A Review of Research Related to Supply Chain Security

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1. Introduction

The term, cargo theft, represents any stealing or hijacking of cargo moving by planes, trucks, rail cars, ships, etc., from the point of origin to it's destination. It is considered cargo theft if it is stolen at any point between those two. If it is in the warehouse or loading dock of it's origin until it is in the possession of the recipient, it is cargo theft. Many companies do not report such crimes, especially the smaller ones, for several reasons. They often feel it might damage their reputation, increase their insurance rates, or otherwise become an embarrassment to them. So there is no accurate estimate as to the total amount of this criminal activity, however, industry experts estimate it to be as much as $30 billion in annual losses in recent years in Asia.

Cargo crime, which very frequently takes the form of an organized criminal group purposely targeting a specific vehicle or route, as opposed to opportunistic thieving, is an issue internationally The Transported Asset Protection Association, more commonly referred to as TAPA, is an organization that was set up specifically to try and combat this massive issue of cargo crime. Amongst its hundreds of members, all united with a view of cutting this expensive criminal activity, are vehicle security specialists, law

enforcement agencies, goods manufacturers and logistics and transit companies. The transportation industry handles billions of dollars in freight every year, and goods in transit are an attractive and easy target for thieves. But what can we all do to cut cargo crime?

2. Factors Impacting Physical Security

The security incidents considered in this case study are those taking place in distribution networks, where products, components or raw materials are temporarily stored or moved between companies that are part of supply chains (networks of buyers and suppliers). Hence, all attacks deliberately perpetrated against cargo at intermodal terminals, storage warehouses, etc. and links (road, water, rail and air transportation) of the physical distribution network. Today security, logistics and supply chain managers have wide access to handbooks and certification programs, to enhance the protection of their assets. Technology is at the forefront and offers wide sets of devices to hinder criminals from attacking cargo. In addition, organizations often have specialized security personnel in charge of spreading the security culture among the employees as well as ensuring that security routines and technologies are correctly implemented and working in line with the organizations' operations. Security certifications like the TAPA, CTPAT, ISO28001, CSI or ISPS are available to practitioners to support the understanding of security and learn how to prevent security threats. Every day cargo is stolen, hijacked, and counterfeited. Further, personnel working in transportation companies are exposed to the risk for being seriously injured. Hence, we wonder how companies are coping with this situation that we don't believe is sustainable from either an economic or a

social responsibility viewpoint. More specifically, we wonder what factors are determining the security of distribution networks.

The lack of security is an important source of risk to be considered by supply chain and logistics managers. Therefore, it is fundamental to identify drivers of risks in supply chains to optimize risk mitigation strategies and consequently moderate the negative outcomes of disruptions. However, despite the highly scientific relevance, it appears that too little research has been performed to identify factors external to the supply chain that may influence the efforts made by firms to enact security.

Other factors can be identified as influencing the security of supply chains: supply chain length, customers' requirements, authority regulations, and security partnerships. It appears that the relevance of the security problem found in practical instances is not equally treated in the scientific literature. Moreover, more descriptive research and empirical data are needed in this research area to find the theoretical validity of existing normative studies or even to investigate the existence of further factors influencing security that may be still unknown in the academic field. As a consequence the research question that this case study is aims to have a better understanding the factors that impact physical security as in Figure 1.

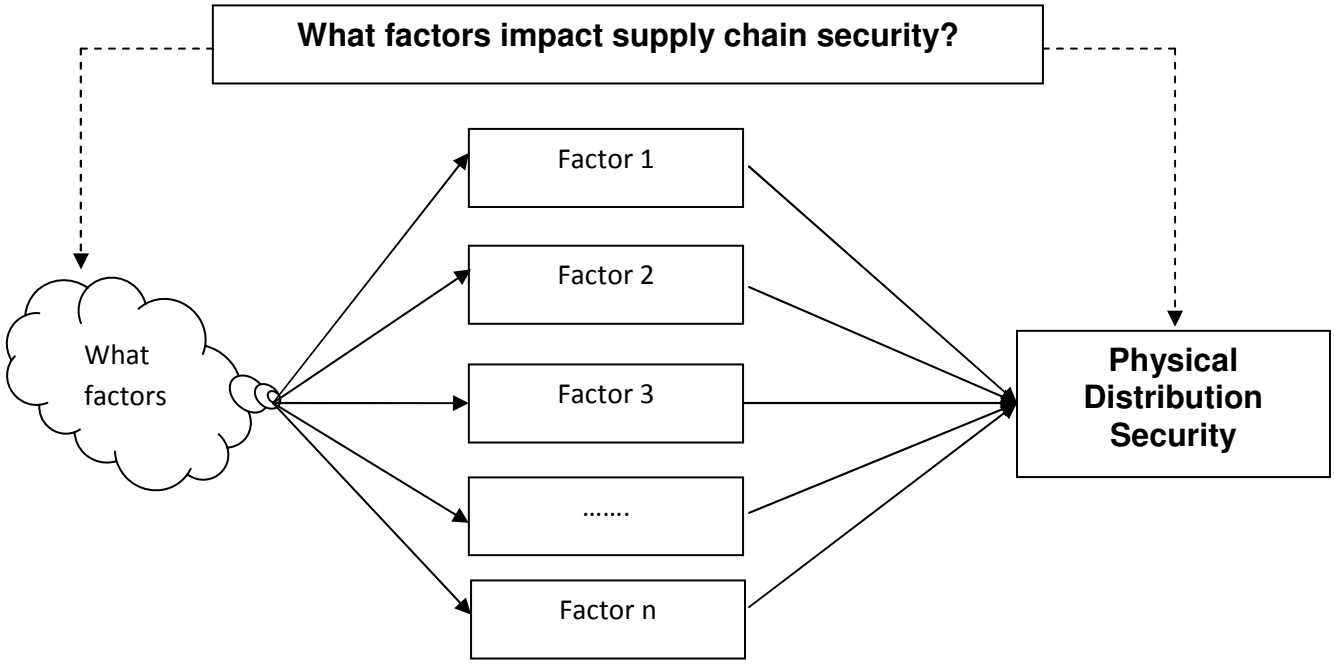
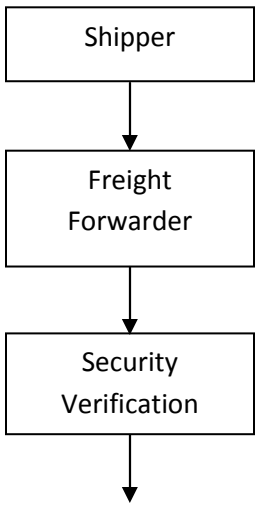


