A SCOR model for customs supply chain process design

Lamia Hammadi, Eduardo Souza de Cursi, Vlad Stefan Barbu, Abdellah Ait Ouahman and Aomar Ibourk

Abstract

Integrated supply chain management has gained increased attention from both researchers and practitioners in recent times, including developing models to describe the elements and activities of a supply chain. Among these models, the Supply Chain Operations Reference (SCOR) model, which is considered to be the most well-known approach, enables next-generation supply chain management. This paper proposes a process design model for mapping the customs supply chain network. Such a mapping aims to describe the processes and the management practices that produce best-in-class integration, and a standard alignment to process features and functionality. Moreover, this model provides a general framework to promote better understanding of a particular customs supply chain by means of mapping it in business process terms and furnishes an adaptable formalism to effectively managing any context of the customs environment.

1. Introduction

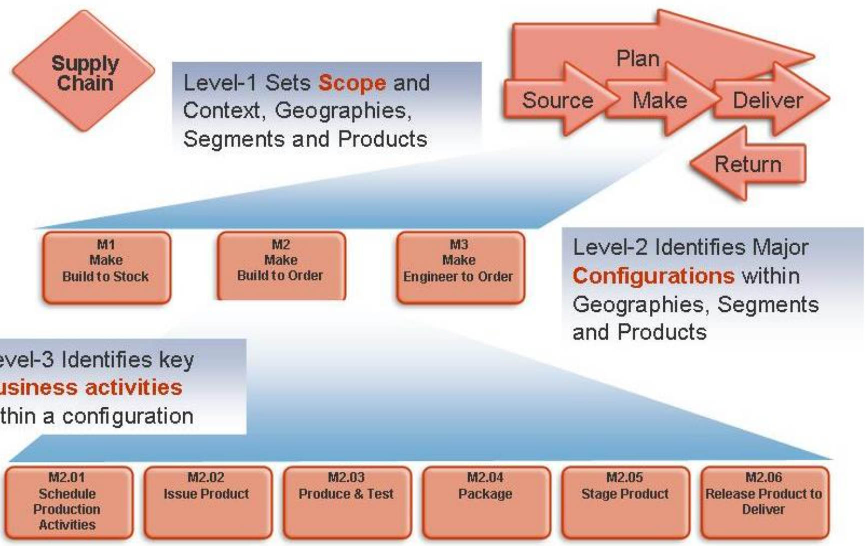
Trade facilitation plays a crucial role in achieving development in countries by making them more effective and competitive by allowing their goods to be traded on time and at low transaction costs. Some countries are unable to benefit from international trade opportunities until they reform their supply chains, especially those dedicated to reforming and modernising customs institutions and investing in infrastructure (World Bank, 2005). In this context, a supply chain is regarded as a series of strong interrelated links. Accordingly, the necessity to coordinate several business partners, business processes and diverse actors across the supply chain (Du Toit & Volk, 2014) gave rise to the field of Supply Chain Process Design (SCPD) (Simchi-Levi, Kaminsky & Simchi-Levi, 2003; Bozarth & Handfield, 2006). At the core of gaining a competitive advantage through SCPD is supply chain integration; when process integration is achieved, the supply chain operates as a single entity (Farhoomand, 2005).

A customs supply chain is a complex system, due to the large number of actors and their complex structural links, and the interactions between these actors. In fact, the theoretical and practical understanding of the concept of a customs supply chain is still marked by ambiguities (Hammadi, Ait Ouahman, & Ibourk, 2014). This study aims to contribute to this area of knowledge by examining both the structural mapping and the process design of customs supply chains as moderators of achieving integration. The study recognises that these shortcomings not only create a theoretical and practical gap in the customs supply chain literature, but leave academics and practitioners without a clear understanding of the concept. Furthermore, as the underlying aspects of process mapping characterise the aspect of customs supply chain integration and a greater understanding of its role in process design, this could provide decision-makers with strategic insights into enhancing the operation management. Therefore, the purpose of this study is to contribute to the literature by addressing these issues within the customs context.

