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The impact of port and trade security initiatives on maritime supply-chain management

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The fundamental objective of the Container Security Initiative (CSI) is to engage both so-called 'mega-ports' (ports sending the highest volume of ocean going container traffic into the US) and the national governments where these ports are located in a way that will facilitate the pre-screening of outbound containers destined to the US. The emerging issue of security as a key factor in global supply chains can be perceived as inconsistent with the objective of facilitating international trade (Dulbecco and Laporte, 2003). However, this perception does not stand up to analysis. Security is an evident part of the mainstream supply-chain paradigm while security can also become a driver for trade facilitation. The purpose of this paper is therefore to discuss the impact of the US CSI on maritime supply chains. The first section will mostly be related to the issue of security and supply chains while the second section will investigate CSI and its impact while exploring some of the financing implications of the security initiative.

1. Introduction

The key role of an integrated logistics system is to assist in the production, consumption and distribution, or the 'supply chain', of goods and services. This means that goods must be produced and delivered to the market (or customer) in the right quantity, required quality—without defect—and at a competitive price. Integrated and seamless logistics can play an important role in facilitating global supply-chain processes.

It is therefore important that the movement of goods can be made by combining several modes of transport from one point or port of origin via one or more interface points to a final point or port where one carrier or many carriers jointly organize the whole transport process. Integrated transport is an efficient transport system that provides the physical operation to be carried out within the environment of simple streamlined documentation, efficient management with effective control, a single liability system and provides a service which is totally reliable, predictable, and fully meeting the needs of the customer.

However, the efficient operation of transport modes and nodal points are dependent on reduced barriers, institutions and simplified legal regime in order to effectively implement integrated logistics operations. It is viewed that trade is not possible without transport; therefore support for integrated transport will facilitate national and international trade by ensuring an uninterrupted and smooth flow of cargo and giving better control over the supply chain.

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The events of September 11, 2001 have created paranoia on possible terrorists' related incidents, especially against the US. The institutional response on the threats let to the implementation by the US Customs department of a strategic programme known as the Containers Security Initiative (CSI). The purpose of the CSI is to secure what is believed to be the most vulnerable but indispensable link in the global supply chain: the ocean going container.

The purpose of this paper is therefore to discuss the impact of CSI on supply-chain management processes. The first section will concentrate on the issue of security and global supply chain while the second section will focus on CSI and its impact on the financing aspects of implementing security initiative.

2. Security and global supply chain

The security of the global supply chain can be perceived as inconsistent with the objective of facilitating international trade [1]. Security is very much part of mainstream supply-chain paradigm while security can also become a driver for trade facilitation.

2.1. *The secure supply chain*

Logistics involve a wide range of related activities, including storage, inventory management, materials handling and order processing. Logistics management is an integrative process that seeks to optimize the flow of materials and supplies from suppliers throughout the organization in order to satisfy the customer.

If all firms involved in a particular supply chain optimize their logistical systems independently of other firms in that chain, the management of product flow across the whole chain, or 'pipeline', is likely to be sub-optimal. Attempts to overcome this problem have resulted in the creation of 'supply-chain management'. Supply-chain management extends the principles of logistics management to customers and suppliers, crossing geographical and organizational boundaries [2].

Supply-chain management will also lead to stricter requirement on service level related to frequency, reliability, lead-time, information provision, and risks of damage to cargo, security of the cargo, complexity of administrative procedures, and the increasing number of smaller consignments.

The security of the supply chain, like the efficiency of the chain, concerns both the physical flow and the information flow from origin to customers. In a supply chain there is no benefit if certain links or stakeholders are operating efficiently while others are not. It is the total performance of the supply chain from origin to final consumption that is relevant. Each link in the supply chain is dependent on the previous link in order to achieve continuity, synchronization and enhanced final customer service level. The security issue is directly related to the performance measurement of any supply chain. This means that all security conditions must be met and guaranteed in order for goods to move unhindered within supply chains.

The supply chain of maritime transportation has experienced important changes during the last 25 years and several ports have specialized in the concentration of transhipment activities [3]. The ocean going containers ensure flexibility of shipments and several ports are dedicated to this technology and are, as a consequence, consolidating their status as hub centres. Economic growth and development have restructured the nature and pattern of maritime supply chains with new demands within the main trading region.

