Master Thesis

Design of a Global Customs Platform: more than connecting data

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Executive summary

A no-deal Brexit has exacerbated the existing and growing problem of customs brokers of receiving reliable and complete shipment and trade data in order to submit a compliant customs declaration. With the prospect of a possible additional annual amount of 1,3 Mil. declarations due to Brexit with in average 35-40 different shipments loaded into a single truck, Kuehne+Nagel (KN), a worldwide operating logistics company, used its IT landscape and experience to develop a customs platform that is aimed at capturing data at the source from different and various sources and information systems available in the KN IT landscape. This has led to the development of the 'ClearBox'.

The objective of this research is to enquire the suitability of an existing system, possibly after adjustments, to demonstrate sufficient reliability of the data and therewith customs and supply chain compliance toward enforcement agencies. This assurance should enable these agencies such as Customs to lower the risk profiles in the supply chains. This objective has led to the following research question:

To what extent can 'ClearBox' function as a data pipeline that may support KN and its customers, upon import into the EU, to demonstrate their compliance toward enforcement agencies such as Customs in order to reduce their risk profiles at these agencies?

The theoretical background describes the data pipeline concept which is an IT innovation enabling a timely provision of data captured at the source from different and various sources and information systems available in the supply chain. The data pipeline makes data available at the moment it is available to the providing party (Klievink, et al., 2012). Key requirements within the data pipeline concept are that source data is shared by the use of high quality systems that support business processes 24/7 (Pruksasri, Van den Berg, & Hofman, 2012). Essential to the data pipeline concept is that businesses themselves can ensure the data quality in their own systems, which would enable government agencies to piggyback on the business data as part of their information and systems based control approach (Tan, Bjorn-Anderson, Klein, & Rukanova, 2011).

This theoretical background describing the data pipeline concept is used as basis to assess to what extent the 'ClearBox' functions as a data pipeline in the two main case studies in this research. The purpose of these case studies is to gain more in-depth insight into the challenges that are faced within a specific product supply chain and how the 'ClearBox' can provide assurance on a number of common mismatches.

The first case study focuses on a "pull from market" product specific supply chain of a hi-Tech company. Both the export and the import stages of the supply chain are directly controlled by KN, which makes it possible to perform reliable verifications between the logistic milestones and the trade data.

The second case study focuses on a "push to market" product specific supply chain of a fresh produce company. Different from the hi-Tech case study KN only controls directly the import stage within the supply chain.

The fresh produce case study shows that 'ClearBox' works best when there is full control over the export and import stages in the supply chain. If this is not the case, additional processes and measures are required to ensure a timely and correct verification between the data and the goods in order to reach the same assurance level as when having full control over both the import and export stages. Therefore, it can be concluded that not every supply chain is suitable for the use of the 'ClearBox' as a data pipeline.

The difference between 'ClearBox' and the data pipeline concept is that the 'ClearBox' does not consistently use the data directly from the source at every stage of the supply chain. Instead it performs a logical verification between the trade data and the logistics data, which makes it possible to overcome mismatches between the data and the goods in the supply chain. The reliability of the trade data that is available in both case studies is highly dependent on many logistical operations and milestones. The data quality in both case studies is of a high level. Nevertheless, the quality and reliability of the data is safeguarded in a different manner. In the hi-tech case study, a thorough refinement of the logistical milestones ensure the necessary reliability. In the fresh produce case study this assurance is achieved by taking additional measures within the supply chain processes of the individual supply chain actors.

Another difference between the data pipeline concept and 'ClearBox' which is described in the theoretical background, is that the 'ClearBox' does not allow piggy backing on the data by enforcement agencies. As additional trade data such as purchase orders and delivery orders are systematically used to generate the customs declaration, Customs could perform an Electronic Data Processing audit (EDP-audit) on the 'ClearBox', which would provide them sufficient assurance on the correctness of the data. Additionally, access to the 'ClearBox' can be provided to Customs on a customer level via an existing customer portal. This portal could be positioned towards Customs and other enforcement agencies as a 'compliance dashboard' which can be used for auditing purposes. The dashboard would eliminate the need to use extra source data to cross-validate the accuracy of the customs declaration.

The case studies show that every supply chain contains different risks, which are dictated by the nature of the product, its origin and the actors in the different stages of the supply chain. The risks of deviations between the data and the shipment are not limited solely to the consignment completion and the deconsolidation moment. The 'ClearBox' allows the recording of every movement of the goods within the supply chain. In combination with the available trade data a high level of traceability and control can be achieved.

Based on the research and analysis performed, it can be concluded that the 'ClearBox' deviates from the data pipeline concept on some elements, but this does not come at expense of the reliability and completeness of the data. Therefore it can function as a data pipeline for selected supply chains. The combination of trade data and refined logistics data offer sufficient guarantees that make it possible for enforcement agencies to reduce risk profiles.

List of abbreviations

3PL	Third party logistics
4PL	Fourth party logistics
AEO	Authorized Economic Operator
BTI	Binding Tariff Information
CCP	Consignment Completion Point
CE	Conformité Européenne
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CN	Combined Nomenclature
CPO	Customer Purchase Order
DN	Delivery Note
EDI	Electronic Data Interchange
EDP	Electronic Data Processing
ENS	Entry Summary Declaration
ErP	Energy related Products
EU	European Union
FSC	Forest Stewardship Council
HACCP	Hazardous Analysis and Critical Control Points
HMRC	Her Majesties Revenue & Customs
HS	Harmonized System
ILP	Integrated Logistics Provider
IoT	Internet of Things
ISO	International Organization for Standardization
LCL	Less Container Load
KN	Kuehne + Nagel
KPI	Key Performance Indicator
LNP	Logistics Network Partner
MNE	Multinational Enterprises
PO	Purchase Order
RDC	Regional Distribution Centre
RFID	Radio-frequency Identification Device
RFQ	Request for Quotation
RoHS	Restriction of Hazardous Substances
SAD	Single Administrative Document
SOA	Service-Oriented Architectures
SOP	Standard Operating Procedure
TMS	Transport Management System
TSP	Transitional Simplified Procedure
UCC	Union Customs Code
UK	United Kingdom
ULD	Utility Loading Device
WMS	Warehouse Management System

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1. Introduction

In the last 25 years globalization has brought a shift in trade patterns from developed to developing economies (Our World in Data, 2018). Many companies have dispersed their supply chain activities, sourcing, product engineering, manufacturing, and logistics across the world. The globalization of supply chains leads to goods crossing national boundaries several times during the production process.

The complexity of customs and global trade transactions has also changed: international businesses are being held by governments to increasingly strict standards of global customs and trade compliance. Non-compliance with customs and trade regulations presents a very significant risk of increased costs, high fines and disrupted supply chains.

1.1 The increasing need for quality data within, and visibility of the supply chain

International companies not only have to clear customs correctly for all their cargo, but are also being held to increasingly strict standards of customs and trade compliance by governments all over the world. Customs and trade compliance is the process of trading and moving goods, technology, software or services internationally in conformance with all applicable laws and regulations (Tuttle Law). An increase in legislation can also be found in the controls on specific ethical product claims such as organic grown products, Fair Trade, FSC, etc. (European Parliament, 2018). End-users of products are becoming increasingly critical and better informed about products they are consuming or using. The carbon footprint is calculated, the use of (single use) plastic has gotten great attention, organic products gain warm attention of a growing group of consumers, sustainability matters (Wiersinga, Vermeulen, Snels, Fray da Silva, & Wiersema, 2013), child labor is considered unacceptable, corporate social responsibility has taken effect. Legislation covering these topics and product claims is translated in to all kinds of certificates and licenses which serve as evidence of the authenticity of the products and the conformity with the requirements that follow from this legislation. Examples include phytosanitary, veterinary, organically grown, CITES and dual use products.

Noncompliance with trade regulations presents a very significant risk of increased costs, high fines and disrupted supply chains. Supply chain scandals most likely will dent the reputation and can cost millions in the involved firms (lazarus, 2017).

A research performed by Deloitte concluded that one of the biggest concerns for companies are related to risks inherent in extended supply chains which are due to visibility shortages (Deloitte, 2017). Companies struggle with the information flows within their supply chains. A recent example can be found in a lawsuit that accuses several of the world's largest technology firms of knowingly profiting from children laboring under brutal conditions in African cobalt mines. Cobalt is an essential element in the rechargeable lithium batteries that fuel many electric devices from smartphones to electric cars. In response, one of the major technology firms that has been accused, says it removed six cobalt refiners from its supply chain in 2019 for being unable to meet the companies safety standards (Associated Press, 2019)

A straight forward example on incompliant Customs declarations that have been submitted due to incorrect and incomplete information, can be found in the research performed on incentives within the flower trade lane Kenya-Netherlands (Borst, Enning, Elswijk, & Van Kruining, 2019). The research also concludes that substantial financial damages are occurring due to mismatches in information and expectations within the supply chain. The mismatches that emerged from this study concern lacking phytosanitary health certificates upon arrival at destination, offloads (part-consignments) that have not been communicated, number count difference between actual quantity shipped and manifested, labeling deficiencies between goods and documents, and quality differences.

Solving these mismatches can mean enormous added value for companies selling to consumers in cross-border trade. The research also concluded that introducing incentives to stimulate the sharing of this information does not address the issues at stake within the supply chain to satisfaction as they have mostly a short-term effect and are costly to maintain. One of the recommendations arising from this study was the use of source data through the set-up of a data pipeline. This data pipeline concept which is earlier proposed by Klievink, et al.

(2012) and Pruksasri, Van den Berg, Hofman & Daskapan (2013) is aimed at collecting information from the moment the goods are packed, as this party has the best knowledge about the content of the shipment.

1.2 The role of the customs broker and recent developments

Having the data from the source does not necessarily mean that the data is actually reliable and up-to-date. The research performed on incentives within the flower trade lane Kenya-Netherlands does also show that mismatches between the data and the physical shipment can occur during the transport and handling of the shipment as a result of various actors performing manual actions. It also appears that these actors have conflicting interests in some aspects.

For customs brokers that generally act as an intermediary between importers/exporters and customs administrations in customs clearance processes, the verification of the reliability of the data provided is challenging. Brokers' knowledge of customs laws and processes in addition to their work experience can be useful not only for importers/exporters (their customers), but also for customs administrations: while customs brokers support importers/exporters by providing all necessary documentation and undertaking formalities related to cargo clearance, they are also expected to maintain government interests by ensuring compliance with customs and other regulatory requirements as well as the collection of appropriate duties and taxes. Combining these customs brokerage services with logistics services such as transport and warehousing can create a high level of compliance with customs and trade laws and regulations.

Nevertheless an increasing number of large companies and multinational enterprises (MNE's) are rationalizing their customs brokerage activities and make a distinction in their Request For Quotations (RFQ's) between customs brokerage and forwarding/logistics services. This rationalization focusses specifically on reducing the number of customs brokers that are used within the supply chain of a single enterprise. Reasons for this trend are related to risk mitigation, specific expertise that is required opposed to a logistics provider providing operational customs services as a "side-line' business, and a growing demand for visibility and traceability of the customs processes within the supply chain. Considerations made by MNE's, is in addition to the track record of the specific customs broker, the local presence and the ability to provide control tower functionalities based on uniform standards and norms. KN notices an increase in this demand based on the various RFQ's that we received in recent years.

An increasing risk of noncompliance with customs and trade laws and regulations and the potential financial risks, causes companies to outsource their customs brokerage to dedicated customs experts. Particularly in tenders launched by multinationals, Authorized Economic Operator (AEO) license has become a pre-requisite to qualify in cross-divisional customs bids (Request For Quotation) the exclusion of such could be prompted in lacking a required customs accreditation. Additionally there is a desire to appoint as few brokers as possible in order to keep reporting and KPI's aimed at monitoring the compliance level within the supply chain as uniform and complete as possible and to streamline communications.

1.3 How a No-deal BREXIT has led to the build of a data platform within Kuehne+Nagel

A no-deal Brexit scenario and the risk of full truckloads of shipments waiting for clearance at Dover has created a broad awareness of the importance of customs data and statuses (bonded, free circulation, selected for verification, etc.) within companies trading with the UK. The expected additional annual declarations in combination with mostly LCL (less than full container loads) shipments provides an enormous challenge for logistics providers. The object of study of this research, Kuehne + Nagel (KN), expects an additional annual amount of 1,3 Mil. declarations due to Brexit with in average 35-40 different shipments loaded into a single truck. In order to prevent ramping up workforces along the Channel to deal with the additional workload, KN realized the importance of re-using customs data which is already available within individual KN country organizations.

KN, being a world-wide operating logistics company with over 83,000 employees at more than 1395 locations in 109 countries, owes much of its current market share to tailor-made IT applications that record logistics data

and shipment statuses. The applications that have contributed to KN being the market leader in both sea freight and air freight in 2019 are primarily focused on sharing consignment and carrier information. In preparation of a no-deal Brexit, KN used its IT experience to develop a customs data platform in which all relevant national customs applications and KN logistics applications are connected to one single customs application, the KN Customs Tool. This application is able to receive customs relevant data from KN and non KN systems, and it is able to enrich this data and forward it to the national customs applications. This process of collecting, enriching and transmitting customs data is named 'ClearBox'.

The ClearBox has the characteristics of a data-pipeline since it collects and uses shipment information between KN stations. Internal information such as airway bill/ bill of lading details and status information concerning the physical handling of the shipment are collected from the forwarding application, the different warehouse management systems and transport management systems and is used to fill the customs declarations. Additionally external information from carriers (e.g. KLM), such as manifest data and timestamps of uplift and offload statuses, and information from sellers/shippers such as number of pieces/packages, can be used to improve the data quality of the customs declarations.

The current IT development of the ClearBox foresees in a two-way direction connection between the national customs applications of the large KN countries (Germany - Zodiak, France - Descartes, Netherlands - Streamliner, Belgium - Streamliner and Luxemburg - Streamliner) and the national customs application ICE in the UK. Export declaration data is shared with the country application of destination and in some occasions this export declaration data can be enriched with relevant import data based on standard customer instructions and Standard Operation Procedures (SOP's). This relevant import data exists of the 'Country of Dispatch', 'Quota authorization number' and the 'Preference data' (Sloot, van der, 2019). In addition to these separate import data fields, the import process is based on a different level of detail at the commodity code level. Where the export from the European Union (EU) is based on the 6-digit Harmonized Commodity Description and Coding System which was developed by the World Customs Organization, the import in the EU and the UK may require at a national level ten or more digits (Porath, 2020). A next step in the ClearBox development is to also connect the countries Norway, Switzerland and Russia.

Connecting the national customs applications of the KN customs organizations within Europe (and in a later stage globally) to the KN Customs Tool and merging relevant shipment and status information (bonded, free circulation, free zone, etc.), provides a valuable overview of customs and trade information. This information forms the basis of a to be developed global trade management platform that provide easily retrievable data and reporting capabilities which enable companies to take full advantage of the main categories of duty savings programs; free trade agreements/trade preference programs, duty drawback and bonded warehouses/free trade zones/free trade areas (Deloitte, 2017).

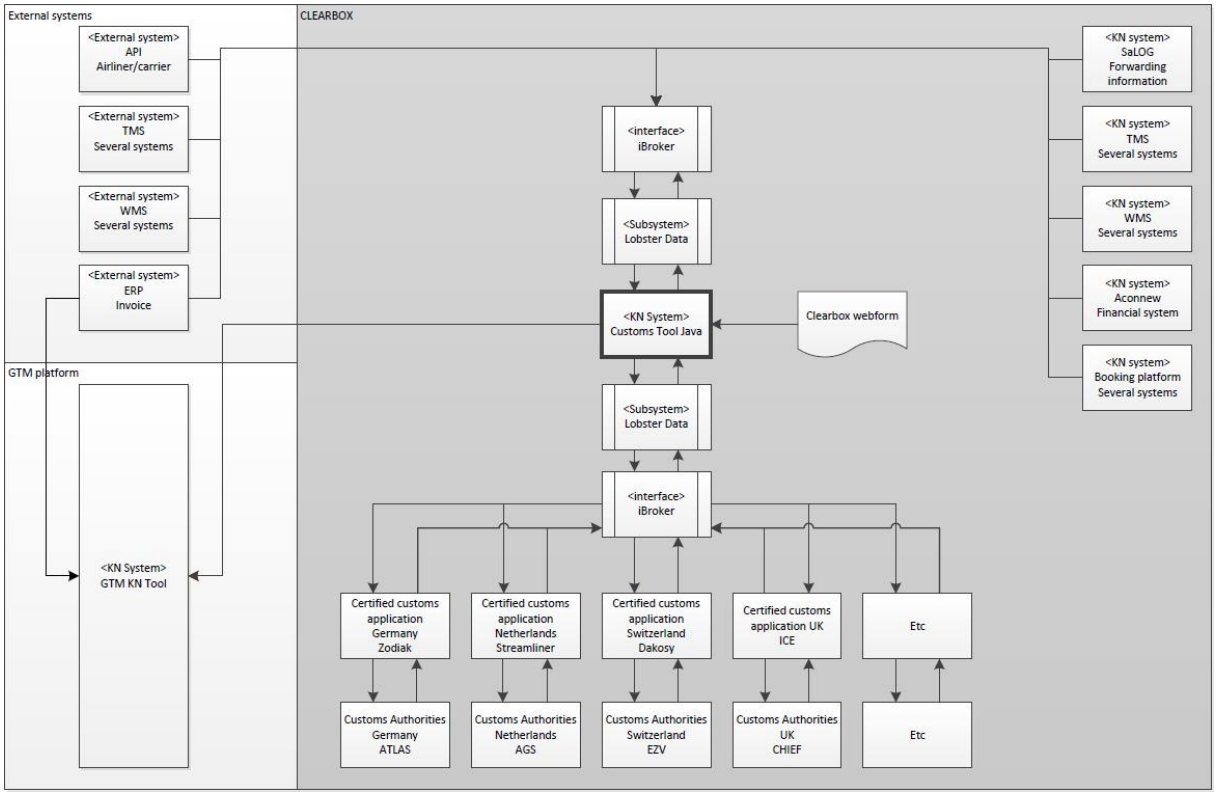

Figure 1: schematic overview ClearBox

2 Problem definition:

A no-deal Brexit has only exacerbated the existing and growing problem of receiving reliable and complete shipment and trade data in order to submit a compliant customs declaration. As freight forwarder, KN has a lot of shipment data available which originates from many different systems, both internal and external. This puts KN in a seemingly good position to set up and use a data pipeline concept for its customs brokerage activities. Besides the usual challenges that the creation of a data pipeline entails, such as security risks and the technical barriers to bring the data together, the most important aspect is probably the reliability of this data.

Can a customs broker rely on the data provided by a system? What certainty does the customs broker have that an arrival notification of a shipment matches the physical location of the goods? The vast majority of shipments are still sent without an RFID tracker and piece count still requires in most occasions manual action in the warehouses (Ceelie, 2020).

The fragmentation of supply chains and the increasing legislative burden cause a growing risk of noncompliance for companies that are trading internationally. The research on the flower trade lane Kenya-Netherlands describes five main mismatches that are occurring within the international trade movement of goods within a supply chain (Borst, Enning, Elswijk, & Van Kruining, 2019). These mismatches are:

1. Lacking import/export certificate
   Some products have strict export and/or import rules. If you want to export or import these products, you may need an import/export permit, certificate or other document. In some occasions license requirement only applies to certain products from certain countries. Permits and certificates are required for strategic goods, agricultural products and (products of) endangered exotic animal and plant species and medicines. It may differ per product which authority issues these documents.
2. Non-communication about offloads or part-consignments
   During the transport of the shipment it may occur that due to a lack of freight capacity a shipment is split into separate parts. However, export and import certificates have already been drawn up and

issued by the authorities. For some products, such as phytosanitary and veterinary products, it is mandatory to submit a pre-declaration before arrival of the consignment in the EU, on the basis of which a risk analysis and possible check is scheduled.

3. Number count differences between actual quantity shipped and manifested
   Each shipment entering the EU must be preceded by an Entry Summary Declaration (ENS). This declaration contains advance cargo information about consignments entering the EU and is based on the manifest data. The ENS is intended to enable customs to conduct a risk analysis for security and safety purposes. If the number of pieces that have actually been sent differ from the numbers stated on the documentation among which the manifest, no proper assessment of the safety and security risks can be made. Smuggling may go unnoticed as a result.
4. Labeling deficiencies between goods and documents
   The primary purpose of a product label is to identify the specific product which is shipped and may make reference to a production batch or purchase order. Depending in the type of product, the label should make reference of product safety measures and/or product claims such as organically grown. As the customs declarations are based on the shipment documentation which is provided, these documents should match the labeling of the products.
5. Product quality differences
   Quality differences between the products shipped and the products that are mentioned on the shipment documentation may affect tax compliance aspects, product safety aspects and health safety aspects. The tax aspects are related to the risk of over- or undervalue the products which are shipped. Safety aspects may refer to dangerous products or substances which can be harmful to humans and animals. Health aspects may refer to fresh foodstuffs that are shipped under high temperatures and therefore no longer suitable for human consumption.

In addition to the risks mentioned above there are the known risks of undervalue and overvalue (Hesketh D. , Weaknesses in the supply chain: who packed the box?, 2010):

6. Undervalue
   This risk is typically related to the import process in which duties and taxes are based on the customs value of the products.
7. Overvalue
   This risk is typically related to the export process in which value added taxes can be reclaimed.

Part of the challenge of obtaining reliable data is the traceability of products in the supply chain. Raw materials, semi-finished and end products are sourced all over the world. This makes it difficult for companies to keep control on aspects that are related to the product, its production, trade transactions and the movement of the product that may impact the customs and trade compliance level of a company.

The setup of a data pipeline such as 'ClearBox' can increase the compliance level of the supply chain, especially since the ClearBox also offers the possibility to link valuable shipment statuses to the available electronic data that is required for the submission of a customs declaration. Connecting the different systems, including the national customs applications (e.g. Streamliner, Zodiak, ICE), entails challenges that relate to the technical limitations of the different systems, the uniformity of the use of shipment statuses, the uniformity of customs data between the different countries and customs regimes, and the data quality that is present in the different systems.

An example of such a difference within the required customs data fields between customs regimes is the introduction of the 'Transitional Simplified Procedure' by Her Majesties Revenue & Customs (HMRC) in February 2019 (HRMC, 2019). This specific code is not included for example in the explanatory notes of the Single Administrative Document (SAD) ((Overheid, 2014)) in the Netherlands nor is it part of the code book that has been published by the Customs Administration of the Netherlands (Belastingdienst, 2019).

Apart from the technical challenges, the question is what level of traceability is required to reduce risks in the supply chain and therewith being able as a customs broker to demonstrate compliance toward enforcement agencies such as Customs in order to lower their risk profiles at these agencies.

2.1 Research goal

The data pipeline concept originates from an initiative made by the English and Dutch Customs authorities that included a new information exchange system based on the assumption that the data at origin (i.e., the place where data enter the system) should be considered as most genuine and, therefore, most correct (Hesketh D. , Seamless electronic data and logistics pipelines shift focus from import declarations to start of commercial transaction, 2009). The data pipeline has to be a private sector driven development. As the business community is too fragmented and has many and diverse interests in setting up a data pipeline, many initiatives remain in the concept phase. It is precisely because of this fragmentation that it is valuable to carry out this research at a logistics provider such as KN, which as a supply chain actor has a direct link with carriers, and also manages third party logistics providers to outsource elements of its distribution, warehousing and fulfillment services. The KN 'ClearBox' IT setup seems to contain many characteristics of a data pipeline as it is aimed at reusing all relevant shipment data for completing a compliant and timely customs entry.

The aim of this master thesis is to enquire the suitability of an existing system, possibly after adjustments, to demonstrate sufficient reliability of the data and therewith customs and supply chain compliance toward enforcement agencies such as Customs in order to lower the risk profiles at these agencies.

The main objective of this research is to find out to what extent the 'ClearBox' is able to function as a data pipeline which provides sufficient assurance on the reliability of the customs data. Moreover, the research will delve into the required level of traceability of the products and the customs data within the supply chain in order to demonstrate compliance towards enforcement agencies.

2.2 Research questions

Based on the research objective as described above, the main question which this research seeks to answer is the following:

To what extent can 'ClearBox' function as a data pipeline that may support KN and its customers, upon import into the EU, to demonstrate their compliance toward enforcement agencies such as Customs in order to reduce their risk profiles at these agencies?

In order to answer the main research question, several aspects of the problem will have to be further investigated. This leads to the following sub-questions which will help to unfold the problem at hand and ultimately will help to answer the main question of this study. The following sub-questions have been formulated:

a) What challenges are related to connecting the different country IT applications?
b) What challenges are related to the completeness of the data within these applications?
c) What challenges related to the quality of the data are encountered when setting up 'ClearBox' as a data pipeline?
d) What level of traceability on the products and customs data within the supply chain is required in order to demonstrate compliance towards enforcement agencies?

2.3 Methodology

In order to address the research questions, a qualitative research is used to empirically investigate to what extent the existing 'ClearBox' set-up can be used as a data pipeline which provides sufficient and reliable data that can be used to complete customs declarations.

The methodology used in this research is a multiple case study analysis, supported by literature study and qualitative interviews.

In depth case studies on a food supply chain, a sector that is specifically dealing with consumer's sensibility which is triggered by several food scandals in the 1990s and 2000s (A. Bernard, 2002) (Xiu & Klein, 2010), and a hi-Tech supply chain, will provide insight in the level of traceability that is required to reduce the risks in the field of customs and trade compliance.

Literature consisting of white papers, academic papers, journals and IT application manuals will be consulted to gain insight in the challenges associated with a data pipeline concept, market developments & requirements, government policy, learnings from the food supply chain sector and IT application standards and developments.

Qualitative interviews with a limited number of key experts with different backgrounds will be consulted to have a clear understanding of the current as-is IT platform and the requirements for a to-be situation. Additionally the input of experts will be used to understand the level of traceability which is required to reduce risks.

The following key experts will be consulted:

Sabrina Benz Kuehne+Nagel
Position: Team lead regional customs applications
Expertise: Development of 'ClearBox' and KN Customs Tool

Motivation for selection:
Mrs. Benz has witnessed the development of the KN Customs Tool and the 'ClearBox' from the very beginning. In addition to her technical knowledge, she has valuable experience related to the process challenges that arise when connecting different IT applications and bringing data together from different applications.

Ed Kooij Kuehne+Nagel
Position: Customs application specialist
Expertise: Development of EDI interfaces with customers and KN Customs Tool

Motivation for selection:
Mr. Kooij is responsible for the customs application team which is part of the NL IT solutions team. In this role he was closely involved in the development of the 'ClearBox' setup for Brexit. As such Mr. Kooij is also directly involved in the developments of the hi-Tech setup with the 'ClearBox' and the further roll-out of the developments to other customers and goods flows.
His experiences are valuable to gain more insight into the technical challenges.

Dennis van Dongen Kuehne+Nagel
Position: IT Solutions Architect
Expertise: Technical and practical restraints of connecting IT applications

Motivation for selection:
Mr. Van Dongen is not only familiar with the IT applications that KN offers, but also has insight into the latest IT developments from his role as IT Solutions Architect.

Renée Wokke Cargonaut
Position: Senior consultant data & Innovation
Expertise: technical and practical restraints when setting up a data-pipeline

Motivation for selection:
Mrs. Wokke has experience in creating international partnerships within a complex field of stakeholders. Her involvement in 2 data corridor projects with Singapore and Mumbai provides valuable insight into the challenges expected in setting up a data pipeline.

Jos Ceelie Kuehne+Nagel
Position: Team Lead Customs Air logistics & Local Trade Compliance Manager
Expertise: Logistical and compliance challenges within hi-Tech supply chain

Motivation for selection:
The operational customs team air logistics falls under the responsibility of Mr. Ceelie. This team is responsible for the customs handling of all products that are shipped by air cargo and vary from pharmaceuticals to aircraft engines. As 'Local Trade Compliance Manager' Mr. Ceelie is also familiar with the restrictions associated with export controls.