A solution is proposed here to use the Supply Chain Operations Reference (SCOR) model (CSCMP, 2012) to identify and map the relevant processes of a customs supply chain. The SCOR model is a process reference model, which is intended to be an industrial standard that enables next-generation supply chain management. It was developed in 1996 by the Council of Supply Chain Management Professionals (CSCMP) to understand, describe and evaluate supply chains (Wang, Chan, & Pauleen, 2010). It provides a common framework, standard terminology, common metrics and best practices (Huan, Sheoran, & Wang, 2004; Palma-Mendoza, 2014). The SCOR model follows a hierarchical structure with different levels of decomposition, as shown in Figure 1 (Bolstorff & Rosenbaum, 2012). The classical hierarchical composition of the SCOR model is as follows:

- Level 1. Process structure: defines scope and content using five process types: plan, source, make, deliver and return.
- Level 2. Process categories: defines the configuration level, where a supply chain can be mapped using key process categories.
- Level 3. Process activities: This level divides processes in process elements, describing inputs and outputs, process performance measurement and best practices.

Figure 1. SCORE framework levels



Source: Bolstorff and Rosenbaum, 2012

This paper starts with a presentation of the conceptual, structural and functional aspects of the customs supply chain. Next is discussed the proposal of using the SCOR model to identify relevant processes and perform the process mapping of customs supply chain as a means to conduct a process design. Finally, this paper concludes with some reflections and implications of the use of SCOR model for customs supply chain design.

2. Customs supply chain characterisation

It is often assumed that the concept of a customs supply chain uses complicated terminology, which restrains the understanding of the concept and its effectiveness for practical application. This section is dedicated to defining and specifying the concept of a customs supply chain from both an academic and practical perspective. The aims of this section are to develop a comprehensive definition that managers and researchers can employ and to identify the stakeholders in order to characterise the chain.

Customs supply chain terminology

Interest in supply chains has increased in recent years, with the attention of many researchers focusing on the need to build the concept and metrics of supply chains in many fields, such as hospital logistics, import-export logistics, customs logistics and retailing. To deal with the concept of a customs supply chain, researchers have proposed several definitions, but most of them are not itemised. Thus, we propose a structured definition of a customs supply chain as follows:

> Customs supply chain is a set of all aspects that incorporate the moving of cargo and information from the exporter through the transport process, the logistics operations, customs crossing and financial process to the final importer. The customs supply chain is no longer contained within a country's borders, but encompasses all nations, whether they are exporters, importers or manufacturers. (Hammadi, Ait Ouahman, Souza De Cursi, & Ibourk, 2018)

As a result, our supply chain structure is composed of five blocks. That is the proposed building blocks of our definition come from the existing operations management within supply chain, emphasising on customs operations:

Customs operators: the parties that receive and send the goods: an importer in the receiving country and an exporter from the sending country. Importation and exportation are the main financial transactions of international trade.

Transport process: multimodal transport, which covers at least two modes of transport, with the main one being sea transport (CTBL: combined transportation bill of lading).

Customs crossing: includes any point authorised by the customs authorities for the crossing of external borders. It covers declaration processing, custom clearance, data analysis, risk assessment, document checking, scanning, physical inspection, etc. Accordingly, customs crossing is the main bloc for securing the supply chain, due to customs intervention in all stages along the routing of cargo. It includes the border checks both for goods entering and exiting the country.

Logistics operations: encompasses of all activities associated with the flow and transportation of goods, as well as the associated information. Such activities follow three steps: 'organise' (organise the activities for each function of the supply chain to deliver results); 'carry out' (implementing and controlling what was planned); and 'monitor' (which denotes checks and measurement of the functions and results against Customs' policies, objectives and requirements). It comprises activities such as warehousing, inventory, materials, order fulfillment, supply/demand planning, and management of third-party logistics service providers.

Financial process: supports financial transactions between the actors in the supply chain and facilitates the monetary flows.

These elements are presented using generic descriptions.

Stakeholders in customs supply chain

A customs supply chain is a complex network (Christopher, 2016). Based on their roles and responsibilities in the customs supply chain, stakeholders are grouped into categories related to managing their processes and activities and achieving their goals and objectives. These stakeholders are broadly grouped into five different categories, as listed in Table 1.

