SSTL Ph3 and the data pipeline

Using reliable data to achieve trade facilitation and compliancy

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Preface

This thesis has been conducted as part of the Executive Master in Customs and Supply Chain Compliance Program of the Rotterdam School of Management Erasmus University.

The thesis project researches and possibly solves a real customs issue that is hindering the organization by combining safety, security, trade facilitation and sustainability with compliance and efficiency. Is does so, by applying and critically assessing the knowledge that the executive master program provided.

The scope of this research is the design of the new data exchange process for SSTL Ph3 (DG TAXUD, 2018). This new data exchange process still has to be developed. The planned date of being set into operations is Q3 2021.

The aim of this research is to contribute to solving the following problem definition:

(1) How does the SSTL Ph3 data-exchange process relate to the data pipeline concept, and
(2) How does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation?

This thesis is the last study activity of the Executive Master in Customs and Supply Chain Compliance Program. I was already happy to work for Dutch Customs, but this master study made me even more enthusiast of working for Dutch Customs.

Erik Devilee has been of great value for the thesis research. I am very grateful for all the time he took to share his knowledge on SSTL and the discussions we had on the (previous) versions of this report. Prof. Yao-Hua Tan provided me with lots of guidance and many constructive comments that helped me become a better researcher. I consider myself lucky with the lessons learned that I can use in my every day work. I am also grateful to Prof. Rob Zuidwijk, who as a co-reader provided me with very valuable feedback on the earlier versions of this report.

Last but not least, my gratitude goes out to my wife Olivia and my son Pablo, for their understanding and support on the many moments I was not there for them but working on this thesis project.

Mike Sanderman
Rotterdam, 28th of June 2020.

Executive Summary

Aim to this research

The aim of this research is to contribute to solving the following problem definition:

(1) How does the SSTL Ph3 data-exchange process relate to the data pipeline concept, and
(2) How does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation?

The first part of the problem definition is relevant, because Dutch Customs also invests in data pipeline research, and within Dutch Customs the relation between these two concepts is not clear. This raises all kinds of questions, e.g. which concept is better, the Data pipeline or the SSTL Ph3 data-exchange process? Do these concepts have the same purpose / benefit for Dutch Customs? Should Dutch Customs invest in one concept, or in both concepts, and why?

The second part of the problem definition is relevant, because developing and using the SSTL Ph3 data-exchange process requires significant investments in time, technology and (human) capacity. These investments need to be justified in terms of their contribution to the goals Dutch Customs wants to achieve. Compliance and trade facilitation are important goals Dutch Customs want to achieve by participating in the SSTL pilot project.

Research method

This research is a combination of desk research and interviews. The person interviewed is Erik Devilee, who is an expert on SSTL. He is involved in the SSTL project since the beginning, and well informed on data pipeline research. The interviews were used to validate the findings from the desk research. This way the findings from the desk research were improved.

Conclusions

A datapipeline is a federated IT-solution based on existing information systems and driven by a certain power of influence, that provides customs with timely, accurate and internationally (WCO) standardized trade data on the goods and on the integrity of the transportation process for crosschecking the customs declaration, based on a system-based-control approach.

Regarding the first part of the problem definition, the main conclusion is that the SSTL Ph3 data-exchange process is a very special type of datapipeline, because:

1. It is driven by a Coordinated Border Management (CBM) initiative,
2. Besides trade data it also exchanges government data
3. It focusses on import control i.e. safety and security risk assessment on the Entry Summary Declaration (ENS).

Ad. 1

A CBM initiative is the driving force behind the development of the SSTL Ph3 data exchange process. This initiative consist of a cooperation of customs authorities, with a common goal of compliancy and trade facilitation. The SSTL PH3 data-exchange process facilitates the two main CBM elements: (1) Reliable data that one border agency has is re-used for control purposes by

another border agency, and (2) On request of one border agency, a control is performed by another border agency, for compliancy reasons, or reasons of trade facilitation

Ad. 2

Unlike other datapipelines in literature and (commercial) datapipeline in practice, the SSTL Ph3 data-exchange process also exchanges government data, besides trade data. The government data is on the system-based control approach, and on the transaction-based-control approach of the border agency, that provides the data. Having this government data increases the reliability of the trade data.

Ad. 3

Import control refers to the risk assessment for safety and security (S&S) purposes, based on the Entry Summary Declaration (ENS) that is lodged for goods brought into the customs territory of the Union (UCC, art. 127). The purpose of the SSTL Ph3 data-exchange process is to crosscheck the Entry Summary Declaration (ENS) that often is not accurate. If the ENS is not accurate, the output of the risk assessment (S&S risk/no S&S risk) is not accurate.

Regarding the second part of the problem definition, the main conclusion is that the SSTL Ph3 data-exchange process does improve compliancy and trade facilitation.

Ad. Improving compliancy

The SSTL Ph3 data exchange process improves compliance in two ways.

- It enables the CA-IMPORT NL to cross-validate the data that the importer (or carrier) provides in the entry summary declaration with the source data from the exporter. In case the cross-validation points out that the importer has provided invalid data, this allows the CA-IMPORT NL to correct the importer to improve compliancy.
- The SSTL vetting procedure to become a certified SSTL pilot partner, might reveal flaws in the processes and systems of the importer that account for the ENS-data, and help to improve the importer (or carrier) to become more compliant.

Ad. Improving trade facilitation

The SSTL Ph3 data exchange process improves trade facilitation, by reducing the time related to customs controls. It does this in three ways

(1) More accurate risk-assessment, via cross validation of the ENS, resulting in less controls
(2) Diversion of controls to a more convenient place and moment in time
(3) Relying on the risk controls of another agency resulting in fewer controls.

To achieve more tangible benefits, a higher volume of Entry Summary Declarations should be cross-checked by the SSTL Ph3 data exchange process. The main problem of the SSTL Ph2 data-exchange process is that it cannot handle large volumes, because the tasks related to sending and receiving the SSTL export and conveyance data require too much manual activity from customs officers. The Ph3 data exchange process solves this problem by automating these tasks in systems that are capable of handling large volumes.

Recommendations

The following recommendations are made:

(1) Develop the SSTL Ph3 data-exchange process further, and allocate resources to its development
(2) Increase the volume of data-exchanges, as soon as the SSTL Ph3 data-exchange process is implemented, and add trade lanes with a clear and significant potential for trade facilitation
(3) Develop a common way to make the goals of compliancy and trade facilitation measurable
(4) Ask the author of the specification of the SSTL Ph3 data-exchange process to clarify the parts in the specification that are not understood

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List of Tables and Figures

1. Introduction

In its 2015 vision, *Pushing Boundaries: The enforcement vision of the customs administration of the Netherlands,* Dutch customs introduced the concept of trusted trade lanes. It considers the flow of goods through the trusted trade lanes (the so called 'yellow flow') the greatest asset and a vision for the future that helps achieve a balance between security and trade facilitation. Although certification schemes like AEO exist to recognize individual trusted traders (the so called 'green flow'), a supply chain typically consist of multiple economic operators, each of which might introduce a risk for customs and the other actors in the supply chain. Therefore, the ideal situation for both companies and customs would be that the whole supply chain could be trusted. This would justify e.g. less physical controls on the goods that flow through the trusted trade lanes, to facilitate the economic operators that constitute these trusted trade lanes. This way, Dutch customs allocates control capacity better, to control goods that flow outside trusted trade lanes. To test the concept of trusted trade lanes Dutch customs is participating in several projects, among which the Smart and Secure Trade Lanes (SSTL) pilot project.

The Smart and Secure Trade Lanes (SSTL) pilot project was launched in 2006 (SSTL Phase 1) by the European Union (EU) and the People's Republic of China (CN) to test specific safety and security related recommendations of the WCO SAFE Framework of Standards (DG TAXUD, 2018). The main aim was to test security measures applied to containers, to facilitate 'Customs-to-Customs' data exchange, to determine joint risk rules and to mutually recognize customs controls and trade partnership programs, and to facilitate trade. The SSTL pilot project is one of the key activities under the "Strategic Framework for Customs Cooperation 2014-2017 between China and the EU".

The SSTL pilot project aims at strengthening of the end-to-end supply chain security and provides trade facilitation to participating economic operators (AEOs) by establishing maritime, air and rail trade lanes between the EU, China and Hong Kong. Customs controls are performed upon export to allow better targeting of dangerous traffic whilst granting benefits for SSTL consignments through faster customs clearance at import. Regarding import, SSTL is primarily focusing on the risk assessment for safety and security purposes, based on the Entry Summary Declaration that is lodged for goods brought into the customs territory of the Union (UCC, art. 127), and not e.g. on the risk assessment for customs duties when the goods are put into free circulation (UCC, art. 201). To achieve these objectives, export declaration and control result data as well as risk information is exchanged between the participating customs authorities.

The pilot project has gone through different phases. SSTL Ph2 (launched in 2010) demonstrates the critical importance of sustainable data communication. Due to the non-automated data exchange, the data communication is labor intensive during Ph2and this significantly affects the operation of the SSTL trade lanes. Therefore, the Ph2 data-exchange process is not suitable to handle larger volumes. The data exchanges are done via the CENcomm platform owned by the World Customs Organization (WCO), which is intended as pilot for data exchange.

SSTL Ph3 (launched in 2016) has the specific aim to increase the share of goods between participants covered by SSTL, to achieve an impact on the overall EU-China supply chain security and facilitation. Ph3 puts the emphasis on the development of a new automated and

sustainable data exchange process between the EU MS participating in the SSTL pilot project and CN and Hong Kong (HK). Furthermore, the development of an automated data exchange solution for SSTL will contribute to the development of worldwide standards under the Globally Network Customs initiative.

At the end of 2018, a Vision document has been finalized by DG TAXUD (DG TAXUD, 2018) and accepted by the Electronic Customs Coordination Group (EECG). This document presents a (high level) specification for the SSTL Ph3 data-exchange process. To implement the design Dutch Customs, and other participating customs administrations as well, has to adapt some of its information systems. The target date of putting the SSTL Ph3 data-exchange process into production is set to Q3 2021.

The aim of this research is to contribute to solving the following problem definition:

How does the SSTL Ph3 data-exchange process relate to the data pipeline concept, and does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation?

The first part of the problem definition is relevant, because Dutch Customs also invests in data pipeline research, and within Dutch Customs, the relation between these two concepts is not clear. This raises kinds of questions that remain unsolved like:

- Which concept is better, the Data pipeline or the SSTL Ph3 data-exchange process?
- Do these concepts have the same purpose / benefit for Dutch Customs?
- Should Dutch Customs invest in one concept, or in both concepts, and why?

The second part of the problem definition is relevant, because developing and using the SSTL Ph3 data-exchange process requires significant investments in time, technology and (human) capacity. These investments need to be justified in terms of their contribution to the goals Dutch Customs wants to achieve. Compliance and trade facilitation are important goals Dutch Customs want to achieve by participating in the SSTL pilot project.

A problem that relates to the second part of the problem definition is, as it turned out during this research, that the specification of the SSTL Ph3 data-exchange process (DG TAXUD 2018) does not make clear to the more business-oriented stakeholders how the SSTL Ph3 data-exchange process works in the context of the customs business process. Knowing how the SSTL Ph3 data-exchange process works is a prerequisite to understand how it can help Dutch customs improve compliance and trade facilitation, and to assess whether is solves the main problems of phase 2.

2. Research project

2.1. Problem definition

The aim of this research is to contribute to solving the following problem definition:

How does the SSTL Ph3 data-exchange process relate to the data pipeline concept, and does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation?

To help solve this problem definition, this research focusses on the following research questions:

1. What is a data pipeline?
2. What is a trusted trade lane?
3. What is SSTL (Safe and Secure Trade Lane)?
4. How does the SSTL Ph2 data exchange process look like?
5. How does the SSTL Ph3 data exchange process look like?
6. Is SSTL Ph3 a specific form or extension of a Data Pipeline?
7. What are the requirements for the SSTL Ph3 data-exchange process?
8. How are the requirements for the SSTL Ph3 data-exchange process fulfilled?
9. How does SSTL Ph3 contribute to improved compliance and trade facilitation of a supply chain?

2.2. Research type an methods of data collection

2.2.1. Methods of data collection

The methods of data collection used in this study are literature study and interviews. The table below shows the use of the data collection methods in relation to the research questions.

Research questions	Literature research	Interviews
1. What is a data pipeline?	V	
2. What is a trusted trade lane?	V	
3. What is SSTL (Safe and Secure Trade Lane)?	V	V
4. How does the SSTL Ph2 data exchange process look like? Problems?	V	V
5. How does the SSTL Ph3 data exchange process look like?	V	V
6. Is SSTL Ph3 a specific form or extension of a Data Pipeline?	V	V
7. What are the requirements for the SSTL Ph3 data-exchange process?	V	V
8. How are the requirements for the SSTL Ph3 data-exchange process fulfilled?	V	V
9. How does SSTL contribute to improved compliance and trade facilitation?	V	V

Table 1 Research methods

2.2.2. Design science

This research is a design science project. This thesis uses the definitions of Wieringa (2014) on design science projects. The major components of a design science project are its object of study and its two major activities. The object of study is called the artifact and the two major activities are designing and investigating the artefact in context. These two parts of design science, design and investigation, correspond to two kinds of research problems in design science, namely, design problems and knowledge problems.

Design problems call for an improvement in the real world and require an analysis of actual or hypothetical stakeholder goals. A solution is a design, and there are usually many different solutions. These are validated by their utility with respect to the stakeholder goals and there is no single best solution.

Knowledge questions, by contrast, do not call for an improvement in the world but ask for knowledge about the world as it is. The answer is a proposition, and when we try to answer a knowledge question, we assume that there is one answer only.

With these definitions, a design problem (aka technical research question) can be expressed as:

- Improve <a problem context>
- By <(re)designing an artifact>
- That satisfies <some requirements>
- In order to <help stakeholders achieve some goals>

A design science project iterates over the activities of designing and investigating. The design task itself it decomposed into three tasks:

1. Problem investigation
2. Treatment design
3. Treatment validation

The set of these three tasks is called the design cycle, because researchers iterate over these tasks many times in a design science research project. The design science researcher designs not just an artefact, but designs a desired interaction between the artefact and the problem context, intended to treat the problem. Hence, the term treatment design is used and not artefact design.

Treatments, and hence artifacts, are designed, and the designs are documented in a specification. There is a considerable diversity in the use of the terms design and specification in software engineering and other branches of engineering. A design is a decision about what to do, and a specification is a documentation of that decision.

2.2.3. Design science in this thesis

As mentioned in 1 *Introduction* one problem that relates to the second part of the problem definition is that the specifications of the SSTL Ph3 data-exchange process (DG TAXUD 2018) does not make it clear to the more business-oriented stakeholders how the SSTL Ph3 data-exchange process works.

One of the aims of this thesis is to treat this problem. The design problem is to:

- Improve the understanding of the specifications of the SSTL Ph3 data-exchange process at Dutch customs
- By designing a requirements analysis
- That shows which user requirements are taken into account in the specifications, and how they are fulfilled
- So that business-oriented stakeholders at Dutch customs can assess whether the SSTL Ph3 data-exchange process solves the main problems of phase 2 and understand how it can help Dutch customs improve compliance and trade facilitation

The requirements analysis is the artefact of this science design project. To design this artefact the three steps of the design cycle have been executed as follows.

1. Problem investigation

The specification of the SSTL P3 data-exchange process (TAXUD, 2018) was analyzed, to find the reason it is not easily understood by business-oriented stakeholders at Dutch customs. It turned out the specification has been written with an IT target audience in mind; It only specifies IT systems and data-exchange relations between IT systems. Business-oriented stakeholders think of the business process first, and secondly of the role of the IT systems in the business process in terms of receiving, using, creating and sending of data. For their understanding they need to see the relation of the business process with the IT systems. However, the specification only specifies IT systems and does not show the business process. Earlier in time the business process has been modelled (DG TAXUD, 2016-1, 2016-2, 2016-3, 2016-4, 2016-5, 2016-6) but without IT systems. As a result, these models are of little use in understanding the specifications.