Diederick Olijve Blue Skies Holding Ltd
Position: EU Logistics & Operations leader
Expertise: Logistical and compliance challenges within food supply chain

Motivation for selection:
Mr. Olijve is responsible for the logistical an operational part within the supply chain of BlueSkies. His experience is not only limited to the logistics components in the supply chain, but he has also valuable knowledge concerning the product specific requirements that are determined by the retailers.

This paper is structured as follows. The first part of this thesis will describe the theoretical background that focuses specifically on the concept of the data pipeline, the background of its emergence and the challenges this poses within international supply chains. The next section describes the background of the IT landscape of KN and the development of the KN Customs Tool over the recent years leading to the setup as it is in use today. This section is concluded by the findings emerging from the various tests to connect the national customs applications of Belgium, The Netherlands and Luxemburg to the KN Customs Tool in order to prepare customs declarations in the UK and vice versa. The case studies are described in section 4 followed by the findings. These findings describe the extent to which the chain of custody can be reached within the hi-Tech and fresh produce supply chains and the technical challenges associated with connecting the various systems within the supply chain to the KN Customs Tool. In the final section the results are discussed and conclusions are drawn.

3 Theoretical Background

3.1 The Data Pipeline concept

The data pipeline concept or "Seamless Integrated Data Pipeline" is an IT innovation based on the use of Service-Oriented Architectures (SOA) enabling a timely provision of data captured at the source from different and various sources and information systems available in the supply chain. The data pipeline makes data available at the moment it is available to the providing party. The access to this data is controlled in the data pipeline by security technology in such a way that only actors, authorized by the owner of the data can have access to this data (Klievink, et al., 2012). The data pipeline concept focusses on the "SHIP" phase within the standard trading model, known as the "BUY-SHIP-PAY model (Unece, 2001) and is aimed to support the international supply chain to maximize the overall value generated by unlocking data and shipment statuses. Key requirements within the data pipeline concept are that the source data is shared by the use of high quality systems that support business processes 24/7 and that the information exchanged is secured and reliable (Pruksasri, Van den Berg, & Hofman, 2012).

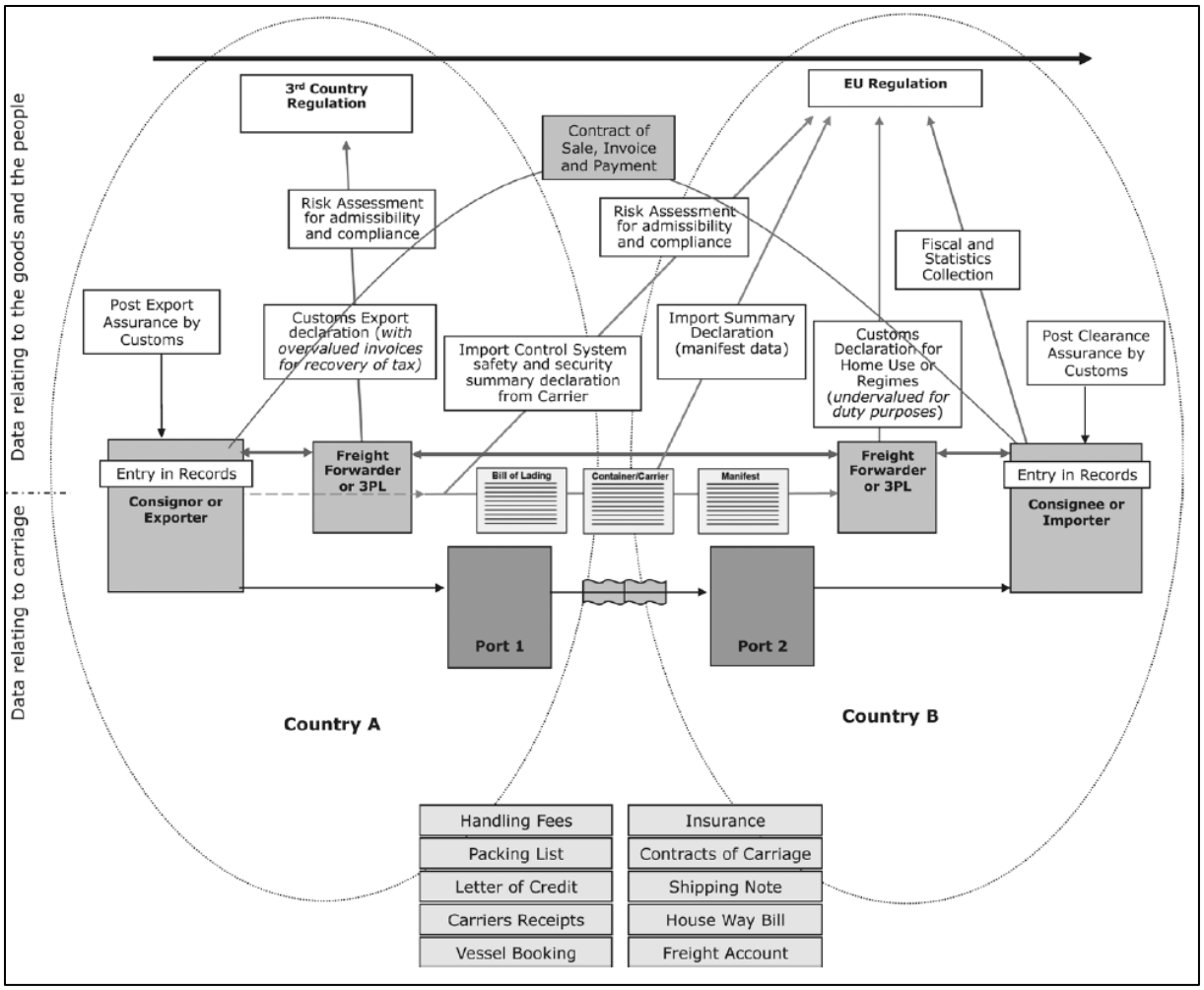

Figure 2: Current international trade system and customs (Hesketh D. , 2010)

A main benefit of the data pipeline concept from a business perspective is that the supply chain actors can optimize their operational processes and planning as they can be informed about any discrepancies or delays within the logistics process as is foreseen in the Holland Flower Alliance information sharing project (Berg, 2016). Given the increase in international trade, and the substantive risks involved, border management has also increased in complexity, and can cause time delays, cost increases, as well as reductions in the competiveness of supply chains (Holloway, 2010). Therefore it makes sense that the setup of a data pipeline is typically of use in a supply chain with a global character. Examples of time delays and cost increases in the supply chain are shown in the research performed on incentives within the flower trade lane Kenya-Netherlands (Borst, Enning, Elswijk, & Van Kruining, 2019). Based on the 5 main mismatches that are described in the research on the flower trade lane, the optimization of the operational processes and planning can potentially save unnecessary costs compromised by transportation costs, information costs, contract enforcement costs, local distribution costs and costs incurred due to noncompliance with trade regulations. Together with the costs associated with policy barriers and with the use of different currencies, these costs form part of the total trade costs that can be reduced when companies are made aware of it (Anderson & Van Wincoop, 2004).

Information related to policy barriers is not typical information that is shared in a data pipeline, but the concept enables companies to lay down an information layer that can serve as a basis for more in-depth information that is typically provided by a Global Trade Management information structure. Typical information that is shared in a data pipeline concept is information that is used for filling timely and compliant customs declarations. This information is retrieved from different sources varying from the forwarding agent at origin to the importer itself. Each actor can by either providing information or confirming the validity of this information, a valuable contribution to a transparent supply chain. This can vary from a shipment status to detailed information related to the financial transactions.

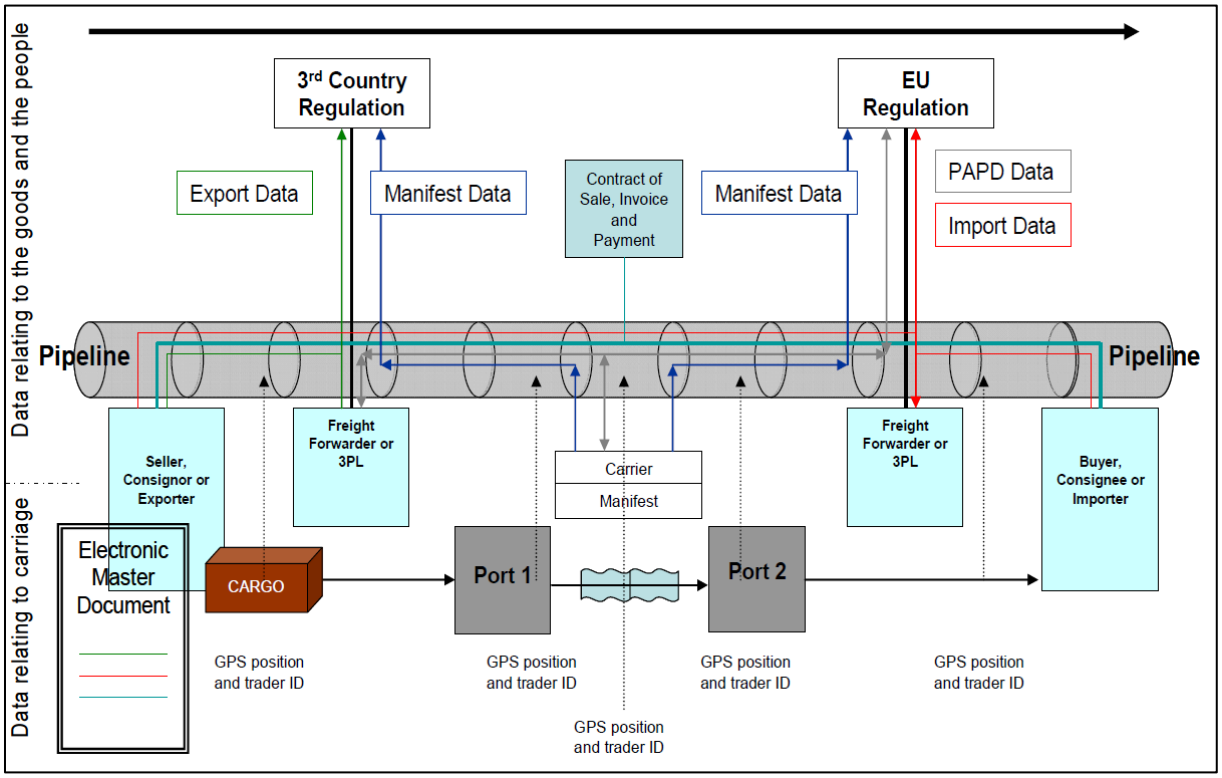

Figure 3: International trade system and customs in pipeline situation (Hesketh D. , 2010)

A benefit from both government and business perspective is, that if the data within the pipeline is originating from the source and is not compromised and timely provided, this data enables government inspection agencies to perform a better risk analysis of the shipment and the goods. Key role in this process is reserved for the consignor and the true packing list. The Consignment Completion Point (CCP), introduced by David Hesketh as a key performance indicator, is the moment within the supply chain in which the purchase order, the description of the goods, the contractual agreements related to the (sales) transaction and transport come together (Hesketh D. , Weaknesses in the supply chain: who packed the box?, 2010). As a result of the data originating from the source and the confirmation of the CCP, risk analysis on the shipment and the goods can be executed more effectively which can save time upon arrival at the port of destination or transit. If all parties that are receiving and/or shipping the goods can be secured and no alerts or suspect changes to the route have been reported, the shipment in principle could be treated as a green lane shipment, which implicates a minimal inspection rate.

If there is a need for a physical customs inspection, the inspection may in certain cases be shifted to a non-bonded warehouse location at e.g. the premises of the importer. The data pipeline therewith facilitates a decoupling of border management activities from the actual moment of border crossing (Klievink, et al., 2012).

The data in the data pipeline as described, remains with the individual companies that are responsible for it. To make full use of the benefits of the data pipeline such as green lane treatment when crossing a border, it is essential that the businesses themselves can ensure the data quality in their own systems. If this can be ensured, this enables government agencies to piggyback on the business data as part of their information and systems based control approach (Tan, Bjorn-Anderson, Klein, & Rukanova, 2011). As a condition the government agencies must be given access to the data. Therefore the data pipeline concept requires a public-private governance model (Klievink, et al., 2012).

3.2 Challenges within the international supply chain and the data pipeline concept

The creation of a data pipeline within a supply chain has to be driven by the private sector as businesses are able to link the data together and make agreements regarding the sharing of this data. As the supply chain

consists of many parties that are involved directly or indirectly, the business community itself is very fragmented and has too many and too diverse interests to realize a data pipeline infrastructure (Klievink, et al., 2012). The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves. The primary purpose of any supply chain is to satisfy customer needs and, in the process, generate profit. Within a supply chain the end customer may not always be clear for every supply chain actor (Chopra & Meindl, 2016). A trucking company in the country of export has a different customer to satisfy than the seller of the consumer end product. As a result the interests within the supply chain between the different actors may differ per actor as seen in the flower trade lane Kenya-Netherlands case.

The term 'supply chain' may imply that actors are acting in a consequent order and taking action after the previous actor completed a stage. In reality supply chains are more networks which are operating in a web of transactions. Each stage within the supply chain is connected through the flow of products, information, and funds (Chopra & Meindl, 2016). This makes the development and implementation of a data pipeline complex, as many technical and organizational challenges need to be overcome.

As the concept requires that all global partners would be linked up to one single pipeline, a natural implementation of the data pipeline involves the set-up of many (web-based) information services (Hofman, 2011). This is definitely not the standard implementation approach of current information systems in the international supply chain. Besides linking the data together, other obstacles that need to be overcome are related to the realization of secure and efficient data access and other information security characteristics such as data confidentiality, data integrity and accountability (Pruksasri, Van den Berg, & Hofman, 2012)

3.3 An increasing need of traceability

In today's global economic system, countries globally exchange not only final products but also intermediate inputs. Today one fourth of the total global production is exported (Our World in Data, 2018). This globalization of the supply chains results in goods produced in one part of the world being transported to another part of the world. Within the hi-Tech industry supply chain for example, this means smart phones are assembled in China, but actually consist of various many components which are produced in different countries. Within the fresh produce supply chain this globalization results in supermarkets offering fruits or vegetables independent of the season.

Where the data pipeline concept is based on the 'SHIP' phase within the Buy-Ship-Pay reference model that has been developed by UN/CEFACT, the information detail level that is often requested by companies, actors within a supply chain and authorities extends beyond the standard data that is part of this 'SHIP' phase. Examples can be found in the food sector where the quality assurance demands ideally a full traceability of each individual ingredient of the end product to provide not only assurance for consumers but also helps to meet the increasingly stricter national and international regulations (Behnke & Janssen, 2019).

The need to trace ingredients or parts of products is not only limited to the food sector. The annual report of 2017 from RAPEX shows that the top 5 dangerous product categories within the EU are: toys (29%), motor vehicles (20%), clothing, textiles and fashion items (12%), electrical appliances and equipment (6%) and childcare articles and children's equipment (5%). The top 5 most notified risks was injuries (28%), Chemical (22%), choking (17%), electric shock (10%) and fire (6%) (RAPEX, 2018).

Noncompliant products that are brought into the EU form a threat to the most fundamental freedom of the EU, the free movement of goods. According to the EU parliament, consumers within the EU must be able to rely on the safety and reliability of product claims. The parliament recognizes that there are still unsafe and noncompliant products which undermine consumers' trust in quality, the safety, the security and the environmental friendliness of the products. This endangers consumers and other public interests and puts businesses which comply with the rules at a competitive disadvantage therefore it introduced a proposal for a regulation that is laying down rules and procedures for controls on products entering the EU market. In order to prevent unsafe or noncompliant products to be placed on the EU market, the Customs authorities are required to carry out adequate checks before they are released for free circulation (European Parliament, 2018).

The focus of this research is on the product specific compliance requirements for hi-Tech and fresh produce supply chains that play a role when importing in the EU. These product specific compliance elements are focusing on;

- Product safety
  The safety of non-food products is covered by a general directive on product safety (Directive 2001/95/EC), supported with several product specific Directives. Specifically for the hi-Tech supply chain the Directives on the Restriction of Hazardous Substances (RoHS) (Directive 2002/95/EC) and on Energy related Products (ErP) (Directive 2009/125/EC) is applicable. The safety of food products is covered in Regulation (EC) No 178/2002.
- Protection of flora and fauna
  The protection of flora & fauna is covered by Regulation (EC) 2016/2031
- Product claims
  An example in the fresh produce supply chain is the control on organic grown production, such as organically grown avocados or asparagus. Carrying the label of organic grown products requires mutual recognition between the third country and the EU based on the growing conditions. This mutual recognition is reflected in an internationally recognized certificate which should be presented upon import into the EU (Regulation (EC) No 834/2007).
- Tax aspects
  Import duties and taxes are levied on the basis of the UCC and national legislation. All import duties imposed by the European Union are included in the Common Customs Tariff (Regulation (EC) No 2658/87). The import duties of the Common Customs Tariff are linked to the description of the goods and the codes of the Combined Nomenclature and the country of origin (Regulation (EC) No 2658/87). At the basis of the duties are the following elements of interest; chargeable event, object of levy, taxable amount, import tariff. The taxable amount may include the customs value or price (free-at-frontier price or CIF-price, which are Incoterms that are based on an international set of rules on delivery conditions, risks, obligations and cost agreements. It may also include quantity (kilograms, liters, etc), area (square meters, etc) and combination of these elements (Douane Belastingdienst, 2016)
- Sanctions
  Sanctions also apply to imports. As a result, the import of certain goods from certain countries is prohibited or may only be done with a license. In these cases, the Customs authorities check whether the license required for import is included with the goods.

The Buy-Ship-Pay reference model distinguishes 5 stages:

1. Prepare for export
2. Export
3. Transport
4. Prepare for import
5. Import

In the case of assembled products, which is very common in the hi-Tech supply chain, the buy-ship-pay model may be repeated several times before goods are imported in the EU. For a data pipeline to provide sufficient assurance for governmental authorities to lower risk profiles on flows of goods entering the EU, some of the information that is shared within the supply chain requires a certain level of traceability of these goods within the supply chain and verification on the data that is shared with data originating from other supply chain actors. The degree of traceability required by Customs authorities is laid down in the UCC in articles 188-193 UCC and 238-243 UCC IA. These articles describe the requirements for verification and release of goods. The identification measures that are described can be divided into 3 levels of traceable units:

1. production batch/ purchase order
   The production batch or purchase order batch makes reference to a batch of products that undergo the same process steps, e.g. pre-packed fresh cut fruit packages which have the same best before

date. The level of testability on the 5 compliance elements described above depends entirely on the amount of detailed information and the degree of precision that is available. Information concerning the purchase order, forms the basis for determining the customs value. Information related to origin of the product components can be used to assess the country of origin of the end product.

2. loading unit containing the same batch number/ purchase order
   The loading unit containing the same batch or order is referring to a trade unit which is sent from one actor to another actor in the supply chain, e.g. several carton boxes containing mobiles devices that are part of a single purchase order and are loaded onto a single wooden pallet.
3. loading unit containing different batch numbers/ purchase orders
   The loading unit containing more than a single batch order is referring to the consolidation of loading units in preparation for transport or storage, e.g. an air cargo loading device containing several boxes with different order numbers. During the transport of the shipment it might be necessary due to a lack of cargo space to split a loading unit that contains a single batch number. In that case a loading unit is created that contains multiple batch numbers.

In accordance with experiences from the food sector, the characteristics of a traceability system depend on the objectives and can be characterized by breath, depth and precision of the traceability system. Breath is the amount of information that is recorded, depth determines the capability of how far back or forward tracking and tracing is possible, and precision defines the level of certainty to identify a particular traceable resource unit (Behnke & Janssen, 2019).

In order to determine whether the ClearBox can act as a data pipeline that provides sufficient assurance for Customs authorities to reduce risk profiles on specific products entering the EU, it must be demonstrated by case studies that the product-specific compliance elements are supported by the different systems and that traceability of the products and the customs data can be carried out.

3.5 The KN IT landscape

3.5.1 The KN IT philosophy and the most common KN systems

Kuehne + Nagel is one of the world's oldest logistics companies and while started as a traditional forwarder, is nowadays a full service 3PL (Mangan & Lalwani, 2016). The company provides sea logistics, air logistics, contract logistics, road logistics and customs brokerage services with a focus on IT driven solutions. Within the industry KN stands out when it comes to profitability levels that are for decades above the industry average. There are two important key components for this success, of which the first consists of a stable and consistently applied operating framework, i.e. clearly defined organizational structures, processes, and key performance indicators. The second component is having stable productive business systems in place. The deep understanding of industry revenue and cost levers that exist within KN is supported by the IT landscape (Gritz, 2020).

With the help of different IT specialists from the market (IBM, BlueYonder), various global IT systems have been developed which make it possible to master shipment and supply chain data throughout the global KN network.

The main non customs KN IT systems related to this research are:

- SaLOG
  SaLOG is an acronym for the Sea Freight and Air Freight operational system which is used in all KN countries globally. SaLOG is used to make electronic bookings with carriers, generate airway bills/bills of lading and is used to record the different shipments statuses along the supply chain.
  The system follows the quality standards for the international sea cargo and air cargo industry. The shipments statuses that form the basis of the forwarding system are based on the Cargo iQ business processes and milestones which cover the standard end-to-end process of transporting cargo (Cargo iQ, 2019). The system is connected with the global e-booking platform KNLogin

- CDMS — The Cross Dock Management System is a warehouse management system (WMS) which is designed to be used as shopfloor system to support various scanning operation throughout the inbound, sorting, outbound and warehousing processes. The system enables flows through cross-docking locations at the package or serial number level for hi-Tech and Aftermarket solutions. CDMS exists of 4 modules; Transport Hub Operations, Return Hub Operations, Stock Management and Load Management.
- CIEL FW — Ciel FW is a warehouse management system which is currently being replaced by SwiftLOG. It is being used in more than 270 sites in 50 countries.
- SwiftLOG — SwiftLOG is a warehouse management system. The core of SwiftLOG is based on the BlueYonder (formerly JDA Software group) WMS, but is enhanced with completed KN internal developments existing of different layers and functionalities. The system is currently being rolled out worldwide and therewith replacing CIEL FW.
- RoadLOG — RoadLOG is one of the globally used transport management systems (TMS) within KN. Like SaLOG, the system is based on shipment statuses within the supply chain. The modules are divided among the import and export flows. The system is connected with the global e-booking platform KNLogin.

3.5.2 The KN Customs Tool, the heart of the ClearBox

The heart of the 'ClearBox' consists of the KN Customs Tool, of which the development started in 2012. The in-house development of this Customs Tool started with a specific request from the German business unit Contract Logistics who were implementing a new hi-Tech customer in their bonded warehouse operations. The business unit was in search for a solution to reduce the manual labor for preparing and submitting customs import declarations. The KN Customs tool enabled the merging of order and invoice data coming from the customer with data originating from the KN warehouse management system CIEL FW. The KN Customs Tool was able to combine a dataset for the preparation of the customs declaration in Zodiak (local customs application) which could be checked by customs specialists before submission to ATLAS, the German authority customs system (Annex I shows an overview of the data fields and the systems that were in scope). After the successful implementation of this customer, the implementation for other customers from the German business units Air Logistics and Sea Logistics followed (Benz, 2020).

Around 2017, the Customs Tool was first used outside Germany after receiving a request from KN Dubai. Unlike many other countries, Dubai does not demand a specific authorization for software providers to communicate with the national customs systems as is the case in for example The Netherlands. Since 2017 the KN Customs Tool is used to file customs declarations in Dubai with success.

The KN Customs Tool itself is based on Java and supported by a middleware system, named iBroker, which is used to "glue" the available data from two different software applications together. The KN Customs Tool exists of multiple instances matching the different KN country organizations that are making use of this tool. As shipment and customs declarations data needs to be reused by multiple countries, for example when exporting from the Netherlands to the United Kingdom, it is important to match the specific shipment information that exists within the instances of the Netherlands and that of the United Kingdom. The best you can compare this with is a cash register system within a large department store, where sales data from different cash registers need to be brought together to match the sales data of a specific department. The application that is responsible for bringing this data together is Lobster Data.

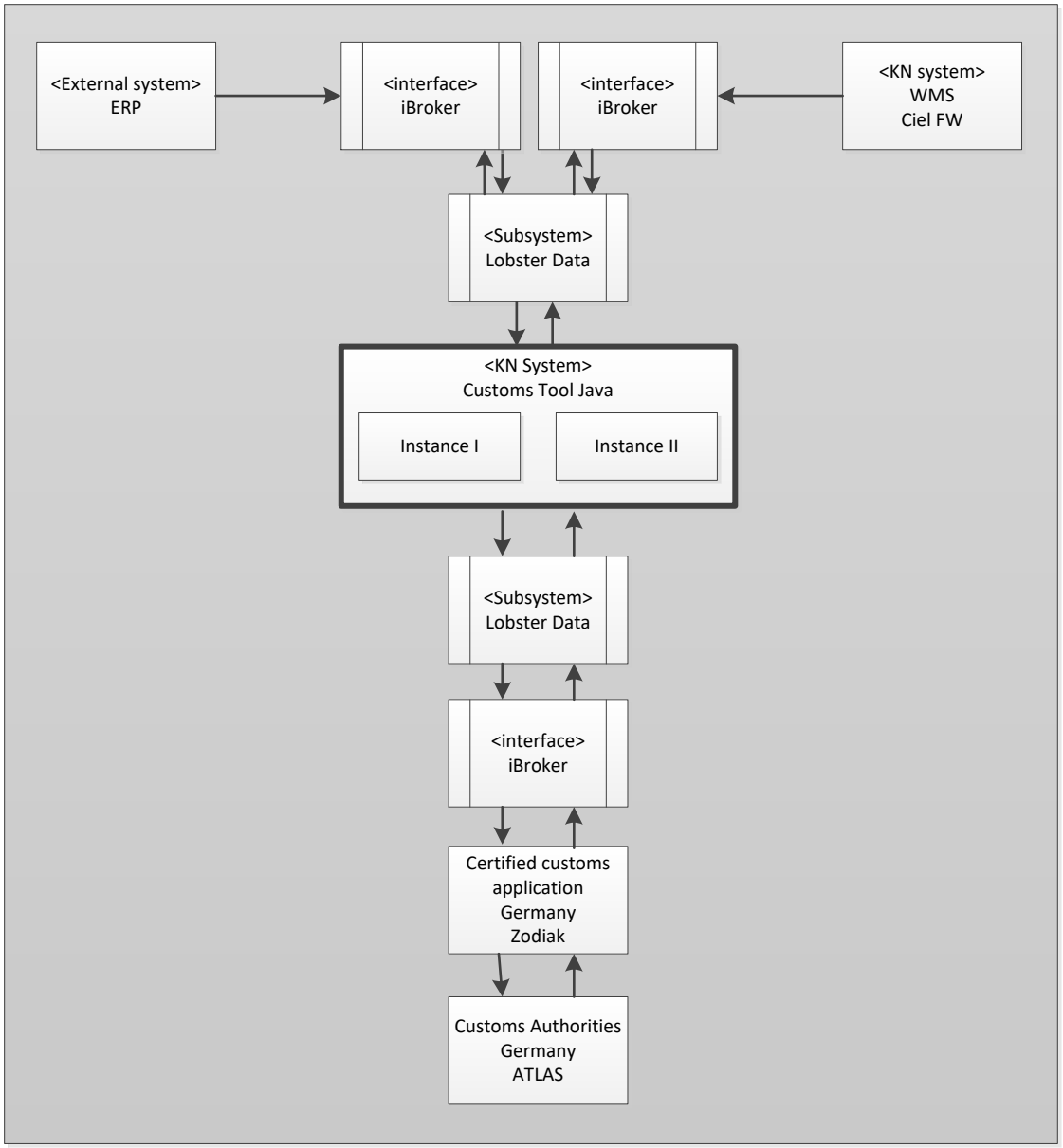

Figure 8: Schematic overview KN Customs Tool, December 2012

3.5.2 The ClearBox

After the success in Dubai several functionalities were added in the KN Customs Tool that enabled the preparation of NCTS declarations in Germany for the business unit Road Logistics (Benz, 2020). This turned out to be a stepping stone to Brexit IT developments that were driven in particular by the Road Logistics division and which led to the development of the ClearBox.