Table 1: Stakeholders of customs supply chain

Category	Stakeholders
Commercial category	Importer, exporter
Organising category	Forwarder; shipping line agent; logistics service provider
Physical category	Sea terminal operator; shipping line/sea carrier; pre- or on-carrier: air/rail/sea carriers; border highway carriers; logistics service provider; empty container depot operator
Authorising category	Customs; port authorities; seaport police; river police; inspection authorities
Financial category	Bank; insurance company

The commercial category is concerned with the importation and exportation and constitutes the commercial transactions (buying/selling). This category has competencies and direct interests in providing products to end-customers from a foreign country into a domestic country—import, or in the opposite direction, export. For transporting the products, logistics services provided by the second and third categories are employed. The organising category mainly consists of brokers and intermediaries who integrate the cargo transportation, whereas the physical category performs the physical flows. These two categories usually have less interest in products but focus on the operational efficiency of the physical flow of cargo.

The authorising category has the responsibility for monitoring and inspecting the cargo flow for the purpose of enforcing security and regulatory requirements and international standards. Lastly, the financial category supports financial transactions between the actors in the supply chain and facilitates the monetary flows. These five categories depend on one another to achieve the goals of the customs supply chain. These dependencies influence the configuration of a customs supply chain network and affect the many operational, tactical and strategic level decisions of the chain.

3. A SCOR model of the customs supply chain

The purpose of this paper is to develop a process-design-based model of a customs supply chain that shows how process components are related in the supply chain and how they operate. Our model provides a clear image of the customs supply chain's current state and defines its vision for the future by mapping it in business process terms (Zhang & Riemann, 2013). Accordingly, the three levels of the SCOR model—supply chain structure, pillars configuration and process configuration—can be used to identify and map the supply chain processes present. The mapping process starts at level 1 by setting the structure of the chain, followed by identifying the pillars for configuration and interactions. Once the process categories have been established, it is necessary to select which configuration best describes the supply chain processes and their activities with respect to the interactions between the actors of the chain and the functions of each pillar.

Level 1: Customs supply chain network structure

A supply chain network is structured through upstream and downstream linkages among the processes and activities that require the involvement of the actors of the chain. Its network configuration can be built from their missions and functions among inter-and intra-organisations of the supply chain (See Table 1). The customs supply chain structure can be depicted as per Figure 2, in which 13 core processes are linked by three flows (goods flow, information flow and financial flow). These core processes categorise the eight typical function areas in customs supply chain (Hausman et al., 2010) as follows:

Planning the transaction: When the importer places an order with the exporter, the full description of the goods, unit price, incoterms, payment details, insurance, dates and logistics plan are negotiated, and an international contract of sale agreed upon.

Export declaration: A broker/freight forwarder obtains approval from inspection agencies and prepares and transmits export declarations/security filings for export customs clearance. A freight forwarder is engaged by the exporter to manage the export, although this situation depends on the terms of trade (i.e. the Incoterms), for instance the exporter will not engage a freight forwarder if the goods are sold EXW.

Export transport plan: In the case of containerised sea cargo the exporter (or freight forwarder, if applicable) identifies the sea carrier, the port of loading and port of discharge and orders a container from the carrier to be sent to the seller/consignor.

Import transport plan: The container is ready for consigning into the customs supply chain (Consignment Completion Point, CCP). Ocean transport of the goods is complete.

Import declaration: The buyer generates and submits import documents for import customs clearance where required (i.e. this is not always necessary, such as in the case Delivered Duty Paid [DDP]).

Customs control: Customs generally apply risk management strategies to determine whether shipments are selected for documentary and/or physical verification (Martincus et al., 2015).

Import customs clearance and financial process: Inland delivery from the border to the importer's site, receipt of goods, review of landed cost (i.e. landed cost is the total expenditure involved in buying a product and shipping charges for importing it; apart from the cost price of the product, landed cost is made up of different charges, such as customs duties, currency conversion, insurance and other costs up to the destination storing), payment of duty and other taxes and fees (if applicable) and filing for foreign exchange verification and tax refund if applicable (i.e. drawback of duty paid).

The important consideration from structuring of the customs supply chain is that the relations between the importer and exporter run upstream on one side: the exporter provides the importer with goods and information. For the execution of the exchange throughout the chain, information is flowing downstream among the actors who realise the activities. The actors then receive monetary recourses through payment transactions.