Hub centres thus require specialized high-capacity transhipment infrastructures. However, infrastructures are not the only dimension in port restructuring. Maritime supply chains are structured by an integration of maritime services and transhipment functions to maritime distribution functions at hub centres [4]. The security of these hub centres as nodal links in the maritime supply chain is of critical importance.

The world has become a system of maritime links in which individual ports are linked into intricate patterns of dependency in hub/feeder relationships as well as into end-to-end shipping linkages that reflect the increasing trade dependencies among regions [5]. This trade dependency is conducted within a broader competitive regional environment, with the development of maritime supply chain underlining the need for efficiency as well as security; and these conditions have impacted upon, and will continue to have an impact on, management strategies of ports around the world [6].

Since the events of 9/11, security is now considered one of the necessary pre-conditions for a high-performance maritime supply chain that is able to guarantee high economic performances. The search for global supply-chain efficiency is currently leading towards the development of techniques, which allows a wide variety of unforeseen events to be overcome [7] through the use of prevention measures. This is even more evident by the 'just-in-time' paradigm and 'door-to-door' service that require a high security level coupled with low inventory level and efficient movements between several points of origins and destinations.

However, security has a cost. Supply-chain security is leading to an increase in logistics costs and may even exert a negative pressure on economic growth for all countries involved. The short-term effect will be negative but the medium- to long-term impact is likely to be beneficial to certified and recognized operators. This will permit the creation of dedicated secure supply chains where supply-chain processes are considered more efficient. More security could therefore mean greater facilitation with a possible expansion of trade. It must not be forgotten that the cost of delays and procedures linked to the trade of goods is estimated between 5 and 13% of the value of goods traded [8]. But, security issues, if not dealt with properly, can also become the main cause of delays. Table 1 describes the main players involved with the security of the global supply chain.

The stakeholders are diverse with often-conflicting objectives but it is of interest to all parties to improve the security of global supply chains.

2.2. *Public interest in secure supply chain*

It is important to guarantee the protection of global supply chains and its capacity to serve international markets. If a port is considered secure, it is likely to benefit from increased traffic of goods, but in reality only a uniform level of security in all ports will reduce the risk of disruption to global supply chains. It is not enough just to have a number of selected secure ports if other ports in the vicinity are not assessed by the same criteria, except if non-secure ports are withdrawn from the main maritime networks.

World markets have become increasingly 'globalized' [9]. To a large extent, this reflects the fact that the majority, if not all, countries are adjusting to the strong trade liberalization pressures observable around the world. These pressures stem from international trade agreements, including the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA). There is also the development of other trading blocs like the European Union, the Association

Table 1. Players in the security supply chain.

The governments	Customs have the duty to protect the national economy and society instead of merely focusing on goods control at the border
The traders	Reliable, secure and efficient supply chain will theoretically contribute to global trade expansion
The ports	Security will represent a critical variable in terms of competitiveness
The service providers	Key player in terms of security as they move goods and information.
The insurance providers	Increase security less insurance premium

Source: Adapted from [7].

of South East Asian Nations (ASEAN), the Asia Pacific Economic Co-operation (APEC) and the growth of intra-Asian trade. These trade-policy initiatives have a common objective: to open up new trading opportunities by facilitating international trade.

Global economic integration relies upon efficient global supply chains but integration can only succeed if security is guarantee as there is a relative degree of mistrust among trading nations. Certain trade routes are served by relatively fewer transport operators; with less favourable operational conditions and where risks are higher, etc. For these countries, this situation results in failure to develop their international trade potential, higher price for imports, lower foreign exchange earnings from exports, restricted investment and employment, and, thus, in limited economic growth.

The competitiveness of internationally traded products is greatly influenced by various factors, which build up the overall logistics cost within global supply chains.

The main ones are:

1. Cost
   The cost associated with the physical transfer of the goods is an essential piece of information in the negotiation of an international trade transaction [10]. To maintain a product's competitiveness, the seller must make sure that his or her cost is as low as possible. However, on any particular trade route, this cost is made up of a number of costs elements corresponding to the services provided along each specific link. These elements cannot always be clearly quantified beforehand:
   - Some cost elements (direct costs) are directly related to the logistics service provided. In general, they are based on published tariffs, which reflect the local market conditions, the quality of the service, and the management capacity of the service provider. These considerations depend on the state of the local infrastructure and equipment, and on the local infrastructure/equipment maintenance policy to provide reasonable transport services.
   - Other cost elements (indirect costs) are a consequence of the service provided. They build up as financial costs resulting from poor operations (low speed, unexpected delays, etc.) as additional costs (e.g. increased insurance premiums), or as 'consequential costs' (e.g. sales opportunities lost because goods are not readily available). They reflect the efficiency of the services,

the level of risk involved, and the capacity of the service providers to cope with administrative and operational problems.