The term 'ClearBox' was introduced early 2019 in the preparation of a 'hard' Brexit and was intended to be used as a solution to handle the expected increase of import declarations in the UK that would need to be filled. The challenge within the 'hard' Brexit scenario was two-fold. On the one hand KN UK would be faced with an increase in the number of import declarations for shipments coming from the EU member States for existing KN UK customers. On the other hand a 'hard' Brexit scenario would offer a huge commercial opportunity to handle the customs import declarations for non-KN UK customers, the so called stand-alone customs brokerage.

The 'ClearBox' itself is not a single application, but a process of data set building. Within this process different sources of data coming from different applications are combined to a single dataset that is required to file a customs declaration. Depending on the supply chain structure, the data set can be built with data from KN

warehouse management systems (WMS's), transport management systems (TMS's) and/or forwarding systems. Data elements that are part of the customs declaration can be broadly distinguished into elements that must come from the customer (importer, exporter, shipper or consignee), as it involves financial transaction data and/or fabrication related details (HS code, country of origin, etc), and data which is related to the logistics process and therefore should originate from the logistics provider. These data elements and distinctions are shown in Annex II.

Some data elements that should be known from the factory can be verified in the logistics process. An example concerns a hi-Tech customer who has his boxes weighed separately in the warehouse by KN, after which this data is interfaced to the local customs application (Kuehne+Nagel, 2020).

The ClearBox allows an interface with the IT application of the customer, but it also offers the possibility of supplementing missing data through a web form, the ClearBox web form. This web form was created as a front-end solution for customers to add and complete their own customs declarations into the UK.

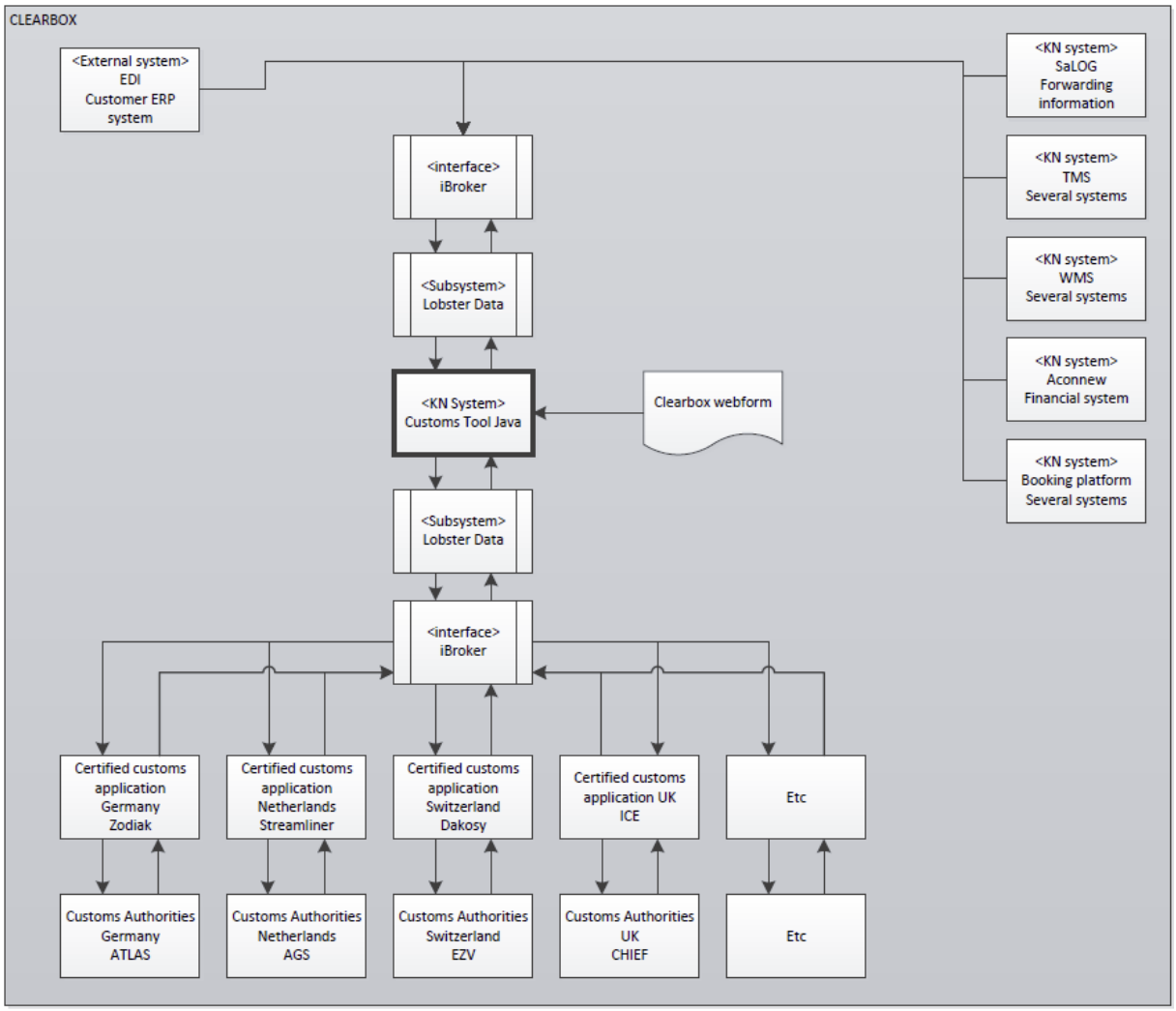

Figure 9: Schematic overview ClearBox process, December 2019

The ClearBox process and Brexit solution is divided into two phases. The first phase is based on the export flows from the EU Member States to the United Kingdom. The second phase focuses on the shipments being exported from the United Kingdom and imported into one of the EU Member States. In both phases the basis of the data that is shared exists of an export declaration (EX-A) which will be enriched. Enriching the export declaration implies a further specification of the commodity codes (export uses 6 digits, while import in the EU requires 8 and more on a national level) and country specific import license details. An example related to the commodity codes is, for example, the export of a "Sanitize and Disinfecting preparation" which is exported under HS code 380894, while upon import in the EU it is divided into three tariff subdivisions containing in total

ten possible CN codes. Another example is a chocolate bar which is classified under the CN code 1806 3290 00, but upon import in the Netherlands requires an additional code of 4 digits which refer to the amount of consumption tax which is applicable. An example of a country specific import license that quickly emerged during the testing of the first phase of the ClearBox was the introduction of the Transitional Simplified Procedure (TSP) by the HRMC in 2018 in the United Kingdom. Within the data fields that are part of the export declaration no field is available for entering an import license that is applicable in the country of destination.

Within the first phase of the 'ClearBox' the KN Customs Tool was divided into two different instances: an EU instance and a UK instance. Figure 10 shows a process flow that describes the export from one of the EU Member States KN organizations to the United Kingdom KN organization. The export data is enriched by the Customs Tool EU to create an import data set for import in the United Kingdom. The Customs Tool UK verifies whether the mandatory data fields are filled. If not, a webform (Importer ClearBox) is send to the importer of record with a request to add the missing fields. The match with the contact details of the importer is based on the EORI number. Once the form is completed and all mandatory fields are filled, the Customs Tool UK submits the import declaration into ICE.

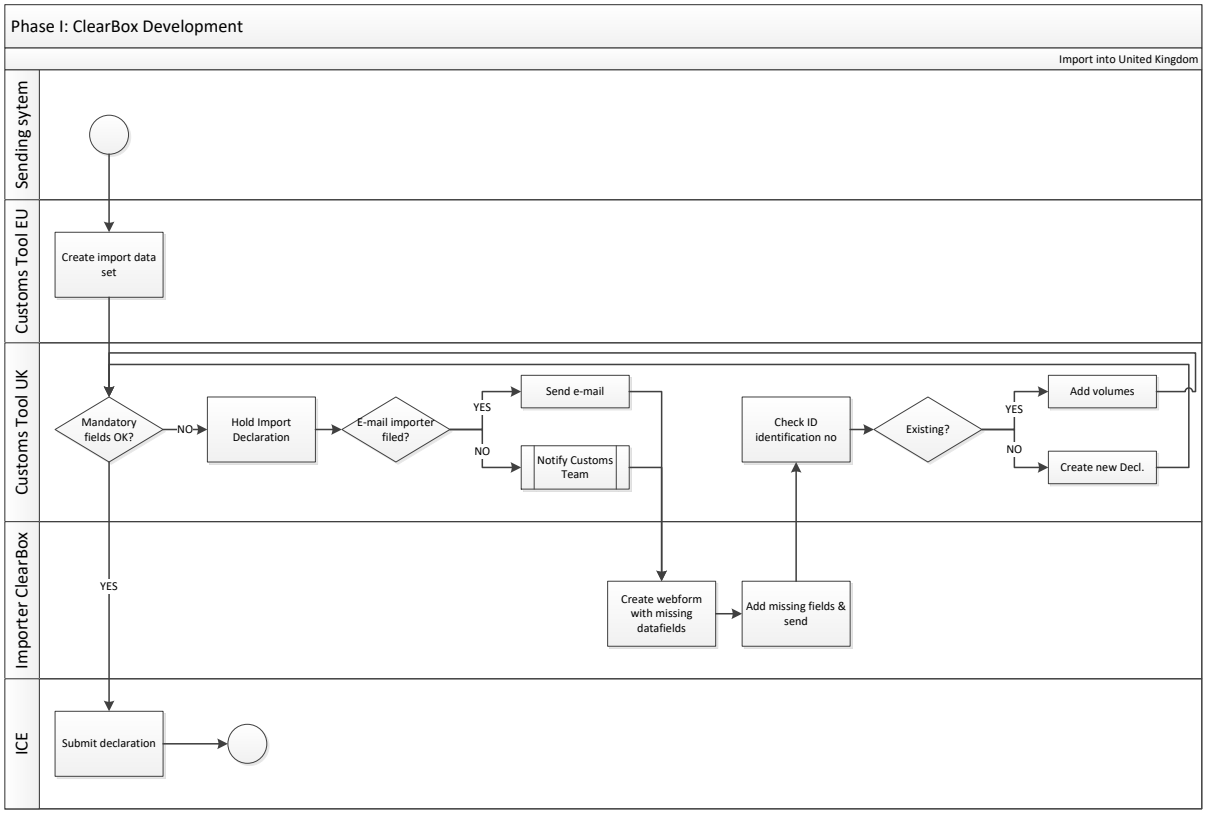

Figure 10: Schematic overview of UK Customs Tool process, October 2019

Based on the expected shipment volumes heading to the UK, the country organizations of Germany, The Netherlands, France, Belgium and Luxemburg were the first ones to be connected to the KN Customs Tool. In this development phase test scenarios were created per business unit.

By the end of September 2019 the KN Customs tool was connected with the national customs applications of Germany, The Netherlands, Belgium, Luxemburg and France. The set-up between the national customs applications and the KN Customs Tool enabled the different business units (Road Logistics, Air Logistics, Sea Logistics, Contract Logistics) within these countries to enrich their export customs declaration data with specific import data and therewith prepare a customs import declaration in the UK customs application ICE. By the end of December 2019, the tool also made it possible to share UK export data in the KN Customs Tool with the aim to re-use this for the import declarations in the KN EU organizations that are connected to the KN Customs Tool. This set-up required separate instances within the KN Customs Tool per EU Member State.

With the transitional phase in force until the end of December 2020, following the agreement between the EU and the UK on the exit of the UK from the Union, a new phase of the KN Customs Tool development has begun. The focus is currently on connecting the Switzerland and Norway customs applications with the KN Customs Tool in order to create a similar solution as is implemented for the Brexit scenario (Benz, 2020).

3.5.3 Challenges encountered during the development

The KN Customs Tool is being developed agile which implicates that the development of the software is limited to short time boxes that contain a strict planning, analysis and design. With agile methods, the emphasis is on direct communication rather than written reporting. Since the first development in 2012 many functionalities were added to the KN Customs Tool. Over the years not all these steps have been described and recorded equally accurately.

The KN Customs Tool has already proven itself in several countries with different customs regimes. During the development of the Brexit solution, it was the first time that a data set was build based on two different customs regimes. Despite the fact that the UK's post Brexit customs regime is based on that of the EU, there were challenges that needed to be overcome. One of these challenges relate to the introduction of the 'Transitional Simplified Procedure (TSP), that was aimed to make importing into the UK as easy as possible after Brexit. TSP is a simplified import procedure that can be used for EU goods that are being imported into the UK and which provides importers extra time to send in their customs forms. Also it delays the payment of any import duties.

The TSP is not known in the EU customs process, this specific dataset is not part of any Message Implementation Guide (MIG) which is the agreed list of coding's (message elements) and the structure with which messages according to EDIFACT standard for import and export are sent between declarants and Customs. However, to take advantage of having a TSP number and avoid delays at the border, the number should be known upon entry into the UK. For these reasons this data field was mandatory in the enriched export data coming from the EU KN Customs organization and their local customs applications. Besides finding a free text field within the local customs applications (Streamliner, Zodiak, etc.), it required a specific mapping as initially not all importers were in possession of such a TSP registration. Later the UK announced in September 2019 that all importers automatically were registered for TSP.

During the development of the UK solution several issues were faced that dealt with the interface between the local customs application and the KN Customs Tool. These issues, however, were fairly easy to solve. One of the examples describes a test scenario in which data from Streamliner was not picked up by the interface to iBroker. In the end it turned out that iBroker could not process pull messages, but it required a push message. A pull coding is a style of network communication where the initial request for data originates from the client, and then is responded to by the server. The reverse is known as push technology (Wikipedia, 2020). Another example describes the confusion about the use of a specific country code that was used in the messages send. For example, the country code of Belgium in the KN Customs Tool Belgium was known as BL instead of BE and therewith not following the prescribed UN/LOCODE list 2020-1. This too was a fairly easy mistake to track down, but it does indicate that the set-up of an interface and the mapping of the individual data elements is very sensitive.

Besides challenges related to the data elements also agreements with regard to the process were necessary to guarantee optimal functioning of the KN Customs Tool and the ClearBox. Article 177, section 1 of the Union Customs Code describes the option to combine multiple commodity codes under a single commodity code under specific conditions within an export declaration. This provision eases the export process and therefore saves time. As such a provision is not applicable upon import, the ClearBox process requires country organizations not to use this provision as otherwise no automated import declaration process could be triggered.

4 Case studies

Subject of a more in depth investigation for this study are 2 different supply chain processes. As described in the introduction, supply chains have become more complicated the last 25 years due to changing business models, political decisions and an increase in regulations, specifically on safety and security. The purpose of the case studies is to gain more in-depth insight into the challenges that are faced within a specific product supply chain and till what extent the 'ClearBox' can provide assurance on the following mismatches that have been identified earlier in the research on the flower supply chain Nairobi-Amsterdam (Borst, Enning, Elswijk, & Van Kruining, 2019) and in the research on the data pipeline performed by David Hesketh (Hesketh D. , Weaknesses in the supply chain: who packed the box?, 2010):

- Missing (import/export) certificates;
- Non-communication about offloads or part-consignments;
- Number count differences between actual quantity shipped and manifested;
- Labeling deficiencies between goods and supporting documents;
- Product quality differences;
- Undervalue;
- Overvalue.

The selection of the two supply chain processes is based on product diversity, production (difference in pull and push to market model), processes (ranging from mass production to small batches) and deviating risk elements. In this way boundary conditions, representing a variety of different situations, will be identified which the 'ClearBox' must meet in order to act as a data pipeline and in order to provide authorities, such as Customs, product Safety and Consumer Health and Plant authority, sufficient reassurance to adjust risk profiles downwards.

The first case study focuses on a "pull from market" product specific supply chain of an American multinational hi-Tech company that designs, develops and sells consumer electronics, computer software and online services. A key characteristic of this supply chain is the widespread manufacturing process in which elements originating from different factories and countries of origin are assembled in a single country and shipped from that country. The case study supply chain describes an inbound flow (import into the EU and distribution to other EU Member States) from China. Being a "pull process", execution is initiated in response to a customer order (Chopra & Meindl, 2016).

The second case study focuses on a fresh produce company that supplies to large supermarket chains in Europe. The key characteristic of this supply chain is its "push to market" process in which execution is initiated in anticipation of customer orders based on a forecast. This speculative aspect of this supply chain is enhanced by the dependence on the weather and therefore breeding conditions. Once the fruits are fully grown, it will have to be shipped immediately. The company's main philosophy is to add value at the source, which means that the finished product is made in the country of origin where the fruit is grown. The product itself is claimed to be fresh from harvest.

Both cases describe an airfreight trade lane to Amsterdam airport which are controlled by KN from the shipping station at country of dispatch until arrival at the warehouse facility of KN at Amsterdam Airport. Following the logic of the KN IT application structure, the supply chains of the two case studies are analyzed by describing the sub processes and activities within the 5 main categories within the logistics process. These 5 main activity categories are:

1. Prepare for export;
2. Export;
3. Transport;
4. Prepare for import;
5. Import.

Per activity category the sub processes are described per shipment status and data elements that are important for the customs brokerage process. Each activity category contains a 'Transaction' layer which describes a physical action within the supply chain, different IT layers depending on the number of IT

applications that are in use and a 'Data' layer which describes the required data elements for completing a customs declaration.

The data elements that are important for the customs brokerage import process in the Netherlands is based on the data fields that are required in the Declaration IT System of the Customs Administration of the Netherlands, named AGS. These data fields are divided in the local Customs application of KN Netherlands, Streamliner, into 'header data' and 'article data'. The 'header data' refers to the generic data fields of the declaration and the 'article data' refers to the underlying products and CN codes that are part of the (import) declaration (Sloot, van der, 2019).

4.1 Case Study: hi-Tech Inbound

Within the hi-Tech supply chain case, large volumes of tech products are shipped from the main production and assembly place China. The products can differ from cell phone for radiotelephony, tablets, laptops, headphones, etc. that are sold through their own web store, own bricks-and-mortar stores or to licensed resellers. A key characteristic of the hi-Tech supply chain is a relatively limited product variety while continuously introducing new products on a yearly basis. As a result product platforms with common components are designed, while a tailored and strictly monitored supply chain is maintained. Due to the short life cycle of the products, a responsive solution to handle new products and other low-volume products and a low-cost solution to handle successful high-volume products is required (Chopra & Meindl, 2016).

Within this inbound flow part of the case study we focus on the trade lane Zhengzhou, China and Amsterdam, The Netherlands. KN Luxemburg is acting as Integrated Logistics Provider (ILP) and performs the task of control tower. In this position it acts as a single point of contact within the supply chain and provides instructions to other Logistics Network Partners (LNP) being KN country organizations and business units within the EU region. Within the trade lane Zhengzhou-Amsterdam, KN Forwarding Airfreight Amsterdam is acting as the LNP and is designated as the Regional Distribution Centre (RDC). The LNP is required to provide services as stated within the Service Operating Procedure (SOP).

In general the KN activities comprises the following logistics services (Bijma, 2019):

- Origin airfreight export gateway;
- Airfreight export consolidation;
- Destination airfreight import gateway acting as RDC;
- Airfreight import receiving at RDC including import customs clearance or external transit clearance;
- Cross-dock and deconsolidation at RDC;
- Line haul distribution from RDC to National Distribution Centre (NDC). This NDC is not operated by KN;
- Transit lanes.

In the service contract drawn between the customer and KN, it has been agreed that the KN Luxemburg will act as control tower and as the single point of contact to the customer. This set-up also has consequences for the delivery of data from the customer to KN. The data from the customer will always go through the ILP, which makes use of the cross-docking management system CDMS.

4.1.1 Common compliance risks

Product safety:
The assessment on electronic product safety is not something which is simply part of listing safety standards and paperwork that is accompanying the products when being shipped into the European Union. In order to ensure compliance on safety regulations such as Restriction of Hazardous Substances (Directive 2002/95/EC) , Energy related Products (Directive 2009/125/EC) and CE markings (Conformité Européenne), it is essential to have exact knowledge of the design and production process of these electronic products. This is typically information which is not known to a logistics provider and is not part of the typical shipment documentation (Ceelie, 2020).

It is not customary in the logistics chain to check packaging of sales units on CE markings upon export or import. Within this case study the sales packages are covered with cardboard overpacks and plastic foil and in some occasions even wooden board material at the KN origin warehouse. Although the consignment completion process is under control of KN, a check on the CE markings is not part of this process. As the CE markings are part of a self-certifying procedure, assessing the validity of these marking require specific knowledge and information that only can be provided by the manufacturer. The manufacturer could be asked to provide a detailed technical file which includes tests they have carried out. As a confirmation of this process, the manufacturer can prepare a declaration of conformity (Gronkvist, 2019). This is currently not part of the export and import process, but this information including an example of a CE marking could be part of a digital customer profile file which is kept by the customs broker KN. The same applies to the legislation that relates to the legislation on Restriction of Hazardous Substances (RoHS) and the legislation on Energy related Product (ErP).

Protection on Flora & Fauna:
The legislation on the ErP could be ranged under this topic. As already described above, this is not typically something that can be checked upon import. The documentation provided by the customer which covers this legislation can be stored within a digital customer profile folder. In addition to the electronic product itself, the legislation on the protection on flora & fauna also relates to packaging material. Within this case study the electronic products are shipped on wooden pallets. These pallets need to comply with ISPM (International Standards for Phytosanitary Measures) No.15 which require that all wood packaging material is debarked and heat treated or fumigated with methyl bromide and stamped or branded. In this case, a statement is issued by the customer on the invoice that “no solid wood packaging material (SWPM) or if SWPM exists, it has been treated and marked in accordance with article 15 of the IPPC standards.” In addition to a check on the documentation, a physical check on receipt of the shipments can be carried out in the warehouse.

Product claims:
Currently no checks on product claims are being carried out (Ceelie, 2020). Possible future product claims could be carbon neutral production and transportation, and/or child labor free production, etc. As counterfeit products are an increasing risk, the traceability of the product within the supply chain from factory to shop can become important.

Tax aspects:
During the transport of the goods between China and the European Union, another sales transaction takes place before the goods entering the European Union. According to art. 70(1) UCC & art. 128(1) UCC IA this transaction should be used as a primary basis for determining the customs value upon import. A known risk within this supply chain is that it is unknown to the customs operations team whether the last sales invoice is shared or not. The occurance of various sales transactions can indicate the presence of known risks in the supply chain related to overvalue and undervalue. Overvalue is typically related to the export process in which a higher value in the export declaration can be used to reclaim a higher amount of value added taxes. Undervalue typically relates to the import process in whereby a lower customs value leads to a lower amount to be paid for import duties and value added tax.

Another risk, but less common in this specific supply chain, is the misstatement of the country of origin. A correct origin statement on item level is relevant for preferential tariff claims, anti-dumping, anti-subsidy and technical requirements to trade.

A third risk relates to the incorrect classification of products. Specifically within the hi-Tech supply chain the products have a short life cycle and new products are being introduced on a regular basis. Some of these new product launches give rise to classification discussions. This classification is essential to determine import tariff, preferential tariff, import restrictions, anti-dumping measures, etc.
A final risk that has been identified relates to possible mismatches between the actual numbers shipped and the documentation provided. Manual errors and/or offloads that were not communicated can be reason for these mismatches. Upon import revised invoices are required in order to prevent unnecessary duties and taxes from being due.

Sanctions:

Currently no sanctions are applicable in the hi-Tech supply chain of this case study. However, the trade war between the United States and China may affect in future the use of specific products and/or software that have origin China. If this is the case, then certificates or statements of origin will be required next to supplier statements.

Other risks:
Other potential risks in this supply chain are related to the storage and transportation of lithium batteries, which should be noted on the airwaybill and shipment documentation. Also, due to the high value of the products, the supply chain is susceptible to theft. This makes it necessary to avoid manipulation of shipment documentation and transport equipment by performing double verification moments in the supply chain.

A final risk is related to the removal or shipment from customs supervision. As the current systems CDMS and SaLOG are not connected, the receipt message in the warehouse is triggered manually. This has caused a mismatch between the physical location of the goods and the location reported in the customs import declaration for two cases in 2019 (Ceelie, 2020).

	Reported Mismatches					
	Prepare for Export	Export	Transport	Prepare for Import	Import	remarks
Product Safety	**Labeling deficiencies**					Correct labeling is an essential requirement to ensure the identification of the goods (art. 188-193 UCC & 238-243 UCC IA. Item labels should make reference to specific standards in confirmation with EU legislation such as CE markings. Also the label should make reference to a serial number or production batch number which is required to assess the product safety and quality.
		Product Quality Differences				A correct classification of products is essential to determine import restrictions and conditions.
Protection of Flora & Fauna	**Missing Certificates**					The use of wooden pallets is restricted to treated pallets in conformation with IPPC art. 15. Treated pallets are marked. Not marked pallets should be placed under the customs procedure 'processing' art. 5(16)(37) UCC. This requires a value statement for these pallets used.
	Labeling deficiencies					Correct labeling is an essential requirement to ensure the identification of the goods (art. 188-193 UCC & 238-243 UCC IA. Identification of the product is required in order to assess the risk.
Product Claims	**Labeling deficiencies**					Item label is essential to ensure identification of the product. Also it should make reference to specific product claims and make reference to a serial number or production batch number.
Tax Aspects	**Overvalue**		**Undervalue**			During the transport of the goods another sales transaction takes place before entry in the EU. According to art. 70(1) UCC & art. 128(1)UCC IA this transaction should be used as a primary basis for the customs value of the goods
	Missing Certificates					A correct origin statement on item level is relevant for preferential tariff claims, anti-dumping, anti-subsidy and technical requirements to trade. A certificate of origin provides assurance on the origin of the product.
			Number Count Differences			Actual numbers shipped may deviate from the shipment documents due to manual errors and/or offloads that were not communicated. Revised invoices are required in order to prevent unnecessary duties and taxes from being due.
	Labeling deficiencies					Packinglist does not match the actual content of the palletnumbers. As a result different products with a different value may be claimed for import.
		Product Quality Differences				A correct classification of products is essential to determine duties and taxes. New product launches may cause discussion due to a different opinion about the application of the classification rules.
Sanctions	**Missing Certificates**					A correct origin statement on item level is essential to determine any possible export and import restrictions.
	Labeling deficiencies					A correct labeling is an essential requirement to ensure the identification of the goods (art. 188-193 UCC & 238-243 UCC IA.
		Product Quality Differences				A correct classification of products is essential to determine export and/or import restrictions.
Other Risks			**Removal from Customs supervision**			An important formality of placing goods under a new customs procedure (such as release into free circulation) is the examination of the goods. In case examination cannot be carried out, the release of goods cannot be granted. (D. Wandel Case C-66/99)
	Dangerous Goods			**Dangerous Goods**		Storage and transport of Dangerous Goods such as lithium batteries require specific handling and conditions.