Figure 1: Factors impacting supply chain security.

3. How the Cargo Moves?

Here we seek to understand the simple question of how a given piece of cargo moves between its origin and destination. The general overview of the process can be summarized in Figure 2.



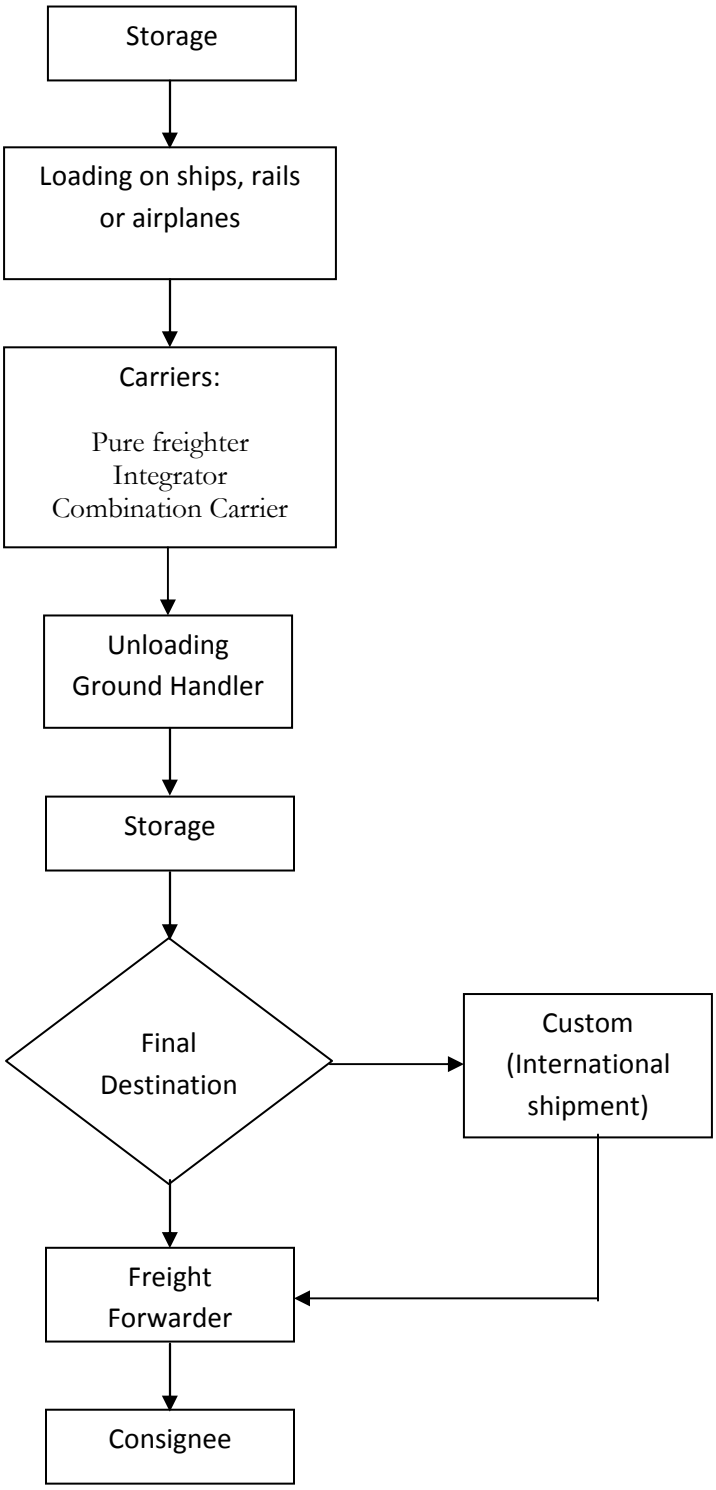


Figure 2: Movement of cargo in the supply chain.

