on the scenarios and they also divulged more relevant information on the case.

Interviews: Three open interviews were held with the researchers present in TU Delft via Skype. These two researchers are experts in the field of customs domain and have immense knowledge about the PROFILE project and ICT innovations in the field of customs domain. The interviews were unstructured and were in the form of conversations mostly.

Websites of PROFILE project and EU customs: The official website of the profile project (https://www.profile-project.eu/) and the information of the customs offices and customs processes have been obtained from the European Commission website for the taxations and customs (https://ec.europa.eu/taxation_customs/home_en)

Assumptions:

While obtaining information, it has been observed that several assumptions have been made while providing information by the developers of the blockchain-based platform. The assumptions and simplifications have been listed:

- The carriers are responsible to submit the ENS information to the Customs of First Entry (COFE) but in reality, other actor can also submit ENS information. Additionally, the ENS information can also be submitted to another customs office rather than the COFE.
- Only ENS information have been selected for analysis for the blockchain-based platform although the traders are supposed to submit several documents containing information about the shipped goods.

3.3 Case description: Blockchain-based platform adopted by PROFILE project

In this section, the case study will be discussed. First, the blockchain technology will be explained in 3.1, the PROFILE project will be discussed in brief in section 3.3.2 and then the reason for using the blockchain technology by the PROFILE project will be discussed in section 3.3.3. Lastly, the case study scope and focus will be discussed in section 3.3.4.

3.3.1 Blockchain Technology and its features

Blockchain Technology is a distributed database where data can be made accessible by different actors simultaneously (Zheng et al., 2017). Every executed transaction is added as a new block to the chain after it is validated by all the nodes through a consensus mechanism (Ølnes et al., 2017). The blockchain technology has the following main features: decentralization, persistency, anonymity, auditability (Zheng et al., 2017). Thus, blockchain technology makes it possible for actors to exchange information and documents, without any intermediaries, and maintaining a permanent record of transactions (Zheng et al., 2017).

Blockchain technology is an artefact of social agreements as the participating actors play a huge role in deciding the course of the blockchain (Ølnes et al., 2017). Blockchain technology faces problems of scalability and privacy concerns when developing the blockchain architecture.

3.3.2 The PROFILE Project

The case is set in the Horizon 2020 (H2020) PROFILE research project which is funded by the European Commission (PROFILE, n.d.). This project was established in 2018. The purpose of the PROFILE project is described as “Innovative Data Analytics, Data Sources and Architecture for European Customs Risk Management” and it aims to connect the customs risk management systems to data owners and “Big Data” providers (PROFILE, n.d. p. 1). There are five countries in the role of Customs Partners for the PROFILE project: Belgium, Norway, Estonia, Netherlands and Sweden. These countries are participating in the Living Labs set up by the PROFILE to “test technical viability and economic value of new data-driven risk management solutions in real-world conditions” (PROFILE, n.d. p. 2). The other partners include leading technology and data analytics providers, a research centre of the European

Commission, associations and academic partners. The Living Labs are in pilot stages and results have not yet been implemented in practice (Rukanova et al., 2020).

3.3.3 Blockchain-based platform as part of the PROFILE project

The PROFILE project by the EU focuses on the improvement of customs risk assessment process by using data analytics and new data sources (European Commission, n.d.). In 2017, Blockchain Technology (BCT) has been recognized by the European Commission as an enabler for digital initiatives. In 2018, DG TAXUD evaluated BCT application within customs (DG TAXUD, 2018). The PROFILE project is interested to use the BCT for the purpose of data availability and improving the data quality among the Member States.

The European Commission (EC) proposed a new Import Control System (ICS 2.0) for all Member States (MS) that will be implemented by 2024 (DG TAXUD, 2017c). The ICS 2.0 will deploy a common repository of ENS information and other documents relevant for the risk assessment process and pre-arrival/arrival of shipments in EU ports. This means that the customs can retrieve information directly from the system.

The main objectives for ICS 2.0 are improving the data quality and availability of ENS information to the EU customs authorities (DG TAXUD, 2017a).

Purpose of the Blockchain-based platform

The ENS information need to be sent to the Customs Office of First Entry (COFE) 24 hours before loading the shipment onto the vessel. This is done to identify risks during the pre-loading risk assessment by the customs office. When the COFE changes from the planned COFE due to changes in the initial itinerary of the vessel, the new COFE does not possess the necessary ENS information that are relevant for performing the risk assessment. This is an issue of data availability for the customs authorities as they must request information to other customs. This leads to an inefficient risk assessment process because of lack of information to conduct the assessment.

Using a blockchain-based platform it would be possible to determine at any moment which customs has access rights to the ENS data. This would enable the customs authorities to not

only receive timely relevant information but also retrieve ENS data to facilitate secure import of trade (DG TAXUD, 2017) thereby increasing availability of data[1].

Based on the goal of enabling exchange of data among public authorities such as the Member States of the EU to coordinate trade activities and improve risk assessment, a blockchain based platform has been proposed as part of the PROFILE Risk Data Sharing Architecture. The blockchain-based platform would aid in establishing access control to the ENS documents for the EU customs and thereby contribute to solving the problem of data availability for the EU customs authorities.

The blockchain based platform will use the itinerary of the shipments as pre-arrival notification and allow the customs authorities to access the changed information in case of change of itinerary.

It is important to take note that the blockchain architecture is developed particularly for access control among the actors and to have information about route deviations in the process of shipping (Di Benedetto, 2020). The ENS declarations will be submitted to the ICS 2.0. This shows that the blockchain architecture is a complementary addition to the ICS 2.0. Presently, such route deviation data is not easily available to customs, and not immediately captured in ICS 2.0, therefore exploring possibilities for a collective process for the Customs authorities.

3.3.4 Case Study Scope and Focus: Governance of the blockchain platform

The blockchain technology is a decentralized system (Chang et al., 2020). Because of this, the issue of which actor develops and maintains the platform arises. The blockchain technology undergoes a transition from a centralized platform (while developing technically) to a decentralized one (after development). Thus, the organizational network of the users need to be analyzed more than the IT providers.

The main users of the platform are clearly the Member States of the EU. This platform poses a requirement for a collaboration process between the EU Member States (Di Benedetto, 2020) so that they can exchange information with each other, and between an IT process and national risk processes (DG TAXUD, 2017).

[1] In the blockchain solution developed in PROFILE, ENS data is stored outside the blockchain, only access control is stored on the chain.

The information of interest in this case is at the hands of the business organizations initially (the carriers). The business organizations need to share the data with the EU customs organizations before the arrival of the cargo for the improvement of the risk management (Yasui, 2011). To align the interests of the business and government organizations for the design of the platform requires blockchain governance. Blockchain governance is “process of social organization and coordination that relate to blockchain-based B&G information sharing" (Van Engelenburg et al., 2020, p. 3). The framework in Van Engelenburg et al. (2020) in figure 3.1 shows the relationships between the governance requirements, stakeholders’ interests and blockchain design choices. Analysis of these relationships can be done in two ways according to the framework: stakeholder view (analysis of the stakeholder relationships to determine impact on the governance requirements and identify the design choices) and the and blockchain control view (to determine the impact of the design choices on the governance and the stakeholders).

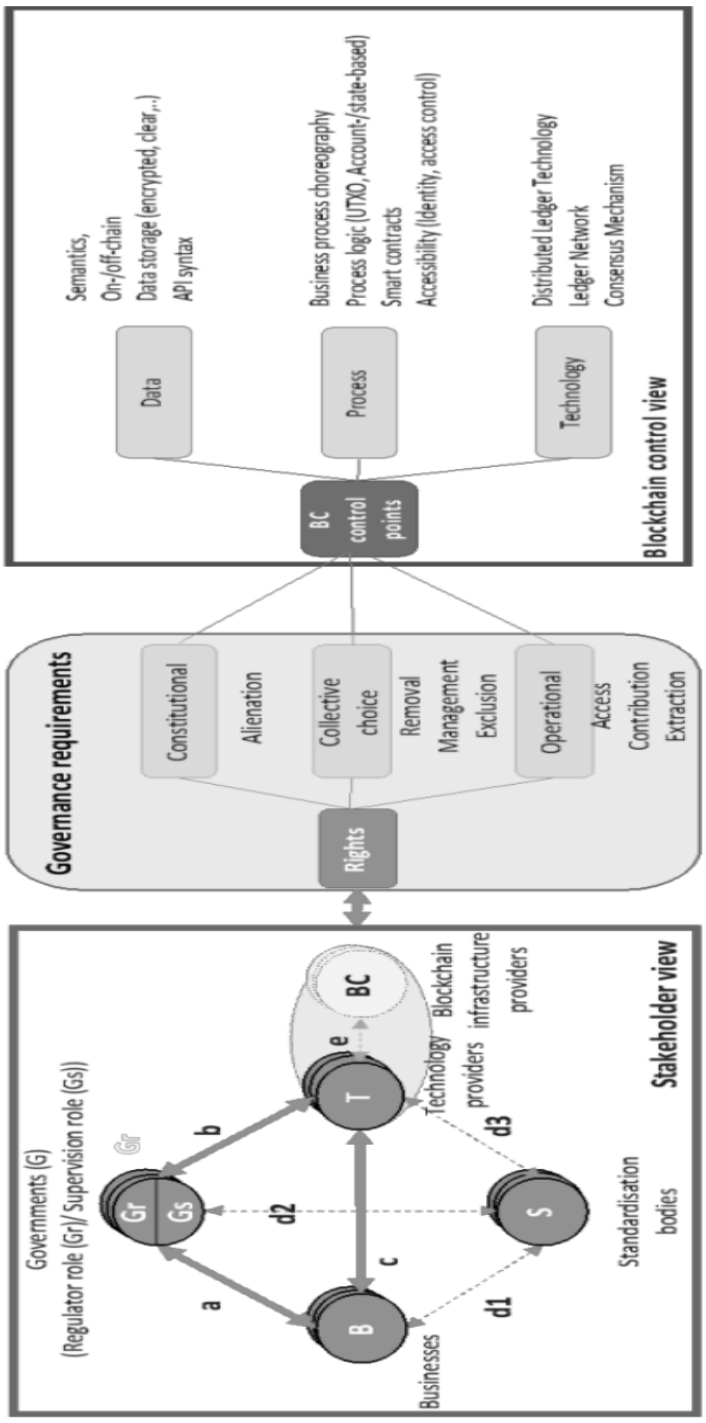

Fig: 3.1 Blockchain governance framework (Van Engelenburg et al., 2020)

In the blockchain governance framework of Van Engelenburg et al. (2020), the governance requirements are depicted by constitutional, collective and operational rights. The governance requirements affect the stakeholder relationships and vice versa according to the framework in fig. 3.1. The carriers and the customs organizations are the two main actors identified in the blockchain-based platform. For simplicity in the research, two governance options will be

considered for further analysis and for developing scenarios (in chapter 4). The two governance options are: private domain governance: where carriers (and other private firms) oversee the governance of the platform; and a public domain governance, where customs and possibly other public authorities are in charge of the governance of the platform. The design of the blockchain-based platform will vary depending on whether the public authorities develop the platform or the private firms.