Level 2: Customs supply chain pillars configuration

This level defines the configuration level, where a supply chain can be defined using core process categories. Thus, the customs supply chain can be divided into three interrelated pillars: the logistic pillar, the operations pillar and the inspection pillar, as depicted in Figure 3 (Van Oosterhout, 2008).

The **first pillar** relates to physical activities (such as transport and transhipment), storage infrastructure (such as warehouses), unit loads (such as containers, trailers) and the cargo (goods transported) itself.

The **second pillar** is a set of activities and interactions that gather all commercial and non-commercial links between stakeholders in the supply chain. In this pillar information is created, stored and transmitted in electronic format or otherwise.

The **third pillar** is the inspection pillar, in which supply chain decision-makers allocate resources, control performance and cargo flows. This level covers all inspection and verification activities, such as customs and port authorities. The second and third pillar consist of information and financial flows.

*Figure 2: **SCOR Model level 1:** Customs supply chain structure*

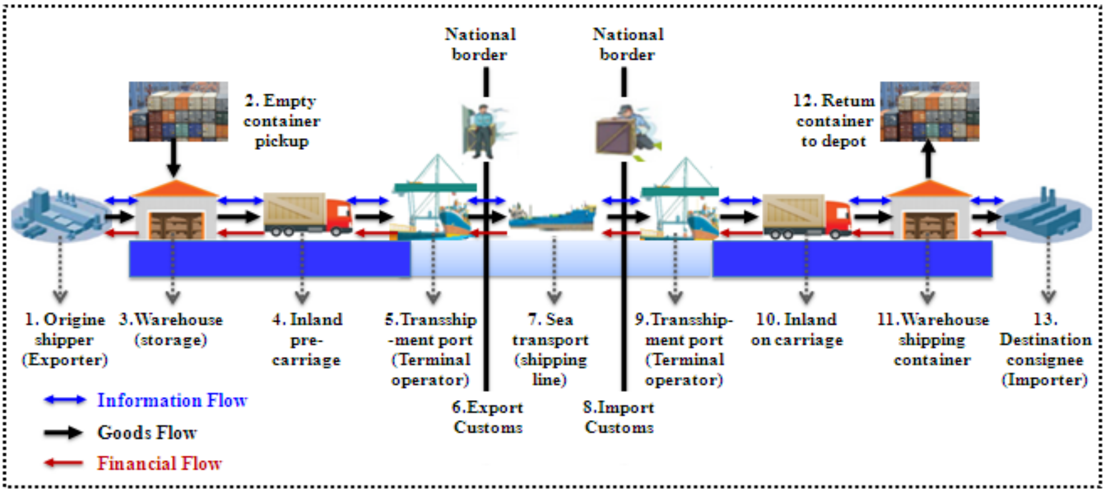
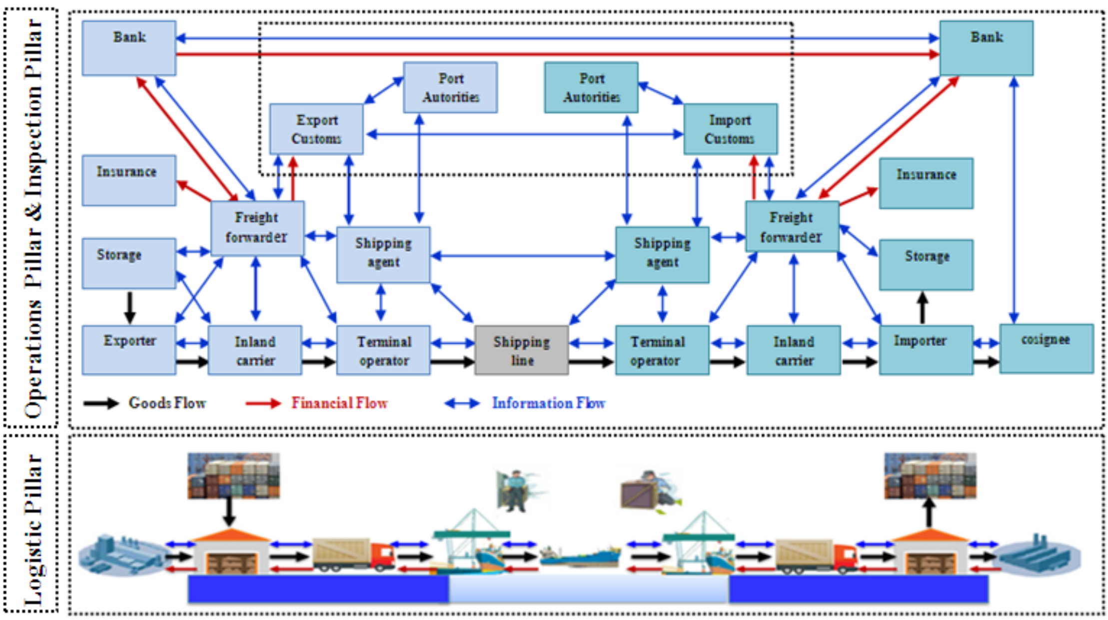