2. Treatment design

To solve the problem the following design activities were undertaken:

A. The SSTL Ph3 data-exchange process was modelled, including the steps of the business process, and the role of each IT system, using the standardized Business Process Modelling Notation (BPMN).
B. The SSTL Ph2 data-exchange process was modelled, including the steps of the business process, and the role of each IT system, using the standardized Business Process Modelling Notation (BPMN), to better explain the current problems in this process that should be solved in phase 3.
C. On the basis of the specifications (DG TAXUD, 2018) the requirements were identified and described in a way that is comprehensive for business-oriented stakeholders, by using the same terminology as in the process models, and by categorizing them in functional and non-functional user needs. In addition, they were clustered to make them more comprehensive (see Appendice 1 - Traceability table SSTL Ph3 user needs).
D. Based on the specifications (DG TAXUD, 2018) the way each user requirement is fulfilled by the design was identified and described in a way that is comprehensive for business-oriented stakeholders, by using the same terminology as in the process models.
    - In case it was not clear in what way a user requirement is fulfilled by the design, or why a certain way of fulfillment was chosen, these “specification issues” were also described.

The outcome of these design activities are the following components that make the artefact ‘requirements analysis’ of this design study:

Requirements analysis components	Presented in paragraph
A. Business process models SSTL Ph3 data-exchange process	3.6.1 SSTL Ph3 data-exchange process – Export maritime (BPMN) 3.6.2 SSTL Ph3 data-exchange process - Import maritime (BPMN)
B. Business process model SSTL Ph2 data-exchange process	3.5.2 SSTL Ph2 data-exchange process (BPMN)
C. Table with SSTL Ph3 data-exchange process requirements	3.9.1. Requirements for SSTL Ph3
D. Table with SSTL Ph3 requirement fulfillment and specification issues	3.9.2. Fulfillment of requirements for SSTL Ph3

3. Treatment validation

The requirements analysis was validated by means of structured interviews with the Dutch SSTL expert Erik Devilee. The components (process models and lists) were send to him before the interviews. During two interviews, the table with requirements and the table with requirement fulfillment and specification issues were successively discussed per requirement. If necessary for a better understanding, the business process model that the requirement (fulfillment) was about, was consulted. The expert was asked if the artefact improves the understanding of the specifications of the SSTL Ph3 data-exchange process. Regarding the specification issues the expert was asked if he acknowledges theses issues.

The outcome of the validation is described in paragraph 3.9.1. Requirements for SSTL Ph3 and paragraph 3.9.2. Fulfillment of requirements for SSTL Ph3.

2.3. Research steps

To answer the research questions, and finally the problem definition, this research consist of the following, successive, research steps:

1. Review data pipeline literature
2. Review trusted trade lane literature
3. Interview expert on SSTL data-exchange process
4. Interview expert on SSTL casus
5. Interview expert on SSTL Ph2 data-exchange process and desk research
6. Model the SSTL Ph3 data-exchange process
7. Compare the SSTL Ph3 data-exchange process model with the data pipeline definition
8. Analyze the SSTL Ph3 data-exchange process model (compliance and trade facilitation)
9. Analyze requirements SSTL Ph3 data-exchange process
10. Draw conclusions
11. Make recommendations

The next paragraphs give for each research step the rationale, on how the research step contributes to finding an answer to a research question, details on how the step has been executed, as well as a reference to the paragraph in the next chapter that contains the outcome.

2.3.1. Review datapipeline literature

To understand how the SSTL Ph3 data exchange process relates to the data pipeline concept, a good understanding and clear definition of the data pipeline concept is needed. This study started by reviewing the available literature on the data pipeline concept to understand its

purpose and functioning, and obtain a clear definition. It turned out that there are quite some articles published on the data pipeline concept, but no common definition exists of the datapipeline. The articles give different characterizations of the data pipeline. By reflecting on these different characterizations, an appropriate data pipeline definition was made. The result of this research step is presented in 3.1 *The data pipeline concept*.

2.3.2. Review trusted trade lane literature

To understand how the SSTL Ph3 data exchange process and the data pipeline relate, also the literature on trusted trade lanes has been studied. The reason for this is that in both concepts, trust seems to plays a role: Both concepts data provide customs with data for control purposes, and – generally - controls are used to gain trust. Therefore, it is interesting to know if the literature on trusted trade lanes can learn us more, on what is needed for company to be trusted by a customs authority. This knowledge might well be applicable on the SSTL Ph3 data exchange process and the data pipeline. The result of this research step is presented in 3.2 *The trusted trade lane concept*.

2.3.3. Interview expert on SSTL data-exchange process and desk research

To understand how the SSTL Ph3 data exchange process relates to other concepts, and is supposed to contribute to compliance and trade facilitation, at least a clear, general, view of the SSTL data exchange process is needed. Because no articles were found on the SSTL Ph3 data exchange process, SSTL expert Erik Devilee of Dutch Customs, who has been involved in the SSTL project from the beginning, was interviewed to give his view on the SSTL data-exchange process in general. The SSTL expert was also asked to provide internal policy documents that could further help to clarify the SSTL Ph3 data-exchange process, in case a more detailed view of the data exchange process was needed, which he did.

The collected data, both from the interview and the internal policy documents, was used to create a high level view of the SSTL data-exchange process, that was verified by the SSTL expert later on. As a result of this verification, the element of mutual recognition of controls was added to complete the view. This view is presented in 3.3 *The SSTL data exchange process*.

2.3.4. Interview expert on SSTL casus

To find out if the SSTL Ph3 data-exchange process can help Dutch customs improve compliance and trade facilitation in practice, a case study was performed. The data for this case study was collected via a structured interview with the SSTL expert. The case is about a candidate SSTL trade lane that exports dairy products to China and is currently under investigation by the SSTL project. The result of this research step is presented in 3.4 *SSTL case: Exporting dairy products to China*.

2.3.5. Interview expert on SSTL Ph2 data-exchange process and desk research

One of the aims of this research is to get an answer to the question: Does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation compared to the Ph2 process? To get an initial answer to this research question, it should be clear how the current SSTL Ph2 data-exchange process looks like, and what problems is regarding increasing compliancy and trade facilitation. To get an answer to these questions, the SSTL expert was interviewed and internal policy documents (provided for by the expert in research step 3) were researched for more detail, and to validate the outcome of the interview.

Based on the collected data, a general description of the SSTL Ph2 data exchange process and a BPMN model of the SSTL Ph2 data exchange process were made. Finally the current problems of the Ph2 process regarding (increasing) compliancy and trade facilitation were described. These research findings are presented in paragraph 3.5 *The SSTL Ph2 data exchange process.*

The BPMN modelling activity is part of the design science project of this thesis, and has been described in 2.2.3 *Design science in this thesis*. It concerns design activity B of the second step of the design cycle (Treatment design). The outcome of design activity B is the following component of the artefact 'requirements analysis' of this design study:

Requirements analysis - component	Presented in paragraph
B. Business process model SSTL Ph2 data-exchange process	3.5.2 SSTL Ph2 data-exchange process (BPMN)

2.3.6. Model the SSTL Ph3 data-exchange process

This step is part of the design science project of this thesis, and has been described in 2.2.3 *Design science in this thesis*. It concerns design activity A of the second step of the design cycle (Treatment design). The outcome of design activity A is the following component of the artefact 'requirements analysis' of this design study:

Requirements analysis - component	Presented in paragraph
A. Business process models SSTL Ph3 data-exchange process	3.6.1 SSTL Ph3 data-exchange process – Export maritime (BPMN) 3.6.2 SSTL Ph3 data-exchange process - Import maritime (BPMN)

2.3.7. Compare the SSTL Ph3 data-exchange process with the data pipeline definition

To find an answer to the research question if the SSTL Ph3 data-exchange process is a specific form of extension of a datapipeline, the models of the SSTL Ph3 data-exchange process were compared with the datapipeline definition as formulated in the first step of this research. The outcome of this research step is presented in 3.7 *Comparing the SSTL Ph3 data exchange process with the datapipeline*.

2.3.8. Analyze the SSTL Ph3 data-exchange process (compliance and trade facilitation)

Based on the BPMN process models generated in research step 6, the SSTL Ph3 data-exchange process was analyzed (desk research), on how it can improve compliance and trade facilitation. The conclusions are presented in 3.8 *Process analysis on compliance and trade facilitation using BPMN models*.

2.3.9. Analyze requirements SSTL Ph3 data-exchange process

This step is part of the design science project of this thesis, and has been described in 2.2.3 *Design science in this thesis*. It concerns design activities C and D of second step of the design cycle (Treatment design) and the third step of the design cycle: Validation.
The outcome of design activity C and D is the following component of the artefact 'requirements analysis' of this design study:

Requirements analysis - component	Presented in paragraph
C. Table with SSTL Ph3 data-exchange process requirements	3.9.1. Requirements for SSTL Ph3
D. Table with SSTL Ph3 requirement fulfillment and specification issues	3.9.2. Fulfillment of requirements for SSTL Ph3

The result of the validation is also presented in these paragraphs (3.9.1 and 3.9.2).

2.3.10. Draw conclusions

Based on the outcome of the previous research steps, the conclusions to the problem definition were summarized. The conclusions were validated by the SSTL expert, in a structured interview. The conclusions are presented in Chapter 4 Conclusions.

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2.3.11. Make recommendations

Taking into account the conclusions of this research, recommendations were made. The recommendations were validated by the SSTL expert, by means of a structured interview. The recommendations are presented in Chapter 5 Recommendations

2.4. Reading guide

The next chapter contains the outcome of this research. For a quick view on the outcome of the research, see Chapter 4 Conclusions, and Chapter 5 Recommendations. Chapter 6 Contribution for research, gives the contribution this thesis has for research in the field of the data pipeline and on the SSTL Ph3 data-exchange process. Finally, Chapter 7 Contribution for practice gives the value this thesis has for practice, in particular for Dutch customs.

3. Research findings

3.1. The data pipeline concept

The fundamental idea of the data pipeline is that the data in customs declarations often is not accurate, which undermines the successful execution of customs tasks. E.g. to protect society for dangerous goods from third countries, customs needs to have reliable information on goods, and on the seller and the buyer of the goods. Examples of such information are the exact name and address of the seller and buyer, and exact description of the goods, or (HS) commodity code of the goods. Commercial documents such as the purchase order, invoice and packing list contain such accurate data. Therefore, it would be good if customs had direct access to this commercial data in the IT-systems of the companies who create this data, e.g. the seller for the purchase order and invoice, maybe a freight forwarder for the packing list, and the carrier for the loading manifest. The data pipeline is an IT-solution customs can use to access this accurate data.

The first notion of the data pipeline concept in the field of Customs was made by Hesketh (2009) as part of the, by that time, updated UK customs strategy. After this, Klievink et.al. (2012) further developed the concept. Hesketh positions the data pipeline as a concept of an information system with the following specific characteristics:

1. Provides customs with the timely and accurate data it needs for performing its tasks.

   The tasks of customs are collecting revenue, facilitating trade, protecting society and collecting trade statistics. Customs must focus its efforts on continually assessing the revenue, compliance, admissibility and security risks, starting early in the supply chain in order to allow a timely and better-placed response. This risk assessment requires timely and accurate data.

2. Gets data from the source.

   This way the data is more timely and accurate. The input of data related to the international movement of goods starts by the consignor who instigates the movement of goods (exporter), since he knows best 'who packed the box', then builds upon as the goods move along the supply chain to the point of export then import. Referring to Oosterhout (2008) Hesketh (2010) calls this data 'from the transaction layer' (instead of data 'from the logistics layer), which refers to the transaction between buyer and seller. Traditionally the flow of data to customs only starts after the ship or vessel has been loaded with the ship or aircraft manifest from the carrier, followed up by the customs declaration, and the data about the consignment is re-entered by other parties then the consignor, which is inefficient and insecure.

3. Data is internationally standardized, using the WCO Data Model.

   When data is internationally standardized, the data can be used both for export and import related customs risk assessments. Organizations providing open standards are also important stakeholders, including e.g. the United Nations CEFACT, World Customs Organization

(WCO) and organizations like GS1. For this purpose, WCO has developed the WCO Cross-Border Data Model v3 and GS1 the so-called EPC Global standard. Every stakeholder has to adopt one set of uniform international standards, or the data pipeline has to offer translation modules between messages based on different standards (Klievink et.al. 2012)

4. Also provides for data about the integrity of the transportation process.

   In order to obtain integer consignment data, the supply chain itself has to be integer, and customs needs a way to monitor this. Therefore, the consignment has to be secured during transportation, using electronic seals, track-and-trace technology, and approved entities, and the related 'transport' data (seal, location, involved entities) is put into the pipeline.

5. Has to be developed by the private sector driven by commercial incentives.

   The reason for this is that given the global scale of a data pipeline, governments cannot, because they have neither the funds, the IT expertise, nor the international jurisdiction to act outside their own country (Klievink et.al, 2012).

   Stakeholder companies than can be identified from a market driven approach range from the seller to the buyer and include the economic operators in between, such as inland carriers, freight forwarders, shipping agents, sea terminal operators, Port Community Systems, and port authorities. The main benefit of the pipeline is increased visibility, which enable better business decisions and planning. Especially the companies with an interest in the goods themselves (e.g. the buyer and seller) could benefit from this (Klievink et.al, 2012).

   Currently the business community is too fragmented and has too many and too diverse interests to realize a data pipeline infrastructure. Therefore, government organizations have to create some of the conditions that could include: (1) regulation or subsidies for companies to make a fair return on investments in the data pipeline; (2) development and operation of parts of the data pipeline that do not have a viable business model (3) development and adaptation of (open) standards via standardization bodies. Therefore, a public-private governance model to accompany the data pipeline is needed. (Klievink et.al. 2012).

Klievink et.al. (2012), like Hesketh, also define the data pipeline as a concept of an IT-system. They define the data pipeline concept as *an IT innovation to enable capturing data at the source*, and add some an extra characteristics concerning its construction and benefits:

6. federated (IT solution), based on accessing existing information in existing information systems

   The data pipeline is a concept based on the use of Service-Oriented Architectures (SOA) to enable access to the existing information systems that are used and operated by the various parties in global supply chains. It provides one integrated access point to different already existing sets of informations fragmented throughout the supply chain

and that is held in the different type of documents. This way, government can 'piggyback' on the business data (Tan et.al. 2011). Piggybacking means that data are re-used for other purposes than they were originally intended for. In this case, original commercial data from businesses are re-used by governmental actors for governmental control purposes like risk assessment, customs clearance, and coordination of inspections. In the previous example of inaccurate data on the consignor in the entry summary declaration (ENS), having access to the purchase order or invoice in the system of the seller (or buyer), or to the house bill of lading in the freight forwarder's system, would tell customs the data on the consignor in the ENS is not accurate. This would enable customs to do further research on the trustworthiness of this consignor.

7. Enables a System-Based-Control approach

   To assess whether governments can rely on the data it pulls from business systems and their internal procedures, governments can focus on assessing the systems and operations of the company, instead of assessing individual transactions. Companies can get a certification if certain system-based approach requirements are met. An operator with AEO security and safety certification implies that it is compliant to security and safety standards and could therefore be considered as a secure trader and thus reliable trading partner.

   This System-based-Control approach or 'compliance by design' helps to fulfill the desire of politicians to reduce administrative burden for business and governments. Compliance by design refers to the situation in which control objectives are by default realized by developing and having in place a sound architecture. It enables government agencies to do more (tasks) with fewer (resources), but they also promise benefits for companies, including higher information quality and lower compliance costs. Essential for this is having an architecture that enabling B2G information sharing and ensuring 'compliance by design' (Bharosa, 2013).