2. Time
   Transit time is an important element as goods in transit cost money [11]. Any reduction in transit time would therefore reduce the overall cost of the delivered goods. Transit times can be improved by increasing transport speed while cargo is moving on any particular transport mode, and/or by reducing idle time while cargo is waiting at some interface point for its next movement. The lack of proper co-ordination of transport operations or the excessive burden of administrative and documentary requirement might neutralize any effort or investment in increasing commercial speed.

   To reduce the financial cost of their inventories, producers favour arrangements that supply the required input goods 'just in time' (JIT), that is, within a short time span just before the anticipated use in production or sale [12]. Under these conditions, time reliability is very important. An industry under tight schedule operations (JIT supply chains) cannot afford delays on delivery [13].
3. Safety
   Safety of goods is equally important. Any loss or damage, because of theft, mishandling, poor quantity packaging or physical damage caused by accident, will result in the non-availability of the goods at the expected time and place, and in the expected conditions. The financial consequences of such non-availability, in addition to the cost of loss or damage, are similar to the time reliability consequence mentioned above.
4. Risk
   Uncertainties of schedules, breakages, loss, pilferage, rules and regulations, etc., are some of the issues faced by traders and may disadvantage exporters and importers.
5. Security
   Security measures are necessary to guarantee the protection of global supply chains against acts of terrorism or any possible unexpected threat. Beyond the loss of human life and material destructions, a terrorist attack will disrupt the flow of goods within global supply chain.

The above-mentioned considerations indicate that trading opportunities can benefit from better-organized and secured supply-chain services. To take advantage of secure supply chains by increasing their competitiveness, sellers and buyers must adapt their commercial practices and governments must provide the transport/logistics service providers with an institutional, regulatory, and operational environment, which can stimulate and guarantee the level of security needed for the efficient movement of goods.

A secure supply-chain approach must encompass not only the economic, commercial and operational aspects of the international movement of goods, but also all issues related to the facilitation of trade and the responsibility for the goods while in transit.

To take into account all interests involved in the development of secure supply chain, the relationships between traders, services providers and governments must be clearly identified and proper co-ordination in the implementation of security measures must also be established. The development of secure supply chains will

also demand the need for properly regulated service providers. This can result in an increased level of competitiveness for all three key players.

Traders can expect the economic and financial benefits from the use of secure supply chains in the forms of the following factors:

- Reduced transit-time; increased time reliability; and increased security of cargo, particularly at interface points.
- Reduced transport costs (resulting from the use of modern transport-related technologies: ocean going containers, EDI, etc.).
- Closer commercial relationships with services providers.
- Greater awareness and understanding of supply chain and logistics related issues influencing their trade.

Service providers can expect the following benefits:

- The importance of their profession as international logistics service providers. This is particularly important in the development of their relationship and their recognition with governmental agencies.
- Commercial incentives to adopt new technologies such as the Internet and EDI.
- A need to reconsider their marketing strategies, for example logistics service providers to concentrate their activities in 'niche' operations to serve specific commodities on specific trade routes [14].

Governments will theoretically benefit from secure supply chains since it offers an opportunity to update trade and transport related administrative procedures and regulations. A secure national supply chain will facilitate commerce with other trading partners, in particular with the US.

3. The container security initiative and its impact

The globalization of the world economy and the increasing threat of terrorism have placed pressure on the world's governments, especially Customs administrations. Merchants have demanded faster, more standardized and uniform service while governments require more revenues and more secure borders. At the same time Customs must produce trade statistics and enforce other agency laws (i.e. health, intellectual property, etc.) at the nation's border. Customs are faced with the prospect of balancing the requirement of facilitation with the increased importance of security enforcement as a consequence to the emerging terrorist threats. Using a traditional approach to Customs practices and procedures is not practical for security issues. In the European Union and in other regional grouping (e.g. AFTA or APEC), Customs have reduced their day-to-day work and the number of officers to concentrate mainly on intelligence gathering rather than high-profile policing. Table 2 is a review of the traditional Customs operation still in service today in a number of countries contrasted with the more modern approach being put in place in many countries.