Figure 11: Schematic overview of risks within hi-Tech supply chain

4.1.2 Data pipeline setup

4.1.2.1 Prepare for Export:

The cross border logistics supply process of hi-Tech products is initiated in response to a customer order. This order is translated into a 'Customer Purchase Order' (CPO). Several CPO's can be combined based on the ship to address (NDC's). A combined set op CPO's with the same ship to address is translated into a 'Delivery Note' (DN). A DN will in all cases be translated one-on-one into a single house airway bill. This upload of the CPO and DN triggers status 94 in SaLOG, which confirms that the customer has uploaded the required shipment documentation. Based on this upload a booking is created in SaLOG, which triggers a status 101. This booking takes place untill 24 hours before pick-up of the shipments at the factory. As the CPO contains all data fields that are part of an sales invoice, in theory all 'customer' data fields mentioned in Annex II are already available for the Customs declaration. However, as the shipment has not been loaded onto the aircraft yet, essential checks on the number of pieces have not been performed yet. Also we know that a following sales transaction can still take place before the goods are brought into the European Union (Ceelie, 2020). Data fields that can be confirmed when reaching SaLOG status 101 are limited to the following 'Header Data':

Header data	Previous system in use	New system in use	Data source party	Data available	Data verified	Remarks
- Tracking number Kuehne + Nagel	SaLOG	SaLOG	KN	SaLOG 101: eBooking transmitted	SaLOG 101: eBooking confirmed	
- Consignor	SaLOG	SaLOG	Customer	saLOG 94: customer uploaded document	SaLOG 101: eBooking confirmed	
- Country of Dispatch	SaLOG	SaLOG	KN	saLOG 94: customer uploaded document	SaLOG 101: eBooking confirmed	

Within this specific case study the 'exporter' is indeed the 'true seller' of the products. There are also examples where a different party acts as exporter. As the exporter might still change before submitting the export declaration, this data field cannot be confirmed yet. However, the 'consignor' and 'Country of Dispatch' will not change once the eBooking has been confirmed.

Before the actual pick-up of the goods from the factory is taking place, the booking can still be adjusted up to 8 hours before planned pickup. These adjustments can vary from the number of pieces and the customer PO. An adjustment on the customer PO also may have effect on the consignee, the seller and the destination country. Therefore these data fields that are part of the 'Header Data' can only be confirmed after reaching SaLOG status 144 (Booking modified).

Header data	Previous system in use	New system in use	Data source party	Data available	Data verified	Remarks
- Consignee	SaLOG	SaLOG	Customer	saLOG 94: customer uploaded document	SaLOG 144: Booking modified	
- Seller	template	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	SaLOG 144: Booking modified	
- Destination country	SaLOG	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	SaLOG 144: Booking modified	

Once the shipment has arrived at KN origin (SaLOG status 1000), the physically received shipment can be verified with the unique order reference number and the product details that are part of this order. These order number and product details are known under the below mentioned 'Header Data' and 'Article Data'. The verification process which takes place in the KN warehouse is a pre-existing process related to checking received goods and is based on the packaging labels.

Header data	Previous system in use	New system in use	Data source party	Data available	Data verified	Remarks
- Unique order reference number	SaLOG	SaLOG	KN	saLOG 94: customer uploaded document	saLOG 1000: Arrived	

Some data fields that are part of the ‘Article Data’ originate from master data which is shared by the customer. The content of this master data differs per customer. In this case study, the master data includes among other data elements the product article numbers, Harmonized System codes, Combined Nomenclature codes, goods description and document codes and is shared on a weekly basis. These files are uploaded weekly in the KN Customs Tool. This is comparable to the setup created in Germany in 2012 for another hi-Tech customer (Benz, 2020). The KN Customs Tool matches the master data based on the product article numbers that are mentioned in the purchase order data.

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Product code	Manual	CDMS/ Customer	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Goods Description	Manual	CDMS/ Customer	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- HS code / Taric	manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Document codes	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- BTI number	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	BTI is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- BTI Date valid till	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	BTI is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Additional national codes	Manual	KN Customs Tool/ masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	Codes are available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Quota authorisation number	Manual	KN Customs Tool/ EU database	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	Quota number is available on EU database, but only applicable when information on labelling is verified with shipment documentation provided
- Import / Export license number	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	License is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Bonded or non-bonded	Manual	CDMS	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	Bonded status is connected to the actual products shipped and therefore only applicable when the labelling information is verified with the shipment documentation provided
- Country of Origin	SaLOG	CDMS/ Customer	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Packaging type	Manual	CDMS	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Preference code	Manual	KN Customs Tool/ masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Preference data	Manual	KN Customs Tool/ masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Serial numbers	Manual	CDMS/ Customer	Customer	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse

Once the airway bill is created, SaLOG status 1200 is reached and the 'prepare for export' phase is completed. With triggering SaLOG status 1200 the following 'Article Data' can be confirmed:

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Marks and numbers	SaLOG	SaLOG	KN	saLOG 1200: AWB created	saLOG 1200: AWB created	Airway bill is mentioned as 'Marks and Numbers'

The role and function of the 'ClearBox'

Based on logical checks in the process on possible changes in shipment status, number of packages received, type of product received at the KN origin warehouse, etc., it is possible to determine which customs data elements are reliable for the automatic filling of the declaration fields based on statuses in SaLOG. Technical set-up of the 'ClearBox' makes it possible to hold data and release it after a certain verification has been completed at a later stage in the process. An essential part of this process is the identification of a unique key element. Within this specific case study this key element consists of the Unique KN Tracking Number. This number is linked to the purchase order number which refers back to the production batch.

Within the KN Customs Tool a separate instance is created for this specific customer which enables the 'ClearBox' to store not only relevant customer master data such as commodity codes, but also information related to applicable licenses and binding tariff information (BTI). Depending on the willingness of the customer it is possible to store product specific information making reference to CE markings, etc. In this case study this option was used only for BTI information. Therefore, it was not possible in this case study to gain insight into the manufacturing origin of the parts from which the end product was created. In view of the deviations per customer on available master data, it will be necessary to make a separate mapping for each individual customer with the KN Customs Tool.

At the KN origin station warehouse the shipments are loaded into air cargo loading devices. Due to the strict dimensions that the loading device must comply, it may be necessary in some occasions to split a loading unit (wooden pallet) with a unique batch number and create a loading unit with multiple batch numbers. Since this is recorded in the KN systems, it is also possible to trace the shipment unit back to the production batch of the customer. The highest level of the loading unit within air cargo is the master airway bill.

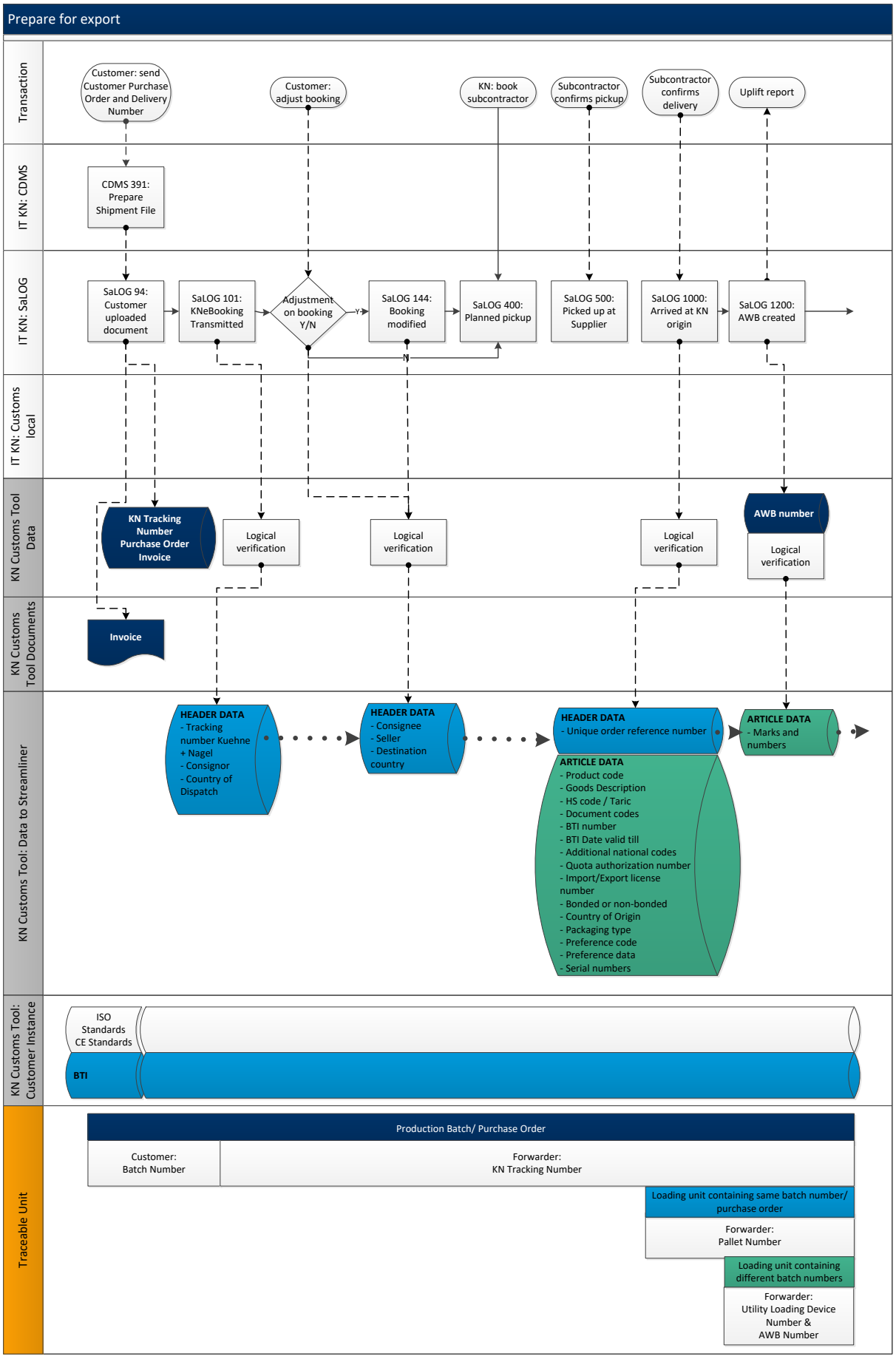

Figure 12: Prepare for export process and data elements

4.1.2.2 Export

After the creation of the airway bill (SaLOG status 1200) the customs clearance process starts. A workflow management module within SaLOG (Business Process Automation) ensures that a task is assigned to the local customs staff. This task is to check the provided documentation on validity and completeness and to issue a customs export declaration. Once the export clearance has been started, the local customs application triggers status 1105 in SaLOG (Export Customs Clearance started). This status is attached to a time stamp which is important for measuring the Key Performance Indicators that are part of the service level agreement.

Within this hi-Tech case study the focus is on the entry into the EU. Although both Header and Article data concerning the customs value is available upon SaLOG status 94, 'upload of shipment documents' by customer, this is not yet used as another sales transaction could take place before entry into the EU. According to art. 128 UCC IA the transaction value of the goods sold for export to the customs territory of the EU shall be determined on the basis of the sale occurring immediately before the goods were brought into the customs territory.

Based on the possible notification of 'incomplete documents' or data, SaLOG status 1153 is triggered by the local customs application in China. This notification could be added to the customer digital customer file. The same goes for the Single Administrative Document (SAD) and the shipment documentation that formed the basis of the export customer declaration. The complete customer profile and shipment history can be made available to the Customs Administration in the EU. Disclosing this information to Customs could reduce the need for additional source data to cross-validate the customs declaration.

As figure 13 shows, the customs process has a non-consecutive status code on the creation of this airway bill. Partly this has to do with different customs regimes and processes globally. It also appears that different customs statuses have been added afterwards as these were initially not included in the development of the IT application. However, as long as the status codes do not automatically trigger a successive status, the order of the status codes does not affect the interface with the customs application Streamliner.

<u>Customs application at origin</u>

In the set up with the 'ClearBox' it was deliberately chosen not to connect the customs application in origin with the KN Customs Tool. Main reason for not connecting this system is that it transmits existing data, while it doesn't generate new relevant data. On the other hand, the status messages from the local Customs authorities are included in the KN Customs Tool and processed as 'documents'. These statuses can be interesting for the Customs authorities at destination if they mention, for example, a physical inspection.

Applicable Customs licenses, security and ISO standards can be recorded in the customer instance part of the KN Customs Tool.

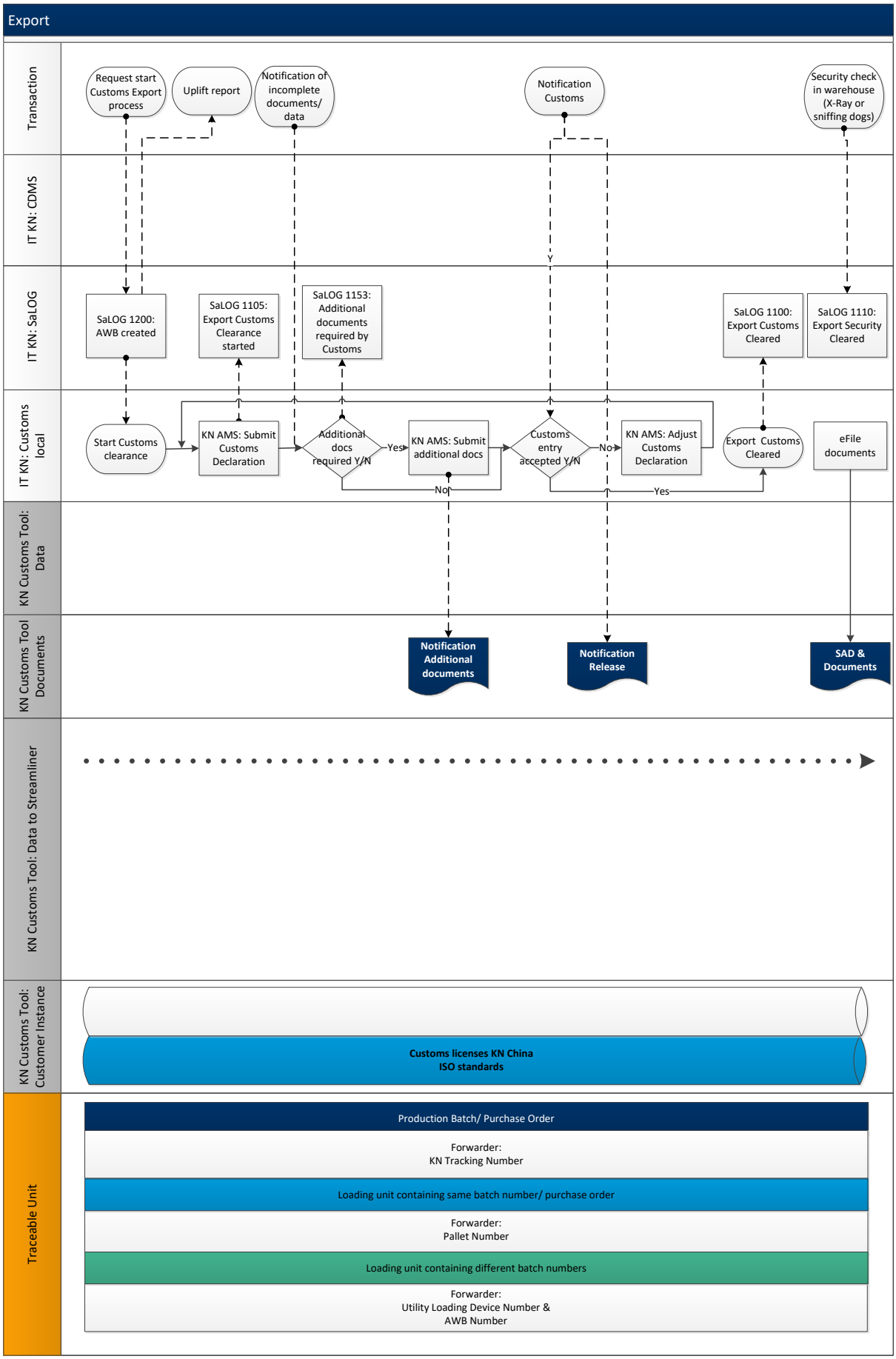

Figure 13: Export process and data elements

4.1.2.3 Transport

The transport process starts when the shipment is delivered to the ground handler who is responsible for loading the aircraft and issuing the flight manifest. As seen in the research on the flower trade lane Kenya-Netherlands mismatches can occur due to non-communication about offloads (Borst, Enning, Elswijk, & Van Kruining, 2019). The likelihood of such mismatches occurring depend on the type of packaging and the loading units used. In the example of the hi-Tech case study there is a limited variety of products and therewith a limited variety of packaging sizes. To prevent theft of these high-value shipments, the assembled pallets are covered with hardboard plates and sealed with black foil. Since these pallets are delivered as such to the ground handler, there is little change that differences in numbers will occur during the loading of the aircraft.

Nevertheless it is only at the time of departure that the following 'Header' and 'Article' data can be confirmed with certainty:

Header data	Previous system in use	New system in use	Data source party	Data available	Data verified	Remarks
- AWB number / BL number	SaLOG	SaLOG	KN	SaLOG 1200: AWB created	SaLOG 1300: Departed	The AWB is to be confirmed upon departure
- Arrival departure code	SaLOG	SaLOG	KN	SaLOG 101: eBooking transmitted	SaLOG 1300: Departed	The airportcode is confirmed once the AWB is created
- Transport cost	Manual	SaLOG	KN	SaLOG 101: eBooking transmitted	SaLOG 1300: Departed	Rate agreement is part of contractual agreement between forwarder and customer. Rate is based on weight which is to be confirmed by the carrier
- Total gross weight	SaLOG	SaLOG	Carrier	saLOG 94: customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Total colli	SaLOG	CDMS	KN	saLOG 94: customer uploaded document	SaLOG 1300: Departed	Number of colli is to be confirmed by the carrier

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Quantity	Manual	CDMS	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Number of packages	Manual	CDMS	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Net weight	Manual	CDMS	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Gross weight	Manual	CDMS	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Additional units	Manual	CDMS/ Customer	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)

Information concerning the transport costs, Gross weight, Net weight, etc. are transferred from SaLOG to the customs application Streamliner by EDI.

<u>Verification of hand-over to carrier</u>

Within the 'transport' phase there are three important stages that are important for the verification of the received amount of goods by the ground handler and carrier. Within this case study two of these stages are stored in the KN Customs Tool. The cargo receipt is a legal transfer document between the shipper's representative and the carrier representative and makes reference, among other details, of to the airway bill and the number of pieces received. The document itself is stored in the KN Customs Tool in the eFile section and can be retrieved under the reference of the airway bill number or the KN tracking number. The confirmation of exit is an important status update which confirms the departure of the shipment with the amount of pieces mentioned in the declaration.

The Entry Summary Declaration (ENS), which is submitted by the carrier in accordance with art. 127 (4) UCC, is processed as a 'document' in the KN Customs Tool. The ENS declaration contains the following information:

- Shipper (EORI number whenever this number is available)
- Consignee (EORI number whenever this number is available)
- Notify Party, mandatory where goods are carried under a negotiable "to order" B/L (EORI number whenever this number is available)
- Preferably HS code, at least 4 digits but 6 digit HS Code is recommended, or acceptable cargo description
- Package Type (Code)
- Number of packages
- Container number
- Seal number
- Cargo gross weight (in kilograms)
- UN code for dangerous goods
- Transport charges method of payment code (e.g. payment in cash, payment by credit card, payment by check, electronic credit transfer, the account holder with the carrier, not pre-paid).

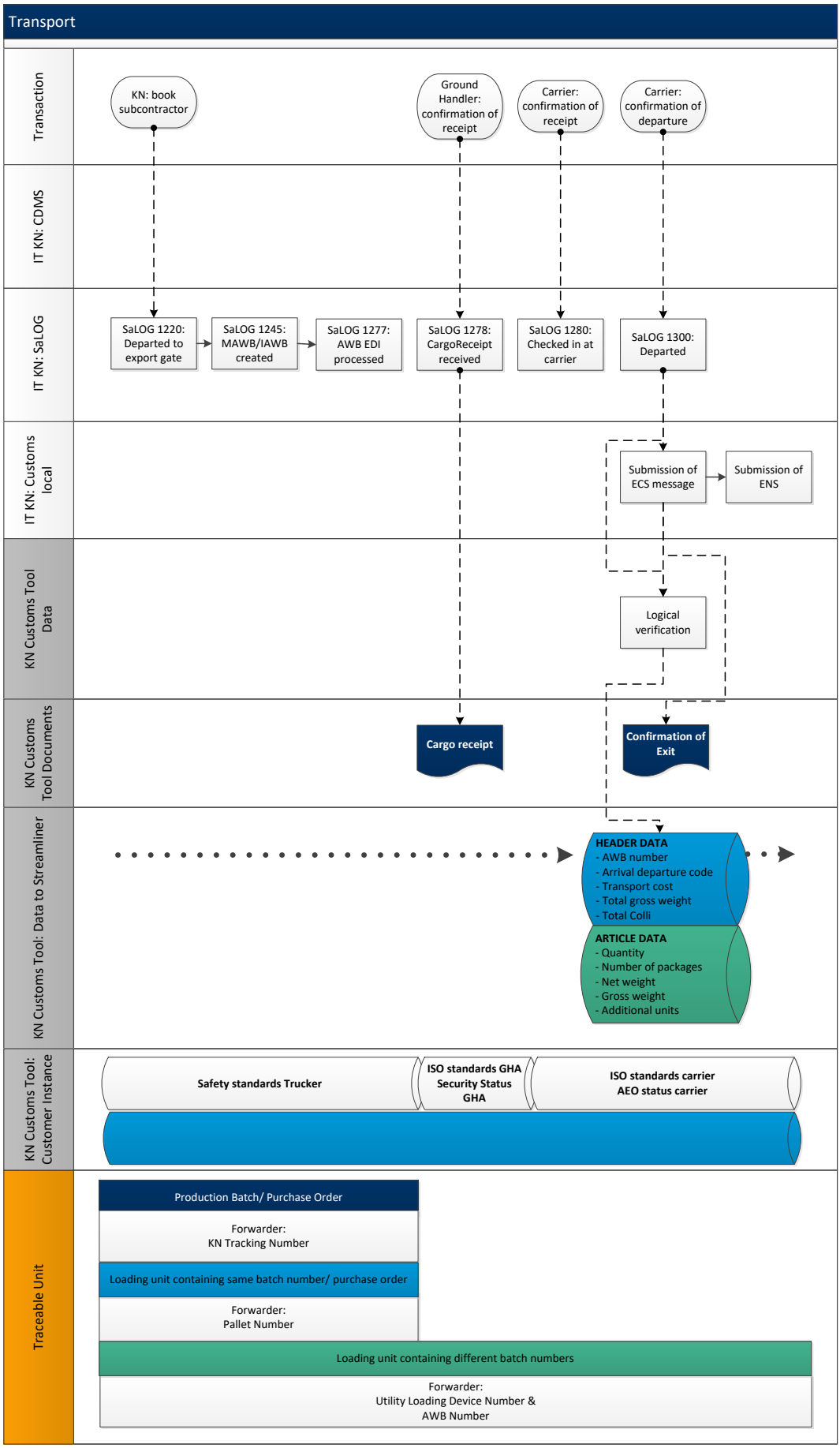

Figure 14: Transport process and data elements

4.1.2.4 Prepare for import

Once the carrier has departed, SaLOG status 1300 (Departed) triggers via EDI the customs clearance process in the Customs application (Streamliner) of the Netherlands customs team. In the previous set up without EDI connections between SaLOG and Streamliner a physical paper file was handed over from the customer service team to the customs team. In the 'ClearBox' set up a business rules can be set which follow the logic associated with the required customs procedure. In this specific example a rule has been set which indicates that an import declaration must be made (choice can be import, special or export procedure). In this case, this rule indicates that specific 'Header' and 'Article' data can only be confirmed after arrival in order to ensure that the last sale before entry in the EU is used for the import declaration.

Revised shipment documentation referring to a final sales transaction before entry in the EU is sent from the customer by EDI to CDMS (status 391). Although it is desirable that the data is sent to the KN Customs Tool directly, it was decided to maintain the existing set up with the customer as much as possible. This was to prevent the customer from having to maintain an interface with multiple KN applications.

Once SaLOG status 1400 (arrived) has been reached, the following 'Header' and 'Article' data is made available to Streamliner:

Header data	Previous system in use	New system in use	Data source party	Data available	Data verified	Remarks
- Invoice number	manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Invoice date	manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Other reference nr purchase order, consignee ref, etc. (invoice purposes)	manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Data involved parties (address details, EORI, VAT nr, Unique relation id)	SaLOG	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Importer	SaLOG	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Exporter	SaLOG	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Buyer	template	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Connectedness between parties	template	CMDS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Incoterm	SaLOG	CMDS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Place incoterm	SaLOG	CMDS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Transaction type	template	KN Customs Tool	KN	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Currency	manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Invoice amount	manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Insurance cost	Manual	KN Customs Tool	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Additional cost	Manual	SaLOG & CDMS	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- VAT cost	manual	Streamliner	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	Concerns a DDP calculation

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Invoice amount	Manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Currency	Manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Royalties	Manual	CDMS/ Customer	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport

Customs clearance can be done on the location of the Ground Handler or at another Customs approved location such as a bonded warehouse facility. In the latter case, an additional Customs Transit declaration is required. In the example of this case study the shipments are customs cleared at a KN facility on the location of the Ground Handler. Within this KN facility the arrival confirmation within CDMS (status 1060) is triggered by scanning the received shipments. CDMS 1060 triggers via EDI the SaLOG status 1420, 'Arrived at KN Destination'. With reaching this status the following 'Header' and 'Article' data is confirmed:

Header data	Previous system in use	New system in use	Data source party	Data available	Data verified	Remarks
- Deviating delivery Address	SaLOG	SaLOG	Customer	saLOG 94: customer uploaded document	saLOG 1420: Arrived at KN Destination	Depending on the physical place of the goods when submitting the import declaration
- Place goods	template	CDMS	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	Depending on the physical place of the goods when submitting the import declaration

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Previous regulation	template	KN Customs Tool/ template	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	Previous regulation might be 'Transit' or 'Paperless Goods Transfer System' and might be decided up till the moment of pickup from carrier.
- Previous document	SaLOG/iBroker template	KN Customs Tool/ template	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	The previous document is linked to the previous regulation
- Previous document date	Manual	CDMS	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	The previous document is linked to the previous regulation

As shown in figure 15, the data related to the previous regulation and the location of the shipment is triggered in the KN Customs Tool by CDMS. The KN Customs Tool transfers this data to Streamliner via EDI.