3.1.1. Definition of a data pipeline

The previous paragraph describes the different characteristics of a datapipeline that were found when reviewing the datapipeline literature. Most of these characteristics turn out to be very useful for defining the data pipeline. Based on these characteristics this research made the following definition of a data pipeline:

A datapipeline is a federated IT-solution based on existing information systems and driven by a certain power of influence, that provides customs with timely, accurate and internationally (WCO) standardized trade data on the goods and on the integrity of the transportation process for crosschecking the customs declaration, based on a system-based-control approach.

There are two characteristics described by Hesketh (2009) and Klievink et.al. (2012) that do not turn out to be useful. These characteristics are not incorporated in this definition:

- Data has to be captured at the source

  This problem with this characteristic is the underlying assumption that capturing data at the source is the only way to provide for timely and accurate data, which is not true. When data from the source is passed through to customs via another information system, it can still be

on time and remain accurate, when having procedures and systems in place to control (and prove) this. Especially in a time when information systems become more and more interconnected, and agencies rely more and more on a systems-based-approach, it does not make sense to require that the data be captured at the source.

- The data pipeline has to be developed by the private sector
  The problem with this characteristic is the assumption expressed by Hesketh and Klievink that governments cannot develop a datapipeline, because they do not have the funds, the IT expertise, and the international jurisdiction to act outside their own country. This is not true, since governments have significant IT-budgets and expertise, and customs administrations of the EU made agreements, both bilateral and via the EU, with customs administrations of third countries, to create jurisdiction for administrative cooperation. What is clear is that a data pipeline does not simply exist or emerge. An organization or combination of organizations with power of influence has to take the initiative to develop a datapipeline. Therefore, the pipeline definition of this thesis leaves all options open, by speaking in more general terms, that the datapipeline is driven by a certain power of influence.

Another data pipeline characteristic mentioned by Hesketh has been operationalized, since it is not considered rigid enough in the light of this research. This characteristic concerns the *purpose* of the data:

- Hesketh argues that the purpose of the datapipeline is to provide customs with timely and accurate data it needs for performing *its tasks*. For this research, and for the use of the definition in practice, this purpose it too general. Following the definition by Hesketh, a customs administration would only need one information system to perform its tasks: the data pipeline. This is not realistic. Each customs administration has invested in numerous information systems to perform its tasks. No customs administration would replace all these information systems, to solve the customs problem described in the datapipeline literature, of customs not receiving reliable data in the customs declarations. To make the data pipeline definition usable for the customs administration, the definition should be more specific on the purpose: What does the customs administration want the data for? In the context of this research, the purpose of the data is for customs to cross-check the data in the customs declaration. The customs declaration is key is in the transaction-based system of customs supervision, because the goods are put under a customs supervision regime by the declarant via the declaration. Different transaction-based customs supervision regimes exist, e.g.:
  - when the goods are brought into the customs territory of the Union (UCC, art 127), on the basis of the Entry Summary Declaration (ENS)
  - when the goods are put on the Union market for private use or consumption within the customs territory of the Union (UCC, art 201), on the basis of the Import declaration.
  - when the goods are put under a special customs procedure (UCC, art 210), e.g. on the basis of a Transit or Storage declaration.

  "When the declaration is not reliable, customs cannot supervise the goods" applies for all these customs supervisions regimes. By cross-checking the declaration data with reliable data from another source, the customs administration can determine the reliability of the customs declaration.

- Regarding the purpose, is should be noted that since this research is on how a customs administration can increase compliance and trade facilitation by using a datapipeline, the purpose is also customs oriented. This is also the case in the definition by Hesketh, but not in the definition by Klievink, who made the purpose broader, and includes the benefits for the (private) parties in the supply chain to invest in IT-systems to share this data with other parties in the supply chain (not only customs).

Finally, the concept of internationally (WCO) standardized trade data in this definition needs clarification:

- In this definition, trade data refers to data that originates from a company. A company has originally, created it and therefore the company is considered as the source of the data. It does not mean that the company who created the data provides the data to the customs administration that wants to use it. It can be provided for via e.g. another customs administration, who passed this information through. In such a case, although the data is provided for by government agency (G2G), it remains trade data.
- Based on the literature, the definition makes a distinction between data on the goods, and data on the integrity of the transportation process. Examples of data on the goods are the commodity classification (HS-code of the goods), the consignor name and the consignee name. A typical example of data on the integrity of the transportation process is the seal number (identification number of a seal affixed to a piece of transport equipment).

The definition focusses on the purpose of the data pipeline for customs. Therefore, the data should be internationally standardized by using the WCO Data Model. The WCO Data Model is adopted by European Union: All Trans-European IT systems to be employed with the Union Customs Code (UCC) will be based on the EU Customs Data Model that is based on the WCO Data Model (WCO, 2019)(DG TAXUD, EUCDM).

3.2. The trusted trade lane concept

Hulstijn, Hofman, Zomer and Tan (2016) explain why the concept of trusted trade lanes was introduced. Customs administrations must improve regulatory compliance, specifically related to safety and security, while on the other hand reducing administrative burden and facilitating trade. To meet these two opposing challenges, they tend to shift from a transaction-based regulatory supervision approach to a system based supervision approach, in which they rely on the compliance efforts of the companies themselves. Companies that can demonstrate to be 'in control' of the risks, are recognized as so called 'trusted traders' and receive benefits in terms of reduced inspections. Certification schemes exist to recognize trusted traders, like AEO in the European Union. However, supply chain risks affect the entire trade lane and cannot be solved by individual companies. For this reason, recent vision documents, such as the 2015 *Pushing Boundaries: The enforcement vision of the customs administration of the Netherlands,* introduced the concept of trusted trade lanes.

Hulstijn et.al (2016) define a *trusted trade lane* as a collaboration of supply chain partners who maintain a system of control measures in order to cover the risks of the entire trade-lane, which makes the trade lane trustworthy, both to the authorities and to commercial partners. They identify three essential characteristics of a trusted trade lane that must be demonstrated, for a trade lane to be considered trustworthy:

- Members are known and individually trustworthy

- A long-term, stable collaboration among members exists, motivated by a viable business proposition and coordinated by a governance structure
- An adequately designed well implemented and operationally effective system of control measures exists to ensure
    - Physical integrity of the flow of goods
    - Reliable trade data, to be made available to the authorities

Hulstijn et.al (2016) envision three scenario's for trade lanes to choose to demonstrate to the regulator they are trustworthy, that in practice will probably be combined:

- *Dominant party scenario*. A commercially dominant party takes the role of supply chain orchestrator and acts as representative for a trade lane. Steinfield, Markus and Wigand (2011) call this a private coordination hub.
- *Data-driven scenario*. A platform acts as a kind of information broker, the host of the platform acts as a legal representative, or helps to elect a representative. Supply chain partners choose to join the platform for commercial reasons, e.g. reduce uncertainty and delays.
- *Cooperative scenario*. Supply chain partners and public agencies collaborate. Trust is based on acquaintance; formal agreements are drawn up at a later stage. Business cases are developed but based on estimates only. Subsidies may be needed to overcome initial hurdle. Technology for information exchange only follows after agreements have been made.

Hulstijn et.al (2016) identified variability in lead-time as a big advantage that might be the dominant business driver for a trusted trade lane. The following issues were identified:

- Companies do not perceive the benefits from having a trusted trade lane status. European shippers are already dissatisfied with the benefits they perceive from their current AEO status in terms of trade facilitation and reduced administrative burden, to counter the investments in internal controls. There is no legal certainty attached to the certificate.
- Companies lack a common understanding of the way the supply chain is functioning, the risks, and risk mitigating measures, and therefore of the data that must be exchanged, it's use and it's meaning (semantics).
- Companies lack guidance by the customs authority of what is being expected, and therefore no level playing field.
- The role of a representative is not clear to the companies

In the 2015 *Pushing Boundaries: the Enforcement Vision of the Customs Administration of the Netherlands*, Dutch Customs considers the flow of goods through the trusted trade lanes the greatest asset, and a vision for the future that helps achieve a balance between security and trade facilitation. Dutch customs is testing the concept in two projects: SSTL and CORE.

- SSTL entails a collaborative venture between the customs authorities of the countries through which the goods are transported, that exchange data on goods, findings of inspections and information on risks.

CORE developed various data pipelines, to pilot data sharing across supply chains. The data pipeline enabled customs to retrieve reliable data from the source companies. All were developed by commercial parties. One example of such a data pipeline is Tradelens developed by MAERSK and IBM.

3.2.1. Reflection on the trusted trade lane literature

The trusted trade lane literature has been studied, to find out if the literature on trusted trade lanes can learn us more, on what is needed for a company to be trusted by a customs authority. The following arguments by Hulstijn et.al. (2016) are applicable on the SSTL Ph3 data exchange process and the data pipeline that this research focusses on:

- Trade facilitation and compliance are two customs objectives. When a customs administration recognizes collaborating supply chain partners as a trusted trade lane, they are considered compliant, and can receive benefits in terms of reduced inspections (trade facilitation).
- Less variation in lead-time is a dominant business driver. Less variation in the time related to customs controls that influence lead-time, is therefore an import type of trade facilitation.
- A trusted trade lane can be seen as a collaboration of supply chain partners who maintain a system of control measures in order to cover the risks of the entire trade-lane, which makes the trade lane trustworthy, both to the authorities and to commercial partners.
- For a trade lane to be considered trustworthy it must be demonstrated that:
    - Members are known and individually trustworthy.
    - An adequately designed well implemented and operationally effective system of control measures exists to ensure reliable trade data, to be made available to the authorities, and the physical integrity of the flow of goods.

  It is clear that, when members are known and individually trustworthy, this directly contributes to the provision of timely and accurate data that is key in the data pipeline concept. The second point refers to the system-based-control approach that, that is also a key element in the definition of the data pipeline.
  Hulstijn et.al. (2016) argue that is must also be demonstrated that a long-term, stable collaboration among members exists, motivated by a viable business proposition and coordinated by a governance structure. However, since it not obvious why and has not been operationalized, it is not applicable on this research.
- A datapipeline is driven by a certain power of influence (see 3.1.1 Definition of a data pipeline). The three scenarios envisioned by Hulstijn et.al. (2016) for trade lanes to choose to demonstrate to the regulator they are trustworthy, can also be considered as powers of influence that might drive the development of a data pipeline.

3.3. The SSTL data exchange process (high-level)

SSTL is a pilot project that wants to test specific safety and security related recommendations of the WCO SAFE Framework of Standards (DG TAXUD, 2018). Dutch customs participates in this project since it started. The project aims at strengthening of the end-to-end supply chain security and provides trade facilitation to participating economic operators (AEOs) by establishing maritime, air and rail trade lanes between the EU, China and Hong Kong. Currently the pilot project runs in phase 2 and a design has been made for phase 3 (DG TAXUD (2018).

To achieve its project aim, the SSTL pilot project has implement a data-exchange process. Based on Devilee, E., Imming, A. (2016) and DG TAXUD (2018) the following high-level view can be made to represent the SSTL data exchange process. This view is so general, that is represents both the data-exchange process of phase 2 and the data-exchange process of phase 3.

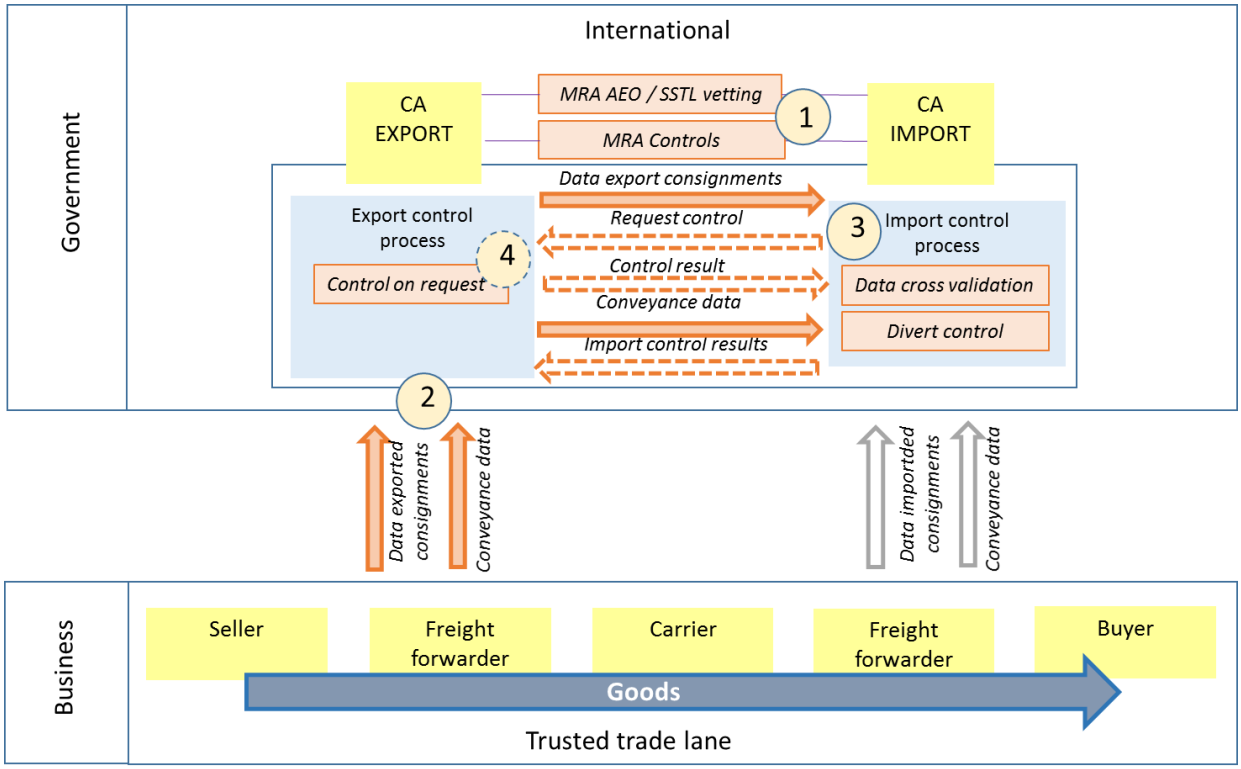

Figure 1 High-level view of the SSTL data-exchange process

[1] Between the customs authority of the country of export (CA-EXPORT) and customs authority of the country of import (CA-IMPORT) mutual recognition agreements (MRAs) have been made on the risk management process, that cover:

- AEO status and a SSTL vetting procedure
  It is agreed that only companies that have the SSTL vetted status can participate in the SSTL pilot. To get the SSTL vetted status the company has to be vetted by means of vetting procedure that is developed for the SSTL pilot. This requirement for this vetting procedure are similar to the requirements of the AEO status. Therefore, if the company already has the AEO status, by re-using the outcome of AEO assessment customs can execute the SSTL vetting procedure faster. The CA-IMPORT agrees to recognize the AEO/SSTL vetted status that the CA-EXPORT issues.
- Controls
  It is agreed that the CA-EXPORT can perform a control on request of the CA-IMPORT, and the CA-IMPORT recognizes the control results of the CA-EXPORT.
- Data
  It is agreed what data will be exchanged (the content of the orange arrows) and in which data format.

[2] The CA-EXPORT receives data from a Trusted Economic Operator (e.g. a seller or freight forwarder) on consignments that are to be exported, as an input to its regular export control process. This data is forwarded to the CA-IMPORT. The MRA AEO / SSTL vetting procedure guarantees the CA-IMPORT that the data can be trusted.

[3] The CA-IMPORT uses this data to cross-validate the accuracy of the data it receives in the Entry Summary Declaration (ENS) that is lodged by the carrier. The ENS contains the data on

the consignments that are to be imported, and is used by the CA-IMPORT as the main input to its regular IMPORT CONTROL process. The import controls process is the process of the CA-IMPORT to assess the safety and security risks related to the entry of goods into the customs territory.

The term IMPORT CONTROL can be confusing. Regarding the IMPORT CONTROL, SSTL is only focusing on the risk assessment for safety and security purposes, based on what is called in the EU the Entry Summary Declaration (ENS) that is lodged for goods brought into the customs territory of the Union (UCC, art. 127). SSTL does not focus on other types of risk assessment that might be associated with the term import control, e.g. on the risk assessment for customs duties when the goods are put into free circulation (UCC, art. 201), based on the import declaration. This does not mean that the export data is not usable for crosschecking the import declaration. It just is not in scope of the project, for the SSTL Ph3 data-exchange process.