In order to implement secure maritime supply chains, Customs are required to facilitate the container flows, through minimization of import/export documents and to permit the movement of cargo to and from ports under bond or in a sealed container. However, with the multitude of US led security initiatives, the facilitation of container movement is perceived as hindered, especially by exporters in the main trading partners of the US.

Table 2. Customs procedures.

Customs procedure or practice	Traditional Customs	Modern Customs
International Standards of the WCO [15] and WTO [16]	Non conformance or only partial conformance	Full conformance with all international Customs standards for classification, value, and procedure
Customs automation	No or only partial	Full automation
Measures of performance	Limited output measures, process measures and frequently the wrong measures	Full measures of compliance & facilitation leading to improved performance
Tariff system	Complex and high duty rates	Simplified & reduced duties
Revenue collection	Prior to entry of goods	Entry & collection separate. Duties paid after entry
Enforcement and compliance approach	Characterized by manual inspections nearing 100% and paper reviews	Minimal inspections and paper documentation
Information	Provided at time of entry	Advance and historical information prior to arrival of goods and conveyance
Personnel	Poorly trained and low skilled	Highly trained and professional
Appeals of Customs decisions and transparency	Limited and unknown appeal process, limited publication notice of rules and practices	Fully defined appeals process within and beyond Customs, full transparency and co-operation with trade
Results	Low and unknown compliance, high cost for government and industry and poor facilitation	High and measured compliance, lower costs for government and industry, vastly improved facilitation and framework for continued improvement

Source: Adapted from [17].

It is believed by US authorities that a proactive stance by Customs in screening ocean going containers before they reach the US will significantly contribute to Customs, in particular US Customs, overall efforts to secure borders against dangers that might be introduced through commercial traffic.

3.1. *The US container security initiative*

The US CSI consists of four core elements [18]. These are:

1. to establish security criteria to identify high risk containers;
2. to pre-screen those ocean going containers identified as high risk before they arrive at US ports;
3. to use advance technology to quickly pre-screen high-risk containers;
4. to develop the use of smart and secure ocean going containers.

From an American perspective, CSI is an effort to enhance the security of global maritime supply chains. Through bilateral agreements with major ports and national Customs agencies around the world it would be possible for the US to theoretically achieve a far greater level of security than screening all ocean going containers at their port of arrival in the US. A critical element for the success of the CSI will be the availability of advance information in order to perform efficient pre-screening targeting. Risk assessments and trade analysis will form part of the decision-making process regarding the pre-screening of containers. On a similar note, the WCO on 28 June 2002 also passed a unanimous resolution that will enable ports in all 161 member nations to develop security initiatives along the CSI model.

According to US Customs, only 2% of inbound containers are physically inspected each year for a total of around 6 million sea containers [19]. This places a heavy reliance on the good faith of the shippers and the accuracy of the documentation. This system worked adequately when the only risk was commercial under-reporting and the occasional smuggling. The terrorist attacks of September 11, 2001 dramatically changed the risk factors and led to a re-examination of government-related procedures to imports into the US. Increasingly, physical inspection by Customs officials is a last resort. Physical inspection of one container might involve at least two inspectors and last a full day.

Despite the good intentions of CSI, there exist problems in terms of implementation. Some ports have publicly stated that their participation to CSI is contingent upon efficient integration of new security practices related to physical container inspections at the port of departure while others do admit that the integration of CSI will not be easy and may results in congestion and decline in terms of throughput. The US Customs relationships with the so-called 'mega-ports' continue to be defined as these ports are very careful to minimize any resulting inefficiencies caused by the CSI. However, ports not specifically targeted by US Customs are concerned that those ports within the CSI may gain an unfair competitive advantage as pre-screened cargo will be given priority in terms of faster clearances through US ports of entry.

3.2. *The customs' trade partnership against terrorism*

The US Customs Initiative on Supply-Chain Security or C-TPAT (Customs' Trade Partnership against Terrorism) has already been implemented in a number of countries; this is because many US importers and their suppliers have been 'advised' to join this initiative. Eventually the scheme will cover the entire supply chain of the US importers, which includes foreign manufacturers, suppliers, suppliers' vendors, contractors and sub-contractors, warehouse providers, as well as air, sea and land carriers.

Theoretically, the primary benefit of joining C-TPAT will be the expedited processing of cargo. Importers who are not C-TPAT members may, over time, find their shipments subjected to higher scrutiny and added examination with no guarantee of processing times.