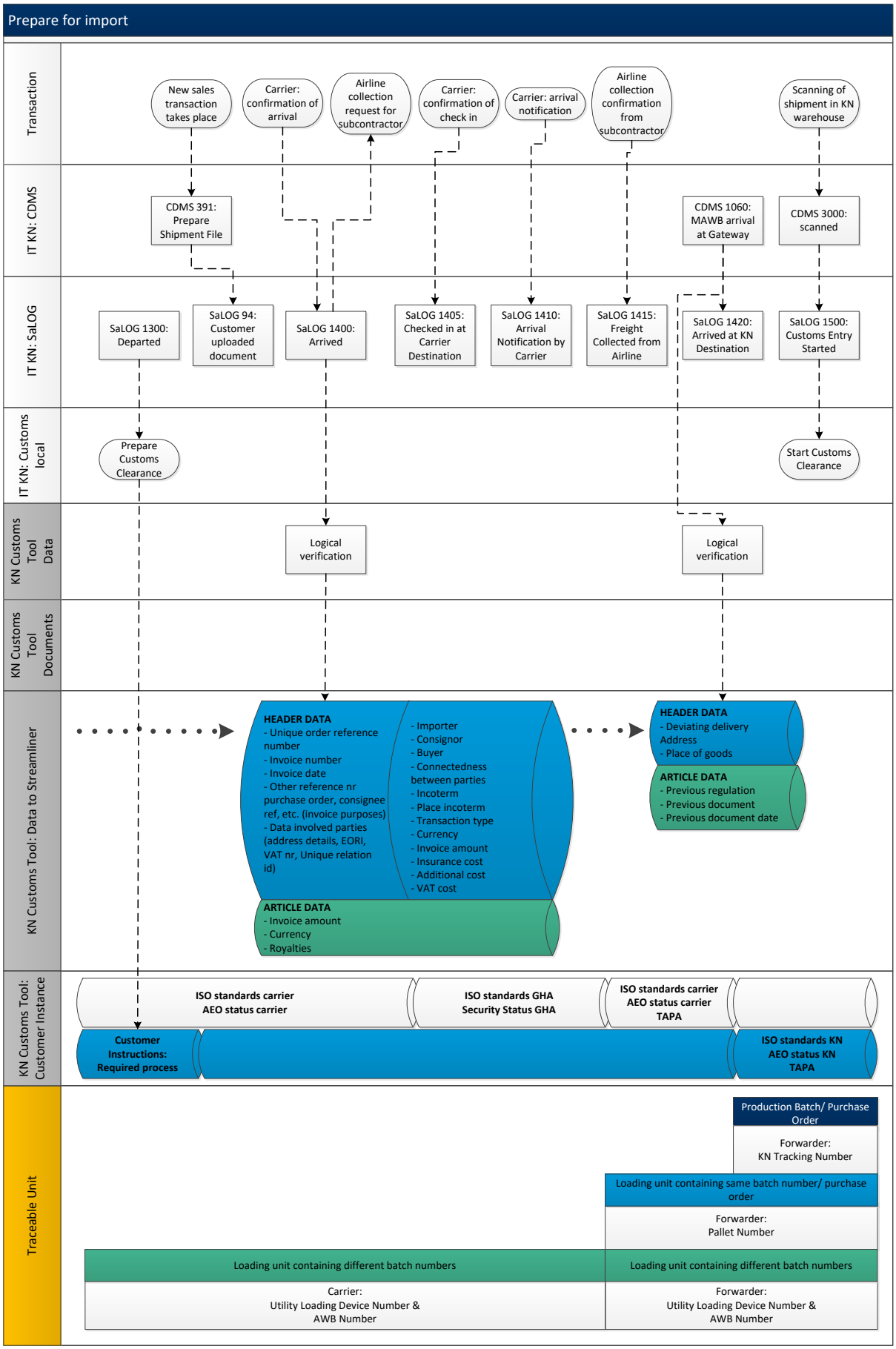

Figure 15: Prepare for import process and data elements

4.1.2.5 Import

Since all necessary data fields for the import declaration are already known and available in the customs application Streamliner, the submission of the declaration can be triggered automatically on receipt of SaLOG status 1500 (Customs Entry Started). In this case study, it was decided to submit the declaration manually. The reason for this is that the data can still be checked by the declarant. A copy of the Single Administrative Document (SAD) and all shipment documentation of relevance can be added to the digital shipment file in the KN Customs Tool.

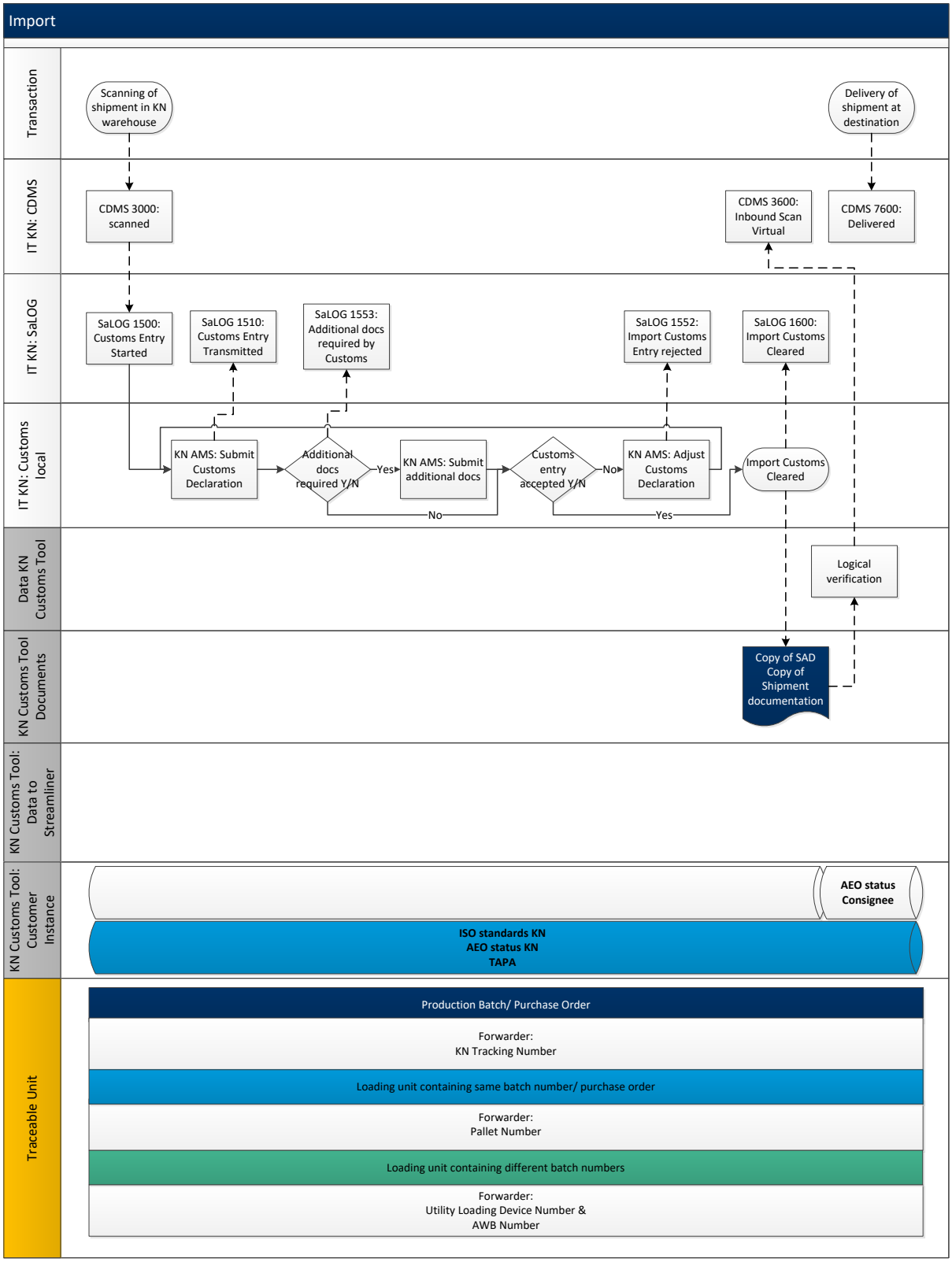

Figure 16: Import process and data elements

4.1.2.6 Analysis to what extent the 'Clearbox' in the hi-Tech case study can function as a data pipeline

The basis of this hi-Tech case study concerns the existing system of the 'ClearBox' process as it is designed for the Brexit solution. Based on the logistics specifics of this hi-Tech supply chain and the applicable IT systems, adjustments have been made to these applications and the 'ClearBox' set-up. In order to understand to what extent the 'ClearBox' can function as a data pipeline for this specific case study, it is necessary to answer the sub-questions of this research.

Sub-question a) What challenges are related to connecting the different country IT applications?
The hi-Tech case study describes a set up in which both forwarder origin station and forwarder destination station are operated by KN. Compared to the Brexit setup of the 'ClearBox', an additional system applies, namely a cross docking management system CDMS, which is used to provide fourth-party logistics (4PL) services for this specific hi-Tech customer. 4PL is originally defined as a supply chain integrator that assembles and manages the resources, capabilities and technology of its own organization, with those of complementary service providers, to deliver a comprehensive supply chain solution. In practice this it is more common for third party logistics providers (3PL) such as KN to outsource, where it makes most sense for the customer, certain activities to other 3PL's (Gattorna, 2006). In this specific hi-Tech case study the prepare for export, export, transport, prepare for import and import stages of the supply chain are serviced by KN. The stages after import which focus on the parts distribution and reverse logistics is outsourced. Since the CDMS application is also used to monitor these outsourced services for the customer, a number of existing interfaces limit the development of a specific 'ClearBox' setup for this case study. These limitations manifest themselves in the fact that the customer only wants to interface preferably with a single system, namely CDMS. Specific data relating to the type and value of the product is directly interfaced with the KN Customs Tool in an optimal 'ClearBox' setup, in order to limit the number of interfaces and thus the vul
nerability of the 'ClearBox' process (Dongen, 2020).

As result of the pull-to-market supply chain characteristic, the dataset related to the purchase orders in this case study is made timely available within CDMS but contains more valuable data elements than CDMS initially could handle. Since it was desirable not to set up a second interface between the customer and another KN application such as SaLOG, the KN Customs Tool and Streamliner, it was necessary to add data fields in the CDMS application. After adding these data fields to CDMS, these fields had to be matched with the databases of the other KN IT applications. This process is time-consuming as each source can define similar data points in different ways (Dongen, 2020).

When creating the interfaces it was important to re-use existing interfaces and expand them. Figure 17 shows a schematic of the interfaces created. The orange arrows indicate newly created interfaces.

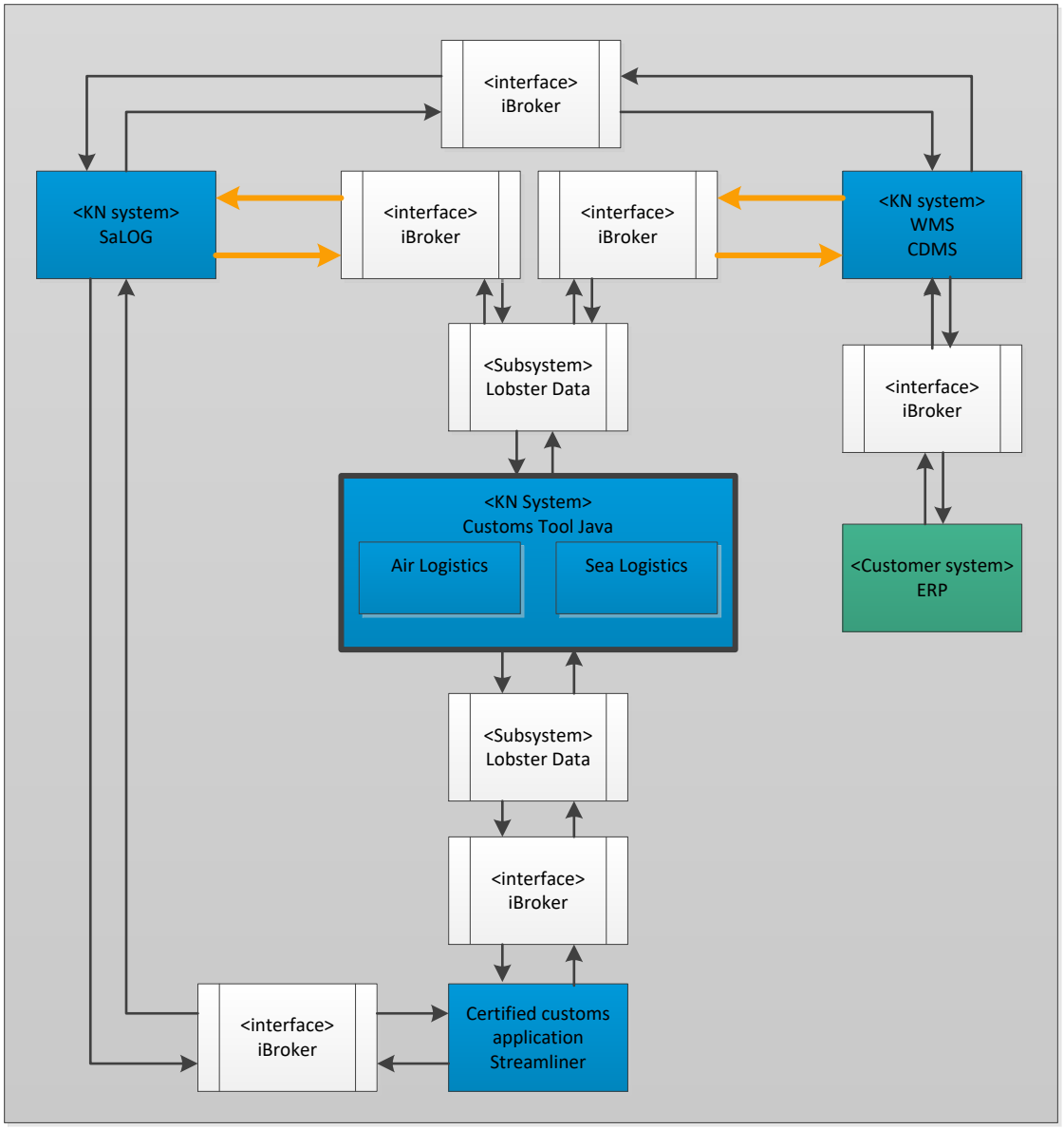

Figure 17: Schematic overview of interfaces

The new interface between CDMS and the KN Customs Tool covers a limited number of data elements related to the location of the goods and the previous customs procedure. The interface created between SaLOG and the KN Customs Tool covers all other required data elements. The case study deals with an air freight process that uses specific air freight IT applications. Since the customer also ships freight via sea, which require different IT applications, a second instance has been created in the KN Customs Tool to distinguish the data belonging to the mode of transport.

The various system statuses have been used to set up automated actions such as the filling of the SAD. As indicated above, the numbering of the customs statuses of SaLOG are not set up sequentially. For example, the SaLOG status which indicates a transmission of the customs entry (status 1510) is followed by the status indicating that the cargo is ready for customs clearance (status 1599). Therefore it is important to be careful with the use of automated triggers that are based on the use of sequential statuses. The CDMS application does not seem to have any customs specific statuses available. In order to block shipments in the warehouse which have not yet been released by Customs, an existing status code (CDMS 3600) has been 'misused' to set up this block. Besides the need to carefully consider the use of statuses that trigger actions based on numerical order, there is an additional risk that certain Key Performance Indicators (KPI's) are not reflecting the actual situation due to the incorrect use of these statuses.

The lack of (consecutive) customs statuses in the system is partly due to different customs procures worldwide. However, the main reason seems to be that in the development of logistics applications such as SaLOG the initial focus is on recording transport statuses instead of customs statuses (Dongen, 2020).

Another challenge that was encountered during the testing of the newly created system set up relates to the process in which information is shared between a customer service team and a customs brokerage team. Several system interruptions in SaLOG challenged the operational teams to fall back from a fully digital process to a manual process in which documents must be printed and statuses must be entered manually. This requires well-coordinated communication. The issues encountered indicate how quickly a new automated process can become embedded in an organization.

Sub-question b) What challenges are related to the completeness of the data within the applications?
Within this case study KN has control over the logistics process from the 'prepare for export' stage to the 'import' stage. Similar to the flower case (Borst, Enning, Elswijk, & Van Kruining, 2019), there are many variables in the five elaborated stages of the supply chain in which deviations between the shipment and the documentation may occur. Important logistic stages in the supply chain, such as the consignment completion and the deconsolidation process, are carried out directly by KN, there is besides trade data also access to important logistical milestones. As a result, a complete dataset is available which is required for submitting an import customs declaration in the EU. Compared to the overview of the international trade system and customs in a data pipeline situation shown in Hesketh's research (Hesketh D. , 2010), this case study shows a further refinement of the available logistics statuses.

As stated in the answer to sub-question (a), the challenge within this case study is not the completeness of the data but the availability of specific customs data fields within the systems. Since CDMS was not set up to use the available customs data elements, these additional fields had to be created.

Sub-question c) What challenges related to the quality of the data are encountered when setting up 'ClearBox' as a data pipeline?
A difference with the data pipeline concept which is described by Hesketh is that 'ClearBox' does not use the data elements immediately after they are made available in the supply chain. It is only used after a logical verification has been performed between a logistic milestone in the supply chain and specific trade data For example after a piece count check by a subcontractor, the data related to that physical action is forwarded to the Customs application. This does not alter the fact that the data originates from the source, but it is assessed on reliability by means of a logical check first. As stated above there are many factors within the export, transport and import phase that can cause a mismatch between data and the physical shipment (Borst, Enning, Elswijk, & Van Kruining, 2019).A strong 'feature' of the 'ClearBox' is that it is able to hold data, verify it with a logistic status and release it based on programmed logic checks within the KN Customs Tool. Within the hi-Tech case study, the logical verification within the 'ClearBox' process on the last sales transaction before entry into the EU ensured that a common compliance problem was tackled (Ceelie, 2020). Despite the fact that the vailable source data is not directly used for creating the customs declaration, the 'ClearBox' setup shows a further development in the notion of a data pipeline.

Sub-question (d) What level of traceability on the products and customs data within the supply chain is required in order to demonstrate compliance towards enforcement agencies?
Another difference with the data pipeline concept is that the data in this case study is not (yet) made available for piggybacking by enforcement agencies such as Customs. This makes it impossible for Customs to cross-validate the data in the declaration, but since additional trade data such as a purchase order is systematically used to generate this customs declaration, Customs could perform an audit on the 'ClearBox' setup which would provide them sufficient assurance on the correctness of the declaration. Such an audit could be performed periodically in combination with a standard conformity check on formalities as it is currently performed at customer level (Ceelie, 2020). Access to the 'ClearBox' on customer level can be provided via a customer portal, KNLogin. This application can provide an overview of the data elements, the data source party and the SaLOG status which shows when the data is made available. Besides the shipment documentation, KNLogin can also provide an overview of quality and safety standards (e.g. ISO standards, AEO) of both KN and other supply chain actors and (internal) audits performed. KNLogin therefore possibly could be positioned towards Customs and other enforcement agencies as a kind of 'compliance dashboard' that can be used for

auditing purposes. The dashboard would eliminate the need to use extra source data to cross-validate the accuracy of the customs declaration.

Traceability of the shipment is made visible on three levels in the 'ClearBox'. The unique key to trace pallets, ULD's and airway bill numbers within the supply chain, consists of a combination between the purchase order number and the unique KN Tracking number. The 'ClearBox' does not provide direct insight into serial numbers of products, however these can be traced back to the purchase order number via additional information, which should be provided by the manufacturer. The 'ClearBox' therefore offers the possibility to trace back shipments and parts of shipments accurately within the supply chain. Nevertheless, full traceability of all individual components of the end product is most likely not possible due to the amount of detailed information and degree of precision that this would require.

4.2 Case Study: Fresh-produce Inbound

The fresh-produce case study is based on an award winning fruit company that produces fresh-cut fruits, freshly squeezed juice and dairy-free ice creams for leading retailers around the world. The company is head-quartered in the UK and has production sites in Ghana, Egypt, South Africa, Brazil, Senegal, Ivory Coast and the UK. Key markets are UK, France, Netherlands, Denmark and Switzerland. This specific study focuses on pre-packed fruit which does not require phytosanitary inspections upon arrival in the EU.

The main motto of the company is 'Adding Value at Source', which means that it aims to make the finished product in the country or region where the fruit is grown. By doing this, the company aims to return more value to the communities that produce the fruit, through employment, skills development and technology transfer. Additionally it can deliver products fresh from harvest in as little as 36 hours (Olijve, 2020). The fruits are transported at a constant temperature between 0 and 5 degrees Celsius.

Social responsibility is high on the agenda, therefore the company works closely with the growers and adheres to a number of international standards including Fairtrade and LEAF. All production places are certified and are being audited regularly. The main priorities which are published in their blueprint are to minimize the impact of the business and the supply chain on biodiversity, to minimize the amount of waste, to minimize the environmental impact of the materials used, and to use as little energy and water as possible.

Within this Inbound flow part of the case study we focus on the trade lane Accra, Ghana and Amsterdam, The Netherlands. Contrary to the hi-Tech case study, KN does not organize the transport from Accra to Amsterdam. The KN station in Amsterdam does handle incoming shipments and arranges transport within the EU and the UK. The tradelane Accra – Amsterdam is part of a 'green tradelane' agreement with the Customs Administration of the Netherlands. This 'green tradelane' agreement allows a reduced risk profile upon import and is based on the AEO licenses of the carrier (KLM), KN and the security measures taken by the customer in the country of origin (Koning, Konst, Lantema, & Visser, 2009).

Shipment data is mainly provided manually, but is available electronically. The customer does not make use of production batch numbers, but uses the 'best before date' as a reference. The carrier KLM shares current flight statuses ('ready for carriage', 'departed', 'estimated time of arrival', 'departed' and 'arrived') actively via EDI with SaLOG.

4.2.1 Common compliance risks

Product safety:
The product safety aspect in this case study is related to food safety only and therewith subject to HACCP. When handling food products it is mandatory to comply with certain HACCP food safety measures. HACCP is an acronym for Hazard Analysis and Critical Points and is a management system in which food safety is addressed through the analysis and control of biological, chemical and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product (Safe Food Alliance, 2020). Important requirements are linked to hygiene and temperature control. Maintaining a constant

temperature between 0 and 5 degrees Celsius require a good communication and interaction between the various actors in the supply chain. The shipments are equipped with temperature loggers that record the temperature development during the transport (Olijve, 2020).

As pre-packed fruit packages are exempted from phytosanitary controls, the number of phytosanitary import controls is limited to the exceptional cases in which non pre-packed fruit is shipped.

Protection on Flora & Fauna:
Risks related to the protection of Flora & Fauna consist of the introduction of harmful organisms, and the smuggle of coral, ivory and non-registered medicines (Koning, Konst, Lantema, & Visser, 2009).

The possible introduction of harmful organisms is limited as the fruits are cut in origin and pre-packed. In the exceptional case that a shipment of non-pre-packed fruit is shipped to the EU, the shipment is subject to a phytosanitary import control.

Important indicators for smuggle are mismatches between the number of packages which are mentioned on the manifest and the number of packages received at destination airport (Koning, Konst, Lantema, & Visser, 2009).

Product claims:
Various product claims form an important part of the customer's business model. Not only do agreements exist with retailers, but specific product claims are also stated on the product label (Fairtrade) which should make the products more interesting for consumers than similar products without such a label.

Important contractual agreements that are made with retailers are (Olijve, 2020):
- 50% of the suppliers must be located within 50 kilometers of the airport or seaport;
- Use of cooling blankets instead of styrofoam during transport;
- Transport via passenger flights only instead of dedicated freighters.

Tax aspects:
Given the time pressure on the supply chain and the fact that the piece count process is fully manual, a common risk is a deviation between the number of pieces shipped and the number of pieces manifested. Mismatches between the data and the physical shipment result in an incorrect Entry Summary Declaration and thereby an incorrect assessment on the risks upon entry in the EU.

Additionally a mismatch between the number in pieces shipped and the number of pieces mentioned on the shipment documentation can potentially lead to the evasion of duties and taxes. Since a preferential tariff of 0% applies for the countries of production (regular tariff for Ghana is 8,8%), a deviation in the number of boxes rather represents an increased risk of smuggle. A combination of a large amount of pieces, the speed of action that is required in the supply chain to maintain the low temperatures and the low percentage of Customs inspections (below 1%), form ideal conditions for drugs smuggling activities.

Similar to the hi-Tech case study, there is a risk of overvalue in export and undervalue in import. This is particularly present in the perishable sector and push-to-market supply chains, as often no sales transaction has taken place at the time of export.

Sanctions:
Currently no sanctions are applicable in the fresh produce supply chain.

Other risks:
The countries of production are known to be sensitive to bribery. In particular, the issue of certificates and certifications and the quality of audits can be influenced.

	Reported Mismatches					
	Prepare for Export	Export	Transport	Prepare for Import	Import	remarks
Product Safety	**Labeling deficiencies**					Correct labeling is an essential requirement to ensure the identification of the goods (art. 188-193 UCC & 238-243 UCC IA. Item labels should make reference to specific standards in confirmation with EU legislation such as CE markings. Also the label should make reference to ingredients and a 'best before date'.
		Product Quality Differences	**Product Quality Differences**			While food supply chains become more and more global, the food safety measures are getting more strict due to a number of recent food scandals. For this specific supply chain the main criteria of control is the temperature and the processing date.
Protection of Flora & Fauna	**Missing Certificates**					An assessment on the quality of the product is based on the phytosanitary or health certificate that is issued in the country of origin. A CITES certificate may be required for specific plant and animal species
	Labeling deficiencies					Correct labeling is an essential requirement to ensure the identification of the goods (art. 188-193 UCC & 238-243 UCC IA. Identification of the product is required in order to assess the risk.
Product Claims	**Labeling deficiencies**					Item label is essential to ensure identification of the product. Also it should make reference to specific product claims such as 'organically grown' and it should make reference to a production batch number or harvest date.
Tax Aspects	**Overvalue**		**Undervalue**			During the transport of the goods another sales transaction takes place before entry in the EU. According to art. 70(1) UCC & art. 128(1)UCC IA this transaction should be used as a primary basis for the customs value of the goods
	Missing Certificates					A correct origin statement on item level is relevant for preferential tariff claims. A certificate of origin provides assurance on the origin of the product.
			Number Count Differences			Actual numbers shipped may deviate from the shipment documents due to manual errors and/or offloads that were not communicated. Revised invoices are required in order to prevent unnecessary duties and taxes from being due.
	Labeling deficiencies					Packinglist does not match the actual content of the palletnumbers. As a result different products with a different value may be claimed for import.
		Product Quality Differences				A correct classification of products is essential to determine duties and taxes. New product launches may cause discussion due to a different opinion about the application of the classification rules.
Sanctions						
Other Risks			**Removal from Customs supervision**			An important formality of placing goods under a new customs procedure (such as release into free circulation) is the examination of the goods. In case examination cannot be carried out, the release of goods cannot be granted. (D. Wandel Case C-66/99)

4.2.2 Data pipeline set up

4.2.2.1 Prepare for export

As the booking of the airfreight at the carrier is not performed by KN, a virtual tracking number needs to be created after uploading the shipment documentation in SaLOG. This tracking number is required to match the specific shipment documentation with the airway bill and to perform the logical verifications of the available data within the supply chain. Contrary to what applies in the hi-Tech case study, there are no updated booking statuses that might trigger specific data elements. The 'ClearBox' allows the possibility to receive external data from, for example, the forwarder or agent in origin. The possible sharing of information depends on agreements that are made in the field of data exchange and security of this data. Some data elements such as transport costs will be sensitive to share. To be able to share data with the KN Customs Tool, a separate interface is required. The setup of such an interface is time-consuming and can be costly (Dongen, 2020).

When reaching SaLOG status 94 the following 'Header' data can already be confirmed:

Header data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Tracking number Kuehne + Nagel	SaLOG	SaLOG	KN	saLOG 94: customer uploaded document	saLOG 94: customer uploaded document	A virtual tracking number is created after uploading the documentation
- Consignor	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 94: customer uploaded document	
- Consignee	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 94: customer uploaded document	
- Seller	template	SAP	Customer	saLOG 94: customer uploaded document	saLOG 94: customer uploaded document	
- Destination country	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 94: customer uploaded document	
- Country of Dispatch	SaLOG	KN Customs Tool	KN	saLOG 94: customer uploaded document	saLOG 94: customer uploaded document	Country of dispatch could be part of the standard customer instruction

In comparison with the hi-Tech case study no additional verification can be performed on the country of destination and country of dispatch as this would require information directly from the airliner.

After the upload of the airway bill by the customer, SaLOG status 1200 (AWB created) can be triggered virtually. An update on the following 'Article' data is made:

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Marks and numbers	SaLOG	SaLOG	Carrier	saLOG 1200: AWB created	saLOG 1200: AWB created	Airway bill is mentioned as 'Marks and Numbers'

As the supply chain is time critical there is no use made of loading units containing more than a single 'best before date' batch. The piece level which is used refers to the pre-packed fruit packages. These pieces are packed in an half-sized lower deck air cargo container (AKE or LD3 container) at the ground handler. These AKE containers are marked with a unique identification number. This number is mentioned on the freight manifest of the carrier.