One of the problems of the risk assessment in the import control process is, is that it is based on the data in the ENS en this data is not always accurate. Moreover, if the data is not reliable, the output of the risk assessment (risk/no risk) is not accurate. What the risk assessment of the import control process needs, is accurate data on the goods. This includes especially:

- Data on the seller (consignor),
- Data on the buyer (consignee) and
- Data on the goods description.

The carrier, who is responsible for submitting this data in the ENS, does not always have this data. E.g. in international business the seller often has a contract of carriage with a freight forwarder (agent), who has a contract of carriage with the carrier. This way often, the freight forwarder ends up in the ENS as the seller (consignor), when in fact he is not the true seller (consignor). The true consignor (seller) that is not mentioned in the ENS might be a party that, based on intelligence, is not trusted by customs; however, this risk will not be detected because the ENS does not contain the true consignor (seller). For the same reason the carrier does not know the true consignor (seller), he might not know the true consignee (buyer). This way the freight forwarder also ends up as the consignee in the ENS, when in fact he is not the true consignee (buyer). This way the true consignee (buyer) is not mentioned in the ENS.

One of the reasons the carrier does not know the consignor (seller) (or consignee / buyer), is because the freight forwarder does not want to give this information to the carrier. The freight forwarder is an intermediary between the seller (or buyer) and the carrier. If the carrier knows the seller, the carrier himself might offer the seller a (cheaper) contract of carriage, and leave the freight forwarder out of the game.

In addition, the carrier might not know the detailed goods description, because the freight forwarder only provided him a very general description on a consolidated consignment, and not on the individual (so called ‘house’) consignments that together make the consolidated consignment. Such a general description on of consolidated consignment is not detailed enough for customs to assess the safety and security risk.

Therefore, to resume, the accuracy of the data in the ENS is key to the CA-IMPORT. If the data is not accurate, the CA-IMPORT might detect a risk that does not exist. The examples above

explain why in practice this data often is not accurate. Cross-validation might reveal this, so customs can downgrade the risk and cancel the corresponding control measure, thus achieving a higher level of trade facilitation for the trusted trade lane. If the data in the ENS is not accurate, also the opposite can occur. The CA-IMPORT might not detect a risk on the consignment that in reality does exist. Cross-validating the data in the ENS with the export data from the CA-EXPORT might reveal that the data in the ENS is not accurate and prevent that the risk assessment is based on data that is not accurate. Based on the reliable data for crosschecking purposes the risk might be detected in the end.

In the UCC there are provisions (UCC art.127-4) that try to solve this problem, by allowing more then one party to file the data of the ENS (multiple-filing) and by enhancing the data quality requirements on the data that should be in the ENS regarding the (true) seller, (true) buyer and the product in the consignment. This allows the carrier to file the data from his contract of carriage with the freight forwarders, and the freight forwarder to file the data from his contract of carriage with the consignor. It is still possible for the carrier to file all the data of the ENS, but if he does, he has to provide the (true) consignor. If the freight forwarder does not want to provide this data to the carrier, then the freight forwarder is obliged to file this data himself (UCC DA art.112-113). To make multiple filing possible, the content and data structure of the ENS is changed. As a result, companies and customs administrations have to change their IT-systems. These changes are implemented by a trans-European project called ICS2, in the coming years (DG TAXUD, ICS2)(DG TAXUD, 2019) .

[4] Furthermore, the SSTL concept also enables:

- The CA-IMPORT to request the CA-EXPORT to perform a physical control and receive the control result data. The CA-IMPORT can then use this data in the import control process. When the control result is that the consignment is not a threat to safety and security, then the CA-IMPORT does not have to control it anymore. This might facilitate trade when CA-EXPORT can perform the physical control faster then the CA-IMPORT. It might also increase compliance, in case the consignment concerns goods that are not allowed to enter the country of the CA-IMPORT; because the CA-EXPORT performs a control on the goods, it will detect they are forbidden in the country of the CA-IMPORT, and will prevent the consignment to be shipped to the CA-IMPORT.
- The CA-IMPORT to receive conveyance data (e.g. transport document number, voyage reference number, customs office of exit, IMO or Lloyd's number ship and seal number) from the CA-EXPORT, and use this for cross validating the received declaration data that the risk assessment of the import control process is based on. In case the CA-IMPORT is European, the declaration data is the data in the Entry Summary Declaration, which often is not accurate as has been explained before.
- The CA-EXPORT to receive eventual control results from the CA-IMPORT.

These are all enablers of coordinated border management (CBM) between the EU and CN/HK. It is very interesting to see that, to implement the provisions on the UCC, the ICS2 project currently develops the same type off CBM-enablers to coordinate the tasks of the customs authorities of the European Union (UCC, art. 46). E.g. in ICS2 the customs authority where the consignment enters the Union, can divert the control to the customs authority where the consignment is destined to, in case the risk is low, to facilitate trade. Also in ICS2 the involved customs authorities exchange data on risks (risk analysis result) on the same consignment, so they do not only rely on their own risk data, but also enrich their risk data with the risk data of

another customs authority. In ICS2, this concerns especially the sharing of risk analysis results. The involved customs authorities are the different customs authorities of the EU that are involved in the safety and security risk assessment of consignments entering the Union. Apart from risk analysis results, also risk criteria (the so-called common risk rules) are shared and developed together. Finally in ICS2, when the consignment is controlled, the customs authority that performed the control shares the control results with all other involved customs authorities.

3.4. SSTL case: Exporting dairy products to China

This paragraph describes the result of the case study that was performed, to find out if the SSTL Ph3 data-exchange process could help Dutch customs improve compliance and trade facilitation. The first paragraph describes the case, the second paragraph the conclusions to the research question.

3.4.1. Case description

This case is about a Dutch producer of dairy products exporting to China. When the dairy products are imported into China, the goods are being controlled upon arrival in China by both the Customs Authority of China (CA CN) and the Chinese General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ). According to the company, these controls can take up to 3 weeks: One week for customs controls performed by CA CN and up to 2 weeks for the food safety controls performed by AQSIQ. The Dutch producer wants to participate in the SSTL Ph2 pilot, under the condition that the time for *both* controls can be reduced.

Based on the experiences of other cases in the SSTL Ph2 pilot, the time for control by CA CN can be reduced from one week to one single day . To achieve this reduction the producer needs to participate in the pilot. In order to be allowed to participate in the pilot, the producer needs to be vetted with a positive outcome as part of the pilot by CA NL. The requirements for this SSTL vetting are the same as for the EU AEO program. Between CN and the EU, since November 2015, a mutual recognition agreement (MRA) of AEOs exist [DG TAXUD, 2020].

When the company already has the EU AEO status, logically the outcome of the SSTL vetting procedure is expected to be positive. Nevertheless, the SSTL vetting procedure is an extra guarantee because circumstances might have changed recently. Customs systems and the responsible customs client manager are consulted to evaluate the compliancy of the company.

Once admitted as a pilot partner, in the SSTL Ph2 data-exchange process

- The Dutch producer has to send a minimal dataset in case of every export, that the CA of the EU and CA CN agreed upon as part of the SSTL Ph2. This dataset will be entered in the CENcomm system by CA NL to share the data CA CN. The CENcomm system is a platform owned by the World Customs Organization (WCO). CENcomm is a web-based communication system that permits exchange of messages via encrypted channels to a restricted user group of officers in real time and for duration of an operation or project. CENcomm has a number of program specific applications and one of them is the real-time communication system for information exchange under the SSTL pilot project.
- . In the SSTL Ph3 data-exchange process, the Dutch producer does not have to send the minimal dataset anymore. Apart from sending the minimal dataset, the producer also lodges the exit declaration that contains the same data. In the SSTL Ph3 data-exchange process, CA NL will send this data in a newly automated way to CA CN.

- CA CN will then read this data and use it in its customs risk analysis system to cross-validate the declaration data. In the EU this is the data on the ENS, but in China this declaration is not called ENS. In China it consist of two successive declarations. The first one is called Pre-arrival notification, and the second on Import declaration (DG TAXUD. 2016-1), When the cross-validation confirms the accuracy of this Chinese declaration data, the consignment is marked as trusted, and no control is needed upon entry in CN.

At this moment, CA NL and CA CN and AQSIQ are investigating how the lead time for the AQSIQ control for the food safety of diary products can be reduced. In this respect, the recent merger of AQSIQ and CA CN is very promising. In March 2018, China's State Council announced a governmental reorganization aimed at improving efficiency and customer service in many parts of the Chinese government [USDA, 2018]. The reorganization merged most of the AQSIQ into the CA CN. This merger includes the integration of all former China Inspection and Quarantine (CIQ) offices located at Chinese ports into CA CN existing import/export structure. As a result, the question how to reduce the lead-time of the AQSIQ food safety control can be discussed much better with the AQSIQ stakeholders then before was the case before this merger. It is important to mention that typically the current data pipeline research focusses on customs risk and controls. Adding other types and controls to the data pipeline research, means exploring a whole new field of research.

According to GACC/AQSIQ Notice No. 133, from 1 May 2018, all milk producers, exporters, agents and domestic consignees are required to file their company information online with CA CN [AQSIQ, 2020]. Information such as the exporter and agent's name, country, area, address, contact name, telephone, milk food category, etc. needs to be submitted before the product are imported. After submitting the application, the exporter obtains a registration number by CA CN that it needs to use in the import declaration to CA CN. In addition, the producer should have a production quality management system in place in line with CN standard requirements (GB 23790-210 and GB 12693-201), and the exporter is required to provide a test report before goods will be cleared at ports of entry. The test reports required depend on whether it is a first time or repeated import. For first imports, there is a list of dairy standards, which items need to be tested and which test methods laboratory should use. The certificate / registration number remains valid 5 years. AQSIQ keeps a file of applications of exporters, who have submitted complete filing information, including: Dairy test report or certificate, the company's commercial certificate, certificate of origin, application form and export country official license.

In order to reduce to lead-time, the question that is at the table now for the case of the Dutch producer, is if the data mentioned earlier and that is already available to AQSIQ, is sufficient for AQSIQ to perform its food safety control upon import. Another question is, if the AQSIQ control can be performed *before* arrival in CN, instead of the current practice of performing the control after arrival causing the delay in delivery time for the producer.

If more information is needed by AQSIQ, the next question is what the requirements are for this data to be useful (trustworthy, on time, etc.) for AQSIQ. In case additional data is needed, then the next question would be how to get this data to AQSIQ. One of possibilities to consider would be adding the data to the SSTL-dataset that is sent by CA NL in advance via the SSTL digital infrastructure.

In this case, the Dutch producer would be facilitated by faster customs clearance in China. Besides this, the company would also get direct access to the SSTL coordinator of CA NL and the SSTL coordinator of CA CN that is dealing with the port of entry. When needed, these coordinators can provide the company extra information on the status of customs controls, e.g. the AQSIQ control in China.

3.4.2. Conclusions

The case shows, that the SSTL Ph3 data-exchange process can facilitate the company, by reducing the time related to customs controls. This results in less variability in the lead-time to get the product to company's import office in China, which the company considers as an important business driver to participate in the trusted trade lane program.

However, the case also shows that for the company not any reduction in lead-time is perceived as a valuable form of trade facilitation. A certain threshold or minimum amount of trade facilitation has to be achieved for the company to justify the investments to participate in the trusted trade lane program, such as the cost of going through theSSTL vetting procedureand (only in Phase 2) the cost of sending the minimal dataset in case of every export. The cost of going through the vetting process is a on-off (labor) cost, but the cost of sending the minimal dataset is a recurring cost. These are the labor cost for typing the required export data on each exported consignment into the required format and for sending the file by email to CA-NL. Some pilot partners have automated most of this manual activity to eliminate most of this recurring cost. They develop their export system so it can automatically generate the required data in the required format. Of course, this development requires a one-off investment and some maintenance costs.

The case also shows that this trade facilitation can be achieved, when the different government agencies that have a role in controlling the flow of goods from producer to consumer work together. They can:

1. Exchange the trade data they received on the goods, and the integrity of the transportation process, in the declarations / reportings made by the company for cross-checking purposes
2. Exchange the government data they create in their audit to check the reliability of the companies declarations / reportings (their systems-based-approach)
3. Exchange data on the controls they do on each declaration / reporting they receive from the company (their transaction-based-approach). This data includes both the risk rules and control results.
4. Ask another agency to perform the control on a moment that has a less negative effect on the transport lead-time e.g. before the goods are loaded into the transport equipment.

By providing government data, the SSTL Ph3 data exchange process integrates a Coordinated Border Management (CBM) capability into the data pipeline concept. It also becomes clear, that there is a strong relation between the three types of data mentioned above. Having access to the second and third type of data, increases the reliability of the first type of data, as illustrated in the figure below.

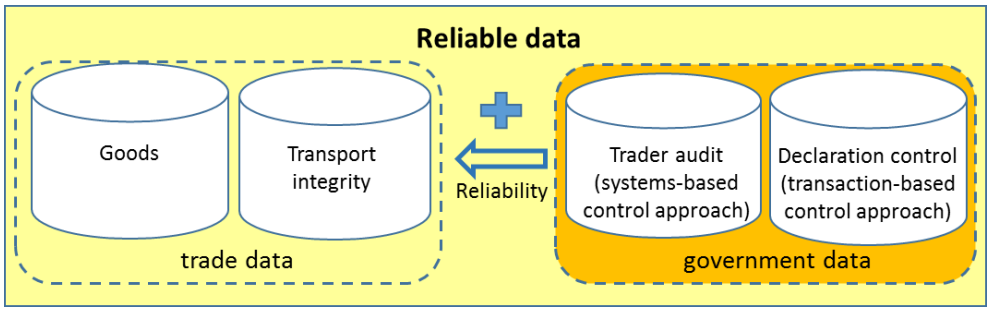

Figure 2 Having government data increases the reliability of trade data

The trade data is the data that the CA-IMPORT receives from the CA-EXPORT, to cross-validate the data in the import declaration. In the case of exporting dairy products to China, the trade data on the goods would be the data in the minimal dataset-file (in Ph2) or export declaration (in Ph3) that the dairy producer sends to Dutch customs as CA-EXPORT. It originates from trade. China as CA-IMPORT uses this data to cross-validate the Chinese declarations that China requires from the importer for the Chinese import process.

Dutch customs audits the producer to guarantee the accuracy of the trade data the producer provides for. In the case of the dairy producer, the audit is the SSTL vetting procedure on the moment the producer want to become an SSTL pilot partner, and the AEO assessment Dutch customs did in the past and re-assesses periodically. The Chinese customs acknowledges the quality of these audits. Therefore, when Dutch customs also shares the data on the outcome of these audits, this increases the reliability of the trade data for the Chinese customs.

Apart from auditing the producer, which is a systems-based-approach, Dutch customs also has a transaction-based-approach in place to guarantee the accuracy of the trade data the producer provides for. This is the risk-assessment of each export declaration that the producer lodges bases on risk rules, and the physical or in some situations administrative controls in case the risk-assessment detected a risk. Chinese customs acknowledges both the risk rules and control approach; they are agreed, commonly developed risk rules and control approaches. Therefore, when Dutch customs also shares the data on the outcome of the risk-assessment and (in case a risk was detected) the data on the result of the control, this increases the reliability of the trade data for the Chines customs.

3.5. The SSTL Ph2 data exchange process

This paragraph describes the result of the expert interview and desk research, into how the SSTL Ph2 data-exchange process look like, and the problems it has regarding (increasing) compliance and trade facilitation. The first paragraph describes the phase 2 process in general. The second paragraph gives a BPMN model of the phase 2 process, and in the final paragraph, the problems of the phase 2 process are described.