3.4 Case Analysis

In this section, the case will be analyzed according to the case study questions formulated in 3.2.1. The following section will be reported in the order of the case study questions.

a) Actors, power and resources

In this section, we answer the following case study question 1: *what actors are involved in the case and what are their different levels of power and resources?* The different actors involved in the case are categorized into three categories: business organizations, government bodies and technology providers (fig. 3.1).

Business organizations: These organizations are mainly from the supply chain partners involved in international trade. These actors are motivated to participate in the platform because of "competitive gains and economic benefits, and increasingly by social responsibility" (Van Engelenberg et al., 2020, p.4). Examples of business organizations are ocean carriers, freight operators and consignors (Tradelens, n.d.). The freight operators arrange the shipping process and document the international carriage, whereas the carriers perform the shipment process and they submit the ENS data to the customs at the importing country. The carriers have the knowledge of the shipping vessels' itinerary.

Due to simplicity, the carriers will be the center of analysis from the category of business organizations. This is because, they have the most relevant information in real time, namely the itinerary information of the vessels. In case of change of itineraries, the carriers possess the information of the changed routes and the changed COFE for performing the risk assessments.

Government bodies: In this case, the government bodies are performing the supervisory role for the business activities. The customs authorities at the importing country in the EU acts as a gatekeeper for the international trade. They perform the risk assessment for the shipped cargo. These customs authorities are interested to receive additional information (like the itinerary of the vessel) from the carriers through the blockchain-based platform in order to continue their

role of supervision. In this case, there are two levels of governmental organizations involved: the supranational (EU) and the national governments (the customs authorities of the EU countries) (PROFILE, n.d.).

The government bodies cooperate with each other for the purpose of improved data availability which will enable them to perform their supervisory roles efficiently.

Technology providers: They provide technological solutions and developers of the platform. These actors have their own business model. They have the technical competency to develop and maintain the blockchain-based platform. They are a part of the collaboration because the carriers and the customs authorities do not have the technical skills to develop the platform by themselves. Including the technology providers into the collaboration will make the stakeholder relationships more complex. Confidential information will be divulged to the technology providers through the platform.

b) Interdependency between the actors

In this section, we answer the case study question 2: *what is the interdependency between the actors?* In the context of international trade and global supply chain, the business and government actors form a complex relationship amongst themselves. There are key choices that affect the implementation of the blockchain-based platform like the voluntariness of the business organizations to share information, authorization of the actors to access information, and collaborative process of the customs offices to share information amongst themselves.

The carriers possess ENS information of the shipping goods which they have to share with the customs offices before loading them onto the vessel. Sometimes, the itineraries of the vessel while on the sea may change due to several factors like the climate, geopolitical reasons etc. These changed itineraries pose a problem for the risk assessment of the goods at the customs offices because the changed customs offices did not get the notification/ENS information. These causes an issue in the efficiency of the risk assessment process. The customs offices are dependent on the carriers' voluntariness to join the platform and share the information for them to perform their roles. The customs offices are also dependent on each other to share information amongst each other.

c) Drivers influencing the collaboration

In this section, we answer the case study question 3: *what are the drivers that are influencing the collaboration in this case initiative?* From the elements listed in the table 2.1, the drivers

that will be influencing the collaboration of the actors for the design of the blockchain-based platform are: incentives, leadership, and institutional design/rules, norms and sanctions during collaboration. In the following paragraphs, it will be seen how these elements are affected in the case study.

The priorities of the stakeholders involved in the design of the platform are different. The carriers are from the private sector and their goals are economic benefit for themselves. The blockchain platform will put them at a position where they must reveal their strategic information on routes and itinerary on the platform. Some competitive nodes on the blockchain-based platform may use this additional information to gain competitive advantage. It has been found in previous research that "power and resource imbalances affect the incentives of groups to participate in collaborative processes" (Ansell et al., 2008, p. 552). The inclusion of the EU in this collaboration will not motivate some of the carriers to join the collaboration as they might feel that their business will be influenced by the EU.

Similarly, even though the goal of the customs organizations is public value, not all customs organizations will be interested to join the platform. The Member States of the EU that is not affected in case of changed itinerary of the vessels will be reluctant to actively join the platform. Some Member States may be having other political tensions or issues that are at a higher priority than the design of the blockchain-based platform. The lack of resources for the Member States may be another reason to join the platform.

Thus, there is a need to incentivize the process of joining the collaboration and finding a balance between the economic benefits and public values to motivate the actors to join the collaboration. In this way, the element '**incentives**' is affected.

Further, the collaboration will depend on who leads the collaboration and takes charge of designing the platform. The actors that take the lead will have the decision rights on the functionalities and technical design choices of the platform. The other actors will only take the role of the users. These decision choices will make the platform favorable/unfavorable for the actors to the join the collaboration and use the platform. Thus, **leadership** in this collaboration matters in the outcome of the collaboration and the platform.

Moving on to institutional design in a collaboration, it is "the basic protocols and ground rules for collaboration, which are critical for the procedural legitimacy of the collaborative process" (Ansell et al., 2008, p. 555). Inclusion of the stakeholders is relevant to cultivate in the collaboration because the actors "that feel they have had a legitimate opportunity to participate

are likely to develop a commitment to the process" (Ansell et al., 2008, p. 556). At the same time, the exclusiveness of the platform is necessary so that the stakeholders do not seek out "alternative venues for realizing their agenda" (Ansell et al., 2008, p. 556).

d) Actor Dynamics in Collaboration

In this section, we answer the case study question 4: *How is the collaboration affected by the elements of the conceptual model listed under actor dynamics in table 2.1 (trust, power/resource conditions, prior history, network connectedness etc.)?*

First, we will look into the elements trust and prior history between the stakeholders. It was noted in Ansell et al. (2008) that a history of conflict between the actors give rise to "low levels of trust, which in turn will produce low levels of commitment" (Ansell et al., 2008, p. 553). Thus, bad history between the Member States or between the carriers can create more suspicions and distrust. It is also true for the contrary that a good history between the stakeholders can create more social capital and trust amongst the actors. Prior history between the actors and trust levels are interdependent and have significant influence on the collaboration in this case.

For the power/resource conditions, Ansell et al. (2008) found that stakeholders having unequal "capacity, organization, status, or resources to participate" (Ansell et al., 2008, p. 551) find themselves prone to manipulation by stronger actors in the collaborative process. Having a multi-level and multi actor network for this case does pose a problem for imbalances in power and resources, which in turn will affect the stakeholder relationships and dynamics in the collaboration.

Lastly, network connectedness can exist from the connections of the actors in the collaboration, which can be because of same objectives between the actors, different objectives or actors using the resources of another actor. The carriers will have the objective of economic profits and the customs of Member States will have the objectives of public value needs. But, in the collaboration, things become complicated because of competition between the carriers, not enough incentives for the all the Member States to join the collaboration etc. This shows how there can be several types of connections within the carriers, customs and technology providers and these network connections affect the dynamics between the actors (Pretty, 2003).

e) Elements from the conceptual model

In this section, we answer the case study question 5: *what elements need to be included from the conceptual model based on the empirical refinement in the customs domain?* In the last chapter, the elements for the conceptual model have been attained, it is important to identify whether all the elements are applicable for this case initiative. Nonetheless, another point to consider about making a conceptual framework/model is that it is not exaggeratedly simple or specific (Ostrom, 2007). Thus, it makes sense to have a conceptual model that is specified for this case, in particular. During the process of refinement of the model, it makes sense not to use all the elements found in the articles because it proves complicated for the model to be made and tested. Thus, further selection of the elements and the reason for selection is listed in table 3.1.

Elements	**Tracing number for the element**	**Justification**
Power, resource conditions	T1	Power and resources among the actors determine the dynamics between the actors (within the carriers or between the carriers and the government bodies)
Levels of conflict/trust	T2	The actors may have prior interactions and issues with each other which will affect their relationships as discussed in the case study analysis.
Network connectedness	T3	The connections between the actors within the network is useful to be included in the model as it determines the motivations and objectives of actors as a whole and individually (Pretty, 2003). The connections between the carriers, customs and the technology providers provide insight into their dynamics within the collaboration and shed light on their objectives.
Policy legal frameworks	T4	This determines whether the actors have the facility to achieve the required outcomes from the collaboration. It allows space to analyse whether such a collaboration is backed by the legal system. Existence of a blockchain platform where exchange of information takes place between business and governmental organizations should be allowed by the legal system. Also, using the information from the platform for public values need to be allowed by legal frameworks.