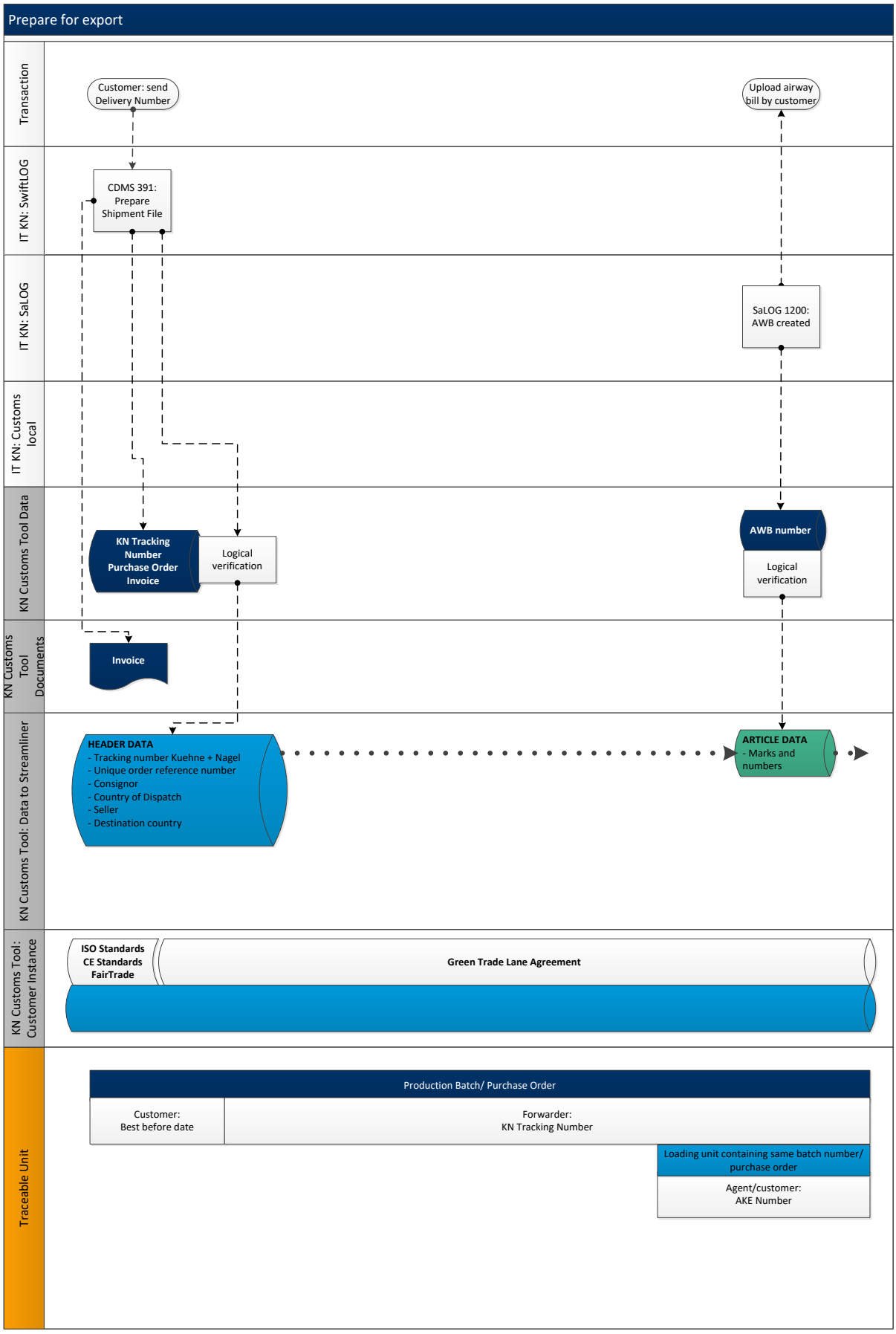

Figure 18: Prepare for export process and data elements

4.2.2.2 Export

During the export process no updates are available on the data elements that are required for the import customs declaration in the EU. Depending on the customer, agreements can be made about uploading the Single Administrative Document for example or security check confirmation.

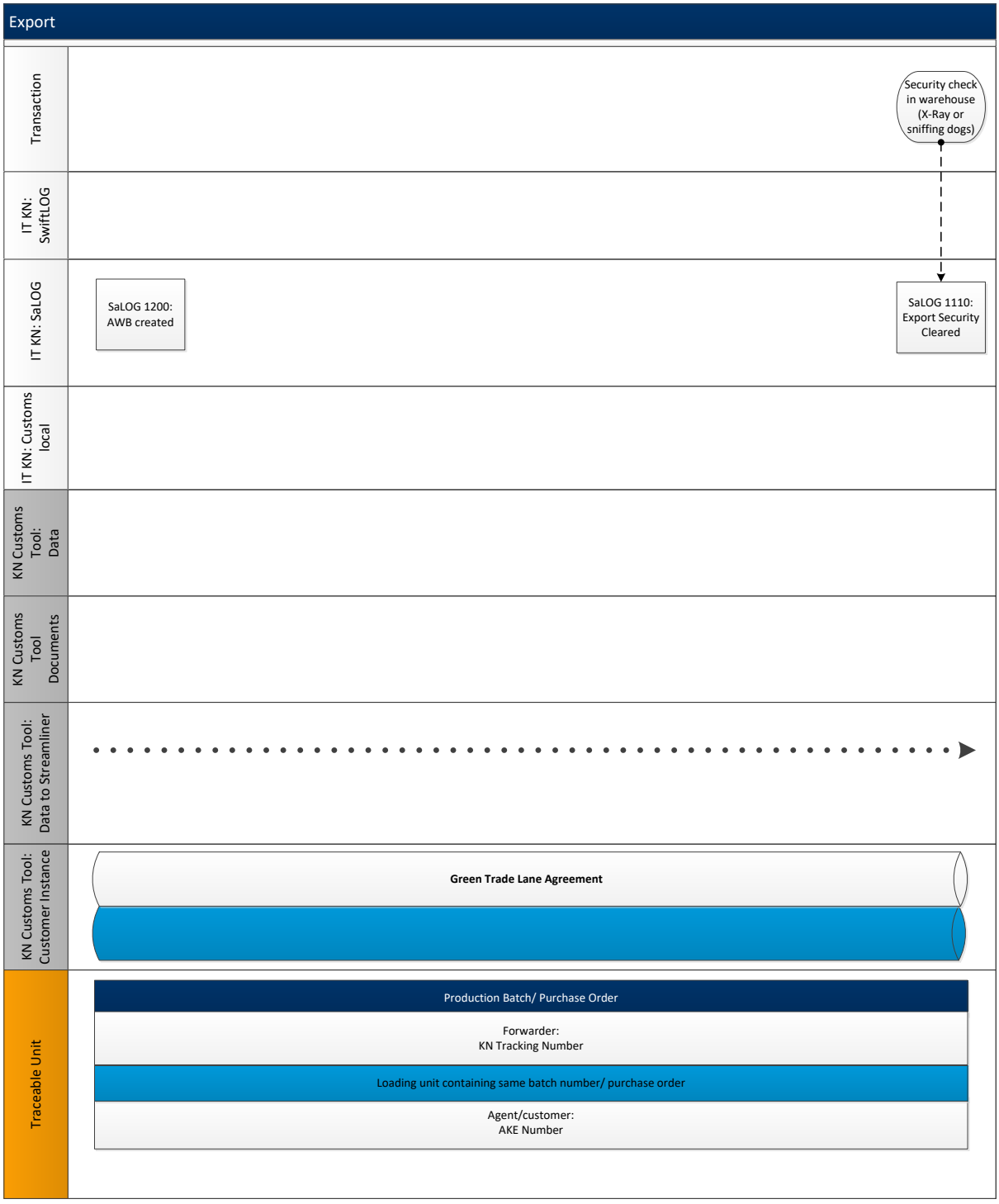

Figure 19: Export process and data elements

4.2.2.3 Transport

Since several checks within the export process cannot be carried out by KN, the reliability of the data elements transmitted can be only confirmed after receiving the confirmation of departure from the carrier by EDI. This message triggers SaLOG status 1300 (Departed). As is the case in the hi-Tech case study, an existing EDI with SaLOG is used to receive the different statuses from the carrier. Optimally, this data is shared directly with the KN Customs Tool to avoid additional interfaces with systems.

Due to the limited availability of status checks on the number of pieces or boxes (colli) and the identification of the goods, a number of data elements can only be verified upon the confirmation of departure of the carrier.

Header data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- AWB number / BL number	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	SaLOG 1300: Departed	The AWB is to be confirmed upon departure
- Arrival departure code	SaLOG	KN Customs Tool	KN	saLOG 94: customer uploaded document	SaLOG 1300: Departed	The airportcode is confirmed upon departure
- Transport cost	Manual	SAP	Customer	saLOG 94: customer uploaded document	SaLOG 1300: Departed	
- Total gross weight	SaLOG	SAP	Carrier	saLOG 94: customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Total colli	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	SaLOG 1300: Departed	Number of colli is to be confirmed by the carrier

Specifically in the 'Article' data this lack of status checks in the 'prepare for export' and 'export' phase results in additional data elements in comparison with the hi-Tech case.

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Product code	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages
- Goods Description	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages
- HS code / Taric	manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages
- Document codes	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages
- BTI number	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	BTI is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- BTI Date valid till	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	BTI is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Additional national codes	Manual	KN Customs Tool/ masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Codes are available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Quota authorisation number	Manual	KN Customs Tool/ EU database	KN	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Quota number is available on EU database, but only applicable when information on labelling is verified with shipment documentation provided
- Import / Export license number	Manual	KN Customs Tool/ masterdata	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	License is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Bonded or non-bonded	Manual	KN Customs Tool	KN	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Bonded status could be added to a standard business rule in the customer instructions
- Country of Origin	SaLOG	KN Customs Tool	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Country of origin could be part of the standard customer instruction
- Quantity	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Number of packages	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Packaging type	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages received in KN warehouse
- Net weight	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Gross weight	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Preference code	Manual	KN Customs Tool/ masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages
- Preference data	Manual	KN Customs Tool/ masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages
- Additional units	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Serial numbers	Manual	SAP	Customer	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required between data and label on boxes/packages

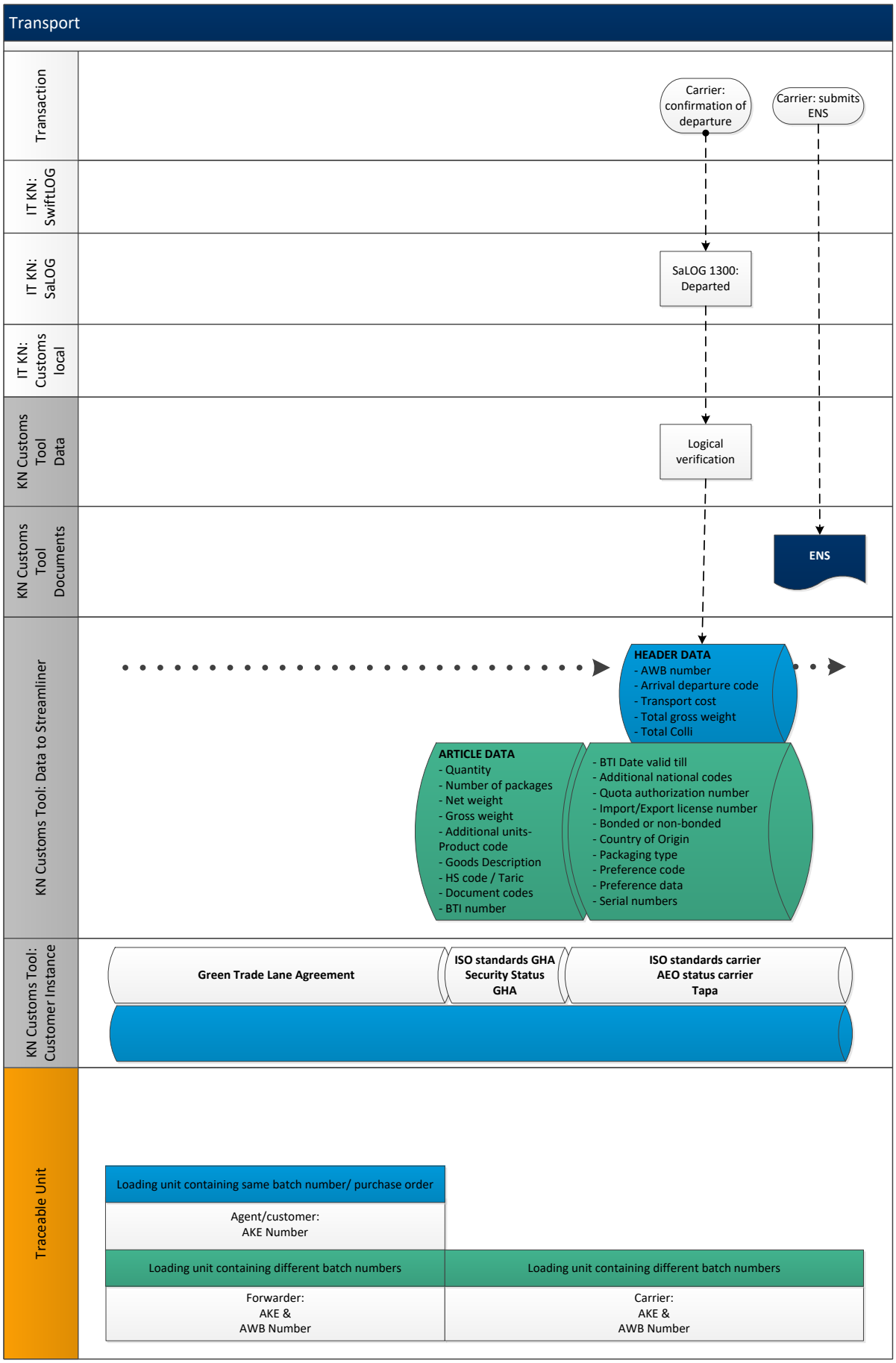

Figure 20: Transport process and data elements

4.2.2.4 Prepare for import

Compared to the 'Prepare for import' stage in the hi-Tech case study, there is no difference in statuses and the moment when the data elements are confirmed. In this specific fresh produce case study CDMS is replaced by SwiftLOG which is a more up-to-date warehouse management system which allows, among other functionalities, robotization of processes.

The following 'Header' and 'Article' data are confirmed when reaching SaLOG status 1400 (Arrived):

Header data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Unique order reference number	SaLOG	SaLOG	KN	saLOG 94: customer uploaded document	saLOG 1400: Arrived	
- Invoice number	manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Invoice date	manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Other reference nr purchase order, consignee ref, etc. (invoice purposes)	manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Data involved parties (address details, EORI, VAT nr, Unique relation id)	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Importer	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Exporter	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Buyer	template	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Connectedness between parties	template	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Incoterm	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Place incoterm	SaLOG	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Transaction type	template	KN Customs Tool	KN	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Currency	manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Invoice amount	manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Insurance cost	Manual	KN Customs Tool	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Additional cost	Manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- VAT cost	manual	Streamliner	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	Concerns a DDP calculation

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Invoice amount	Manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Currency	Manual	SAP	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport
- Royalties	Manual	KN Customs Tool	Customer	saLOG 94: customer uploaded document	saLOG 1400: Arrived	New sales transaction takes place during transport

Customs clearance is performed at a KN facility on the location of the Ground Handler. Within this KN facility the arrival confirmation within SwiftLOG is triggered by scanning the received shipments for 'inbound'. This scanning activity triggers via EDI the SaLOG status 1420, 'Arrived at KN Destination'. With reaching this status the following 'Header' and 'Article' data is confirmed.

Header data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Deviating delivery Address	SaLOG	SaLOG	Customer	saLOG 94: customer uploaded document	saLOG 1420: Arrived at KN Destination	Depending on the physical place of the goods when submitting the import declaration
- Place goods	template	SwiftLOG	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	SwiftLOG is able to communicate the location of the goods

Article data	Previous system in use	New system in use	Data source party	Data available	Data confirmed	Remarks
- Previous regulation	template	KN Customs Tool	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	Previous regulation is based on the location of the goods.
- Previous document	SaLOG	KN Customs Tool	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	The previous document is linked to the previous regulation
- Previous document date	Manual	KN Customs Tool	KN	saLOG 1410: Arrival Notification by Carrier	saLOG 1420: Arrived at KN Destination	The previous document is linked to the previous regulation

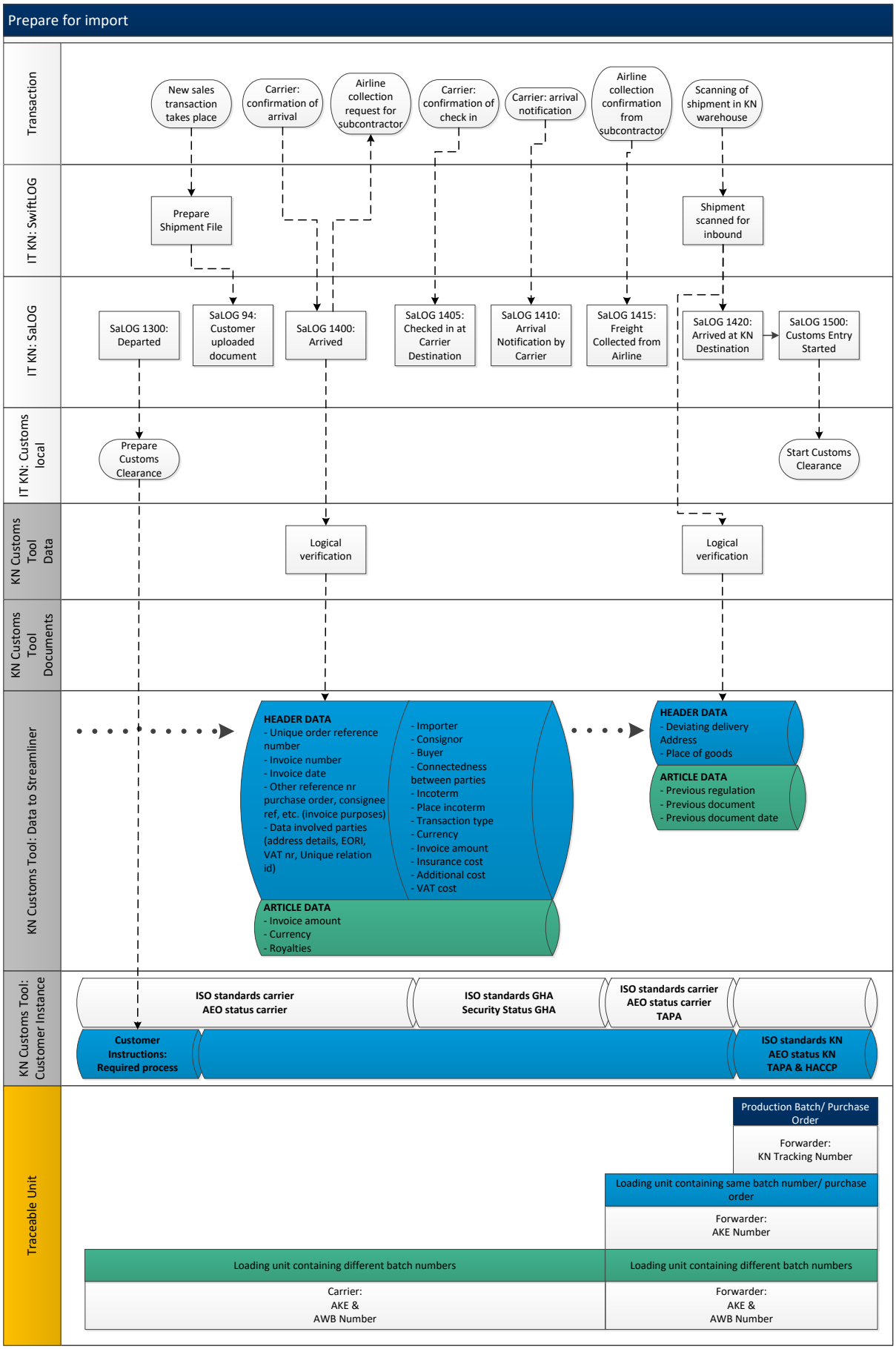

Figure 21: Prepare for import process and data elements

4.2.2.5 Import

As in the hi-Tech case study all necessary data fields for the import declaration are already known and available in the customs application Streamliner at this stage of the supply chain. Submission of the declaration can be triggered automatically on receipt of SaLOG status 1500 (Customs Entry Started). A copy of the SAD and all shipment documentation of relevance can be added to the digital shipment file in the KN Customs Tool.

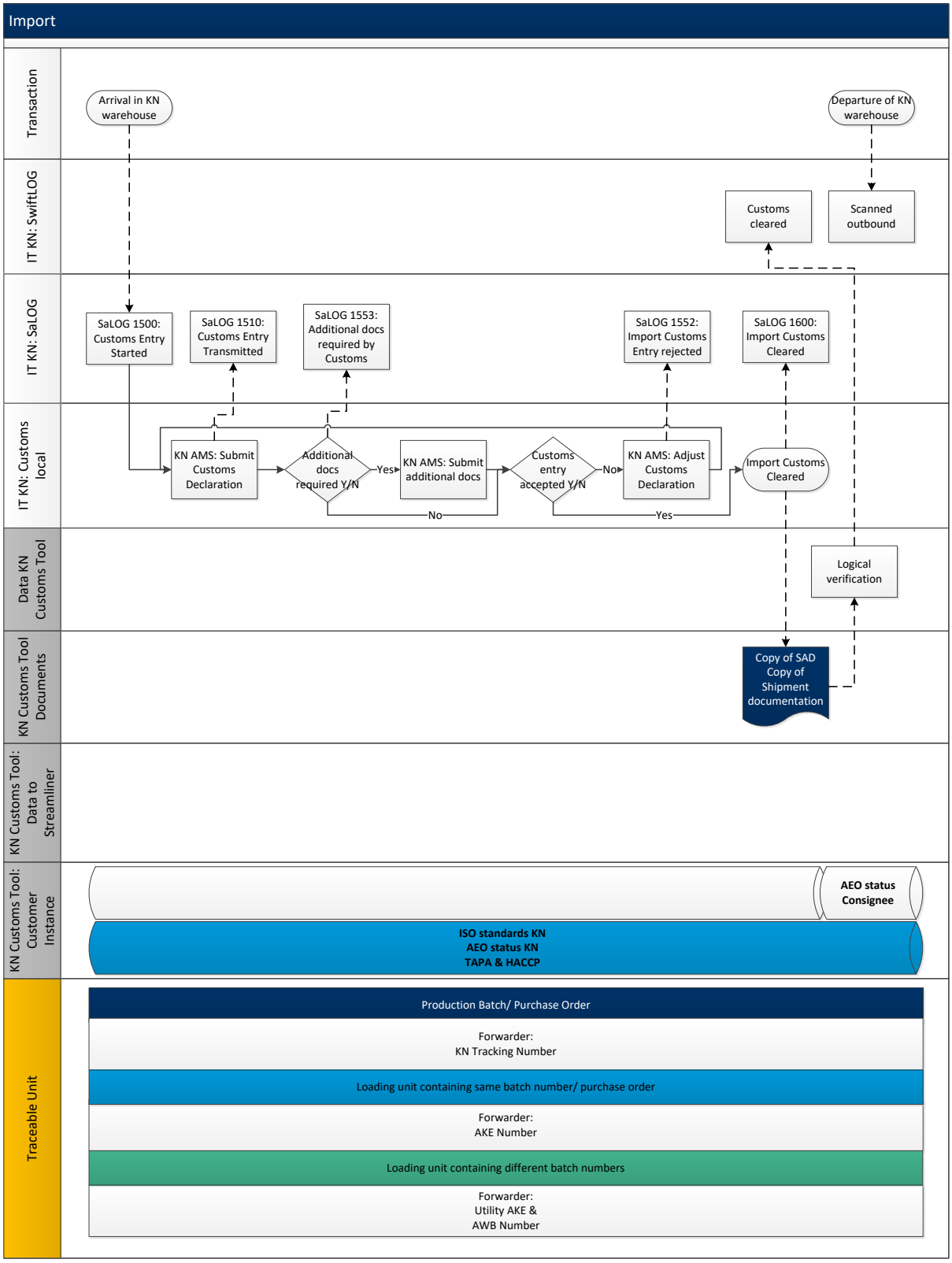

Figure 22: Import process and data elements

4.2.2.6 Analysis to what extent the 'Clearbox' in the fresh produce case study can function as a data pipeline

Similar to the hi-Tech case study, the Brexit 'ClearBox' solution is the starting point of the developments made to the 'ClearBox' for this specific fresh produce study. Based on the logistics specifics of this fresh produce supply chain and the applicable IT applications, adjustments have been made to these applications and the 'ClearBox' setup. In order to understand to what extent the 'ClearBox' can function as a data pipeline for this specific case study, it is necessary to answer the sub-questions of this research.

Sub-question a) What challenges are related to connecting the different country IT applications?
The fresh produce case study describes a push-to-market supply chain in which KN has direct control on the 'prepare for import' and 'Import' stages of the supply chain. The 'prepare for export', 'export' and 'transport' stages are controlled by other service providers. Compared to the Brexit setup of the 'ClearBox', two additional systems apply. These systems consist of an SAP system providing trade data from the customer, and SwiftLOG, a warehouse management system of KN. As was the case with the CDMS application in the hi-Tech study, it turned out that SwiftLOG also lacks essential customs data elements and statuses in the standard setup. For example, it was necessary to set up an additional status in SwiftLOG after the first scan moment in the KN warehouse at destination to prevent customs goods from being scanned for departure without verification upon release by Customs. Due to the new data fields to be added in SwiftLOG, a new mapping had to be created for the interfaces. This mapping requires not only specific knowledge of the applications, but it also requires specific knowledge of customs processes and those of the customer.

In deviation from the hi-Tech case study, the push-to-market characteristic of the fresh produce supply chain entails a different dynamic which is expressed in last minute changes and inaccuracies in the process. This is reflected, for example, in a deviating number of pieces shipped and the number of pieces mentioned in the shipment documentation. Challenges were encountered with the re-submission of adjusted delivery order data after a certain logistic milestone has been reached. Ultimately these challenges can be traced back to human errors in the logistics process. This indicates that despite a high degree of automation, there is still a great dependence on human interaction in the logistics process. A possible solution for this could be the use of RFID trackers, but these are not suitable for every supply chain. In this fresh produce supply chain the type of packaging and the relative high costs of the trackers makes this solution unsuitable.

Another side effect of the push-to-market and perishable supply chain is that the size of the shipments can vary greatly. This means that multiple shipments with different customs invoices and airway bill numbers can be loaded on the same flight. The direct creation of a unique KN Tracking number after the upload of a 'delivery number' was essential in this case study. Without this unique key it was not possible to temporarily store the trade data and re-use it in a later stage of the supply chain (Benz, 2020).

Sub-question b) What challenges are related to the completeness of the data within the applications?
The availability of the trade data elements in this case study does not deviate from the hi-Tech case and is therefore complete. The trade data in combination with information from the carrier such as the security status and the confirmation of arrival, ensures that a complete dataset is available which is required for the customs declaration for import.

The lack of direct control on the logistics process by KN on the 'prepare for export' and 'export' stages prevent that trade data can be cross-validated with crucial logistic milestones such as the consignment completion status.