3.5.1. The SSTL Ph2 data exchange process in general

Devilee, E., Imming, A. (2016) explain that the SSTL Ph2 concept, besides customs and company internal processes, consists of several types of inter-organizational data exchange processes:

- B2G: between exporting company and customs administration of the country of export
- B2B: between exporting company and importing company
- G2G: between customs administrations of country of export and import

To reduce complexity, this paragraph focusses on export from the EU to CN/HK, and leaves export the other way around, out of scope. However, the process flow is largely the same.

B2G data-exchange process
The national customs administrations of the EU are to some extend free to chose they way they implement the B2G data-exchange process for SSTL. Because this research focusses on the Dutch implementation, this paragraph describes the Dutch implementation.
Besides the regular formality for export of submitting an export declaration, the exporting SSTL-exporter sends an additional dataset in an agreed structured file format to the Customs administration of the country of export by e-mail. This dataset is not the same for the different modes of transport [DG TAXUD, SSTL User Manual]. The dataset contains data to identify the exported consignment. E.g. for the maritime mode of transport the mandatory data-elements are listen in the table below. It is possible to exchange data of multiple consignments in one file.

Unique consignment reference (UCR)	Unique number assigned to goods, both for import and export. ISO/IEC 15459-8:2009 specifies a unique, non-significant, string of characters for the unique identifier for grouping of transport units, that make up a single shipment from a consignor and are treated as a single logical grouping for customs and other shipping requirements
Brief cargo description	Plain language description of the cargo of a means of transport, in general terms only.
Commodity classification	The non-commercial categorization of a commodity by a standard-setting organization; First 6 digits of HS Code
Number of packages	Number of individual items packaged in such a way that they cannot be divided without first undoing the packing. Only mandatory in UK/NL.
Exporter, Coded	To identify the name and address of party who makes, or on whose behalf the export declaration is made, and who is the owner of the goods or has similar rights of disposal over them at the time when the declaration is accepted.

Table 2 Mandatory data-elements SSTL dataset (maritime mode of transport)

B2B data-exchange process
The exporting company informs the importing company to make sure the same UCR is used when fulfilling the import formalities.

G2G data-exchange process
The customs administration of the exporting country (CA-EXPORT) sends the standardized SSTL dataset to the customs administration of the country of import (CA-IMPORT). To do so CA-EXPORT uploads the file with the consignment data in the CENcomm system.

The Customs Enforcement Network Communication (CENcomm) Platform is a web-based communication system of the WCO that permits exchange of messages via encrypted channels to a restricted user group of officers in real time and for duration of an operation or project(WCO, CENcomm). CENcomm has a number of program specific applications and one of them is the real-time communication system for information exchange under the SSTL pilot project. To exchange the data, the sending customs officer can upload the data into the CENcomm system when the data has the required file format, or manually type the data into the CENcomm system. The receiving customs officer can consult the data using the CENcomm user interface and download the data in certain file format for cross-checking purposes in the risk assessment. Because of these manual tasks, the CENcomm system requires, the system is not suitable (and build) for real-time exchange of large volumes of data.

If the CA-IMPORT as part of its regular (pre-load) import control process wants to inspect the consignment, it can request an inspection by the CA-EXPORT via CENcomm. The CA-EXPORT as parts of its regular export control process then performs the inspection and sends the inspection results to the CA-EXPORT via CENcomm.

The CA-EXPORT can also send additional conveyance data to CA-IMPORT, often at a later moment as it becomes available. This includes the means of transport, transport document number (evidencing a transport contract), conveyance reference number (e.g. voyage number) and place of loading, transport equipment number (e.g. container number) and date and time of customs release by the office of exit. This way the SSTL data exchange process also covers the exchange of (reliable) data of the packing list in the datapipeline.

Customs internal SSTL-processes
The current customs internal SSTL-ph2-processes are:

1. SSTL-vetting
   The CA EXPORT investigates if the exporting company is (or will be) a trusted trader.
   The CA IMPORT investigates if the importing company is (or will be) a trusted trader.
2. Process data of SSTL-consignments by CA-EXPORT
   This process was explained before as part of the B2B-data exchange process.
3. Process data of SSTL-consignments by CA-IMPORT
   The CA-IMPORT registers the data of the SSTL-consignments in the database that is used by the risk-engine of its national import control system. This way the SSTL-consignments can be marked as SSTL-consignments and be treated differently from the regular (non-SSTL) consignments in the regular import controls process.

Regular import control process (ICS)
Part of the SSTL concept is integrated into the regular import control process that is triggered by the pre-load (before loading in the transport equipment e.g. a container) and pre-arrival (after loading on the means of transport e.g. a ship) submission of the entry summary declaration (ENS). As part of the regular import control process (ICS, in the EU) the consignment undergoes both a preload risk management process for safety and security risks and a pre-arrival risk management process for customs risks. The outcome of these regular processes are either that no (or low) risk has been detected, or that substantial risk has been detected and a (predefined) control is required. In the latter case, when the consignment is marked as SSTL-consignment, it is treated differently by the risk analyst (or automated system), because now two other options are possible:

- The risk is being downgraded (because it is marked as an SSTL consignment)
- The control is being diverted to the CA-EXPORT (only possible in the pre-load risk management process). As explained before, the CA-IMPORT can do this by using the CENcomm system to request the CA-EXPORT to do the inspection, and the CA-EXPORT can send the inspection results to the CA-IMPORT via CENcomm.

3.5.2. SSTL Ph2 data-exchange process (BPMN)

Export of goods from NL to CN
Based on Devilee, E., Imming, A. (2016), and using BPM-notation, the following model has been made as part of this research to summarize the SSTL Ph2 process flow, in BPM-notation, as

designed. In practice not all process steps are used, as will be explained in the next paragraph. It shows the case of direct export of goods from the EU to CN. Direct export means the customs office of export is also the customs office of exit.

- Each lane represent the combination of an organization and (for customs administrations only) the information system or communication infrastructure that is used to execute the process steps within that lane.
- The grey (sub) processes are part of the regular customs import and export control process, the blue (sub) processes are additional processes to be introduced as part of the SSTL-pilot Ph2.

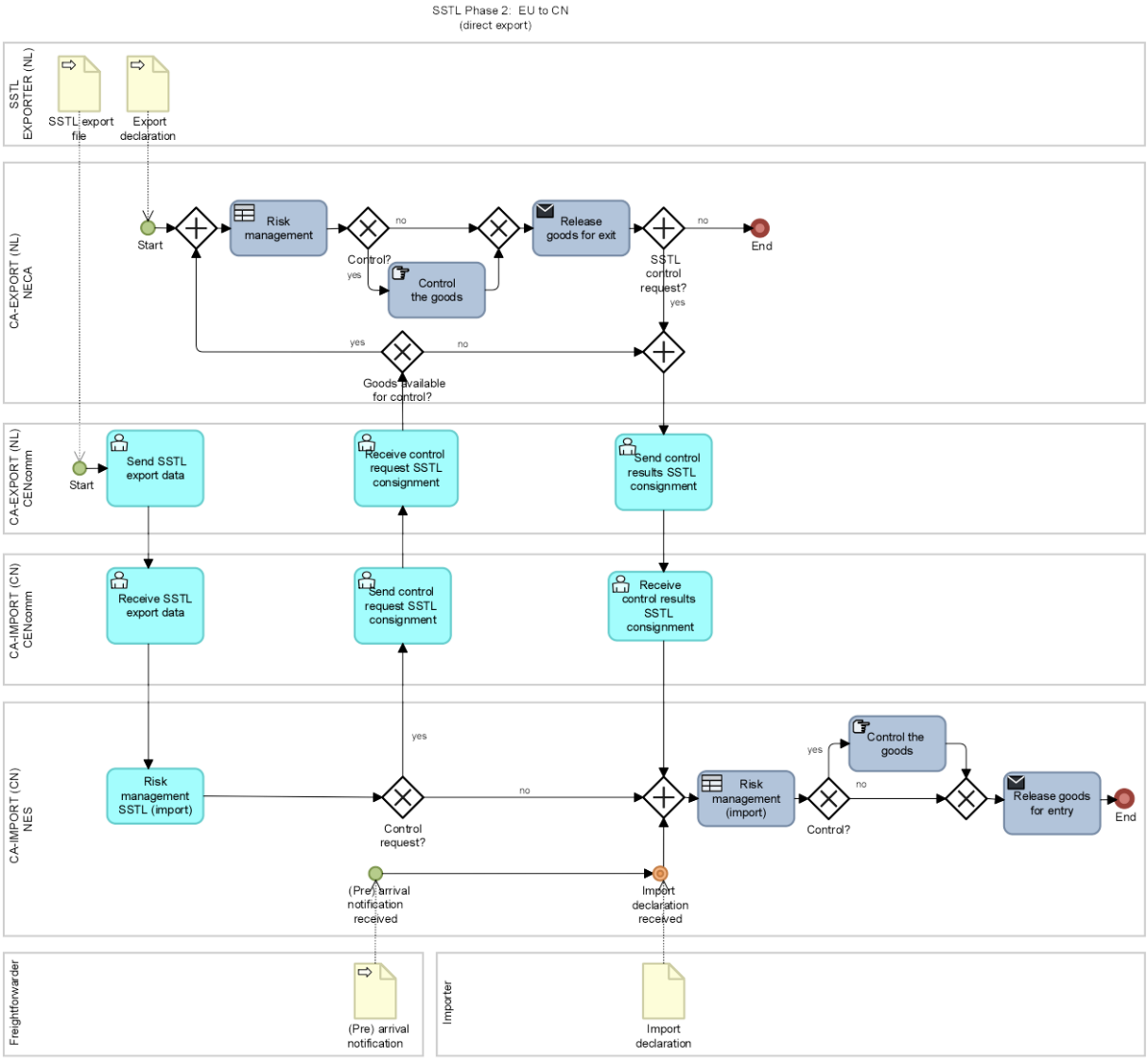

Figure 3 BPM SSTL Ph2 direct export from EU to HK/CN (maritime mode of transport)

CA-EXPORT (NL) receives data from the SSTL exporter in a file. In the Dutch situation this file contains both data on the exported goods and conveyance data (DG TAXUD, User requirements DATA). The CA-EXPORT (NL) manually uploads or keys in this data into the CENcomm system and sends it to the CA-IMPORT (CN/HK) who performs an SSTL risk management process. It can send a request to control an SSTL consignment to the CA-EXPORT (NL) and CA-EXPORT(NL) can receive the control result in return. These are manual user tasks executed by a customs officer, using CENcomm.

CA-EXPORT (NL) also receives data from the SSTL exporter in the export declaration (and from the carrier in the exit manifest, not modelled), as part of its regular export control process. So apart from receiving a control request from CA-IMPORT (CN/HK), CA-EXPORT (NL)'s regular export control process might also lead to a decision to control the goods. In order to control the goods only once, the outcome of the SSTL risk management process by the CA-IMPORT (CN/HK) needs to be taken into account into the regular export control risk management process of the CA-IMPORT (NL). In the SSTL pilot, to cope with this "timing" issue, the exporter is required to file the SSTL export data (for the maritime mode of transport) at the latest 24 hours before loading the consignment in the container at his premises[1].

Export of goods from CN to NL

The case of export of goods from CN/HK to NL, works more or less in the same way. However, CA-IMPORT NL does not perform a separate SSTL risk management process based on the received CN/HK export data. CA-IMPORT NL (manually) downloads the container numbers that are mentioned in the CN/HK export data on a daily basis from the CENcomm system, and uses these in (the automated part of) the regular risk management process that is triggered by receiving the ENS[2]. For each risk that is detected by the regular risk management process for import control, it is determined if it concerns a consignment that is transported via a trusted trade lane (if the container was mentioned in recent CN/HK export data). If this is the case, then the ENS with the detected risk is being notified and the container is flagged as SSTL consignment by the national entry system (NES) to a customs officer. In case of a flagged SSTL consignment the customs officer is instructed that the consignment in principle should not be controlled and he should consult a mandated colleague to decide.

3.5.3. Problems of the SSTL Ph2 data-exchange process

In its evaluation of Ph2, DG TAXUD (2013-1) mentions that traders in Ph2 perceived tangible benefits in term of distinct decrease of lead-time for customs clearance, but also that all participants perceived a clear need to cast a further distinct light on the practical facilitation benefits in particular for trade.

The SSTL expert validated this notion regarding benefits. He explained that, in the practice of the SSTL Ph2 data exchange process, the benefits so far are limited because of the low volume of transactions that currently fall under the SSTL Ph2 data-exchange process. This can be explained as follows:

- Regarding compliancy, CA-IMPORT NL cross-validates the data of in the entry summary declaration (ENS) only in case the regular risk management process for import control detects a risk on the data of the ENS. However, so far no risk has been detected in the regular risk management process for import control regarding SSTL consignments.
- Regarding trade facilitation, since no risks has been detected, as a result, no risks ("false positives") have been downgraded via cross-validation and no controls have been avoided, or shifted to the CA-EXPORT. Therefore, the process steps of sending and receiving the SSTL control request, and sending and receiving control results in figure 3 have not been

[1] This time limit also allows the CA-IMPORT (CN/HK) to take into account the outcome of the SSTL risk management process in its regular import control process.

[2] There are 2 ENS filings. For this purpose the second filing, the "Summiere Aangifte Lossen" is used, since it contains the data about the consignments that are planned to be unloaded in NL.

executed in practice. Presumably, no risk has been detected, because of the low volume of goods that currently is shipped via the piloted trusted trade lanes in Ph2.

The benefits will become clearer when the volume increases. However, the Ph2 data exchange process is not fit for increasing the volume, because the tasks related to sending and receiving the SSTL export and conveyance data with the CENcomm system would require too much capacity from customs officers. Therefore, the most important user requirement for the Ph3 data exchange process is that these tasks are automated.

3.6. The SSTL Ph3 data exchange process (detail)

This paragraph describes the result of the modelling effort, based on desk research, to provide the structured view of the SSTL Ph3 data-exchange process that is needed to compare this process with the data pipeline (paragraph 3.1.1) and to analyze how it can improve compliance and trade facilitation (paragraph 3.8).

The result of the modelling effort are two BPMN models, for two different scenarios:

- Export of goods from EU to CN/HK, maritime mode of transport
- Import of goods from CN/HK to EU, maritime mode of transport

The models are presented in two separate paragraphs. As becomes obvious from these scenarios, the SSTL Ph3 data-exchange process only takes into account the maritime mode of transport (DG TAXUD (2018).

3.6.1. SSTL Ph3 data-exchange process – Export maritime (BPMN)

Based on DG TAXUD (2018, 2016-1, 2016-2, 2016-3) and using BPM-notation, the following model represents the process flow for this scenario.

- Each lane represent the combination of an organization and (for customs administrations only) the information system or communication infrastructure that is uses to execute the process steps within that lane.
- The grey (sub) processes are part of the regular customs import and export control process, the blue (sub) processes are additional processes to be introduced as part of the SSTL-pilot Ph3.
- The model represents the case of direct export, but the differences in the case of indirect export are described at the end of this paragraph.