Prior history between the actors	T5	History of a bad experience or a successful experience between the actors will lead to low-levels of trust or high-levels of trust respectively. Thus, trust levels and history between the actors are dependent on each other as discussed in the case study analysis.
Capacity for joint action/network-level competency/blurring of roles & responsibilities	T6	This is an important element for the conceptual model because the actors will need to collectively work towards their required outcomes. Thus, the actors' roles, resources and competencies are important to be determined for the collaboration.
Mutual Understanding/consensus	T7	While working, the actors need to have a clear consensus of their goal.
Ownership/commitment	T9	Ownership and commitment of the actors will depend based on the power and resources the actors bring into the collaboration.
Leadership	T13	It is important for actors to facilitate and display qualities of leadership in a multi-level collaborative initiative so that the actors can be empowered within the network. In addition, the type of platform will be determined by which actors take the lead to develop the platform.
Institutional design/rules, norms and sanctions during collaboration	T14	This is necessary for determining internal legitimacy, ensure the actors to follow the rules of the collaboration and lastly ensure the inclusivity of the actors.
Incentives	T15	Incentives help to understand the actors motives for joining the collaboration and their actions. As discussed in the case study analysis, incentives play a key role in determining the active participation of the carriers and the customs organizations in the platform.
Interdependency	T16	Resources and capabilities vary among the actors. Thus interdependencies among the actors is a crucial element. As discussed in the case study analysis, the interdependency exists between the customs organizations and the carriers because the risk assessment process performed by the customs organizations are dependent on the ENS information possessed by the carriers.

Table 3.1: Elements chosen for the refined model and the reason for choosing them.

f) Additional elements

In this section, we answer the case study question 6: *what additional elements need to be added to the conceptual model based on the empirical refinement in the customs domain?* During the case study, the blockchain governance framework by Van Engelenburg et al. (2020) provided useful insights on the impact of stakeholder relationships on governance requirements and the design choices of the blockchain platform. The governance requirements listed constitutional rights, collective choice rights and operational rights for the blockchain-based platform. From the workshop conducted in the presence of the authors of the research article by Van Engelenburg et al. (2020) during the data collection for the case study, it was decided that the stakeholder relationships/dynamics affect the constitutional rights and the collective choice rights whereas the technical design choices affect the operational rights. Constitutional rights include the right to alienate, collective choice rights include the right to removal, management and exclusion, and finally the operational rights include the right to access, contribute and access. These rights have been added to the model during the process of refinement of the conceptual model as it sheds light on the rights of the actors during the collaboration and while using the platform.

Another aspect (that is more contextualized to blockchain governance) is the speed of decision-making. The setting of boundaries between the human involvement in the decision-making and the extent of autonomous decision-making within the blockchain needs to be fixed in order to solve the issue of scalability. Increasing the speed of decision-making will increase the speed of transactions within the blockchain. This can enable the blockchain to function faster thus solving the issue of scalability.

Lastly, the issue of privacy of information can be solved by allowing room for flexibility within the collaboration. The actors need to be able to look for a solution dynamically if privacy issues come up in the future. The actors need to be able to adapt to the situation in hand, and the governance framework should have room for that. Hence, adaptability within the collaboration and the blockchain architecture is included in the governance.

3.5. Refinement of the model

After conducting the case study analysis, the refined model is shown in the figure 3.2.

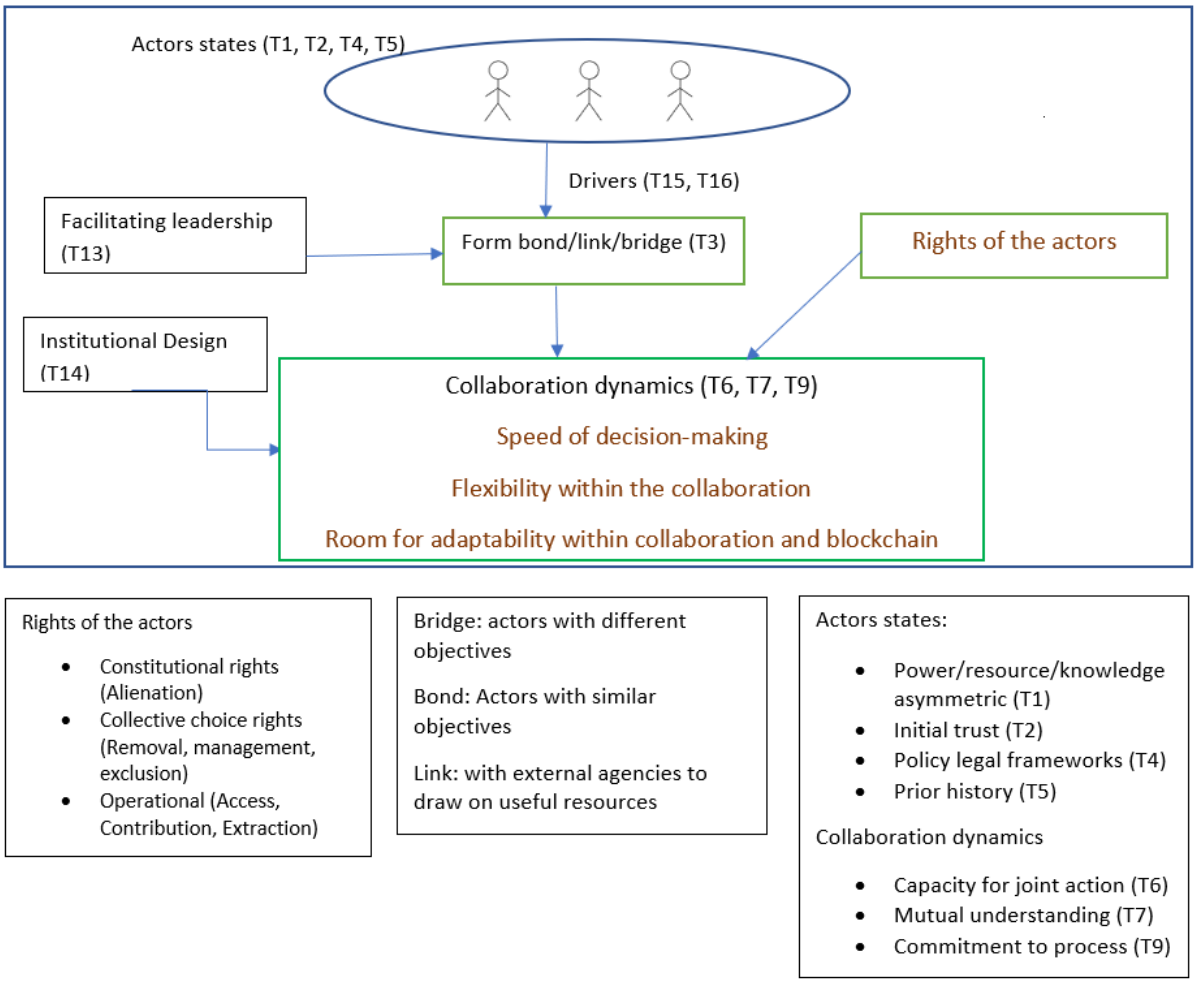

Fig. 3.2 Empirically refined model obtained from the case study analysis

The empirically refined model is thus obtained after conducting the case study analysis. Based on the empirical context, more emphasis is made on the process of forming a collaboration for the blockchain-based platform rather than focusing on the outcomes. The rights of the actors from the blockchain governance framework developed by Van Engelenburg et al. (2020) have been included in the model along with 'speed of decision-making' and 'flexibility within the collaboration' and 'room for adaptation'.

3.6 Summary

This chapter concludes with empirically enhanced conceptual model obtained after the contextual and empirical analysis into the blockchain-based platform developed for the PROFILE project to be used for customs supervision. The chapter was for the purpose of answering the research question: *What governance framework can be used to aid the collaboration of multi-level actors in the context of customs supervision?* This chapter contained the case study research approach as defined by Yin (2018) and sets the case study

design and protocol in section 3.1. The data sources used for conducting the case study are listed in section 3.2. Section 3.3 delved into the case description. The PROFILE project and the ICS 2.0 have been described in detail to set the background for the need of blockchain-based platform in customs supervision. The blockchain technology is explained in detail and lastly the governance related issues for the blockchain-based platform has been highlighted. The chapter ends with an analysis of the case and refining the conceptual model based on the case.

4. Development of scenarios

This chapter uses the technique of developing a scenario to understand the collaboration of different networked stakeholders in an innovation process. From the previous chapter, the case study and the context of the scenario are established. This chapter focuses on answering the research question: *How can the governance framework be used for governance during the development of blockchain technology for customs supervision?* This chapter will apply the conceptual model to each governance option mentioned in the previous chapter and develop scenarios for them consecutively.

Scenarios are defined in existing literature as narrative descriptions of exchanges between people and how they do their activities in a proposed setting (Caroll, 1999; Potts, 1995). To be specific "scenarios highlight goals suggested by the appearance and behavior of the system, what people try to do with the system, what procedures are adopted, not adopted, carried out successfully or erroneously, and what interpretations people make of what happens to them" (Caroll, 1999, p. 2).

Since the context of the case study was a developmental process of an innovative interactive system between the stakeholders, scenarios can be derived at multiple levels and perspectives to reflect design issues (Caroll, 1999; Lim et al., 2003). Scenarios are useful in this research for the following reasons: they can create knowledge to deliberate on problems, and simultaneously demonstrate a solution that is still open-ended (Caroll, 1999).

The development of the scenarios method is used to identify the elements of governance that the stakeholders of the platform need to adopt, and to explore how these elements influence the design choices of the blockchain-based platform.

A typical scenario will include description of setting, agents and actors; a plot; and events that depict how actors influence and get influenced in a particular circumstance of a setting (Caroll, 1999).