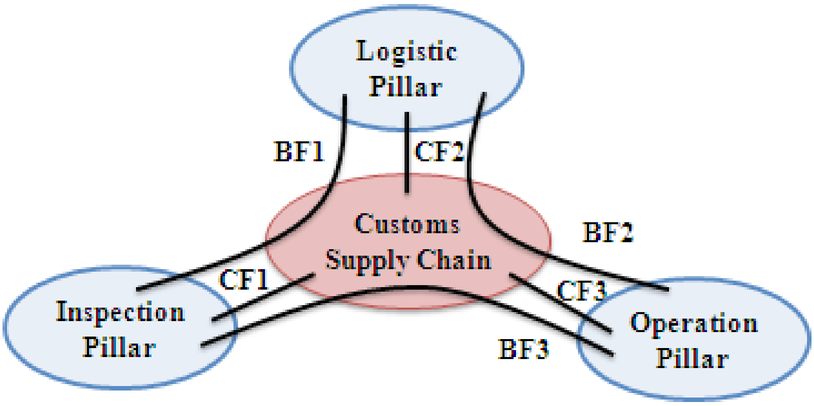
*Figure 3: **SCOR Model level 2:** Customs supply chain three pillars configuration*



Source: Inspired from Van Oosterhout et al., 2008

Therefore, the process design model requires definition of the links (i.e. functions) between the three pillars of the system and its environment, namely, functional analysis (NF X 50–100). For this reason, we opted for a functional diagram to identify most of the functions of the system, as shown in Figure 4.

Figure 4: Functional diagram of customs supply chain



The functional diagram consists of the basic function (BF), which links two pillars via the system, and a complementary function (CF), which links each pillar to the system.

BF1: Achieve customs supply chain safety and security; combat illicit trade; control cargo using risk-based selectivity; and comply with customs laws and international regulations and standards.

BF2: Simplify customs clearance procedures, covering the customs duties and other taxes (if applicable); facilitate commercial exchanges; monitor and manage the supply chain; and co-ordinate various activities and actors.

BF3: Integrate and link the processes and communication between actors.

CF1: Secure international trade; comply with international regulations and standards; and control export-import transactions.

CF2: Satisfy trade demand and customer demand.

CF3: Distinguish and clarify the responsibilities within and across the chain; ensure a smooth flow of operation within organisations; and improve process performance.

Level 3: Process configuration

The supply chain paradigm implies a new way of viewing the organisation, based on the integration of its activities into key processes rather than by departments. This statement indicates that the supply chain must be seen as one single unit and managed as a whole in order to achieve its goals (Gayialis, Ponis, Panayiotou, & Tatsiopoulos, 2015). Lambert and Cooper (2000) stated that successful supply chain management requires a change from managing individual functions to integrating activities into key processes. Consequently, the purpose of this paper is to develop a process-based model of the customs supply chain in order to map the structure of a customs supply chain network, and integrate, align and link processes within the chain. A process-design structure may be specified by a set of logically related activities and resources that yield a certain output. Basically, a process is a series of one or more linked procedures or activities that collectively realise a business objective by transforming inputs into outputs by allocating resources, such as people, materials and tools (Zhang, 2005). In this paper, a process in the customs supply chain is a sequence of activities from exporter to the final importer through transport, logistics operations and border crossing.