Even though US Customs is inviting importers to join the scheme in phases, it is 'an offer that cannot be refused'. The security recommendations will eventually become the actual requirements to be complied with by importers and their suppliers, extending to the carriers. Notices will be posted in the US Customs' website to announce the phased expansion of the C-TPAT membership and open enrolment

for importers. Individual US importers will have to sign a Memorandum of Understanding (MOU) to participate in the C-TPAT.

At the US Customs' website, there are guidelines on security recommendations for manufacturers, importers, brokers, air carriers, land carriers and sea carriers. For manufacturers and importers, for example, these recommendations cover physical security, access controls, procedural security, personnel security manifest procedures, conveyance security, and education and training awareness. Most of these measures are already in place at manufacturing establishments that do business with US importers and the guidelines would serve as a checklist for compliance. It is important to consider that compliance has to be verifiable and traceable. Exporting companies should obtain recommendations as soon as possible so that they can start the documentation of processes for future compliance assessments.

Shippers that are involved with US importers' supply chain should pay attention to the requirements and start implementing the security measures and keeping records. C-TPAT is designed for the entire trade community. It will eventually cover all large and small- and medium-sized importers in the US, and all parties in the supply chain of these importers.

3.3. *Financing the security—who should pay?*

Most experts agree that maritime transportation and logistic activities traditionally have been among the largest costs in international trade. But in contrast to that, the most significant advances in modern logistics have not been in cost reduction, but in improved processes to move goods and materials between nations in a timely and seamless manner. Distance is critical in international logistics. International marketers require systems designed to handle the challenges of distance in a manner that is timely and transparent to customers.

Distance in international logistics equates to transportation speed and dependency. As a general rule, the longer the average distance of movement, the greater is the total cost of transportation. This increased transportation cost results from firms seeking to maintain flexibility while reducing or avoiding extensive inventory commitment. Improved flexibility and lower average inventories translate into an increased number of small shipments moving under positively controlled logistical operations. The distances involved and the specialized nature of international requirements have created a dependence by shippers on third-party providers, such as logistics service providers, capable of providing a broad range of value-added services to assure logistical continuity.

However, the implementation of CSI and other security initiatives have also placed an increased burden in terms of processes and costs for all the players in global supply chains. This would mean that for CSI to be fully sustainable as a process in global supply chains, the financing of CSI must also be equitable or fair.

There are two possible sources for financing CSI:

1. Payment by users
   A tax or a fee can be levied by the relevant authorities. This fee or tax can be either *ad-valorem* or specific but it seems that a specific fee might be the most appropriate. This specific fee can be collected to finance the extra process, equipments and technology used for CSI. The use of appropriate INCOTERMS will become critical in deciding whether the exporter or the importer should pay this specific fee.

2. Public sources
   Financing can be national where each government is responsible for all security initiatives within its borders, but this type of financing is biased as most developed countries would already have the majority of equipment in place while the developing countries would have to invest a significant amount in order to achieve acceptable levels of security.

Financing can be also international where the importing countries, such as the US, provide a grant to the implementation of CSI around the world. However, there must be a guarantee by the receiving government that the grant will be utilized to upgrade the security to an acceptable level as defined in the CSI. Soft loans can also be provided but they are usually considered unfair as they can contribute to the excessive debt of developing countries.

Public financing runs the risk of not achieving the desired level of security in global supply chains. Bilateral financing may help in the implementation of security initiatives but the financial sustainability of the initiatives must be demonstrated.

The collection of funds from whatever source is necessary in order to finance security initiative but it is an insufficient condition for the guaranteeing of full global supply-chain security. However, the present trend is for exporters to fund these security initiatives thus increasing their financial burden.

5. Summary

In order to benefit from efficient and effective global supply chains, the security-related activities incurred must be completely synchronized with the requirement of the said global supply-chain management. Security initiatives are now being considered part of the key logistical activities but it is at the same time one of the most problematic activities, especially in an international context. If the security activity fails to perform, this will surely impact on the competitiveness of global supply chains.

These security initiatives will theoretically facilitate access to major international markets through the use of secure hub centres and interface points. As markets are becoming 'globalized', trading opportunities can be improved by implementing security initiative in global supply chains. An efficient and secure maritime supply chain can help build and sustain the competitiveness of internationally traded products by reducing transit time, reducing transport costs, and increasing reliability and cargo security. However, this may create a two-tier system where priority of access will be given to recognized secure maritime supply chains and non-secure hub centres or interface points will lose out in term of competitiveness.

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