To get an understanding of the actors involved in the case study and their activities, secondary data was gathered from the PROFILE project deliverables, by conducting a telephonic workshop with an employee from TNO (an independent organization that conducts researches on applied science (TNO, n.d.)) and researchers from the TU Delft involved in the PROFILE project. In addition, an interview was held with a graduate researching on the technical view of the blockchain-based platform which provided information on the technical functionalities and the design of the blockchain-based platform. These workshops coupled with the weekly

calls with an expert in the customs domain participating in the PROFILE project researches provided substantial information to conduct the case study and develop two scenarios.

In this chapter, a method to use the empirically enhanced model to develop scenarios have been designed in section 4.1. Using this method, two scenarios have been developed in section 4.2 and 4.3. In section 4.2, the scenario for private-domain governance of the blockchain-based platform is explored and for section 4.3, the scenario for the public-domain governance of the blockchain-based platform have been developed.

4.1. Method of analysis: Method to develop scenarios from the empirically enhanced model

The empirically enhanced governance model was developed in previous chapter (Chapter 3) of this thesis. To use the model to develop scenarios, a method with a series of steps has been defined to conduct the analysis and develop the scenarios. These steps have been defined by using the elements of the model in figure 3.2 (empirically enhanced model). This method can be followed to derive scenarios. Thus, the utility of the model can be demonstrated by using the method described to develop the scenarios. The data that will help to follow these methods are extracted from the case study. For using the empirically enhanced model in the future, some research methods are suggested for each analyses step in the section 4.1.1. These research methods can be used in case more detailed empirical study is conducted.

Step 1: Context analysis

The first step is to analyse the context in which the scenario will take place, namely who is developing the platform: public organizations or private organizations. Based on this, what are the possible implications of having a public domain or a private domain platform for the other users.

Step 2: Actor analysis

In this step, the actor composition and the roles of the actors are determined (who will be involved in designing and using the platform) is analysed. The states of the actors (from the empirically enhanced model) are analysed by applying the model. The possible dynamics between the developers and the users is predicted by analysing the trust and incentives for the actors to perform in the collaboration.

Step 3: Analysis of types of relations between the actors

Formation of link, bond or a bridge between the actors is determined based on their objectives. If the actors come to join the collaboration to fulfil similar objectives, they will form a bond. The actors that are participating in the same collective initiative, but they have different objectives will form a bridge amongst themselves. If some actors form a collaboration with external agencies to use their resources, then the actors and the external agencies form a link between them. This step is necessary because the motives for the actors in the collaboration become transparent and apparent to the other actors.

After knowing the type of connections between the actors, the actor that will be facilitating leadership roles is determined by analysing the amount of power and resources brought into the collaboration by them.

Step 4: Legal Framework analysis

This step is important to determine the external factors that will be affecting the collaboration. The actors and the institutions that bind them, the legalities of forming a collaboration between the actors and the outcome that the collaboration will bring for the actors must be allowed by the legal system. It is necessary to have clear set of ground rules that

Step 5: Institutional analysis

This step determines the institutions and the ground rules that need to be formed and set to ensure successful collaboration for each actor. The ground rules will depend on the type of structure formed between the actors and the power/resources that the actors possess. This step of analysis can determine whether the platform is exclusive for the actors, whether the actors' demands are being met. Analysis of the actors' participation in the collaboration and their level of activeness can be done here.

Step 6: Collaboration dynamics analysis

Based on the networked governance structure and the actors' trust levels and objectives, analysis of the measures needed to be taken by the actors for a successful collaboration is required. These measures include dialogues between the actors and trust building exercises. The actors' commitment to process is determined by their capacity and ability for joint action in the collaboration. Ownership of the process will be determined by the resources that the actors bring into the collaboration.

Step 7: Analysis of the actors' rights

The constitutional rights, collective choice rights and the operational rights of the actors in the blockchain-based platform are analysed for the particular scenario.

4.1.1 Validating the model using the method of analysis

In section 4.1, a method of using the contextual model to develop the scenarios has been listed. This method is a series of analyses, like the actor dynamics analysis or the institutional design analysis, that needed to be performed to develop the scenarios. Sections 4.2 and 4.3 contain the scenarios that were developed using the case study results. While developing the scenarios, limited data were available to fully construct the scenarios. Due to this, in this section, ways to perform the analysis will be prescribed. These ways are research methods that can be performed if there were better access to the empirical data. In the table 4.1, the steps of analysis listed in section 4.1 are matched with the research method that can be performed to complete the analysis.

Steps of analysis	Method to analyse
Context analysis	For this analysis, it is important to understand what it means to have a business-owned or government owned blockchain governance. To understand the context, detailed investigation into the nature of the blockchain platform is required. For example, in the case mentioned in chapter four, detailed investigation of the requirements for the platform needs to done. The deliverables produced in the requirement analysis of the platform can be consulted by the researcher. At the same time, the knowledge about the customs authorities and the carriers is also required as the nature of the users and the developers affect the design choices. The websites of the actors can be visited to have more knowledge about them. Also, the actors' needs and demands can be consulted from the requirements analysis deliverables.
Actor analysis	In this analysis, the dynamics between the actors is of focus. For this, previous projects between the actors can be consulted to derive knowledge about their past history and their trust levels. Comparison of powers and resources between the actors can be done by the researcher. Interviews can be set up with the actors

	to understand their motivation and to know about their willingness to take part in the collaboration.
Analysis of relations between the actors	To understand the relations between the actors, their objectives need to be known, interviews with the customs authorities of the Member States can be done. Interviews can help to know whether they are on board with the other members objectives. Whether their goals meet with the goals of the platform can be checked from the interviews. Similarly, this analysis can be carried out for the carriers. Interviews with the carriers needs to be done and they should be informed about the participation of their competitors in the platform. Interviews to know whether all the carriers' objectives align with each other and with the goal of the platform. Same thing needs to be done with the technology providers as well.
Legal framework analysis	This analysis can be done with the help of interviews with policy analysts and legal experts to know more about the legal context of this platform and the implications of forming a network around the platform to share information. Past legal cases and legal documents can be consulted to know about the legitimacy of the platform and the hurdles and obstacles that can occur during the collaboration with several types of actors (private and public organizations)
Institutional analysis	This analysis can be done with the owners of the platform, depending on the nature of the platform (public-domain, private domain or consortium type), the rules of the platform can be determined and analysed from interviews with the owners. In addition to this, other similar collective initiatives can be observed, and their initiation/operations can be analysed in order to validate.
Collaborative dynamics analysis	Based on the results of the previous analyses into the actors' trust, incentives and resources, the dynamics during the collaboration can be analysed.

Analysis of the actors' rights	Similar blockchain platforms can be analysed to know the distribution of rights. Previous instances of consortium-type arrangements of blockchain platforms can be scrutinized.

Table 4.1 Methods to conduct the analyses

4.2. Scenario of governance option 1: Application of the governance model to the case when blockchain platform is owned by private organizations

The method of analysis designed in section 5.1 was used to structure the scenario development. The method of analysis gave a step by step process of fleshing out the scenario using the elements in the refined model, and thus the method of analysis was used to apply the model to the case to define scenarios.

Step 1: Context analysis

The context of this governance option is that business parties own and are responsible for developing the blockchain-based platform. In such a situation, the ocean carriers of the shipments will own the Entry Summary Declarations data as well as they will have information about itinerary change and route deviations of the goods. This information will be lodged onto the platform by the carriers. The customs authorities will need to acquire authorization from the carriers to get access to these data in the platform.

This context has possibilities to either lead to a situation where the carriers have a strong lead in the design of the platform whereas the customs authorities are merely kept informed of the design choices in the development process of the platform. Or, it can also be a participative approach to design by both carriers and customs authorities and the latter will have more rights in the developmental phase. In either situation, the context that the platform is owned by business parties is definite, and it can lead to an interesting analysis of how supranational actors like the EU and national bodies like the EU customs authorities and private firms (carriers) come to consensus while designing the platform in a business-owned setting. Questions like what rights the EU will have and whether the customs authorities consent to have carriers as the data owners are some that need to be analysed and answered.

Step 2: Actor analysis

The actor composition in this governance option comprises three main actors: the private firms (carriers), the customs authorities and the technology providers. The actor states signify the initial starting conditions that influence the actor's decision to join the collaboration and act. The starting conditions that can influence the collaboration are initial trust level, previous relationship between the actors, incentives and constraints to join the collaboration and the power/resource held by the actors. Based on these elements, there are several dynamics possible between the actors such as:

- Carriers hold more power and resources in this collaboration: As owners of the ENS data and owners of the blockchain-based platform, carriers hold more power and resources in the collaboration with the customs authorities in the blockchain-based platform.
- Technology providers are external agencies having useful resources (capabilities): The carriers can consult the technology providers to develop the platform. Although, there may be constraints legally as well as trust issues between the stakeholders and the technology providers where the technology providers may not have permission to have access to data that the blockchain platform will contain. The tech providers can develop the platform by strictly adhering to the GDPR Law. In addition to this, the tech providers may be in competition with each other as well while developing the platform. This thesis research analyses the dynamics between the tech providers at a high level, and competition between the tech providers is out of scope for this research.
- The carriers are in competition with each other: The numerous ocean carriers transporting the goods to EU Member States will have their internal competition and rivalry amongst themselves as they are business-driven companies. This will prove to be a challenge in the collaboration process while sharing and pooling data in the platform, their strategies might be visible to other private firms. Hence, there may be two possible dynamics with the carriers that can occur.
    - All carriers cooperate with each other while developing the platform: Despite the competition, the carriers come together to collaborate.
    - Not all carriers collaborate for developing the platform: The carriers will struggle to form collaboration with each other and take unanimous decisions.
- All the customs authorities of the EU may not have the same motivation and enthusiasm to form the collaboration with the carriers for the blockchain-based platform. Depending on their needs, some Member States will value this collaboration more than

other Member States. Thus, the incentives of joining the collaboration for the Member States will be strong for some than others. In the same way, the constraints and resource asymmetric of some Member States will be more in this situation. In cases like this, these Member States will only act as much as the EU asks them to act.