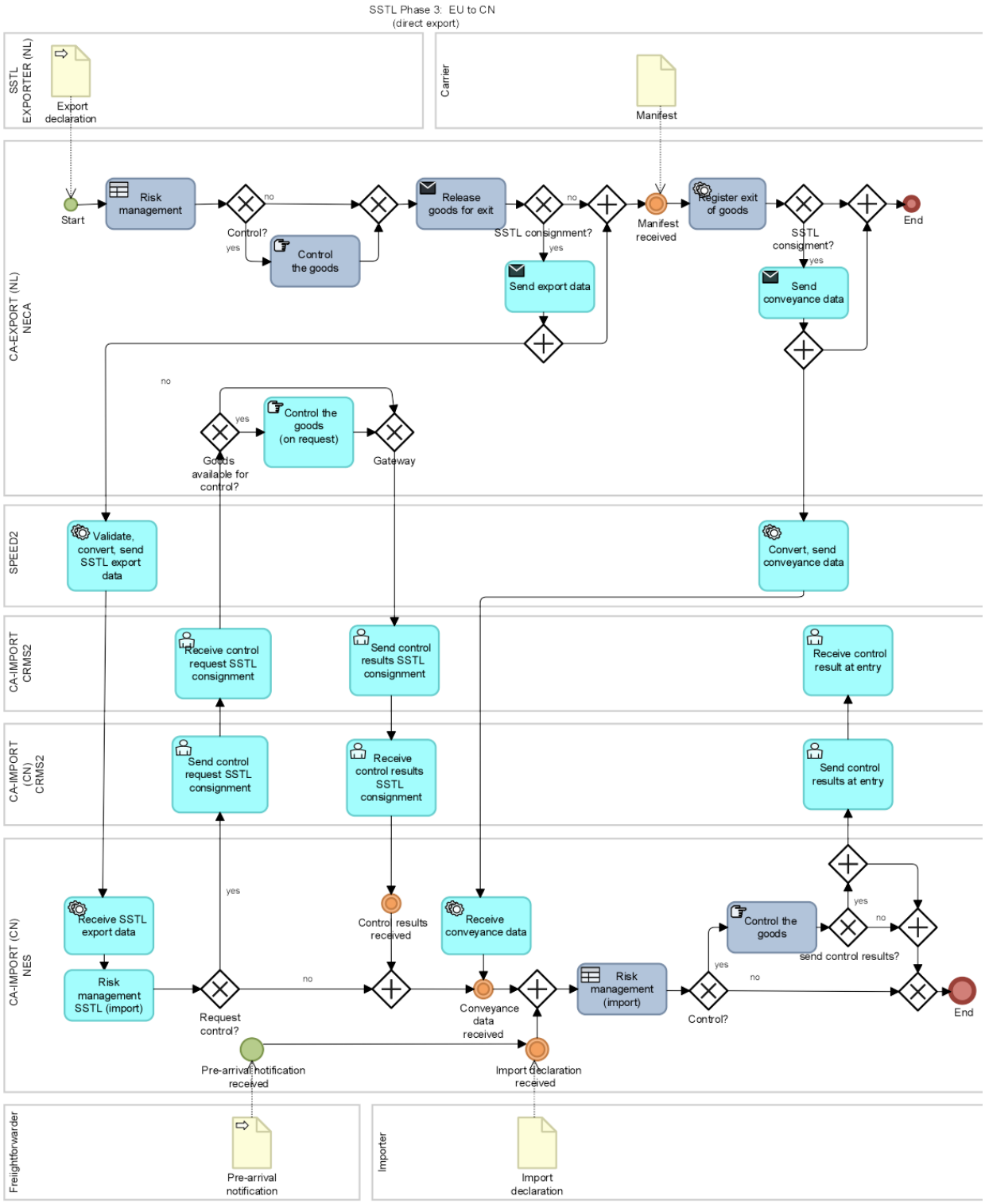

Figure 4 BPM SSTL Ph3 Direct export from EU to HK/CN (maritime mode of transport)

The CA-EXPORT (NL) sends the export data from the export declaration after it has released the goods for exit. The export data includes the customs assigned unique consignment reference (C_UCR). The exporter forwards the C_UCR to its trading partners in the importing country (CN/HK). The sending will be done automatically by the national export control application (NECA) of the CA-EXPORT (NL) to the Single Portal for the Entry and Exit of DATA (SPEED2).

The NECA for Customs NL is developed by Customs NL. Its main feature is to monitor the export and exit formalities (UCC, art. 263-277), which includes a safety and security risk-analysis (UCC, art. 264) based on the data in the export declaration.

SPEED2 is DG TAXUD's established platform for secure data exchanges with partner countries (such as the USA, Japan, China and Russia). SPEED2 then validates (syntax only), converts the data to the SSTL structure, and sends it to the CA-IMPORT (CN/HK). SPEED2 can exchange large volumes of data real-time, something that the CENcomm system cannot do. It already supports or will do so in future all external flows such as Single Window, Transit, Mutual recognition, and International exchanges for taxation (DG TAXUD, 2013-2). It is an Enterprise Service Bus, a building block for a Service-oriented-architecture, that offers multiple transport channels (e.g Web Services, MQ). One of its main features is that it is scalable, to cope with a forecasted growth in number of users and volumes of data (DG TAXUD, 2016-7).

Based on this (SSTL) export data the CA-IMPORT (CN/HK) performs an SSTL risk management process. It can send a request to control an SSTL consignment to the CA-EXPORT (NL) and CA-EXPORT(NL) can receive the control result in return. These are manual user tasks executed by a customs officer, using CRMS2, which is a communication platform developed by DG TAXUD that customs officers can use to exchange unstructured messages.

Finally, the CA-EXPORT (NL) sends the exit (conveyance) data from the manifest. The sending will be done automatically by the national export control application (NECA) of the CA-EXPORT (NL) to SPEED2. SPEED2 then converts the data to the SSTL structure and sends it the CA-IMPORT (CN/HK).

The outcome of the SSTL risk management process and the conveyance data are used in the regular CN/HK risk management process for import, that is triggered by the receipt (and acceptance) of the import declaration. The declarant of the import declaration includes the C_UCR in the import declaration. This way CA-IMPORT (CN/HK) can link the SSTL data from NL to the data in the import declaration. Because for SSTL consignments the risk has already been management in the SSTL risk management process, the idea is that in the regular import process these consignments can be released quicker without being controlled at arrival.

In case CA-IMPORT (HK/CN) nevertheless has a reason to control the consignment and the control turns out positive, it can send the control result to CA-EXPORT (NL) so the latter can use this data in the risk management process when processing future export declarations. These are manual user tasks executed by a customs officer, using CRMS2.

There are two key differences between the SSTL Ph3 data-exchange process and the SSTL Ph2 data-exchange process. The first key difference is that in phase 3 certain process steps are automated. As shown in figure 4, these steps include sending of export and conveyance data by the NECA-NL via SPEED2, and receiving this data via SPEED2 by the NES-CN. As figure 3 shows, in phase 2 these steps are performed manually by a customs officers in the CENcomm system. China uses this data for cross validating the Chinese version of the Entry Summary Declaration (Pre-arrival notification and Import declaration). The systems that are developed to automate these process steps are all capable of handling large volumes of data in real-time.

The second key difference is that in the SSTL ph3 data-exchange process the Dutch exporter does not have to put together and send the SSTL export file as required in phase 2. In the phase 3 data-exchange process the CA-EXPORT (NL) copies this information from the export declaration that the exporter already lodges. As a result, the cost of participating as an SSTL pilot partner for the exporter are lower in phase 3 then in phase 2.

Indirect export
The model represents the case of direct export. The model for indirect export is the same with the following deviations:

- An extra actor is introduced, the customs office of exit of the CA-EXPORT(NL), performing an extra risk management process at exit based on the data of the export declaration and the outcome of the risk management process of the customs office of export.
- An occasional request to control an SSTL consignment from the CA-IMPORT is handled by the customs office of exit.

3.6.2. SSTL Ph3 data-exchange process - Import maritime (BPMN)

Based on DG TAXUD (2018, 2016-4, 2016-5, 2016-6) and using BPM-notation, the following model in figure 5 represents the process flow for this scenario. The model represents the case when consignments are unloaded at the customs office of first entry. It is also possible that the consignments are unloaded at a customs office of subsequent entry. The way this changes the customs process is not modelled, but described at the end of this paragraph.

The model makes clear, that also in this SSTL Ph3 data-exchange scenario the key difference with the Ph2 data exchange process is that process steps are automated by systems that are capable of handling large volumes of data in real-time. These include the process steps of sending and receiving of export en conveyance data, but this time into the other direction, from Chinese customs (CA-EXPORT) to Dutch customs (CA-IMPORT). In phase 2 customs officers with the CENcomm system perform these steps manually. The systems that are developed to automate these process steps are all capable of handling large volumes of data in real-time. These same systems are used in the scenario of Export maritime that is described in the previous paragraph. However, in the scenario of Import maritime an extra system is added: the SSTL repository. The SSTL repository is a new system that will developed by DG TAXUD. This paragraph describes the SSTL Ph3 data-exchange process and the role of the used systems in more detail.

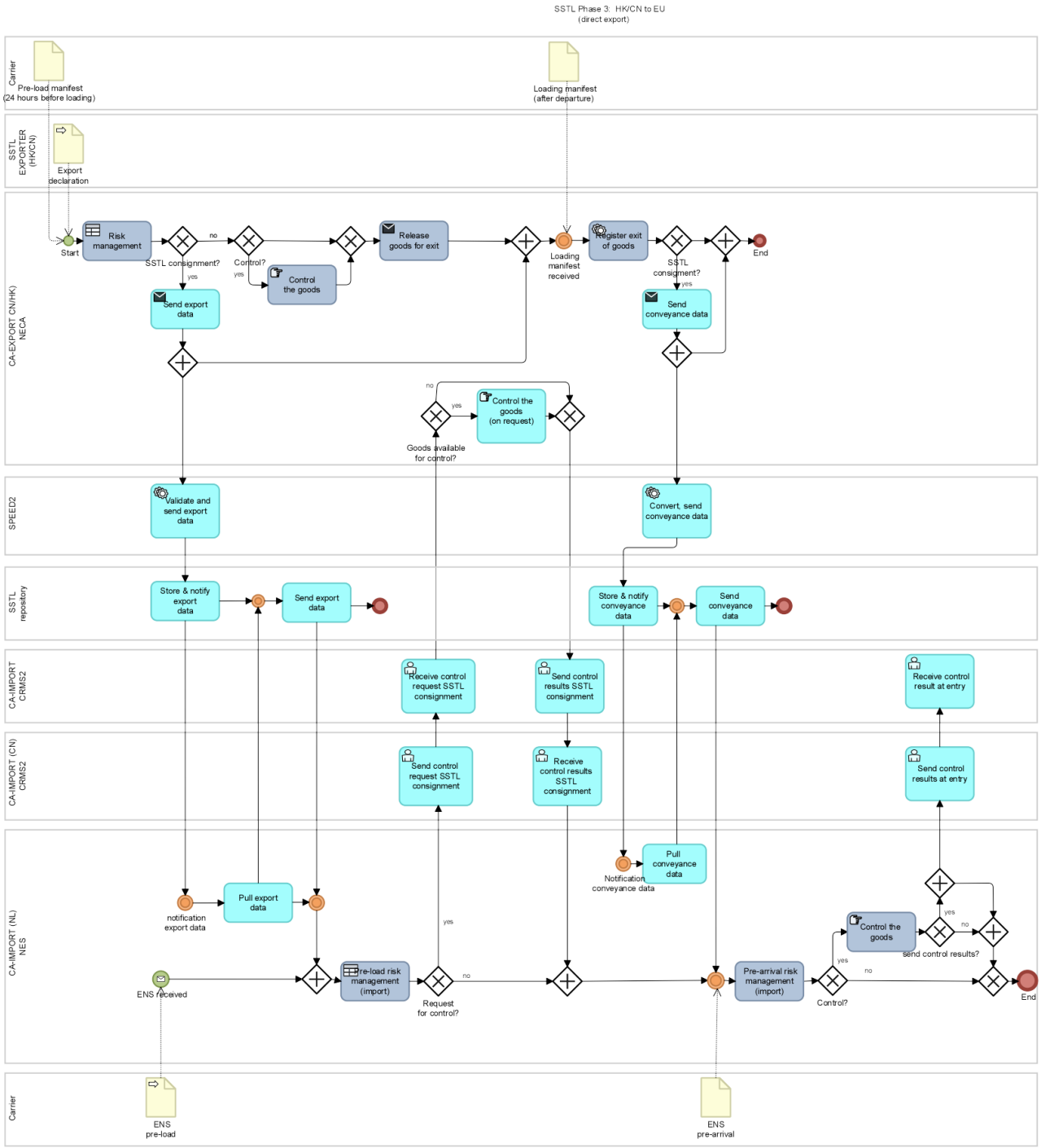

Figure 5 BPM SSTL Ph3 Import from HK/CN into EU (maritime mode of transport)

The CA-EXPORT (HK/CN) sends the export data from the export declaration right after it has performed the pre-load risk management, before an eventual control. The export data includes the customs assigned unique consignment reference (C_UCR). The exporter forwards the C_UCR to its trading partners in the importing country (NL). The sending will be done automatically by the national export control application (NECA) of the CA-EXPORT (HK/CN) to SPEED2. SPEED2 validates (syntax only), converts the data to the SSTL structure, and sends it the SSTL repository where it is stored and notification is send to the CA-IMPORT (NL).

CA-IMPORT (NL) starts its regular preload risk management process when it receives the ENS. It can pull the export data in an automated way from the SSTL repository to cross-check the data

from the ENS. In addition, it is possible for a customs officer to get the data for cross-checking purposes directly from the SSTL repository, by using its graphical user interface (GUI) The declarant of the ENS includes the C_UCR in the ENS. This way CA-IMPORT (NL) can link the SSTL data from CN/HK to the data in the ENS. This collection of extra reliable data to enrich or cross-validate the ENS can be seen as a typical example of data pipeline functionality. CA-IMPORT (NL) can send a request to control an SSTL consignment to the CA-EXPORT (HK/CN) and CA-EXPORT (HK/CN) can receive the control result in return. These are manual user tasks executed by a customs officer, using CRMS2.

CA-EXPORT (HK/CN) sends the exit (conveyance) data after receiving the loading manifest. Exit (conveyance) data is also stored in the SSTL repository and notified to CA-IMPORT (NL). CA-IMPORT (NL) starts its regular pre-arrival risk management process when it receives the pre-arrival ENS. It can pull the conveyance data from the SSTL repository to cross-check the data from the pre-arrival ENS.

Because in case of SSTL consignments the ENS data has been cross-checked, and eventually on request of CA-IMPORT NL have been controlled by CA-EXPORT (HK/CN), the idea is that in the regular import process these consignments can be released quicker without being controlled at arrival. This is a typical example from the data pipeline of piggybacking on extra data to cross-validate lodged declarations.

In case CA-IMPORT (NL) nevertheless has a reason to control the consignment and the control turns out positive, it can send the control result to CA-EXPORT (HK/CN) so the latter can use this data in the risk management process when processing future export declarations. These are manual user tasks executed by a customs officer, using CRMS2.

Customs office of subsequent entry
The model represents the case of consignments are unloaded at the customs office of first entry. In case a customs office of subsequent entry is also part of the pilot, this customs office is also notified about the export and conveyance data by the SSTL repository. It can also pull this data for cross validating the ENS data in his preload and pre-arrival risk management process, and request a control by the CA-EXPORT (HK/CN).

3.6.3. Conclusion

As concluded in paragraph 3.5.3 *Problems of the SSTL Ph2 data-exchange process,* the most important user requirement for the SSTL Ph3 data-exchange process is that the tasks related to sending and receiving the SSTL export and conveyance data are automated. By comparing the BPMN models of the phase 3 presented in this paragraph with the BMPN model of phase 2 in the previous paragraph, is can be concluded that these tasks are all automated in the Ph3 data exchange process.

3.7. Comparing the SSTL Ph3 data exchange process with the datapipeline

This paragraph describes the result of the comparison of the models of the SSTL Ph3 data-exchange process (see paragraph 3.3 and 3.6) with the datapipeline definition (see paragraph 3.1.1), to find an answer to the research question if the SSTL Ph3 data-exchange process is a specific form of extension of a datapipeline. The first paragraph gives the outcome of the comparison, the second paragraph the conclusions to the research question.

3.7.1. Comparison with the datapipeline definition

Paragraph 3.1.1 presented the following datapipeline definition for this research.

A datapipeline is a federated IT-solution based on existing information systems and driven by a certain power of influence, that provides customs with timely, accurate and internationally (WCO) standardized trade data on the goods and on the integrity of the transportation process for crosschecking the customs declaration, based on a system-based-control approach.

Based on the high-level model of the SSTL Ph3 data-exchange process presented in paragraph 3.3, and the detailed model in paragraph 3.6, the SSTL Ph3 data-exchange process can be compared with this definition.