As mentioned above, the customs supply chain process is described in this phase. To visualise the sequence of tasks and flow of operations, the process configuration is introduced to describe business processes within the customs supply chain. Since a business process can be defined as a series of activities that require the input of goods and information and which is executed according to appropriate process logic (Croxton, Garcia-Dastugue, Lambert, & Rogers, 2001; Trkman, Štemberger, Jaklič, & Groznik, 2007; Lockamy & McCormack, 2004; Mario Holzner & Peci, 2012; Zuñiga, Wuest, & Thoben, 2015), the process approach is applied to describe business processes from the function view, flow view and logistics view.

Figure 5 shows the components of a process configuration of a SCOR model for the customs supply chain. The process configuration stage 1 is used to describe the key processes; the goods, financial and information flows; the logistical requirements; and Customs functions, whereas the process configuration stage 2 is mainly used to illustrate the activities and process logic (executed pathway and sequence). In the function view, functional analysis is used to structure the stratum of functions executed in the process.

As shown in Figure 5, the stage 1 process can be broken down into several functions as needed. At the same time, activities are associated to the functions. The activities (Figure 6, stage 2) or elementary functions indicate those activities that do not need to be broken down further. The flow view indicates the existing relationship types in the customs context, which are linked by goods, information and financial flows. In essence, the relationship can be viewed as upstream and downstream linkages within the supply chain (see Figure 1). Finally, the logistical view shows three steps of a business process. The first step is 'organize', which is performing activities for each function of supply chain to deliver results (what to do and how to do it); the second step is 'carry out', which is implementing and controlling what was planned; and the third step is 'monitor', which denotes checking and measuring the functions and results against policies, objectives and requirements, and reporting the results. Thus, our process configuration of the customs supply chain is a combination of function, flows and actors.

Figure 5: ***SCOR Model level 3:*** *Process configuration for customs supply chain based on multimodal transport—Stage 1*