Because of the above dynamics, the following may occur:

- In case of non-cooperation from the carriers during collaboration, one of the carriers could lead and develop the platform like Maersk's joint Tradelens project with IBM case (Tradelens, n.d.).
- If the carriers lack the capacity to develop the platform, the tech providers develop the platform with carriers as the users.
- In case of competition within the tech providers and within the carriers, IT providers can form communities with the carriers and form a separate platform.
- Due to non-cooperation among the carriers, separate infrastructures are present, and in that case the developers and the customs authorities collectively would need to agree on the interface.

By cooperation, it is implied that the carriers do not have an obligation to cooperate and supply the ENS data during route deviations in this blockchain-based platform.

Step 3: Analysis of types of relations between the actors.

Based on the above analyses, the following relations may occur between the actors.

- Carriers with customs authorities - Bridge. (Since, their objectives are different. Carriers are interested in economic benefits for themselves and customs are interested in improving the risk assessment process)
- Carriers with tech providers – Link (The carriers will use the resources present with the technology providers to develop the platform).
- Customs with other customs of the Member States: Bond (if they have similar objectives) and Bridge (if the Member States have different objectives).
- Carriers with each other: Bond (if all cooperate), and Bridge (if not all carriers cooperate).

"The carriers will facilitate and show leadership in this collaboration since they own and develop the platform" a quote by the expert in the field of customs domain in TU Delft. She

continued: “If EU is involved in this governance option, there might be powerplay between the carriers and the EU”.

Step 4: Legal Framework Analysis

The blockchain-based platform is a platform where information will be logged and exchanged between the stakeholders. The platform cannot exist if there is no arrangement by the legal system for such an infrastructure to provide information to customs authorities. The law of GDPR also comes into play to set guidelines for the stakeholders on how to interact with the data and each other. Clear knowledge of ownership of the data and platform at different stages of deployment is compulsory.

Step 5: Institutional analysis

This analysis depends on the previous analysis of system context and actors, then consecutively deciding on the ground rules that need to be followed to ensure successful collaboration in the platform. These ground rules need to ensure platform exclusivity and actors’ inclusiveness.

Platform exclusiveness: In case of rivalry between the carriers, or non-cooperation from the carriers to work on the platform, separate platforms might exist. It is necessary to ensure that the actors do not look elsewhere to meet their needs. This means that the rights of the actors should be safeguarded during collaboration.

Actors inclusiveness: Based on resources brought by the actors to the collaboration, the actors’ participation and investment in the collaboration can be determined. Aside from this, the carriers (leading actors in the collaboration) will determine how the public authorities will influence the design choices of the platform.

Step 6: Collaboration dynamics analysis

Capacity to joint action: Based on the resources and trust the carriers and the customs authorities have during the collaboration, their capacity to undertake joint action can be analyzed. From the interview with the expert in the field of customs domain, it was noted that the customs authorities can impose some requirements for the platform to have while the carriers are responsible for making the decision choices of the platform. The carriers will need to open up the platform for the actors to use the platform and have access to the data. The interdependencies of the actors to make the platform run need to be recognized. The ownership

of the process will be realized by each actor based on the resources and the investment they bring into the collaboration.

Step 7: Rights of the actors

Since, the carriers are taking the lead in the development of the platform, they will be making the decision of design choices of the platform. They can decide to include the customs authorities in the decision making. If they do, the constitutional and the collective rights will be shared by the carriers and the customs authorities.

4.3. Scenario of governance option 2: Application of the governance model to the case when blockchain-based platform is owned by public authorities

The steps to apply the conceptual governance model designed in the previous literature will be used to derive the scenario. Step four (legal framework analysis) of this scenario is same as the previous scenario. This is because the requirements for the legal framework for such a platform to exist is same for both the governance options.

Step 1: Context analysis

The context of this governance option is that public authorities own and are responsible for developing the blockchain-based platform. Here, the customs authorities will own the Entry Summary Declarations data. The customs authorities authorize the carriers to give the ENS data or a reference to the ENS data to them. Hence, a B2G exchange of information takes place. After this exchange of information, the customs authorities own the data and they can pull the data directly from the platform.

This context has possibilities to lead to a situation where not all Member States customs authorities will be willing to put equal resources into developing the platform. Some Member States will have greater interest in developing this platform than others. This is because the Member States of the EU are diverse complex bodies each having separate issues and different financial interests (“EU - what it is and what it does”, n.d.). The scenario that is to be designed is what happens when public authorities develop and own such a platform and analyse the design choices of the platform is such a situation.

Step 2: Actor Analysis

The actor composition in this governance option comprises of four main actors: the private firms (carriers), the customs authorities, the EU and the technology providers. There are several possible dynamics between the actors:

- The Member States Customs Authorities agree to participate in the common platform, and all have same interests.
- There are conflicts between the Member States. This may be because they have different interests while working in the common platform or design choices while developing the platform. These conflicts between Member States have been observed before in a research conducted by Rukanova et al. (2015) in their research to manage transnational information systems.
- Some Member States are passive collaborators in the development of the platform. This may be when their interests or incentives to form a collaboration are not aligned with the rest of the Member States.
- The Member States Customs Authorities do not have the capabilities of developing a blockchain-based platform on their own. They will include technology providers for the same. The inclusion of an extra member in the collaboration changes the dynamics between the actors even more so as there will be tension between the Member States and tech providers regarding data security and ownership of the data within the platform.
- The customs authorities and the carriers (or other business parties involved) conflict with each other regarding design choices of the platform.
- The Member States and the European Commission (EC) are in conflict with each other regarding the decision of participating in the common platform or the design choices of the platform.

Because of the above dynamics, the following are possible:

- Customs take the lead in making the design choices for developing the platform and making it a participative approach for all by consulting carriers with design choices.
- Carriers are not consulted or involved while developing.
- In case of conflicts between the Member States, EU hosts the platform and makes the design choices.
- Some member states play an active role bringing their own choices/needs to the EU when EU is in charge of hosting the platform.

Step 3: Analysis of types of relations between the actors.

Based on the above analyses, the following relations may occur between the actors:

- Customs Authorities with carriers – Bridge (Since, their objectives are different. Carriers are interested in economic benefits for themselves and customs are interested in improving the risk assessment process)
- Customs Authorities with tech providers – Link (The customs authorities will use the resources present with the technology providers to develop the platform).
- Customs with other customs of the Member States: Bond (if they have similar objectives) and Bridge (if the Member States have different objectives).
- The EU with the Member States - Bond (if they have similar objectives) and Bridge (if the Member States have different objectives).
- Carriers with each other: Bond (if all cooperate), and Bridge (if not all carriers cooperate).

The Member States or the EU will facilitate and show leadership in this collaboration since they own and develop the platform.

Step 4: see the previous option in section 4.2, step 4.

Step 5: Institutional analysis

This analysis depends on the previous analysis of system context and actors, then consecutively deciding on the ground rules that need to be followed to ensure successful collaboration in the platform. These ground rules need to ensure platform exclusivity and actors inclusiveness.

Platform exclusiveness: In case of conflicts between the Member States or between the EC and the Member States, there are chances the actors will come out of the collaboration and form separate platforms. To prevent this, the rights of the actors should be safeguarded during collaboration.

Actors inclusiveness: Based on previous analyses, actors' inclusiveness will vary as the following:

- Carriers' involvement while making the design choices will depend on the customs authorities and how they wish to involve them.

- Based on the interests, and incentives, the customs authorities are not all equally active in the collaboration.
- When the EC hosts the platform, what does it mean for all the Customs Authorities and carriers in terms of participation and bringing resources.

Platform exclusiveness: “If the actors fall out of the platform, and in future several platforms exist because of failure to secure platform exclusiveness, the customs will have to look for a way to merge the carriers in both the platforms.” – a quote by the expert in the customs domain present in TU Delft.

Step 6: Collaborative Dynamics Analysis

Capacity to joint action: “When the customs are in the lead, they can decide on how much degree the carriers and the EU can be involved in the decision-making” – by the expert in the customs domain of the TU Delft. Also, capacity of joint action can be useful to analyse which customs authorities are more active than others. With an interview with the graduate from TU Delft involved in the research on blockchain-based platform for customs, it was noted that in case of land/air transportation of goods, different customs will be more impacted than the ones in the maritime transports.

Step 7: Rights of the actors

Since, the customs authorities are taking the lead in the development of the platform, they will be making the decision of design choices of the platform. They can decide to include the carriers or the EU in the decision making. If they do, the constitutional and the collective rights will be shared by the customs authorities, carriers and the EU.

A particular scenario

A particular scenario is described as following: The ocean carriers of the shipments own the Entry Summary Declarations data as well as they will have information about itinerary change and route deviations of the goods. This information will be lodged onto the platform by the carriers. The customs authorities will need to acquire authorization from the carriers to get access to these data in the platform.

The carriers have a strong lead in the design of the platform whereas the customs authorities are merely kept informed of the design choices in the development process of the platform. Thus, the constitutional, access and collective rights are owned by the carriers in this scenario.

The customs will have merely the access rights. Carriers hold more power and resources in this collaboration as they are the owners of the ENS data and owners of the blockchain-based platform,

All carriers cooperate with each other while developing the platform. Despite the competition, the carriers come together to collaborate.

Based on the above, the following relations occur between the actors.