- ✓ ***A datapipeline is a federated IT-solution based on existing information systems***

The process model for import from China (paragraph 3.6.2) shows, that the SSTL Ph3 data exchange process consist of existing information systems:

- The national export control application (NECA) of CA-CN
- The SPEED2 system that was developed by DG-TAXUD
- The CRMS2 system that was developed by DG-TAXUD
- The national entry system (NES) of CA-NL

The SSTL repository that will be developed by DG TAXUD is the only new system. Its function is to serve as the single access point for the CA-IMPORT NL to access the data.

- ✓ ***A datapipeline is driven by a certain power of influence***

The SSTL Ph3 data-exchange process is developed by the participating national customs administrations of the EU, DG TAXUD and the customs administrations of third countries CN and HK, driven by their (common) goals of compliancy and trade facilitation. These border agencies realize they can work together to achieve these goals. The SSTL Ph3 data-exchange process, incorporates the following elements of Coordinated Border Management (CBM):

- Reliable data that one border agency has is re-used for control purposes by another border agency. The border agency of an importing country re-uses data that a border agency of an exporting country has. Data on different things can be re-used:
  - On an object of control (the goods)
  - On the transport of goods
  - On a declarant who provided data on an object of control (e.g. his AEO status)
  - On the transaction-based control on an object of control (e.g. the outcome of the export control process for an object of control)
  - On the systems-of-control that the border agency has in place (e.g. the export control process, the AEO assessment)

- On request of one border agency, a control is performed by another border agency, for compliancy reasons, e.g. in case of dangerous goods that should not be imported, divert the control to the country of export
- On request of one border agency, a control is performed by another border agency, for reasons of trade facilitation, e.g. in case it is more convenient to have the goods controlled before they are loaded, divert the control to the country of export

✓ ***A datapipeline provides customs with trade data on the goods and on the integrity of the transportation process for crosschecking the customs declaration***

The process model for import from China (paragraph 3.6.2) shows, that the SSTL Ph3 data-exchange process provides the CA-IMPORT (NL) with export and conveyance, that the CA-IMPORT (NL) uses in the pre-load process and pre-arrival risk management process for cross-validating the data of the Entry Summary Declaration (ENS). The export and conveyance data is stored in the SSTL repository and can be access in an automated way by the NES of the CA-IMPORT (NL).

Export and conveyance are trade data. Export data originates from the Chinese exporter, who provided this data to CA-CN in the export declaration. Trade data originates from the carrier, who provided this data to CA-CN in the loading manifest.

Export data contains data on the goods: commodity classification, number of packages, brief cargo description, unique consignment reference and exporter.

Conveyance contains data on the integrity of the transportation process: transport document number, conveyance reference number, customs office of exit, place of loading, identification of means of transport crossing the border, equipment identification number, seal number and date and time of goods release.

The pre-load risk management process and pre-arrival risk management process by the CA-IMPORT are transaction-based processes that are triggered by the reception of an Entry Summary Declaration (ENS). These risk assessment in these processes is also based on the data in the ENS. As has been explained in more detail in paragraph 3.3, the data in the ENS is often not accurate, and therefore, the outcome of these processes (risk / no risk) might not be valid. The CA-IMPORT uses the export and conveyance to crosscheck the data in the ENS, to determine if is accurate. In paragraph 3.3 examples were given of typical data in the ENS that might not be accurate, that can be cross-checked with export data. An example of typical data in the ENS that can be cross-checked with conveyance data is the number of the seal on the means of transport (typically a container) of the consignment. The seal mentioned in the ENS should be the same as the seal mentioned in the conveyance data. If this is not the case, than the container has been opened on its way from the CA-EXPORT to the CA-IMPORT. This might indicate a risk that goods in the container have been replaced by goods that impose a risk on safety and security, or dangerous or forbidden goods have been added to the container.

✓ ***The trade data is timely, accurate and internationally (WCO) standardized***

To assure that the data is received on time by CA-IMPORT, the process is automated. When CA-EXPORT (CN) receives export data (in the export declaration) or conveyance (in the loading manifest), the data is automatically passed through by its national export control application

(NECA) to the SSTL repository, that automatically notifies the import control application (NES) of the CA-IMPORT that the data is available.

To CA-EXPORT, for his own (export-oriented) risk assessment also depends on the accuracy of the trade data that the exporter provides for in his export declaration. To assure the data is accurate, the CA-EXPORT has an AEO program in place, and an (export) risk management process, that checks the data in the export declaration (transaction-based) based on risk rules.

The data is standardized, by using the WCO Data Model. The WCO Data Model defines for each data-element a (standardized) ID, name, definition and format.

- ✓ ***A datapipeline is based on a system-based-control approach***

The SSTL Ph3 data-exchange process is based on a systems-based control approach. The CA-IMPORT has to rely on the accuracy of the data it receives from the CA-EXPORT, because the CA-IMPORT uses this data to crosscheck the ENS. The CA-IMPORT relies on the systems and procedures the CA-EXPORT has in place, to guarantee the accuracy of the data: the AEO-program and the (export) risk management system. In the SSTL Ph3 data-exchange process, the CA-IMPORT also receives the output of these procedures, which is not trade data but government data, from the CA-EXPORT.

This makes the SSTL Ph3 data-exchange process a special 'enriched' type of data pipeline, since in the common definition of a datapipeline only trade data is exchanged. Enriching the data pipeline with government data is very useful, as was concluded in paragraph 3.4 *SSTL case: Exporting dairy products to China*, because having government data increases the reliability of trade data.

3.7.2. Conclusion

The SSTL Ph3 data-exchange process is a special, enriched, data pipeline according the definition of this research. It is enriched because it also exchanges government data, besides trade data. This increases the reliability of the trade data.

Another special characteristic is the power of influence that drives the development of the SSTL Ph3 data exchange process. This power of influence is a cooperation of customs authorities, driven by their (common) goals of compliancy and trade facilitation. A Coordinated Border Management (CBM) data pipeline development scenario is special, because so far in the datapipeline literature, it assumed that private organizations should take the initiative to develop the data pipeline.

3.8. Process analysis on compliance and trade facilitation using BPMN models

This paragraph describes the result of process analysis that was performed, based on the process models in paragraph 3.3 *The SSTL data exchange process (high-level)* and 3.6 *The SSTL Ph3 data exchange process (detail)*, to find out if the SSTL Ph3 data-exchange process can help Dutch customs improve compliance and trade facilitation.

From these models can be derived, that SSTL Ph3 contributes to compliance in two ways:

1. It enables the CA-IMPORT NL to cross-validate the data that the importer (or carrier) provides in the entry summary declaration with the source data from the exporter. In case

the cross-validation points out that the importer has provided invalid data, this allows the CA-IMPORT NL to correct the importer to improve compliancy.
2. In addition, the SSTL vetting procedure to become a certified SSTL pilot partner, might reveal flaws in the processes and systems of the importer that account for the ENS-data, and help to improve the importer (or carrier) to become more compliant.

From these models can be derived, that SSTL Ph3 contributes to facilitate trade, i.e. the importer, in three ways:
1. The before mentioned cross-validation might lead to a justified downgrading of the risk detected based on the data in the ENS (and risk rules) and cancelling of the control.
2. The CA-IMPORT can request the CA-EXPORT to control the goods before they are loaded into the transport equipment, instead of controlling the goods by itself. In case the control lead-time of the CA-EXPORT is shorter than the control lead-time in the CA-IMPORT, or the cost of the control for trade is lower in the CA-EXPORT than in the CA-IMPORT, this is a way to facilitate trade. Lead-time and cost of control might be lower in the CA-EXPORT because the control can be done more easily when the goods are not yet stuffed a container.
3. The CA-IMPORT and CA-EXPORT can develop common risk rules, allowing the CA-IMPORT to rely on the risk management process of the CA-EXPORT, which could ultimate result in fewer controls by the CA-IMPORT.

3.9. Requirements analysis of the SSTL Ph3 data exchange process

This paragraph describes the requirements analysis that was performed, to find out if the SSTL Ph3 data-exchange process could help Dutch customs improve compliance and trade facilitation. As explained in paragraph 2.3.9, the requirements analyses consisted of two steps.

The next two paragraphs give the outcome of these steps. The final paragraph gives the conclusions to the research question.

3.9.1. Requirements for SSTL Ph3

On the basis of the specifications (DG TAXUD, 2018) the requirements were identified and described in a table, in a way that is comprehensive for business-oriented stakeholders, by using the same terminology as in the process models, and by categorizing them in functional and non-functional user needs. Also they were clustered to make them more comprehensive (see Appendice 1 - Traceability table SSTL Ph3 user needs). This table is presented below.

The requirements were validated by the SSTL expert, as described in paragraph 2.2.3 *Design science in this thesis* (step 3 Treatment validation). The expert was of the opinion that the table with requirements improves the understanding of the specifications of the SSTL Ph3 data-exchange process for business-oriented stakeholders within customs NL. As a result, no changes were made to the table.

The result of this design activity is presented in the table below.

Nr	Functional requirements (validated)
1	It is required that the CA-EXPORT exchanges standardized export declaration data of SSTL trade lanes in an automated way with CA-IMPORT HK/CN, so the data does not have to be keyed in manually.

2	It is required that the CA-EXPORT exchanges standardized conveyance data of SSTL trade lanes with CA-IMPORT HK/CN in an automated way, so the data does not have to be keyed in manually.
3	It is required that the CA-IMPORT's National Entry System (NES) accesses standardized export data from SSTL trade lanes from CA EXPORT HK/CN, so this data can be used by the NES in the risk management process for import control.
4	It is required that the CA-IMPORT's National Entry System (NES) accesses standardized conveyance data from SSTL CA EXPORT HK/CN in an automated way, so this data can be used by the NES in the risk management process for import control.
5	It is required that the CA-EXPORT/IMPORT has statistical and technical (audit) reportings of the export and conveyance data that it exchanges with CA IMPORT HK/CN, and vice versa.
6	It is required that the CA-IMPORT's customs officers are able to send a control request to the CA-EXPORT HK/CN and receive the control result in return.
7	It is required that the CA-EXPORT's customs officers are able to receive a control request from the CA-IMPORT HK/CN and send the control result in return.
8	It is required that the CA-EXPORT/IMPORT's customs officers are able to exchange risk information with customs officers from CA-IMPORT/EXPORT, so they jointly can test common risk rules
Nr	**Non functional requirements (validated)**
1	(Accessibility) For the CA-IMPORT, it is required that the SSTL Ph3 data exchange infrastructure is more of the time accessible, so controls by CA-EXPORT HK/CN can be requested, and risks (joint risk rules) can be exchanged with CA-EXPORT HK/CN when needed.
2	(Availability) As CA- EXPORT, it is required that the SSTL Ph3 data exchange infrastructure is capable to exchange larger volumes of export declaration data and conveyance data with CA-IMPORT.
3	(Cost) It is required that the SSTL Ph3 data exchange infrastructure is centralized as much as possible, so the changes to the national systems (NES and NECA) are limited to a minimum.
4	(Flexibility) It is required that the SSTL Ph3 data exchange infrastructure is usable for future data exchanges with customs authorities from other partner countries.
5	(Integrity) As CA-IMPORT, it is required that the integrity of stored export and conveyance data received from HK/CN is maintained.

Table 3 SSTL Ph3 requirements

3.9.2. Fulfillment of requirements for SSTL Ph3

Based on the specifications (DG TAXUD, 2018) the way each user requirement is fulfilled by the design was identified and described in a table, in a way that is comprehensive for business-oriented stakeholders, by using the same terminology as in the process models. In case it was not clear in what way the user requirement is fulfilled by the design, or why a certain way of fulfillment was chosen, these "specification issues" were also described in the same table. This table is presented below.

The table was validated by the SSTL expert as described in paragraph 2.2.3 Design science in this thesis (step 3 Treatment validation). The expert was of the opinion that the table improves the understanding of the specifications of the SSTL Ph3 data-exchange process for business-oriented stakeholders within customs NL. As a result, no changes were made to the table.

The result of this design activity is presented in the table below.

Nr	Functional requirement (validated)	Way the requirement is fulfilled (validated)	Specification issues (validated)
1	It is required that the CA-EXPORT exchanges standardized export declaration data of SSTL trade lanes in an automated way with CA-IMPORT HK/CN, so the data does not have to be keyed in manually.	• National export control application (NECA) identifies export declaration for processing under SSTL. In figure 4 this step is represented by the gateways "SSTL consignment". • NECA makes a copy of the export declaration and sends it to SPEED2 • SPEED2 validates and converts export declaration to SSTL export data, and sends SSTL export data to CN/HK Import office The NECA identifies SSTL export declarations in the following way: • Identify if Trade lane ID is valid and belongs to the exporter. • Determine if country of destination is the same (HK/CN) for all goods items. • Determine if mode of transport is maritime	The way the NECA identifies export declaration for processing under SSTL is not clear. The following questions remain: • What party issues the Trade lane ID? • Why issuing new data element Trade lane ID, instead of (re)using a combination of existing data elements, e.g. exporter+ commodity code + country of destination + import office? • Not all import CN/HK import offices participate in the SSTL pilot. This is not taken into account. As a result, the NECA will copy more export and conveyance data for sending to CN/HK, then CN/HK will use.
2	It is required that the CA-EXPORT exchanges standardized conveyance data of SSTL trade lanes with CA-IMPORT HK/CN in an automated way, so the data does not have to be keyed in manually.	• National export control application (NECA) identifies exit manifest for processing under SSTL • NECA makes a copy of the exit manifest and sends it to SPEED2 • SPEED2 validates and converts exit manifest to SSTL export data, and sends SSTL export data to CN/HK Import office	The way the NECA identifies the export manifest for processing under SSTL is not clear (for the same reasons as above)
3	It is required that the CA-IMPORT's National Entry System (NES) accesses standardized export data from SSTL trade lanes from CA EXPORT HK/CN, so this data can be used by the NES in the risk management process for import control.	• Export data from CN/HK is stored in a database, the SSTL repository that is accessible for the NES for risk analysis, potentially when triggered by the reception of an ENS filing. • Export data from CN/HK in the SSTL repository is also accessible for the ICS2-Common Repository. • Export data from CN/HK in the SSTL repository is also accessible for a customs officer of CA-IMPORT via a User Interface (UI).	It is not clear: • For what use the ICS2-common repository accesses the export and conveyance data from CN/HK in the SSTL repository. The main function of the ICS2-common repository in the SSTL context should be clear, so CA-NL knows it does not have to develop this function in the NES. • What ENS data field the declarant of the ENS should use to include the C-UCR in the ENS • How the export data can be used in the risk management