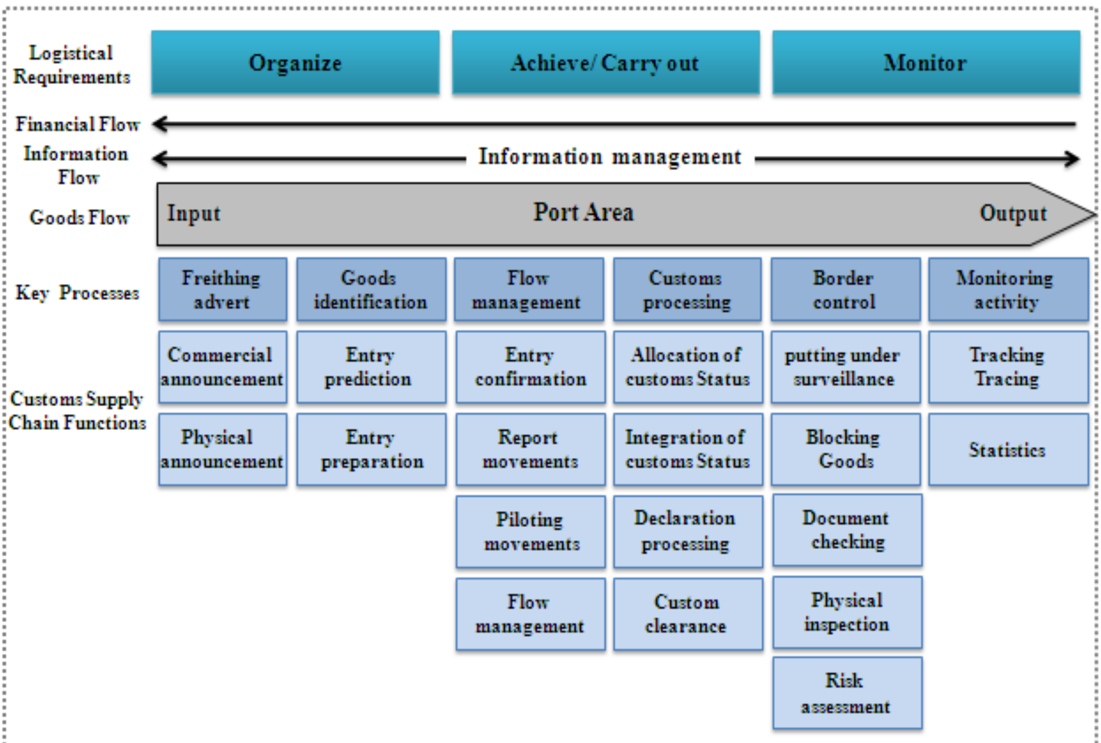
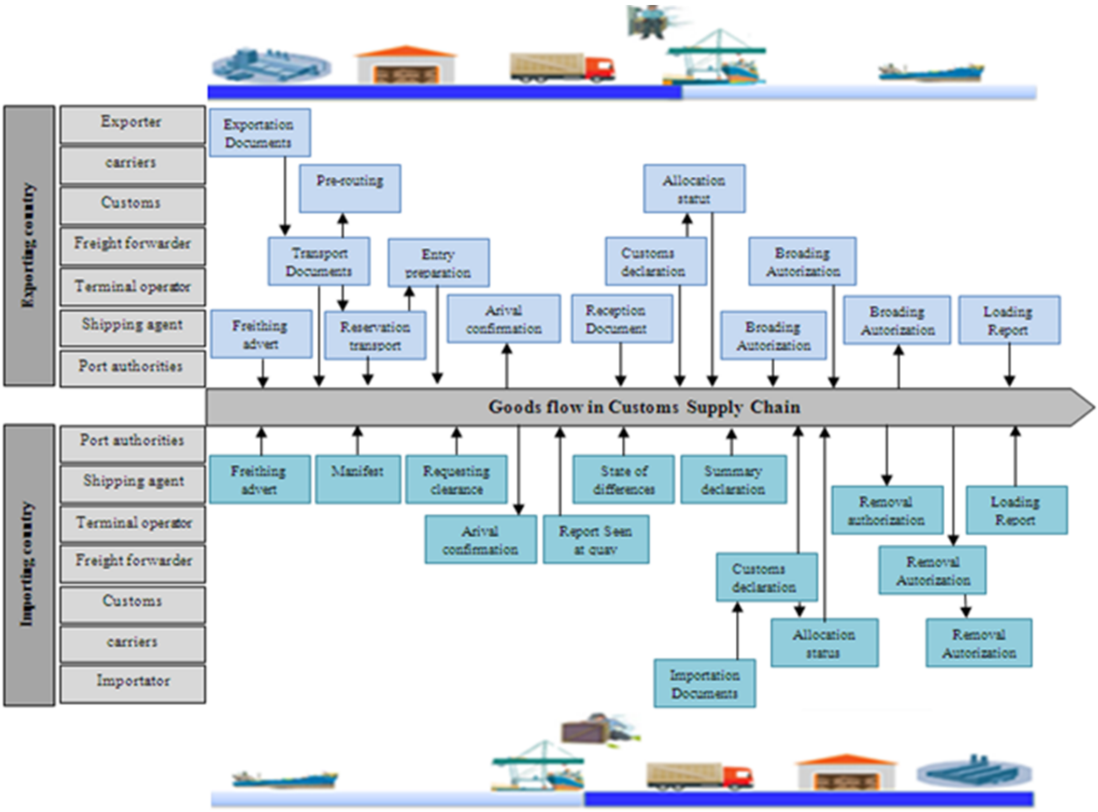


Figure 6: ***SCOR Model level 3:*** *Process configuration for customs supply chain based on multimodal transport—Stage 2*



4. Conclusion

The objective of our study was to determine the key elements of a customs supply chain and current state of process design in the customs context. The findings provide a timely contribution to the management and improvement of operational management in the customs supply chain context, which have not been adequately researched in the current literature. A customs supply chain network is a relatively new concept in the context of supply chain management. This concept is focused on managing the key elements of import and export with respect to border crossing, transportation and logistics operations. This new formulation of a customs supply chain concept has overcome the difficulties in mapping supply chain structure, managing processes and activities and achieving integration.

A SCOR model for process design has been proposed, with the objective of identifying the processes and analysing the structure of a customs supply chain, based on a broader dimension, which consists of a holistic set of activities and processes. Our approach is flexible to accommodate different numbers of partners and able to be implemented in any customs situation. It helps managers to not only prioritise their resources to formulate supply chain designs according to their targeted segments but also to align and integrate the processes. Decision-makers can also use our approach as an evaluation tool for benchmarking their process integration from a bilateral, regional and international perspective. This helps to identify performance gaps and make improvements accordingly.

Acknowledgment

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