- Carriers with customs authorities - Bridge. (Since, their objectives are different. Carriers are interested in economic benefits for themselves and customs are interested in improving the risk assessment process)
- Carriers with tech providers – Link (The carriers will use the resources present with the technology providers to develop the platform).
- Customs with other customs of the Member States: Bond (if they have similar objectives) and Bridge (if the Member States have different objectives).
- Carriers with each other: Bond (since all are cooperating).

The interdependency depicted by the customs on the carriers for access to information is the reason for the platform and the collaboration. The commitment of the actors will be dependent on the amount of resources invested into the platform.

4.4 Evaluating the scenarios

The governance scenarios have been presented in a workshop and the feedback and suggestions received during the workshop have been implemented. The participlants in the workshop were an employee from TNO who had knowledge of the technical design choices that needed to be made for the development of the blockchain-based platform for the customs authorities. The other members present in the workshop are experts in the field of customs domain present in the TU Delft. They are respectively a researcher and a professor of Information and Communication Technology at the ICT Group of the Department of Technology, Policy and Management of TU Delft. During the workshop, the scenarios from the case study were revealed to them and the participants gave feedback on the scenarios and they also divulged more relevant information on the case.

Some techniques for further validating the scenarios in sections 4.2 and 4.3 are given in this section. Qualitative research is often subjective to the researcher perceiving the problem. Hence, validation is essential in the research before generalizing it to larger context. Biases or perspectives should be disclosed while reporting the data. In this thesis, information has been gathered from the PROFILE project deliverables and from workshops and interviews as mentioned in the beginning of this chapter. The informants are jointly working with the TU Delft for the PROFILE project researches, one of those is the Blockchain-based technology platform for customs supervision. These informants are affiliated to the PROFILE project.

The triangulation method (Torrance, 2012) of conducting research by looking at it from multiple angles help to deepen and validate the research. Further research by gathering data from customs authorities of the Member States in the EU to know their perspectives, challenges and constraints to join the collaboration will help to identify the dynamics between the actors. Similarly, for the carriers. Multiple interviews with multiple carriers and multiple customs authorities, representatives of the EC will help the scenarios develop more deeply and generate discussions that has been deemed out of scope with this research. Deeply saturated research into the case help strengthen the validation of the findings.

As mentioned, the two scenarios developed are the two extreme governance options that can be derived with the governance of the blockchain-based platform: business-owned or government owned. Other consortium type arrangements of governments are also possible with the platform. In addition, dynamics of the stakeholders will be affected by analyzing the rivalry and competition of the technology providers. But these have been deemed as too detailed and left out of scope for this research.

4.5 Conclusion

In this chapter, the research question: *How can the governance framework be used for governance during the development of blockchain technology for customs supervision?* has been answered by developing two scenarios by using the governance framework. These scenarios have been developed by using the method of analysis defined in section 4.1. The seven main steps of the method of analysis are context analysis, actor analysis, analysis of types of relations between the actors, legal framework analysis, institutional analysis, collaboration process analysis, analysis of the rights of the actors. The method of analysis is a way to validate the use of the model. The method of analysis that is designed in this thesis can be used for developing scenarios from the contextual governance model.

The governance scenarios are based on the governance options of whether the blockchain-based platform is business-owned or government owned. In real life, there is another type of domain called the consortium-type. But due to simplicity reasons, and due to unavailability of sufficient information, the third governance option has not been explored. The scenarios can be used to create knowledge to deliberate on problems, and simultaneously demonstrate a solution that is still open-ended. Thus, various possibilities in each scenario have been explored and suggestions have been given on how to proceed with solution, like with the actor dynamics and leadership. These scenarios are developed with interviews and a workshop held with experts in the field of customs supervision. Lastly, some validation techniques are discussed for validating the scenarios, such as the triangulation method, multiple interviews with multiple carriers and customs authorities, etc.

The purpose of this scenario developments is mainly to improve the understandings of system and stakeholder's motivation in a collaboration. There are diverse interests of the stakeholders coming to collaborate and work collectively on the platform. Due to this, negotiations and managing trade-offs during decision making is an important step as seen in the scenario development. Gómez et al. (2017) said that scenario development helps in collective decision-making because alternative options can be assessed and analysed. Consequences from possible course of action can be identified. Lastly, scenario developments help in identifying weak or missing points in a model. Due to scenarios being narrative in nature, thoroughness of an analysis may be missing but scenario developments help in exploring uncertain qualitative socio-economic factors in a case.

5. Conclusion and Recommendation

This chapter is the concluding chapter to this thesis research report. In section 5.1, the problem statement and the objective for the research are summarized. In section 5.2, the answers to each research question are presented. Section 5.3 discusses the relevance of this thesis research to the CoSEM (Complex System Engineering and Management) course of TU Delft. Section 5.4 contains the scientific contribution, while societal contributions are discussed in section 5.5. Section 5.6 contains recommendations for further research.

5.1 Summary of the problem statement and the research objective

In chapter one, the issues with the customs risk assessment process were discussed. The vessels transporting the cargo can face change in itinerary because of various factors. The ENS documents are submitted to the customs office of first entry before loading the cargo onto the vessel. The issues that the customs faced were unavailability or incomplete Entry Summary Declarations to perform the risk assessment because of the change in itinerary of the vessels. Due to this unavailability and incomplete ENS documents, the customs authorities need to inspect a large number of cargo or communicate with other Member States customs authorities for information. This results in efficiency in the process and incurs costs.

Due to growing amount of trade into the European Union, these issues cause a serious problem in the functioning of the customs authorities of the EU. In 2018, the EU evaluated the use of blockchain technology for availability of information to the customs. The blockchain technology is a decentralized platform. Governance issues surrounding the blockchain-based platform arose such as who will develop the platform and be held accountable for the platform. The networked organizations around this blockchain-based platform consists of actors from the supra-national level (EU), national level (EU Member States) and business organization (ocean carriers). Since the goals of these actors are different (carriers are interested in monetary profits and customs authorities are interested in security within trade), a governance solution for multi-level network of actors to form a collaboration is required. Thus, the objective of this research is to look for a governance solution that enables multiple actors to join forces and form a collaboration. The research question that has been formulated for this research is: *What governance solution can enable the collaboration of multiple organizations to develop blockchain technology for EU customs supervision?*

5.2 Answers to research questions

In this section, the main research question mentioned above will be answered in a step-by-step process by breaking down the research question into research questions and then answering them.

Research question 1: *Which theoretical frameworks can help identify elements that are necessary for governing collaboration for multi-level and multi-actor networks?*

To answer this question, a systematic literature review was done on the different existing frameworks of multi-level governance and organizational studies. While conducting the literature review, it was found that there are different types of governance in the setting of multi-level and horizontal governance, namely collaborative governance, collective governance and networked governance. These three forms of governance have been found suitable to be used for the formation of the conceptual model. As this thesis requires a governance framework that aids the collaboration of a networked organization to develop blockchain technology for customs supervision, the terms collaborative, collective and networked governance all fit for the literature search. The results of the literature search ended with obtaining five papers that have been highly cited and well-recognized in organizational studies. These papers are in the domains of collaborative innovation and use of social capital and networked connectiveness. Thus, the conceptual model has elements from these domains. The articles that were obtained from the literature review are: Ansell et al. (2008), Emerson et al. (2012), Provan et al. (2008), Pretty (2003) and Stoker (1998).

Research question 2: *What conceptual model could enable governance of multi-level and multi-actor networks?*

After the literature review, it was apparent various frameworks under the domain of collaborative, collective and networked governances exist. But there were no frameworks that combine the elements of networked governance and collaborative governance for a global scale collective initiative. Thus, these elements from the articles were analysed to form a conceptual governance model. The conceptual governance model can be seen in the figure 5.1. Because the results of the literature review yielded articles that are in the domains of collaborative innovation, use of social capital and networked connectiveness. Thus, the conceptual model has elements from these domains. The elements Power, resource conditions (T1), Levels of

conflict/trust (T2), Network connectedness (T3), Policy legal frameworks (T4), Prior history between actors (T5), Capacity for joint action (T6), Mutual Understanding (T7), Dialogue/Definition (T8), Ownership/commitment (T9), Principled engagement (T10), Organization of networks (T12), Leadership (T13), Institutional design/rules (T14), Incentives (T15), Interdependency (T16), Impact (T18) and Adaptation (T19) are chosen to be relevant for the conceptual model.