		• The C_UCR (reference number of CN/HK export declaration) in the ENS is the key to retrieve the CN/HK export data from the SSTL repository.	process for import control. E.g., what data elements from the ENS are to be cross-validated with what data elements from the export declaration, and how does that impact risk? • What the quality of the data is, and as a result, its usefulness. E.g., will using the data not result in too many false positives?
4	It is required that the CA-IMPORT's National Entry System (NES) accesses standardized conveyance data from SSTL CA EXPORT HK/CN in an automated way, so this data can be used by the NES in the risk management process for import control.	As requirement 3.	
5	It is required that the CA-EXPORT/IMPORT has statistical and technical (audit) reportings of the export and conveyance data that it exchanges with CA IMPORT HK/CN, and vice versa.	The existing Central Services Management System (CS/MIS) will be extended to support the SSTL process and collect audit data from SSTL exchanges. DG TAXUD develops CS/MIS.	
6	It is required that the CA-IMPORT's customs officers are able to send a control request to the CA-EXPORT HK/CN and receive the control result in return.	CRMS2 will enable sending the control request.	
7	It is required that the CA-EXPORT's customs officers are able to receive a control request from the CA-IMPORT HK/CN and send the control result in return.	CRMS2 will enable receiving the control request.	
8	It is required that the CA-EXPORT/IMPORT's customs officers are able to exchange risk information with customs officers from CA-IMPORT/EXPORT, so they jointly can test common risk rules	CRMS2 will enable exchanging risk information	
Nr	**Non functional requirement (validated)**	**Way the requirement is fulfilled (validated)**	**Specification issues (validated)**
1	(Accessibility) For the CA-IMPORT, it is required that the SSTL Ph3 data exchange infrastructure is more of the time accessible, so controls by CA-EXPORT HK/CN can be requested, and risks (joint risk rules) can be exchanged with CA-EXPORT HK/CN when needed.	CMRS2 will enable the exchange of this data. The planned availability is 99.8% with 1.3 hour max. Downtime (per month) and 60 min. disaster recovery time.	
2	(Availability) As CA- EXPORT, it is required that the SSTL Ph3 data exchange infrastructure is capable	A combination of 4 system components will enable the exchange of this data: NECA/NES,	

	to exchange larger volumes of export declaration data and conveyance data with CA-IMPORT.	CCN/CCN2, SPEED2, SSTL-Repository. To prevent that failure of one component does not affect the other, these components will be loosely coupled via asynchronous links. The planned overall availability is 97.8% with 16 hours max. downtime (per month) and 32 hours disaster recovery time.	
3	(Cost) It is required that the SSTL Ph3 data exchange infrastructure is centralized as much as possible, so the changes to the national systems (NES and NECA) are limited to a minimum.	Most of the functionality will be realized in central components.	For some functions, it is not clear why they are developed in the NES, a national system, and not in the ICS2 common repository (central system). This concerns the following functions: • Identify if a received ENS filing concerns an SSTL import, and (if this is the case) • Retrieve the export and conveyance data from the SSTL-repository. The ICS2 common repository is a central system currently developed by DG TAXUD that will be used by all customs administration of the EU. It will be operational for the maritime mode of transport by Q4 2023. It looks very feasible to develop these functions in the ICS2 common repository, because • The central ICS2 Common Repository will contain all ENS data and one of its main functions is to check the syntax of the ENS and if valid send the ENS to the NES. • It also does some semantic checks on the data, and enriches the ENS with the outcome of the check. An example is the check on the goods description; it checks the goods description against a list of values that are not allowed, because they are not detailed enough for the import control risk-analysis and enriches the ENS with a 'flag' in case the value is not allowed. According to the specification, it will get access to the SSTL repository.
4	(Flexibility) It is required that the SSTL Ph3 data exchange infrastructure is usable for future data exchanges with customs	The proposed solutions implement a generic message exchange process that can be used for other similar use cases.	

	authorities from other partner countries.		
5	(Integrity) As CA-IMPORT, it is required that the integrity of stored export and conveyance data received from HK/CN is maintained.	Data security and protection measures compliant to Art. 12 UCC will be implemented. It will be defined who can access the SSTL data and on what basis.	

Table 4 SSTL Ph3 requirement fulfillment and specification issues

3.9.3. Conclusion

The table *SSTL Ph3 requirement fulfillment and specification issues* shows that for phase 3, the necessary requirements to solve the problems from phase 2 have been taken into account and are fulfilled by the design. These concern the requirements to automate the human process steps (see functional requirements 1-4).
However, the table also shows that there are some specification issues to be solved.
Summarized, these issues are:

1. How can the Dutch national export control application (NECA) of CA-EXPORT (NL) identify if an export declaration and manifest are to be copied and send to CA-IMPORT (CN/HK):
   - According to the specification, 'Trade lane ID' is to be used for this. What party issues this ID?
   - Why introduce this new data element 'Trade lane ID'? Has (re)using a combination of existing data elements been considered? E.g. exporter + commodity code + country of destination + import office?
   - Not all import CN/HK import offices participate in the SSTL pilot. This is not taken into account in the specification. As a result, the NECA will copy more export and conveyance data for sending to CN/HK, then CN/HK will use.
2. Why should the ICS-CR access the export and conveyance data from CN/HK? This data is to be used in the risk management process for import control, a process that is executed by the National Entry System (NES) of the CA-IMPORT (NL), and not the ICS-CR.
3. Why should the NES determine if a received ENS filing contains SSTL imports, and retrieve the export and conveyance data from the SSTL-repository, when this can also be done centralized by the ICS2-CR?
4. What ENS data field should the declarant of the ENS use to include the customs assigned consignment reference (C-UCR) of the export declaration in the ENS?
5. How should CA-IMPORT (NL) use the export and conveyance data in the risk management process for import control? What data elements from the ENS are to be cross-validated with what data elements from the export declaration and loading manifest? In case the content of the data-elements are not the same, depending on the trade lane, what should be the follow-up action? E.g.
   - CA-EXPORT controls the goods (on request)
   - CA-IMPORT controls the goods
   - No control of the goods

   Such common risk rules that precisely define the use of export and conveyance data and the follow-up action seem to be missing

3.10. Reflection on the research methods

This paragraph gives a reflection on the applied research methods.

As explained in paragraph 2.3 Research steps, this research is a combination of desk research and interviews. The interviews were used to validate the findings from the desk research into the research questions. This approach has proven to be very successful. Because of the validation by the expert, some finding from the desk research were adapted, or improved.

The requirements analysis is an artefact that has been designed in this thesis research, to improve the understanding of the specifications of the SSTL Ph3 data-exchange process at Dutch customs. The requirements analysis consists of the following components:

- BPMN models of the SSTL Ph2 and SSTL Ph3 data exchange processes
- Table with SSTL Ph3 data exchange process requirements
- Table with SSTL Ph3 requirement fulfilment and specification issues

The artefact was used for several purposes:

- The BPMN models were used to compare the SSTL Ph3 data exchange process with the (current) SSTL Ph2 process. The comparison showed that the the most important user requirements for the SSTL Ph3 data-exchange process, namely that the tasks related to sending and receiving the SSTL export and conveyance data are automated, are fulfilled by the SSTL Ph3 data exchange process. The table with SSTL Ph3 requirement fulfilment and specification issues was also used to show this.
- This table was also used to show that, however, there are still some specification issues to be solved.
- The BPMN models of the SSTL Ph3 data exchange process were also used to find out how the SSTL Ph3 data-exchange process can help Dutch customs improve compliance and trade facilitation (paragraph 3.8 Process analysis on compliance and trade facilitation using BPMN models).

These findings were validated by the SSTL experts.

By validating the review of the data pipeline literature, the expert pointed out that the literature contains some assumptions (data has to be captured at the source, the datapipeline has to be developed by the private sector) that can be questioned. Because of this validation, the definition of the data pipeline used in this research was adapted. In addition, due to a comment from the expert the concept of trade data in the definition was clarified, to make clear that trade data can also be exchanged via a G2G process (see 3.1.1. Definition of a data pipeline).

In relation to the research question on the contributions of the SSTL Ph3 data-exchange process to compliance and trade facilitation, multiple research steps were undertaken. Also here validating the initial answers of the desk research on the research question with (the data provided by) the expert turned out to be very useful:

- In the interview on the SSTL casus (diary exporter), the expert pointed out that not any reduction in lead-time is perceived as a valuable form of trade facilitation; there appears to be a certain threshold that should be taken into account.

- In the interview on the SSTL Ph2 data-exchange process, the expert pointed out that having the data-exchange process in place does not mean trade facilitation and compliance is achieved; a certain minimum volume of transactions is needed.
- In the interview on the conclusion and recommendations, the expert commented on the conclusion that no prove exist of a contribution to trade facilitation in practice. He provided a report of an evaluation study, that proved that some companies experienced a shorter lead-time. In addition, he pointed out that the companies in practice perceive having a contact person at customs as trade facilitation. Because of this, the conclusions and recommendations were adapted.

In this research, the choice was made to validate the outcome of the desk research with one expert, in structured interviews. This expert is involved in the SSTL project since the beginning, and also well informed on data pipeline research, because within Dutch Customs, the experts on the SSTL project and the experts on the data pipeline research are part of the same organizational unit. Although having one interviewee has the risk of biases, no other expert was available with the same depth and breadth of knowledge. Since the expert is so knowledgeable having more interviewees would not add extra information. Having access to an expert with so much knowledge, and interviewing him, made it possible to validate the outcome of several research steps, and to go in all necessary detail.

4 Conclusions

This thesis started with the following problem definition:

How does the SSTL Ph3 data-exchange process relate to the data pipeline concept, and does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation?

Based on the research findings presented in the previous chapter, this chapter presents the conclusions to the problem definition.

Regarding the first part of the problem definition, the conclusions are:

- A datapipeline is a federated IT-solution based on existing information systems and driven by a certain power of influence, that provides customs with timely, accurate and internationally (WCO) standardized trade data on the goods and on the integrity of the transportation process for crosschecking the customs declaration, based on a system-based-control approach.

- The SSTL Ph3 data-exchange process is a special "CBM" data pipeline. The power of influence that drives the development of the SSTL Ph3 data exchange process is a cooperation of customs authorities, driven by their (common) goals of compliancy and trade facilitation. So far, in the datapipeline literature, it assumed that private organizations should take the initiative to develop the data pipeline, because governmental organizations would not have the necessary capabilities.

- A "CBM" data pipeline facilitates the following CBM elements
  - Reliable data that one border agency has is re-used for control purposes by another border agency. This can be data on different things:
    - On an object of control (the goods)
    - On a declarant who provided data on an object of control (e.g. his AEO status)
    - On the transaction-based control on an object of control (e.g. the outcome of the export control process for an object of control)
    - On the systems-of-control that the border agency has in place (e.g. the export control process, the AEO assessment)
  - On request of one border agency, a control is performed by another border agency, for compliancy reasons, or reasons of trade facilitation

- The SSTL Ph3 data-exchange process is a special "enriched" data pipeline, because it also exchanges government data, besides trade data. The government data is on the system-based control approach, and on the transaction-based-control approach of the border agency, that provides the data. Having this government data increases the reliability of the trade data.

- The SSTL Ph3 data-exchange process is also special, because it is an "Import Control" data pipeline. Import control refers to the risk assessment for safety and security (S&S) purposes, based on the Entry Summary Declaration (ENS) that is lodged for goods brought into the customs territory of the Union (UCC, art. 127). The purpose of the SSTL Ph3 data-exchange process is to crosscheck the Entry Summary Declaration (ENS) that often is not accurate. If

the ENS is not accurate, the output of the risk assessment (S&S risk/no S&S risk) is not accurate.

Regarding the second part of the problem definition, the conclusions are:

- The SSTL Ph3 data exchange process improves compliance in two ways.
  - It enables the CA-IMPORT NL to cross-validate the data that the importer (or carrier) provides in the entry summary declaration with the source data from the exporter. In case the cross-validation points out that the importer has provided invalid data, this allows the CA-IMPORT NL to correct the importer to improve compliancy.
  - The SSTL vetting procedure to become a certified SSTL pilot partner, might reveal flaws in the processes and systems of the importer that account for the ENS-data, and help to improve the importer (or carrier) to become more compliant.

- The SSTL Ph3 data exchange process improves trade facilitation, by reducing the time related to customs controls.

- The SSTL Ph3 data exchange process improves trade facilitation, in three ways:
  - Cross-validation might lead to a justified downgrading of the risk detected based on the data in the ENS, and cancelling of the control.
  - The control of the CA-IMPORT might be done on an (earlier) moment, and on another place (before loading) by the CA-EXPORT
  - The CA-IMPORT and CA-EXPORT can develop common risk rules, allowing the CA-IMPORT to rely on the risk management process of the CA-EXPORT, which could ultimate result in fewer controls by the CA-IMPORT.

- The SSTL Ph3 data exchange process enables achieving more tangible benefits, by allowing a higher volume of Entry Summary Declarations to be cross-checked. The main problem of the SSTL Ph2 data-exchange process is that it cannot handle large volumes, because the tasks related to sending and receiving the export and conveyance data for cross-checking purposes require too much manual activity from customs officers. The Ph3 data exchange process solves this problem by automating these tasks in systems that are capable of handling large volumes.

- The SSTL Ph2 data exchange process does not yet provide many tangible benefits in terms of (the three ways of) trade facilitation. A certain threshold of trade facilitation (benefits) has to be achieved, to make the benefits more tangible.

- The SSTL Ph3 data exchange process has been designed, but not been developed yet. The specification of the SSTL Ph3 data exchange process is not clear on some points, according to Dutch Customs.

5 Recommendations

The SSTL Ph3 data-exchange process is a very special type of datapipeline. It is driven by a Coordinated Border Management initiative, besides trade data it also exchanges government data, and it focusses on import control i.e. safety and security risk assessment on the ENS. This is unique value proposition.

- Is it recommended to develop the SSTL Ph3 data-exchange process further, and allocate resources to its development

The SSTL Ph2 data exchange process does not yet provide many tangible benefits in terms of trade facilitation. The reason is that no risk has yet been detected in the regular risk management processes for import control for goods that are moved via the piloted trusted trade lanes, presumably because of the current low volume of goods movement via piloted trusted trade lanes. No risks means no controls, and no controls means no opportunities for further trade facilitation. A certain threshold of trade facilitation (benefits) has to be achieved, to make the benefits more tangible.

- It is recommended to significantly increase the volume of data-exchanges, as soon as he SSTL Ph3 data-exchange process is implemented, and to add trade lanes with a clear and significant potential for trade facilitation, such as in the case of the diary exporter.

The SSTL Ph3 data-exchange process and data pipeline research want to contribute to customs compliance and trade facilitation. Yet, these goals are not operationalized. E.g. trade facilitation exist in multiple forms: less controls, less control lead-time, control at another preferred location, having access to a customs officer for knowledge and information, etc. At the same time it turns out that not amount of trade facilitation is perceived as a valuable by trade; there appears to be a certain threshold.

- It is recommended to develop a common way to make these goals measurable, so the benefits of the SSTL Ph3 data-exchange process and datapipelines in general, can be measured.

The specification of the SSTL Ph3 data exchange process has some specification issues, according to Dutch Customs.

- It is recommended to ask the author of DG TAXUD (2018) for clarification. Since the first function has a dependency with the AES project and the other functions with the ICS2 project is also recommended to verify the answers with specialists from these projects.

6 Contribution for research

The research contributes mainly to the existing research field of the data pipeline. The contributions are:

- A definition of the datapipeline has been made, from the perspective of the customs administration. This definition enables future researchers in the field, to determine if a certain designed or implemented data-exchange process can be considered as a datapipeline. The research shows that the definition is useful as such, by applying it on the SSTL Ph3 data-exchange process.

- Two dominant assumptions about the data pipeline have been disproven: The idea that data has to be captured at the source, and the idea that the data pipeline has to be developed by the private sector.

- The concept of the data pipeline has been extended, by adding the CBM scenario as a driver for datapipeline development, and by adding by the exchange of governmental data, in addition to trade data. Having governmental data increases the reliability of trade data.

- The research identified operationalization of compliance and trade facilitation as relevant topics for future research. These topics is also very relevant for further research on the SSTL Ph3 data-exchange process.

7 Contribution for practice

For the reasons explained in Chapter 1 Introduction, it is relevant for Dutch Customs to have an answer to the problem definition of this research:

How does the SSTL Ph3 data-exchange process relate to the data pipeline concept, and does the SSTL Ph3 data-exchange process help Dutch customs improve compliance and trade facilitation?

This research provides Dutch Customs with an answer, by concluding that the SSTL Ph3 data-exchange process is a very special type of datapipeline. It is driven by a Coordinated Border Management initiative, besides trade data it also exchanges government data, and it focusses on import control i.e. safety and security risk assessment on the ENS. This is unique value proposition.

In addition, several recommendations were made, to fully benefit from the potential of this very special type of datapipeline (see 5 Recommendations).

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Appendix - Traceability table SSTL Ph3 user needs

Functional need	DG TAXUD (2018) User need ID
1	N1, N5, N9
2	N1, N5, N9
3	N6
4	N6
5	N11
6	N2
7	N2
8	N3
9	N/A
10	N/A
Non-functional need	
1	N2, N3, N12
2	N4
3	N7
4	N8
5	N10