Sub-question c) What challenges related to the quality of the data are encountered when setting up 'ClearBox' as a data pipeline?
In comparison with the hi-Tech case important logistic status updates at origin, such as a possible modification of the booking at the carrier (SaLOG status 144) and the inbound control and consolidation process at the warehouse (SaLOG status 1000) are lacking. As a result, the importance of the receipt control at the ground handler and the carrier has increased. The research on the flower supply chain indicates that precisely in this stage of the supply chain there are limited options to perform a piece count as the freight is already consolidated on Utility Load Devices (ULD's) (Borst, Enning, Elswijk, & Van Kruining, 2019). In the process of

reaching a green trade lane status, this specific trade lane has been fully audited by Customs. As a result of this audit, important changes were made to the process, with additional measures being taken at the grower and the ground handler, particularly in the area of piece count checks and smuggle (Koning, Konst, Lantema, & Visser, 2009). With this knowledge, the absence of these logistic status updates at origin has little effect on the reliability of the data available in the 'ClearBox'.

Sub-question d) What level of traceability on the products and customs data within the supply chain is required in order to demonstrate compliance towards enforcement agencies?
Similar to the hi-Tech case study, the 'ClearBox' can record and trace the different security and safety measures of each actor in the supply chain. The green trade lane status and the different measures taken by the actors in this supply chain that are aimed at minimizing the risks of mismatches in piece count and smuggle can potentially be recorded in the customer profile of the KN Customs Tool and made available to Customs via the customer portal, KNLogin. A similar approach could be created for specific measures related to product claims, such as FairTrade, which provide retailers additional assurance of these product claims. The recording of every movement in the supply chain in combination with specific certifications and standards of the supply chain actors which can be captured, provide valuable assurance in product claims such as "adding value at source". This makes the data pipeline concept not only relevant for enforcement agencies, but also for retailers, resellers and consumers. In the current setup the 'ClearBox' offers the functionality to trace back the shipment on the basis of the delivery number in order to assess the claim "delivery from harvest in as little as 36 hours". Also the system is able to track whether a passenger flight or a freighter is used.

5. Findings

Within this research the suitability of an existing system, the Brexit 'ClearBox' solution, has been assessed by the in-depth case studies of a hi-Tech supply chain and a food supply chain. Based on the logistics specifics of both supply chains and the applicable IT systems, adjustments have been made to these systems and the 'ClearBox' setup in order to capture data at the source from different sources and information systems available in the supply chain. In order to understand to what extent the 'ClearBox' can function as a data pipeline and can demonstrate sufficient reliability on the data and therewith compliance toward enforcement agencies in order to lower the risk profiles of these agencies, the several aspects of the problem at hand will be unfolded by answering the previously formulated sub-questions. Based on these anwers the main research question can be answered.

5.1 Sub-question a) What challenges are related to connecting the different country IT applications?

The analysis of the case studies in combination with the earlier observations on the creation of the setup of the Brexit 'ClearBox' solution, has led to the identification of a number of challenges that are related to linking the different IT applications. The two case studies show a clear difference between a supply chain in which there is complete control over both the export stage and the import stage, and a supply chain in which control is only limited to the import stage. The advantage of a global freight forwarder, as is the case in the hi-Tech case study, is expressed in an already existing setup of IT systems, which are largely already set up to record and share the various logistics milestones with, in most cases, the customer. The internal and external systems to be linked are all connected via the same middleware system which is used to "glue" the available data from two separate IT applications together. Using the same middleware also means using the same resources and knowledge. This knowledge ensures that the lead time for creating an interface is on average limited to two weeks (Dongen, 2020).

Depending on the IT application, the preparations required, before an assignment can be handed over to this 'middleware' team, can take a lot of time. The main reason for this is that data fields from one IT application needs to be matched with the databases of the other IT application. This process is time-consuming as each source can define similar points in different ways. In both case studies it emerged that the specific customs declaration data elements and customs statuses are not part of the standard dataset of a warehouse management system or transport management system. In the non-Customs IT applications in which customs

statuses are included, it appears that these statuses have not been set numerically in a logical order. This can potentially cause problems in IT applications where use is made of automated triggers that are based on the use of sequential statuses.

The fresh produce case study shows that a 'ClearBox' setup in which there is no full control over the export and import stages by the freight forwarder, can lead to the same result as in a situation in which there is full control over these stages. However, to guarantee the reliability and completeness of data, it is necessary to setup additional control measures within the process or to setup interfaces with external supply chain actors. In the latter case, challenges have to be overcome that relate to the costs to be incurred, data security and the sensitivity of some data elements such as the freight costs.

Other technical challenges encountered while connecting the IT applications of different countries relate to internationally deviating customs processes and the national detail level of commodity codes. In the case of deviating customs procedures, sometimes it is required to share additional data such as a license number. This license number, as was the case with the introduction of the simplified transitional procedure in the UK, was not part of the standard dataset that was supported by the customs application in The Netherlands, Belgium, France and Germany. In such cases it might be necessary to 'misuse' a different customs data field. This can have negative consequences for reports and on the compliance level of the customs declaration.

An aspect that is often neglected, in automation projects, concerns the need to modify existing processes which involve people. Not only is the existing knowledge of the people directly involved important for the success of an automation project, the change in the nature of the work must also be supported. Based on the two case studies, it is clear that the 'classic' customs brokerage tasks (checking and submitting information at a single point in the process) will be replaced by data and supply chain analysis tasks. This requires different capacities and competencies of the customs broker.

5.2 Sub-question b) What challenges are related to the completeness of the data within these applications?

Both case studies show that all relevant customs data elements are available within the different IT applications. Compared to the overview of the international trade system and customs in a data pipeline situation shown in the research of Hesketh (Hesketh D. , 2010), both case studies show that more refined logistics data is required to assess the customs and supply chain compliance. Compared to Hesketh's data pipeline concept, the 'ClearBox' shows more detailed information which can be used for cross-validation of the data used in the customs declaration. The 'ClearBox' allows the recording of every movement of the goods (e.g. factory, warehouse, ground handler) and the arrival at such a location. The combination of trade data and logistic milestones is essential for the functioning of the 'ClearBox'.

A significant difference in the availability and amount of data is noticeable between the pull-to-market and push-to-market products. The push-to-market supply chain has a different dynamic that is manifested in the simultaneous submission of data of different shipments. Due to last-minute changes, this data is often corrected at a later stage in the supply chain. Additional processes and measures to ensure a timely verification of quantities and the identity of the goods are necessary. In order to distinguish the amount of information from various shipments in the 'ClearBox' process, it is necessary to immediately create a unique reference key that is linked to the dataset and the customer, and is visible throughout the supply chain.

Similar to the data pipeline concept, the 'ClearBox' focusses on the "SHIP" phase within the standard trading model, known as the "BUY-SHIP-PAY model legacy (Unece, 2001). Both case studies show a successful setup for a final product that is shipped from A to B. Particularly in the example of the hi-Tech case study it would be valuable to have more detailed understanding of the components from which the final product is manufactured. Information related to the origin of the components can be of interest not only to enforcement agencies, but also to the manufacturer itself. This information is needed in a global trade management system to assess the complete global supply chain and to apply duty & tax management. From a technical perspective the 'ClearBox' is able to provide this information, but currently the content is lacking. In order to create this insight, consensus between the actors in the supply chain is required on the type of traceability and the level of detail. In that respect the completeness is depending on the demand.

5.3 Sub-question c) What challenges related to the quality of the data are encountered when setting up 'ClearBox' as a data pipeline?

The fresh produce case study shows that the 'ClearBox' works best when there is full control over the export and import stages in the supply chain. If this is not the case, additional processes and measures are required to ensure a timely and correct verification between the data and the goods in order to reach the same assurance level. As a result not every supply chain is therefore suitable for the use of the 'ClearBox'. A combination with the use of Internet of Things (IoT) devices, such as RFID trackers, can help to increase the reliability of the data that is shared. The deployability of these trackers is not always feasible and strongly depend on the product characteristics, the type of packaging and the packaging unit.

A difference with the data pipeline concept is that 'ClearBox' does not consistently use the data directly from the source. A strong feature of the 'ClearBox' is that it is able to hold data, verify this data through logical checks with logistic milestones, after which it is later made available to the local customs application. Some of the data elements, such as the additional national codes to the combined nomenclature codes, need to be supplemented. Within 'ClearBox' this additional information is stored in a customer profile.

The choice, not to make use of the available data directly from the source at every stage of the supply chain, makes it possible to overcome deviations in the supply chain. The difference between the two case studies shows how important it is to have direct control over both the consignment completion moment and the deconsolidation moment. The reliability of the trade data available in the different systems is highly dependent on many logistical operations and milestones. The data quality in both case studies is of a high level. However, the quality and therefore the reliability of the data is safeguarded in a different way in both case studies. In the hi-Tech case study, a thorough refinement of the logistical milestones ensures the necessary reliability, in the fresh produce case study this assurance is achieved by taking additional measures within the supply chain processes of the individual actors.

5.4 Sub-question d) What level of traceability on the products and customs data within the supply chain is required in order to demonstrate compliance towards enforcement agencies?

Another difference with the data pipeline concept is that the 'ClearBox' does not allow piggybacking by enforcement agencies. The options for unlocking the 'ClearBox' data are limited to the use of a standard interface setup via a port community system. Reason for this is that it is virtually impossible to set up individual interfaces between Customs and individual customs brokers. In addition, the security of data and the connection plays an important role (Wokke, 2019). Such a standard setup limits the insight that can be shared on the logical verifications on the data that are performed in the 'ClearBox'.

As piggy backing on the dataset is not supported, it is impossible for Customs and other enforcement agencies to cross-validate the data in the declaration. Since additional trade data such as purchase orders and delivery orders are systematically used to generate the customs declaration, Customs could perform an Electronic Data Processing audit (EDP-audit) on the 'ClearBox' setup which would provide them sufficient assurance on the correctness of the declaration. Access to the 'ClearBox' can be provided to Customs on a customer level via an existing customer portal, KNLogin. This application does already provide an overview of critical logistic milestones and documentation to customers. The system could be positioned towards Customs and other enforcement agencies as a 'compliance dashboard that can be used for auditing purposes. Besides the shipment documentation, the data elements, the source party of this data and the timestamps of these data elements, the 'ClearBox' can provide an overview of quality and safety standards (e.g. ISO standards, AEO) of both KN and the individual supply chain actors. The dashboard would eliminate the need to use extra source data to cross-validate the accuracy of the customs declaration.

The traceability of the products on piece level within the supply chain and the traceability of the data related to these pieces is essential to create sufficient assurance for enforcement agencies. Traceability of the shipments is made visible on three levels in the 'ClearBox'. The unique key to trace pieces, pallets, ULD's and airway bill numbers within the supply chain, consists of a combination between the purchase order or delivery number and the unique KN Tracking number. Traceability on components of end-products or ingredients is depending on the amount of detailed information and the degree of precision that this would require. The fresh produce case study proofs that a chain of custody could be set up in such a way that temperature control could be

maintained throughout the various stages of the supply chain. This level of detail shows that the depth of traceability within the 'ClearBox' is sufficient to match customs data with the goods. Further traceability on components of end products is only possible if there is consensus between the supply chain actors about the level of detail, the content of the data and the purpose of providing this traceability.

5.5 Main research question: To what extent can 'ClearBox' function as a data pipeline that may support KN and its customers, upon import into the EU, to demonstrate their compliance toward enforcement agencies such as Customs in order to reduce their risk profiles at these agencies?

Key requirements within the data pipeline concept are that the source data is shared by the use of high quality systems that support business processes 24/7 and that the information exchanged is safe and reliable (Pruksasri, Van den Berg, & Hofman, 2012). The 'ClearBox' does support business processes 24/7 with high quality systems. The exchange of data is also safe and reliable as most of it is shared within a single business environment. Based on the answers given above to the sub-questions of the research question, it can be concluded that the 'ClearBox' differs on a two points from the data pipeline concept.

The first difference with the data pipeline concept is that the data is not consistently made available directly from source. Instead it makes the data available only after a logical verification with specific logistic milestones has been performed. The combination of trade data with logistics data, which shows the movement of the goods through the supply chain, ensures a high degree of reliability of this trade data. Both case studies show that the reliability of the data strongly depends on the degree of control on both the export and import process by the freight forwarder. The design of the 'ClearBox' makes optimal use of KN's worldwide network as a global freight forwarder. Because the 'ClearBox' is based on the close connection of KN with the logistics processes and various actors, the 'ClearBox' can provide more refine logistic data and can therefore be seen as a further development of the data pipeline concept.

The second difference with the data pipeline concept is that piggybacking on the data by enforcement agencies such as Customs is not supported. Since additional trade data such as purchase and delivery orders are systematically used to generate the customs declaration, Customs could perform an EDP-audit on the 'ClearBox' setup which would provide them sufficient assurance on the correctness of the declaration. Additionally access to the 'ClearBox' data can be provided to Customs via a customer portal. Within this portal a compliance dashboard can be created which would eliminate the need to use extra source data to cross-validate the accuracy of the customs declaration. The required level of assurance for other enforcement agencies such as the Netherlands Food and Consumer Product Safety Authority is depending on the critical traceability elements and must be aligned further per agency.

The case studies show that every supply chain has different risks, which are dictated by the nature of the product, its origin and the actors in the supply chain. The risks of deviations between the data and the shipment are not limited solely to the consignment completion and the deconsolidation moment. The level of control on the risk elements is essential in determining any adjustment of risk profiles by enforcement agencies. The 'ClearBox' allows the recording of every movement of the goods within the supply chain, in combination with the available trade data a high level of traceability and control can be achieved.

As a conclusion, it can be stated that the 'ClearBox' deviates from the data pipeline concept on some elements, but that this does not come at expense of the reliability and completeness of the data. The combination of trade data and logistic milestones offer additional guarantees, which make it possible for enforcement agencies to reduce risk profiles for individual cases. The recording of every movement in the supply chain in combination with specific certifications and standards of the supply chain actors which can be captured and which make reference to specific product claims, makes this further development of the data pipeline concept also relevant for retailers, resellers and consumers.

6 Contribution for research

This research aims at testing the suitability of an existing system, the 'ClearBox', to determine to what extent this system can offer the same assurance to enforcement agencies as the data pipeline concept. Based on two different case studies, it can be concluded that the same level of assurance can be reached. However, there is a dependence on the structure of the supply chain.

Global operating freight forwarders seem to be in a better position to set up a supply chain data platform than stand-alone customs brokers. The existing IT landscape of these freight forwarders is often designed to record logistic milestones in the supply chain and make them accessible to the customer. A combination of these logistics milestones and the available trade data, such as purchase orders, ensures a high level of reliability of this data. Another advantage of the global freight forwarder in comparison to stand-alone customs brokers is that they have a great deal of control over both the export and import process.

The studies of Hesketh (Hesketh D. , 2009) (2010) and the studie of Klievink et al. (Klievink, et al., 2012) describe a logistics process in which particular the consolidation moment "shipment said to contain…" and the deconsolidation moment are essential in determining the reliability of the data. The case studies in this research provide insight into an airfreight process in which there are no closed containers and in which, therefore, different actors still have direct access to the goods between the consolidation and deconsolidation moment. In addition, these supply chains show that these consolidation and deconsolidation moments often require manual actions. The use of RFID trackers, for example, does not appear to offer a solution for every supply chain to guarantee data quality.

From this study three important findings can be extracted which can be of value for further research on the data pipeline concept.

The first finding is that the use of data from the source does not necessarily lead to a more reliable dataset. In many cases temporarily holding this data, to perform a verification through logical checks on logistic milestones, ensures that deviations in the supply chain can be overcome. This research shows that further refinement of the logistics data and milestones can contribute to a higher reliability of the data.

A second finding is that the disclosure of data to enforcement agencies is limited to a fixed interface format with port community systems. Such a setup may prevent the full potential of a public data platforms from being unlocked. This research shows that there are alternative options for the use of extra source data to cross-validate the accuracy of the customs declaration. An EDP-audit on the systems and direct access to the data and documentation within this system could provide enforcement agencies sufficient assurance to lower risk profiles.

A third finding is that assurance on the data can partly also be achieved by providing insight in to internationally recognized safety, security and quality standards (e.g. ISO standards, AEO) which are applicable to the various supply chain actors. The ability to record more information related to product specific claims in the data pipeline, could potentially make the data pipeline concept also relevant for business and consumers.

7 Contribution for practice

The role of the freight forwarder in the global supply chain may become more important in the coming years in view of the developments on IT and in view of an increasing need for control on the fragmented global supply chain. Where several customs brokers seem unable to develop an integrated global customs brokerage system (Dongen, 2020), freight forwarders can lean on an existing global IT landscape that is based on recording shipment movements through the supply chain. Potentially this could lead to a new business model in which the freight forwarder acts as a data hub and offers electronic customs brokerage services.

Creating a data pipeline or data platform requires a clear IT landscape development plan in order to properly coordinate the amount of interfaces required. Minimizing the number of interfaces with a single IT application

is important to maintain the stability of this IT application. The increasing demand for interfaces with specific customs applications creates a great need for IT specialists who can develop these interfaces. In addition to the technical knowledge of the IT applications, knowledge of the customs processes is essential.

The cases studies in this research show that many IT applications such as a warehouse management system or a transport management system, are not designed to facilitate customs processes and statuses. Given the increasing demand for control on the customs processes within the supply chain, it is important that these customs processes are taken into account when developing these systems.

An aspect that is often neglected in automation projects, concerns the human part. It is well known that change management is essential for an IT implementation to be successful. It is less known that when it comes to customs data, the role of the customs broker requires different capacities and competences. The traditional customs brokerage tasks, which are based on checking and submitting data at a single moment in the supply chain, will be replaced by data and supply chain analytics. This makes analytical and communication skills increasingly important for a customs broker.

8 Conclusions and recommendations

The findings show that the 'ClearBox' deviates on the data pipeline concept on two aspects, but these differences do not come at the expense of the reliability and completeness of the data. The 'ClearBox' can provide a refine insight in the logistics data and milestones which can be used to cross-validate the customs declaration. The combination of trade data and logistic milestones provide additional guarantees, which make it possible for enforcement agencies to reduce risk profiles for individual cases. Suitable cases depend on the characteristics such as a pull-to-market or push-to-market supply chains and depend on the level of control by the freight forwarder on the export and import stage.

The first l difference to the data pipeline concept is that the data in the 'ClearBox' is not consistently made available directly from the source. Instead it makes the data only available after a logical verification with specific logistic milestones has been performed. The recording of movements of the goods within the supply chain in combination with the available trade data ensures a high level of reliability of this trade data.

The second difference to the data pipeline concept is that the 'ClearBox' does not allow piggybacking on the data by enforcement agencies. The options for unlocking the data are limited to the use of a standard interface which is managed by a port community system. A recommendation for further research would be to see to what extent this port community system principle could be abandoned. An alternative could be to audit the systems and provide direct access for Customs to the data elements, the data sources, the data timestamps and documentation via a customer portal. Further research is required to determine the conditions which such a compliance dashboard must meet.

The findings of this research are largely based on two case studies, both of which describe an air freight process. Although the findings seem to be applicable for other supply chains such as the pharmaceutical industry and other transport modalities, it is recommended that further research is conducted.

The differences in supply chains, product characteristics, the diversity of external systems and the human aspect all determine the success of a data pipeline setup. Therefore the creation of a data pipeline is more than connecting data.

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Annex I: Example case Germany: EDI connection with KN Customs Tool

IT Systems used:

-	Customs Tool	Dataplatform	KN
-	Ciel FW (KN)	Warehouse system	KN
-	Zodiak	Customs application	KN
-	ERP	ERP	Customer

Header data	ERP	Ciel FW	Zodiak
- Tracking number Kuehne + Nagel		■	
- Unique order reference number	■		
- Invoice number	■		
- Invoice date	■		
- Other reference nr purchase order, consignee ref, etc. (invoice purposes)			Manual
- Data involved parties (address details, EORI, VAT nr, Unique relation id)			Manual
0 Importer	■		
0 Exporter	■		
0 Consignor	■		
0 Consignee	■		
0 Buyer	■		
0 Seller	■		
0 Deviating delivery Address			Manual
- Destination country	■		
- Connectedness betw een parties			Manual
- Incoterm	■		
- Place incoterm	■		
- Container Number(s)			Manual
- Seal number			Manual
- Country of Dispatch			Manual
- AWB number / BL number		■	
- Mode of transport border crossing			Manual
- Identity means of transport Border			Manual
- Nationality means of transport border			Manual
- Arrival departure code			Manual
- Identity means of transport Arrival			Manual
- Identity means of transport Departure			Manual
- Nationality transport means			Manual
- Arrival / departure date			Manual
- ETD / ETA			Manual
- Customs office			Manual
- Place goods		■	
- Transaction type	■		
- Currency	■		
- Invoice amount	■		
- Transport cost			Manual
- Insurance cost	■		
- Additional cost	■		
- VAT cost	NA	NA	NA
- Total gross w eight	■		
- Total colli	■		

Article data	ERP	Ciel FW	Manual
- Product code	■		
- Goods Description	■		
- HS code / Taric	■		
- Document codes			Manual
- BTI number	■		
- BTI Date valid till	■		
- Additional national codes			Manual
- Quota authorisation number			Manual
- Import / Export license number	■		
0 dual use	■		
0 Category port number	■		
0 Quantity	■		
0 License number	■		
0 Value dual use	■		
0 Document codes			Manual
0 Special destination permission			Manual
- Bonded or non-bonded		■	
- Country of Origin	■		
- Quantity		■	
- Number of packages		■	
- Packaging type		■	
- Net w eight	■		
- Gross w eight	■		
- Invoice amount	■		
- Currency	■		
- Preference code			Manual
- Preference data			
- Additional units	■		
- Marks and numbers			Manual
- Serial numbers	■		
- Previous regulation		■	
- Royalties	■		
- Previous document		■	
- Previous document date		■	

Annex II: Main sources data elements

Description: Data elements that are part of the customs declaration can be broadly distinguished into elements that must come from the customer and data that should originate from a logistics provider. Data coming from the customer involves financial transaction data and/or fabrication related details. Some data elements can be delivered by both parties such as weight.

Header data	Data source party
- Tracking number Kuehne + Nagel	KN
- Unique order reference number	KN
- Invoice number	Customer
- Invoice date	Customer
- Other reference nr purchase order, consignee ref, etc. (invoice purposes)	Customer
- Data involved parties (address details, EORI, VAT nr, Unique relation id)	Customer
0 Importer	Customer
0 Exporter	Customer
0 Consignor	Customer
0 Consignee	Customer
0 Buyer	Customer
0 Seller	Customer
0 Deviating delivery Address	Customer
- Destination country	Customer
- Connectedness betw een parties	Customer
- Incoterm	Customer
- Place incoterm	Customer
- Container Number(s)	KN
- Seal number	KN
- Country of Dispatch	KN
- AWB number / BL number	KN
- Mode of transport border crossing	KN
- Identity means of transport Border	KN
- Nationality means of transport border	KN
- Arrival departure code	KN
- Identity means of transport Arrival	KN
- Identity means of transport Departure	KN
- Nationality transport means	KN
- Arrival / departure date	KN
- ETD / ETA	KN
- Customs office	KN
- Place goods	KN
- Transaction type	KN
- Currency	Customer
- Invoice amount	Customer
- Transport cost	KN
- Insurance cost	Customer
- Additional cost	Customer
- VAT cost	Customer
- Total gross w eight	Customer/KN
- Total colli	Customer/KN

Article data	Data source party
- Product code	Customer
- Goods Description	Customer
- HS code / Taric	Customer
- Document codes	Customer
- BTI number	Customer
- BTI Date valid till	Customer
- Additional national codes	KN
- Quota authorisation number	KN
- Import / Export license number	Customer
0 dual use	Customer
0 Category port number	KN
0 Quantity	Customer/KN
0 License number	Customer
0 Value dual use	Customer
0 Document codes	KN
0 Special destination permission	Customer
- Bonded or non-bonded	KN
- Country of Origin	Customer
- Quantity	Customer/KN
- Number of packages	Customer/KN
- Packaging type	Customer/KN
- Net w eight	Customer
- Gross w eight	Customer
- Invoice amount	Customer
- Currency	Customer
- Preference code	KN
- Preference data	KN
- Additional units	KN
- Marks and numbers	KN
- Serial numbers	Customer
- Previous regulation	KN
- Royalties	Customer
- Previous document	KN
- Previous document date	KN

Annex III: Case Study hi-Tech: Header Data elements

Description: Overview of Header Data elements available in supply chain and moments when these data fields are confirmed

Header data	Dos. Type	Type	Current systems in use	Desired systems	Data source party	When data available	When data confirmed	Remarks
- Tracking number Kuehne + Nagel	I/O	V	SaLOG	SaLOG	KN	SaLOG 101: eBooking transmitted	SaLOG 101: eBooking confirmed	
- Unique order reference number	I/O	V	SaLOG	SaLOG	KN	saLOG 94: customer uploaded document	SaLOG 1000	
- Invoice number	I/O	V	manual	CDMS/Apple	Apple			
- Invoice date	I/O	N	manual	CDMS/Apple	Apple			
- Other reference nr purchase order, consignee ref, etc. (invoice purposes)	I/O	V	manual	CDMS/Apple	Apple			
- Data involved parties (address details, EORI, VAT nr, Unique relation id)	I/O	V	SaLOG	CDMS/Apple	Apple			
0 Importer	I/O	V	SaLOG	CDMS/Apple	Apple			
0 Exporter	I/O	V	SaLOG	CDMS/Apple	Apple	saLOG 94: customer uploaded document	SaLOG 101: eBooking transmitted	
0 Consignor	I/O	V	SaLOG	SaLOG	Apple	saLOG 94: customer uploaded document	SaLOG 101: eBooking transmitted	
0 Consignee	I/O	V	SaLOG	SaLOG	Apple	saLOG 94: customer uploaded document	SaLOG 144: Booking modified	
0 Buyer	I/O	V	template	CDMS/Apple	Apple			
0 Seller	I/O	V	template	CDMS/Apple	Apple	saLOG 94: customer uploaded document	SaLOG 144: Booking modified	
0 Deviating delivery Address	I/O	V	SaLOG	SaLOG	Apple			
- Destination country	I/O	V	SaLOG	CDMS/Apple		saLOG 94: customer uploaded document	SaLOG 144: Booking modified	
- Connectedness between parties	I/O	T (Y/N)	template	CMDS/Apple	Apple			
- Incoterm	I/O	T	SaLOG	CMDS/Apple	Apple			
- Place incoterm	I/O	V	SaLOG	CMDS/Apple	Apple			
- Container Number(s)	I/O	V	NA	NA	NA	NA	NA	
- Seal number	I/O	V	NA	NA	NA	NA	NA	
- Country of Dispatch	I	T	SaLOG	SaLOG	KN	saLOG 94: customer uploaded document	SaLOG 1300: Departed	The country of dispatch in theory can still change
- AWB number / BL number	I/O	V	SaLOG	SaLOG	KN	SaLOG 1200: AWB created	SaLOG 1300: Departed	The AWB is to be confirmed upon departure
- Mode of transport border crossing	O	N	SaLOG + template iBroker	SaLOG	KN			
- Identity means of transport Border	O	V	SaLOG	Carrier	Carrier			
- Nationality means of transport border	O	T	SaLOG	Carrier	Carrier			
- Arrival departure code	I/O	V	SaLOG	SaLOG	KN	SaLOG 101: eBooking transmitted	SaLOG 1300: Departed	The airportcode is confirmed once the AWB is created
- Identity means of transport Arrival	O	V	SaLOG	Carrier	Carrier			
- Identity means of transport Departure	O	V	SaLOG	Carrier	Carrier			
- Nationality transport means	O	T	SaLOG	Carrier	Carrier			
- Arrival / departure date	O	N	SaLOG	Carrier	Carrier			
- ETD / ETA	O	N	SaLOG	Carrier	Carrier			
- Customs office	O	V	Manual	KN Customs Tool	KN			
- Place goods	I/O	V	template	CDMS	KN			
- Transaction type	I/O	N	template	KN Customs Tool	KN			
- Currency	I/O	T	manual	CDMS/Apple	Apple			
- Invoice amount	I/O	N	manual	CDMS/Apple	Apple			
- Transport cost	I/O	N	Manual	SaLOG	KN	SaLOG 101: eBooking transmitted	SaLOG 1300: Departed	Rate agreement is part of contractual agreement between forwarder and customer. Rate is based on weight which is to be confirmed by the carrier
- Insurance cost	I/O	N	Manual	KN Customs Tool	Apple			
- Additional cost	I/O	N	Manual	SaLOG & CDMS	Apple			
- VAT cost	I/O	N	manual	Streamliner	Apple			Concerns a DDP calculation
- Total gross weight	I/O	N	SaLOG	SaLOG	Carrier	saLOG 94: customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Total colli	I/O	N	SaLOG	CDMS	KN	saLOG 94: customer uploaded document	SaLOG 1300: Departed	Number of colli is to be confirmed by the carrier
I = inbound								
O = Outbound								
N = Numeric								
T = Text								
V = Variable								