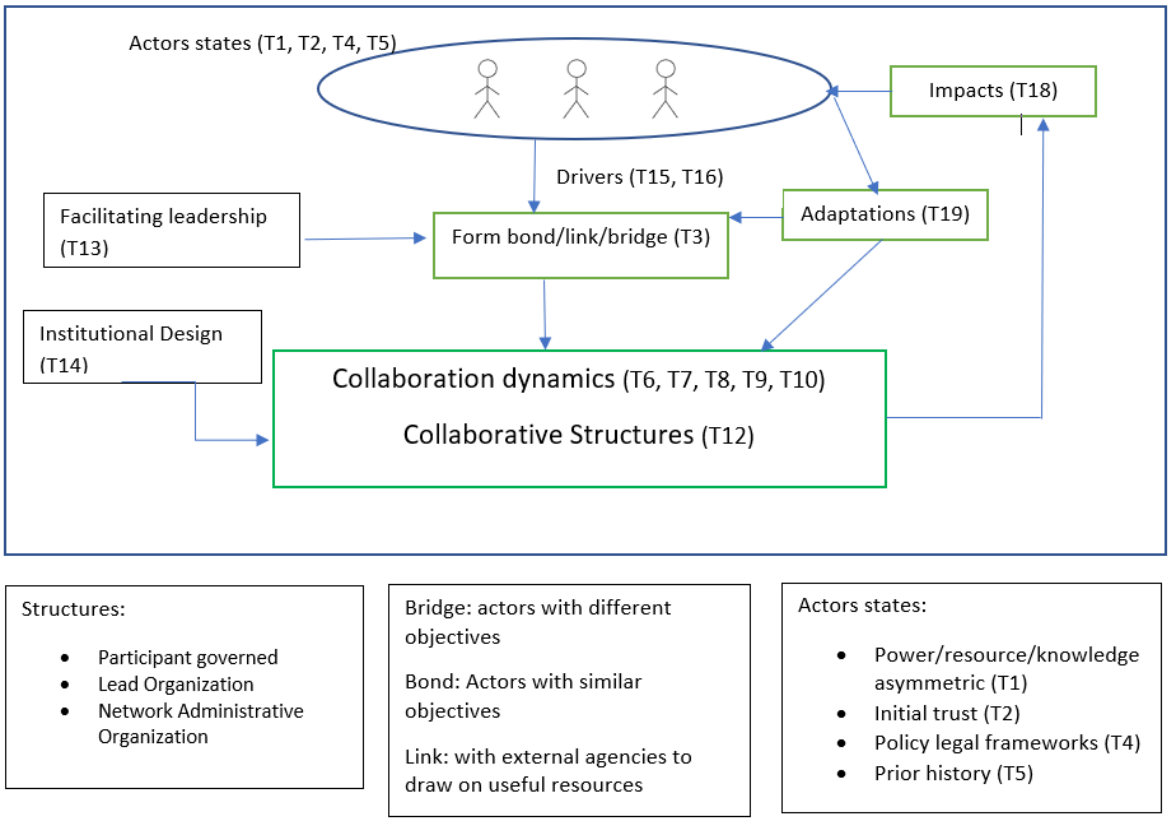

Fig. 5.1 Conceptual Governance model designed from the results of the literature review analysis

Research question 3: *What governance framework can be used to aid the collaboration of multi-level actors in the context of customs supervision?*

To answer this question, a case study was done on the blockchain-based platform that was being developed by the EU to be used for customs supervision. Data sources for the case study included one workshop, and several open interviews with experts in the field of customs domain and researching for the PROFILE project. In addition, research articles for blockchain governance, PROFILE project deliverables and the websites of the PROFILE project and the

European Commission were consulted. Case study analysis was done where the relevance of each of the elements of the conceptual model were analysed with respect to the case. From the analysis, it was found that the following elements were relevant for the case:

Elements	Tracing number for the element	Justification
Power, resource conditions	T1	Power and resources among the actors determine the dynamics between the actors (within the carriers or between the carriers and the government bodies)
Levels of conflict/trust	T2	The actors may have prior interactions and issues with each other which will affect their relationships as discussed in the case study analysis.
Network connectedness	T3	The connections between the actors within the network is useful to be included in the model as it determines the motivations and objectives of actors as a whole and individually (Pretty, 2003). The connections between the carriers, customs and the technology providers provide insight into their dynamics within the collaboration and shed light on their objectives.
Policy legal frameworks	T4	This determines whether the actors have the facility to achieve the required outcomes from the collaboration. It allows space to analyse whether such a collaboration is backed by the legal system. Existence of a blockchain platform where exchange of information takes place between business and governmental organizations should be allowed by the legal system. Also, using the information from the platform for public values need to be allowed by legal frameworks.
Prior history between the actors	T5	History of a bad experience or a successful experience between the actors will lead to low-levels of trust or high-levels of trust respectively. Thus, trust levels and history between the actors are dependent on each other as discussed in the case study analysis.
Capacity for joint action/network-level competency/blurring of roles & responsibilities	T6	This is an important element for the conceptual model because the actors will need to collectively work towards their required outcomes. Thus, the actors' roles, resources and

		competencies are important to be determined for the collaboration.
Mutual Understanding/consensus	T7	While working, the actors need to have a clear consensus of their goal.
Ownership/commitment	T9	Ownership and commitment of the actors will depend based on the power and resources the actors bring into the collaboration.
Leadership	T13	It is important for actors to facilitate and display qualities of leadership in a multi-level collaborative initiative so that the actors can be empowered within the network. In addition, the type of platform will be determined by which actors take the lead to develop the platform.
Institutional design/rules, norms and sanctions during collaboration	T14	This is necessary for determining internal legitimacy, ensure the actors to follow the rules of the collaboration and lastly ensure the inclusivity of the actors.
Incentives	T15	Incentives help to understand the actors motives for joining the collaboration and their actions. As discussed in the case study analysis, incentives play a key role in determining the active participation of the carriers and the customs organizations in the platform.
Interdependency	T16	Resources and capabilities vary among the actors. Thus interdependencies among the actors is a crucial element. As discussed in the case study analysis, the interdependency exists between the customs organizations and the carriers because the risk assessment process performed by the customs organizations are dependent on the ENS information possessed by the carriers.

Table 5.1: Elements chosen from the case study

In addition to these elements, the concepts of allocation of constitutional, collective choice and operational rights have been included from Van Engelenburg et al. (2020). This allocation of rights among the stakeholders help to ease the issue of governance of the blockchain-based platform. The other additional elements are ‘speed of decision-making’, ‘flexibility within the collaboration’ and ‘room for adaptation’ to solve the issues of scalability and privacy. The refined model is shown in the figure 5.2. The elements in the model having a tracing number,

Tx where x is a number, derived from the literature review and the element which is in brown colour font is derived from the case study.

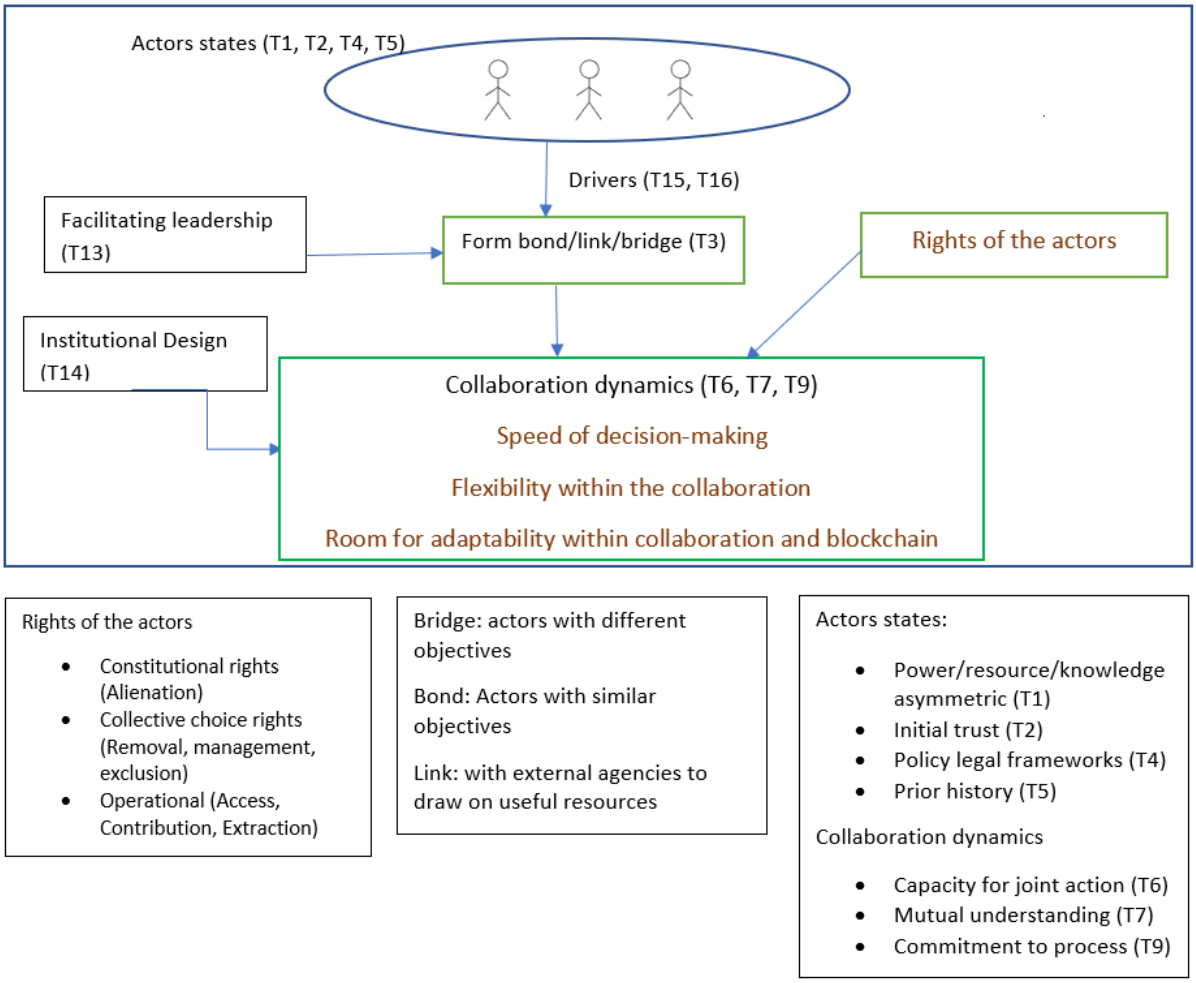

Fig. 6.2: Empirically enhanced governance model

Research question 4: *How can the governance framework be used for governance during the development of blockchain technology for customs supervision?*

This question was answered by developing two scenarios for the blockchain-based platform. The purpose of scenario developments is to improve the understandings of system and stakeholder's motivation in a collaboration. There are diverse interests of the stakeholders coming to collaborate and work collectively on the platform. The governance scenarios are based on the governance options of whether the blockchain-based platform is public-domain or private-domain. In real life, there is another type of domain called the consortium-type. But due to simplicity reasons, and due to unavailability of sufficient information, the third governance option has not been explored. Various possibilities in each scenario have been

explored and suggestions have been given on how to proceed with solution, like with the actor dynamics and leadership. These scenarios are developed with interviews and workshop held with experts in the field of customs domain.

In addition to the scenarios, methods of analysis were defined for using the contextual governance model in the empirical context. These methods can be done when the researcher has access to the relevant documents and actors for getting the empirical data:

- Context analysis: Deliverables from the requirement analyses of the platforms can be consulted by the researcher. The websites of the actors can be visited to have more knowledge about them.
- Actor analysis: Previous projects between the actors can be consulted to derive knowledge about their past history and their trust levels. Comparison of powers and resources between the actors can be done and interviews can be set up with the actors to understand their motivation.
- Analysis of relations between the actors: Interviews can help to know whether the stakeholders are on board with the other members objectives. Interviews with the carriers needs to be done to inform them about the participation of their competitors in the platform. Interviews to know whether all the carriers' objectives align with each other and with the goal of the platform. Same thing needs to be done with the technology providers as well.
- Legal framework analysis: This analysis can be done with the help of interviews with policy analysts and legal experts to know more about the legal context of this platform and the implications of forming a network around the platform to share information. Past legal cases and legal documents can also be consulted.
- Institutional analysis: The rules of the platform can be determined and analysed from interviews with the owners.
- Collaborative dynamics analysis: Based on the results of the previous analyses into the actors' trust, incentives and resources, this analysis can be performed.
- Analysis of the rights of the actors: Similar blockchain platforms can be analysed to know the distribution of rights.

5.3 Relevance to the CoSEM program

To understand how this thesis is relevant to the CoSEM program, it is required to view the activities of the customs risk assessment process as a socio-technical system with multiple

stakeholders. The risk assessment is based on the actions of the ocean carriers (submission of ENS documents), action of the customs officers and the risk rules. To improve the risk rules and the risk assessment, several Digital Trade Infrastructures are used. This thesis was focused on one aspect of the digital trade infrastructures, namely blockchain technology for the purpose of customs supervision. Thus, the technology component of this research is the blockchain technology that is going to be adopted by the customs authorities.

Customs supervision in the EU involves the customs authorities of the EU countries along with the cooperation of the business organizations involved in the supply chain. The business organizations will strive for monetary profits and there will be competition among the business organizations. The national governments have their own rules and regulations that need to be followed to exchange information within a collaboration. Thus, the research covers values originating from both public and private domains. Bringing the stakeholders together in a collaboration for improvement in the risk assessment process is a complex problem as explained in case study analysis in chapter 4. This complex problem is dealt with in a systematic manner by first conducting literature review on organizational studies and then delving into the technology component by conducting empirical study.

The research had a clear engineering structure as seen in chapter one. The research was divided into phases such as problem definition, designing phase where the conceptual framework was developed, refinement to empirical context where the technology component was studied and the relationship between the network of organizations and the design choices of the technology component was established. Lastly, the model was used to develop a scenario. Recommendations for conducting the process related analyses were also given in chapter four.

To conclude, it is seen that the stakeholders have their own motivation and incentives to participate in the collaboration. To take care of such diversified demands within a platform requires governance solution. To make the collaboration successful despite different objectives among the stakeholders and to govern such a network of actors in a collaboration is what makes it relevant to CoSEM.

5.4. Scientific contribution

The systematic literature review helped to gain scientific insights on governmentality of networked organizations, collaborative innovation and multi-level networks. The conceptual model derived from the literature review have been useful in developing scenarios on how multi-level and multi-actor networks of stakeholders can come together and make design

choices for a collaborative innovation. This adaptation of the model from organizational studies to the field of digital trade infrastructures and blockchain-based platforms is a way to fill the knowledge gap that has been identified in the first chapter. The existing literature had very few researches on collaborative innovation for digital trade infrastructures. The theoretical governance frameworks that were selected for the development of conceptual model were not particularly for the governance of actors around blockchain-based platform. The case study into the blockchain-based platform developed by PROFILE project helped turn the conceptual model into an empirically enhanced model. This empirically enhanced governance model thus gave solutions for collaborative innovation and multi-level governance for blockchain-based platform.

In parallel to this research, there has been a research conducted by three of my thesis committee members where I participated as well (Rukanova et al., 2020). In Rukanova et al. (2020) the objective was to derive a governance framework for multi-level network of actors to have collective access to data assets, and for collective data analytics capability building. This thesis is an extension of the research by performing systematic literature review for governance frameworks and scoped to focus only on collective access to data assets in an international blockchain-based platform.

This research is ultimately an extension to the work done in the field of digital trade infrastructures as it contributes to the literature for governance solutions for blockchain-based platform.

5.5 Societal Contributions

The empirically enhanced model of governance can be used by global and complex networks of actors & organizations to derive scenarios for collaborative innovation. The development of the scenarios method is used to identify the elements of governance that the stakeholders of the platform need to adopt, and to explore how these elements influence the design choices of the blockchain-based platform.

These networks of actors can be private firms as well as national or supranational bodies. The method of analysis to derive the scenarios will be useful for the H2020 PROFILE project while developing the blockchain-based platform as it is a guide on how to keep the actors' interests during collaborative innovation. Also, the scenarios showed that the conceptual model can analyse the system context, actors' trusts and institutions and use the analysis as a steppingstone to a successful collaboration. The model can be used to develop the blockchain-based platform

and the Customs Authorities can use the platform to have better risk rules, and ultimately better risk assessment in international trade. Better risk assessment will ultimately lead to improved security at the borders for international trade and reduction of financial losses due to fraudulent customs declarations.

5.6. Limitations and further research

A major limitation of this research is how the conceptual model is applied to only one particular case of new infrastructures. Future research is recommended to analysed whether the conceptual model is applicable to other existing infrastructures. This limitation could have been addressed by conducting a literature review into articles of blockchain governance. Blockchain governance literature could have shed light on the governance issues around the blockchain technology. Since blockchain technology is a centralized platform while developing the platform and a decentralized platform while using. The governance issues related to the transition from central to a decentralized platform could have helped gain insights on the stakeholders' roles and responsibilities.

Another limitation is that the empirical data gathered was limited and this made it difficult to analyse the gathered data intensively. The refined model was obtained in the last four weeks of this research. For future research, more time needs to be spent on refining the model by giving justifications after consulting experts and stakeholders. Interviews can be held with customs officers and the workers at the carriers organizations to gain insights and to refine the governance model further. Involving more stakeholders in the information gathering process can help in understanding the complex global system of information exchange in blockchain based platform having government and business stakeholders. Social learning is an ongoing process and is developed by observing more and more stakeholders. This will help in identifying future management and governance challenges.

Another limitation of this research is that the empirically enhanced model is used to develop governance scenarios for blockchain-based platform for customs supervision. Gómez et al. (2017) said that scenario development helps in collective decision-making because alternative options can be assessed and analysed. Consequences from possible course of action can be identified. Due to scenarios being narrative in nature, thoroughness of an analysis may be missing but scenario developments help in exploring uncertain qualitative socio-economic factors in a case. Whether the model can be used as a guide to implement governance in real life needs to be further researched.

Lastly, it is recommended to explore the third governance option (the consortium-type arrangement of governance) where both the customs authorities and the carriers organizations are involved in the decision-making for the design choices of the platform.

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Appendix

The following sections will contain the appendix of this thesis report.

Appendix A: Literature search

Appendix B: Excerpts from interview with a graduate from TU Delft doing graduation project on developing Blockchain-based platform for EU international trade

1. Other than carriers, there will be other businesses such as freight forwarders (basically all the actors involved in transferring of goods) will be involved in developing the platforms.
2. Technology providers are separate from the private firms.
3. Actors profiles and motivations can be found in Tradelens website.
4. Tradelens developed by IBM and is a consortium of different private firms. Maersk was a leading carrier.
5. Blockchain based platform is a multiple business owned platform. In scenario1, the private firms have developed the platform and share the API with the customs for their use. The customs can only use the platform they have been provided with access to the ENS data.
6. A platform can be made up of different applications for different functionalities. The customs will be provided with only one of these APIs.
7. All customs will have access to similar/same API. Out of scope for Matteo to answer.
8. The architecture or blockchain control view has a direct impact on the operational rights. The constitutional rights and the collective rights established in the initiation phase.
9. Operational phase would be a second step and maybe a consequence of the initiation phase.
10. The operational phase will need to look on the data sharing governance between organizations.
11. Ch4 of Matteo's thesis lists out the functional requirements and technical requirements from the point of view of platform. These technical requirements detail the data access requirements by customs. Does not have governance requirements.
12. EU can own/host the platform. EU will play an important role if the public authorities own the platform. Right now its maritime transport. Later on, in case of land transports, different customs will be more impacted than the ones in the maritime.
13. Customs authorities can be notified in case event is happening or going to happen. Just need to upload the events and other actors will be able to view the data.
14. In scenario 1, The carriers upload the reference of the ENS document and the events to the blockchain. Customs can access this data because they have access to that functionality or API of the blockchain.
15. The event updates the smart contract. When the customs want to access the ENS data, it sends a request to the component of the blockchain. That component queries the smart contract/transport plan. Its going to check whether the customs is affected by the transport plan. And this way, the customs will receive a cryptography key to access the ENS data. The customs will have read permission on the blockchain in any case.
16. If a country doesn't have access initially, that country can have access later in case of route deviation. Dynamic access.
17. From technical architectural perspective, there is not going to be difference on the 2 scenarios. But, governance can influence design choices.
18. Identification process: electronic identities. Assumption that public authorities will use the electronic identities to identify themselves because it is mandatory for them. But, it is not mandatory for the business organizations. In scenario 2, public authorities can make the use of electronic identities mandatory. In scenario 1, businesses can choose not to use the electronic identity.
19. Technically, this problem can be solved by using tokens. When actor joins a platform, he is provided with tokens, and with it he can be identified and authenticated. If an actor don't own the platform, they cannot choose which identification method to use.

Appendix C: Slides used to demonstrate the scenarios in workshops