Annex IV: Case Study hi-Tech: Article Data elements

Description: Overview of Article Data elements available in supply chain and moments when these data fields are confirmed

Article data	Dos. Type	Type	Current systems in use	Desired systems	Data source party	When data available	When data confirmed	Remarks
- Product code	I/O	V	Manual	CDMS/Apple	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Goods Description	I/O	V	Manual	CDMS/Apple	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- HS code / Taric	I/O	N	manual	KN Customs Tool/masterdata	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Document codes	I/O		Manual	KN Customs Tool/masterdata	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- BTI number	I/O	V	Manual	KN Customs Tool/masterdata	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	BTI is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- BTI Date valid till	I/O	V	Manual	KN Customs Tool/masterdata	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	BTI is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Additional national codes	I/O	V	Manual	KN Customs Tool/masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	Codes are available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
- Quota authorisation number	I	V	Manual	KN Customs Tool/EU database	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	Quota number is available on EU database, but only applicable when information on labelling is verified with shipment documentation provided
- Import / Export license number	I/O		Manual	KN Customs Tool/masterdata	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	License is available in masterdata, but only applicable when information on labelling is verified with shipment documentation provided
0 dual use	O				Apple			
0 Category port number	O							
0 Quantity	O				Apple			
0 License number	O				Apple			
0 Value dual use	O				Apple			
0 Document codes	O				KN			
0 Special destination permission	O				Apple			
- Bonded or non-bonded	I/O	T	Manual	CDMS	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	Bonded status is connected to the actual products shipped and therefore only applicable when the labelling information is verified with the shipment documentation provided
- Country of Origin	I/O	V	SaLOG	CDMS/Apple	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Quantity	I/O	N	Manual	CDMS	Apple	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Number of packages	I/O	N	Manual	CDMS	Apple	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Packaging type	I/O	V	Manual	CDMS	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Net weight	I/O	N	Manual	CDMS	Apple	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Gross weight	I/O	N	Manual	CDMS	Apple	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	Weight is to be confirmed by the carrier
- Invoice amount	I/O	N	Manual	CDMS/Apple	Apple			
- Currency	I/O	T	Manual	CDMS/Apple	Apple			
- Preference code	I/O	N	Manual	KN Customs Tool/masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Preference data	I		Manual	KN Customs Tool/masterdata	KN	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Additional units	I/O		Manual	CDMS/Apple	Apple	SaLOG 94: Customer uploaded document	SaLOG 1300: Departed	verification required by carrier (depending on total colli loaded)
- Marks and numbers	I/O	V	SaLOG	SaLOG	KN	SaLOG 1200	SaLOG 1200	
- Serial numbers	I/O	V	Manual	CDMS/Apple	Apple	SaLOG 94: Customer uploaded document	SaLOG 1000: Arrived at KN origin	verification required between data and label on boxes/packages received in KN warehouse
- Previous regulation	I/O		template	KN Customs Tool/template	KN			
- Royalties	I/O	T (Y/N)	Manual	CDMS/Apple	Apple			
- Previous document	I/O	V	SaLOG/iBroker template	KN Customs Tool/template	KN			
- Previous document date	I/O	N	Manual	CDMS	KN			

Annex V: Interview protocol

This interview protocol was drawn up as an introduction to the research. However, the questions are tailored to the specific experience and area of knowledge of the interviewee.

Interview Protocol Form

Institutions: _____

Interviewee (Title and Name): _____

Interviewer: _____

Opening statement

- First of all, I would like to thank you for your support and input in this research project of the Executive Master Program Customs and Supply Chain Compliance at the Rotterdam School of Management
- **Introduction**
  Subject of the research project is the data pipeline concept in the international supply chain. The data pipeline concept originates from an initiative made by the English and Dutch Customs authorities that included a new information exchange system based on the assumption that the data at origin (i.e., the place where data enter the system) should be considered as most genuine, and therefore, most correct (Hesketh D. , 2009). As the business community is too fragmented and has many and diverse interests in setting up a data pipeline, many initiatives remain in the concept phase up till now.

  In preparation of a no-deal Brexit, KN developed a customs data platform in which all relevant national customs applications and K+N logistics applications are connected to one single customs application, the KN Customs Tool. This application is able to receive customs relevant data from KN and non KN systems, it is able to enrich this data and forward it to the national customs applications. This process of collecting, enriching and transmitting customs data is named 'ClearBox'.

  Research question:

  To what extent can 'ClearBox' function as a data pipeline that may support KN and its customers, upon import into the EU, to demonstrate their compliance toward enforcement agencies such as Customs in order to reduce their risk profiles at these agencies?

- A limited number of key experts are interviewed to provide insight in the challenges that are encountered when connecting different IT applications and when re-using external relevant customs data.

- This interview is to last no longer than one hour. During this time, I would like to cover several questions that will give more insight in the challenges and requirements when setting up a data pipeline.

Annex VI: Transcript of interview Sabrina Benz
Date of interview: 27 January 2020

Mrs. Benz is as a team lead responsible for the IT Hamburg team that supports the IT applications within the EU region. The main focus of the team is the support and development of the KN Customs Tool.

1. Are you familiar with the concept of the data pipeline? If yes, what is your opinion?

   Apart from what you explained previously I have not heard about it. Based on what you have explained, I do believe we as KN are creating a similar set-up with the 'ClearBox'.
   I believe this data platform in which customs data from different systems are reused is the new reality. Especially for KN with all the different global systems that are used, it does not make sense not to connect these systems.

2. How would you describe the ClearBox/Customs Tool in short?

   The 'ClearBox' is a term that was introduced in 2019 and does not refer to a single application, but refers to a process of (customs) data set building. The data which is combined originates from the different global KN applications supplemented with data that is made available via a JAVA web form. This web form enables our customers to fill in missing data fields. It is also possible to make data from the customer immediately available via an interface.
   The KN Customs Tool forms the heart of the engine and was developed in 2012. The tool enables the merging of order and invoice data originating from our customers.

3. Which phases can be distinguished within the development of the ClearBox/Customs Tool?

   The development of the KN Customs Tool started in 2012, following a request from the German Contract Logistics business unit to combine the data from the customer HP with the data originating from the warehouse management system. The KN Customs Tool was able to merge invoice data with data from CIEL FW. The aim of this development was to forward the customs data elements that are required for a T1 declaration to Zodiak (German Customs application). The aim was to reduce the manual workload to a minimum. After HP also customs processes of other customers were integrated in the KN Customs Tool, not only for Contract Logistics, but also for air logistics and sea logistics.

   Three years ago Dubai came along and requested a tool to handle all customs declarations for their customs team. In Dubai there is no specific requirement for a certified customs system to issue declarations. This made it possible to build a customized system that is able to create and submit customs declarations.

   Recently the KN Customs Tool has also been used by the Road Logistics business unit in Germany for creating T1 declarations that are based on data coming from customers and data coming from the KN transport management system.

   The last year Brexit came along and the scope was completely shifted to Road Logistics and the UK only. The main question is what will follow now.

4. In which phase are we currently?

   We are currently still preparing our setup for Brexit. The first phase of the 'ClearBox' development , in which data from the mainland (DE, NL, BE, LUX, FR, ES) is enriched and prepared in ICE in the UK, has been completed. Currently we are finalizing the second phase in which we make Customs data available from ICE to the mainland.

   The setup for trade with the non-EU countries Switzerland and Norway are planned for the next phases, but funding needs to be finalized. In the Switzerland case there are still some old legacy systems in place that are used for mapping. These legacy systems have also a database and need to be transferred to the KN Customs Tool.

5. What are the biggest challenges that we have faced up till now?
   The tool has been developed agile according to a specific set of functionalities. The system is not designed as a data warehouse, but we are currently changing the setup. Therewith the scope changes as well. The system itself is very flexible and can easily be customized. Most functional requirements we can implement quite easily. That is why it was possible to act quick in the Brexit preparations.

6. What challenges do you still expect?
   The system can easily be transferred to a data warehouse. However, this requires funding. This funding needs to come from the country organizations. Within the Brexit project this required funding already created discussions and delay.

7. Are there limitations to the IT applications will/can be connected to the ClearBox?
   The limitations are linked to the financial budget. In principle we are able to connect every system.

8. Are there limitations to the data that can be used?
   No, the amount of data to be processed is connected to the budget. The type of data is unlimited.

9. Within the NL set-up we have chosen to connect the systems (SaLog, Ciel, SwiftLog, etc) with the Customs application tool directly by reasons for having a uniform tracking number. Within the philosophy of the Customs Tool, these systems are connected to the Customs Tool directly and from there transferred to the local Customs application tools. How do you connect this data when there is no uniform tracking number or shipment reference number available yet?
   A unique key is required per shipment, especially in situations in which a customer processes several purchase orders within a short timeframe. In the KN Customs Tool we make use of a combination of the KN Tracking number and the purchase order number. The order of entry is not so important. Once the combination of the tracking number and the purchase order number is created, all other can be linked. A similar setup was already succesful in Germany with CIEL FW and SaLOG. In Brexit we faced some challenges with Overland systems that do not have a unique identifier, but also here we found a solution to link the data.

10. In what extent is it possible to receive external data (for stand-alone customs brokerage activities)?
    We are able to receive it, store it temporarily and pass it on. We could use shipment statuses for confirming the data with the logistics milestone if we receive external data from a carrier for example.

11. Is there a specific format that is required when an external party when setting up an EDI with an external party?
    For Brexit a specific XML interface was developed. It is however possible to set up an individual interface.

12. What measures are taken to set-up a secure data exchange with external parties? Do we require a certain level of security level?
    We use very high security standards which is incorporated within the iBroker and ESB systems that we are using.

13. Till what extent can we assure the integrity of the data and statuses provided by external parties?
    We are using high security standards to make sure the data which we receive from a customer is integer. The reliability of the data is difficult to check. In the German example we worked with logistics milestones of the warehouse operation to perform certain logical checks. For example the system verified the number of pieces mentioned on the invoice with number of pieces picked in the warehouse.

14. You spoke earlier during the KN EU Customs meeting about customer instructions that can be added to the Customs Tool. Is there a standard format required?

    Yes, there is a standard instruction model we use, but this is not required.

15. Till what extent can KN influence the quality of data at the source of the supply chain?

    When setting up an interface we always start with a standard questionnaire. In addition to the need of an IT professional, who can challenge on the technical aspect, we also work with a project manager. This project manager can challenge the quality of data based on the questionnaire.

    When setting up several interfaces for a single customer, it makes sense to cross validate commercial data with logistics data as we have done in the German example.

Annex VII: Transcript of interview Diederick Olijve

Date of interview: 7 January 2020

Mr. Olijve is responsible for the logistical an operational part within the supply chain of BlueSkies. His experience is not only limited to the logistics components in the supply chain, but he has also valuable knowledge concerning the product specific requirements that are determined by the retailers.

1. Are you familiar with the concept of the data pipeline? If yes, what is your opinion?

   No, but if this relates to making the steps in the logistics chain visible, then I very much support this.

2. Can you share your experiences with regard to the realization of the green trade lane agreements?

   During 2008, we came into contact with Customs through our carrier KLM and our forwarder KN to discuss the options for reducing the percentage of customs controls. Our product is very sensitive to temperature changes and has a limited shelf life. As Blue Skies we attach great importance to transparency towards our customers. The question was therefore whether we could also show this transparency to Customs with the aim to minimize delays in the supply chain.

   As a result we audited the complete supply chain together with Customs and the carrier. By also visiting the production location in Ghana and the airport with them, we were able to agree on various measures to minimize the known risks of smuggling. Various adjustments to the process were made as a result of this visit and the audit in order to obtain sufficient assurance on the reliability of the data within the supply chain. For example, we have implemented fingerprint scanners to gain access to the goods. Also metal detectors have been installed to prevent any smuggle of weapons and munition. In 2009 these adjustments resulted in a 'green tradelane' agreement with Customs.

3. How does this relate to the specific quality requirements that your customers place on you?

   In addition to the fact that we are better able to control the quality of the product during the transport stage due to a lower change of delays due to Customs controls, we have also made various adjustments to the process in our audit systems. These audits form part of contractual agreements with our customers and provide them with a very comprehensive picture of our processes and quality.

4. You indicate that you deliver 'fresh from harvest'. How do you guarantee this and how do you demonstrate this to your customers?

   In addition to having an extensive internal audit process, the results of which we share with our customers, our customers also conduct periodic audits of our processes. In our process we do not use batch numbers, but a best before date. This makes it easy to assess the freshness of the product.

5. What do you see as the most important developments and challenges in the supply chain?

   We recently had our carbon footprint calculated. We see that our customers are setting increasingly strict requirements with regard to the carbon footprint. We have taken various measures ourselves, such as the reuse of peelings and residues, the use of thin, recyclable plastic and the use of passenger flights instead of dedicated cargo flights. However, proper monitoring of our performance in this area requires much more extensive monitoring of all parties in the supply chain that are involved. This is currently difficult to trace.

Annex VIII: Transcript of interview Ed Kooij

Date of interview: 19 December 2019 & 11 June 2020

Mr. Kooij is responsible for the customs application team which is part of the NL IT solutions team. In this role he was closely involved in the development of the 'ClearBox' setup for Brexit. As such Mr. Kooij is also directly involved in the developments of the hi-Tech setup with the 'ClearBox' and the further roll-out of the developments to other customers and goods flows.
His experiences are valuable to gain more insight into the technical challenges.

1. Are you familiar with the concept of the data pipeline? If yes, what is your opinion?

   Yes, I am familiar with the data pipeline concept. I see a particular challenge to find a unique key with which the data that the customer makes available can be linked to the logistics data of KN.

2. How would you describe the ClearBox/Customs Tool in short?

   'ClearBox' is a name for the process in which customs data from the various internal and external systems is linked to each other and made accessible to the customs applications of the various country organizations.

Phase I: 'ClearBox' Brexit solution

3. Can you describe the technical setup of the 'ClearBox'?

   Basically, the 'ClearBox' consists of 2 external systems that are connected with the KN Customs Tool using a middleware system iBroker and a system that links the different data together, Lobster Data. This linking of data is necessary as the KN Customs Tool has different instances per country. Data from the UK relates to multiple shipments for various countries.

4. What challenges have we encountered in connecting the UK and BeNeLux systems?

   The first challenge was to enrich the export data and specifically the commodity codes. When a shipment is exported, data from the customs application is shared with the KN Customs Tool. However, an export codes contains 6 digits, while an import code has 8 digits or more. Depending on the product and the national measures, further specification of the commodity codes may be required. Initially we tried to enrich this message from the customs application Streamliner, but this turned out to have an impact on the performance of the application. Later we decided to enrich this data in the KN Customs Tool.

   Another challenge that we encountered relates to the configuration of the TSP number. As TSP is not known in the EU customs processes, this specific dataset is not mentioned in any MIG. Therefore we were forced to find a free text field within the customs application. As not all customers initially were in possession of a TSP number, a specific mapping was required.

   While setting up the interfaces between the customs applications and the KN Customs Tool, we encountered some other problems. It turned out that iBroker was unable to trigger pull messages. During testing of the interface it appeared that an error code was caused by using an incorrect country code for Belgium. Instead of BE, Belgium was linked to 'BL' in the KN Customs Tool.

Phase II: Development of the hi-Tech 'ClearBox' setup

5. Can you briefly describe the steps that were taken during the development of the hi-Tech case?

   Together with the customer and the Luxemburg control tower we created an overview of all relevant customs data the customer was already sharing with KN and the data that was still lacking. At the same time, together with the control tower, we also made an overview of all systems in use and outlined the current process in a process flow. Based on this process flow we designed the desired setup in which we use the logistics statuses to verify the data which originates from the customer.

The connection between CDMS and SaLOG and the connection between SaLOG and Streamliner was to a large extent already in production. Compared to the existing setup, some shipment statuses have been added to the existing interfaces, including the 1420 and 1500 message.

In collaboration with the Hamburg IT team we created separate instances for the customer to split the sea logistics and air logistics flows. Also we created a process flow for the logical verifications with the logistic status codes.

6. What are the biggest challenges that we have faced during the development?

   From the initial conversations with the control tower and the customer, it emerged that there was an explicit wish to use only a single interface with the customer. Since an interface was already available with CDMS, this was also the starting point for the created setup. However, it appeared that the data made available by the customer concerns more than CDMS could process, as a result data fields had to be added in CDMS. Following this, the existing interface between CDMS also had to be changed.
   SaLOG turned out to be able to process all customs data fields, but not all status codes related to the customs process were recorded in numerical order. Since the status codes are often linked to a customer report which presents the duration per activity, it was necessary to carefully make a correct choice from the many customs status codes available in SaLOG.

   Apart from a few mapping challenges, we initially encountered some delay mainly due to a discussion about the budget. Especially in the first phase of the project it is difficult to assess to what extent the budget provided is actually sufficient. As a solution, it was decided to cut the development and budget into pieces.

7. The setup created differs from the Brexit 'ClearBox' setup in which all systems are linked to the KN Customs Tool. Can you indicate the consequences of this choice?

   Ideally, you want the customer to share data directly with the KN Customs Tool and transfer this data from there to the various applications. This is to avoid the need for specific development in these applications. Despite the fact that this setup was not carried out in accordance with the initial plan, we were able to take advantage of the existing interfaces. This saved a lot of development time.

8. What do you think should be the next step in the development of the 'ClearBox?

   The KN Customs Tool offers a lot of potential in, for example, establishing safety and security standards that apply in the supply chain. Up till now this has only been used to a limited extent.
   In addition, the setup should also be prepared for small and medium size companies that have the option of adding data and logistics statuses to the 'ClearBox' themselves. A web form option has already been added in the Brexit solution. It is conceivable that external logistics providers of the customer can also issue certain logistic statuses.

Annex IX: Transcript of interview Dennis van Dongen

Date of interview: 2 June 2020

Mr. Van Dongen is not only familiar with the IT applications that KN offers, but also has insight into the latest IT developments from his role as IT Solutions Architect.

1. Are you familiar with the concept of the data pipeline? If yes, what is your opinion?

   I am familiar with the concept of a data pipeline, but not in the context of customs data and the supply chain.

2. Are you familiar with the ClearBox/Customs Tool?

   Yes, I understand that the KN Customs Tool will not only be used as a data warehouse for the EU Customs Organization, but it is also able to hold specific data and route this data into other applications after a logical check has been performed. I am not familiar with the different customs processes in detail, but I can imagine that when, for example, in a warehouse environment it is important for a correct customs declaration to be able to make a verification between the number of pieces that are picked and the number of pieces that are listed on an invoice.

3. What do you think could be the added value of interfacing systems with the KN Customs Tool instead of direct connections with the customs application?

   As I just mentioned, the KN Customs Tool offers the unique functionality to cut the data in pieces and route the parts into another application after a logical check has been completed. Another advantage is that the customs application becomes vulnerable as the amount of individual interfaces that are linked is increasing. Especially now that we are experiencing a trend that customers want to connect their systems with those of KN, this is jeopardizing the system stability. The KN Customs tool is much better suited to handle this.

   Using the interfaces systematically with the KN Customs Tool instead of individual systems ensures that you can reuse parts of these interfaces. A great deal of standardization is emerging. Because the same middleware systems are used to 'glue' data to the KN Customs Tool, the same resources and knowledge are often used. This makes it possible to reduce the lead times for creating an interface with the KN Customs Tool on average to two weeks.

4. During the development of the 'ClearBox' setup for the hi-Tech case, we experienced that the KN IT applications such as CDMS and SwiftLOG do not contain all necessary customs fields. Can you indicate the reason for this?

   The answer is quite simple. These specific systems are designed for a specific framed purpose. A warehouse management system is developed to record and control stock movements on piece and item level. Specific customs processes such as processing in a warehouse under customs supervision, or the recording of the different customs statuses are often not sufficiently detailed. A recent example we see in the development of SwiftLOG, despite the fact that this is a newly developed system. Conversely, we also see that the customs application cannot independently make the translation from an item number in the warehouse management system to an HS code. The system must be supported by a master data file containing the HS codes and itemnumbers.

   In SaLOG we see that almost all data fields that are required for the customs declaration (mentioned in the EDI questionnaire) are available, but these fields are not filled correctly and/or completely by the systems that are connected with SaLOG or the human operators.

5. How would you place the 'ClearBox' in the current IT developments?

   The Brexit setup of the 'ClearBox' is of great added value for KN's customs brokerage and logistics services. Although this setup has only been tested in a test environment, the potential seems to be high. The possibilities to further use the KN Customs Tool as a data warehouse that can also cut and distribute data to different applications are still largely unused. In that respect the development of the KN Customs Tool and 'ClearBox' has just started.

6. What challenges do you still expect?

   The integration of the KN Customs Tool and the 'ClearBox' requires an integration in both the National and European IT landscape strategies. Additionally the adoption of the 'ClearBox' requires adjustments the various systems that are currently in use. Since these systems are often fine-tuned for a specific logistics process or customer, a review is needed on the logistical concepts that are in place. This is a time consuming process and involves stakeholder management. Next to this you will have to deal with legacy systems and interfaces.

Annex X: Transcript of interview Renée Wokke
Date of interview: 19 December 2019

Mrs. Wokke has experience in creating international partnerships within a complex field of stakeholders. Her involvement in 2 data corridor projects with Singapore and Mumbai provides valuable insight into the challenges expected in setting up a data pipeline.

1. Are you familiar with the concept of the data pipeline? If yes, what is your opinion?
   Yes, as Cargonaut we are involved in such initiatives such as the 'Holland Flower Alliance'. I am currently working on setting up a data corridor between Schiphol and Singapore and between Schiphol and Mumbai. Data corridors are crucial for the future of the air cargo sector.

2. Can you describe briefly what the data corridor project is about?
   We are aiming to setup a data corridor between two international airports. By using the data sharing system iSHARE we ensure the necessary trust between the supply chain actors. The new IATA data model 'One Record' facilitates the correct transfer of data. While port community systems can connect with each other, the data corridor provides secure connections between forwarders, airliners, customs brokers, etc.

3. What can we learn from the data corridor with Singapore and Mumbai?
   A data corridor can only be built with standards. In order for a Dutch party to understand the data originating from India in a correct manner, a standard data model is required. The IATA initiative 'One Record' offers this standard in our view. Nevertheless, there is more required than just understanding the data. It is also important that you can trust this data and that it is in save hands. In the data corridor project we aim to cover this with iSHARE which is a uniform set of agreements.
   In order to successfully setup such a project, a certain threshold of volume is required.

4. Why is this threshold of a certain volume necessary to start this data corridor?
   A certain volume is needed to arrive at sufficient data from which reliable conclusions can be drawn. In addition, as the setup takes time and will require funding, it only makes sense for chain parties to get involved if actual benefits can be achieved.

5. What do you think are the critical elements that need to be taken into account to arrive at a successful data corridor or data pipeline concept?
   It is important to start with a clearly framed trade lane where rapid success can be achieved. The parties involved should benefit immediately. Mutual trust among these chain parties is essential.

6. Can you indicate what options there are to give customs insight into the shipment data of KN?
   The sharing of data with Customs is limited to an agreed data model. As is the case in the data corridor we as a port community system provide a connection with Customs based on this data model.

Annex XI: Transcript of interview Jos Ceelie

Date of interview: 3 March 2020

The operational customs team air logistics falls under the responsibility of Mr. Ceelie. This team is responsible for the customs handling of all products that are shipped by air cargo and vary from pharmaceuticals to aircraft engines. As 'Local Trade Compliance Manager' Mr. Ceelie is also familiar with the restrictions associated with export controls.

1. Are you familiar with the concept of the data pipeline? If yes, what is your opinion?

   No.

2. In what sense do you think getting data from the source can support the import process of products?

   We currently receive the data partly via SaLOG and partly via physical shipment documentations which is handed over by our customer service department. Besides the fact that the paper process is not desirable for efficiency reasons, there is also a risk that certain information is not passed on correctly or on time by the customer service team.

   Getting data from the source not only ensures that data is shared on time, but it also prevents manipulation or loss of information upon import. It allows possible automation and therewith ease the workload of the team. A third advantage would be that it offers a clear communication path if the source of the data is known. Within the airfreight trade lane many parties are involved which can complicate the communication.

3. Can you provide examples of shipments of which it was not known whether the information shared was complete or not?

   In principle this applies to all customers with whom we do not have a direct interface with our customs application. A single shipment can contain multiple invoices and packing lists. Therefore, the more documentation is send, the more difficult it is to check whether all information has been received completely.

4. Do you recognize risks in the hi-Tech supply chain in the field of product safety? If recognized where does this occur?

   What we have to deal with indirectly as a customs brokerage team is the transport of dangerous goods, including products containing lithium batteries. More difficult it is to assess the compliance in the field of safety regulations such as Restriction of Hazardous Substances (Directive 2002/95/EC) , Energy related Products (Directive 2009/125/EC) and CE markings (Conformité Européenne). Within the current process it is not possible to check this as this requires exact knowledge of the design and production process of these electronic products. We do not have this information available.

5. Do you recognize risks in the hi-Tech supply chain in the field of protection on flora & fauna?

   Use is made of wooden pallets. These pallets should comply with the ISPM standards. Besides a check on the documentation, this is typically a check to be performed in the warehouse as the pallets should be marked.

6. Do you recognize risks in the hi-Tech supply chain in the field of product claims?

   No, currently no checks on specific product claims are performed.

7. Do you recognize risks in the hi-Tech supply chain in the field of tax aspects?

   Yes, there are several risks related to the tax aspects. An issue that has occurred more often concerns the late transmission of the last sales transaction before entry into the EU. For the customs brokerage team it is impossible to validate whether the sales transaction used is the latest one shared. Other risks relate to the commodity codes, the removal of goods from customs supervision and deviating numbers between the packing list and the number of pieces received in the warehouse.

The commodity codes for new product introductions are often questioned by Customs. This can lead to delays in the supply chain. Our customers, who take care of their goods classification themselves, naturally try to find the most favorable classification.

We encountered withdrawal from customs supervision twice on this flow of goods in 2019. Reason for this was a human error which caused an exchange between batches. As these shipments do not contain RFID trackers and there is no interface yet between the warehouse management system and the customs application, the process of checking is partly paper based and requires manual handling.

8. Do you recognize other risks?

   Other risk are related to theft and counterfeited products. The trade war between China and the US also plays a role in a few hi-Tech companies. There is already a ban on specific software developed in China. Possibly in future this trade war may also affect components that are produced in China.

9. Till what extent can KN influence the quality of data at the source of the supply chain?

   In our customer acceptance and customer onboarding process we pay a lot of attention to the various compliance aspects. These are extensively recorded in SOP's and customer instructions. By using a certain rate structure, we try to encourage customers to share data with us electronically. In addition, we have drawn up an EDI questionnaire in which the required data elements are stated.