3.1 The players involved

The following agents along the chain of cargo are all crucial to the efficacy of the cargo process. Let us formally define them.

***3.1.1 Shipper* (*or Consignor*)** – the one who requests service in transporting the cargo (source node of the supply chain)

3.1.2 Freight forwarder (or forwarder) – analogous to a travel agent with passengers; the forwarder typically arranges for the transportation of cargo from the shipper's warehouse, delivers (or has a contractor deliver) it to the departing airport or ports, prepares the necessary paperwork, picks up at the arriving airport or ports, and delivers (or contracts for the delivery) to the consignee.

3.1.3 Carrier – The firm who provides the delivery of cargo from the origin airport or port to the destination airport or port. There are primarily two classes of air carriers: cargo carriers that primarily carry cargo and freight (e.g. FedEx, UPS, DHL, TNT, Cargojet Airways, etc), and combination carriers that carry both passengers and cargo that is stored in the bellies of aircraft (e.g. Japan Airline, Thai Airline, Singapore Airline, Malaysia Airline, Korean Airline, Cathay airline etc). About 25% of all air cargo is carried on commercial passenger planes with the remainder on freighter aircraft.

3.1.4 Ground Handler – An agent at an airport that physically handles the freight; this usually refers to whenever freight is loaded, unloaded, transferred, stored, retrieved, broken down, or consolidated.

3.1.5 Consignee – The receiving party that the goods are sent to (sink node of the supply chain)

3.2 Process Flow: Movement of Air Cargo

Process flow of air cargo is subject to variability across stations. However, most stations follow the following overview.

3.2.1 From the warehouse to the airport

While shippers may deliver their cargo directly to the airport, the majority of cargo is handled through a freight forwarder. In most instances, the forwarder will pick the cargo up from the shipper or the shipper's warehouse. Unless the freight is rushed, it is generally brought to the forwarder's warehouse and consolidated with cargo to the same (initial) destination. Forwarders generally have their warehouses close to airports as cargo is often transferred. The forwarder must also possess the air waybill which is a contract between shipper and carrier for the carriage of freight over the carrier's routes.

3.2.2 Booking

Days before departure, the forwarder will book freight on a given flight with a carrier. Most large forwarders receive a pre-allocated space on routes on a daily basis, but still

call the carrier to specify the dimension and weight of the cargo on a given flight for planning purposes. Forwarders may or may not have contracts with certain carriers. The booking process is becoming increasingly automated as it allows for more efficient operations and greater transparency. Generally the forwarder first reserves space, then confirms and picks up the cargo only after receiving confirmation from the carrier.

3.2.3 Consolidation

Once in the hand of the forwarder, the cargo is likely to be consolidated with other shipments. The cargo is likely to sit in a warehouse of the forwarder and waiting for cross docking, depending upon the priority of the goods. If the goods are not time-sensitive, they generally are stored one to three days in the forwarder's warehouse to be consolidated before being delivered to the airport.

3.2.4 Upon arrival at departing airport

At the airport, the forwarder will deliver the cargo to the carrier in which the cargo goes through security. This is a significant component of the air cargo process and will be discussed in greater detail below. The air waybill is delivered, in which the forwarder possesses substantial penalty if there are discrepancies. The cargo is usually temporarily stored in a warehouse facility at the airport as it waits to be loaded. Usually, cargo is randomly assigned to bins which induce fast storage but slow retrieval (designing efficient storage mechanisms are of considerable interest). The cargo is then retrieved prior to arrival and loaded via a unit loading device (or ULD) and secured. The aircraft departs when all cargo is secured.

3.2.5 At the arriving airport

Cargo is flown either to the destination airport or an intermediate airport where it likely gets re-consolidated, re-containerized, and placed on another leg. Most likely, the cargo is temporarily stored at a warehouse where it is either transferred to a connecting flight or awaits to be picked up from the forwarder and delivered to the consignee.

If re-consolidation occurs, there are a number of issues to classifying each piece of cargo. It can be consolidated by: size and weight, special requirements (e.g. refrigerated goods together, dry ice cannot move with live animals, etc.), service level (by priority), or destination. Different operators may consolidate differently. If a given leg is international, then the cargo is subject to customs clearance which is done at the airport.

3.2.6 Delivery

From the airport, a forwarder typically will deliver the cargo in the reversed order from where the forwarder delivered the cargo to the airport. The air cargo process is driven by the freight forwarder, the carrier, and the process flow.

4. Research related to Supply Chain Security

4.1 Research on Air Cargo by US Department of Homeland Security – 2009

4.1.1 Audit Conducted at Airport in 2009

US Department of Homeland Security have conducted a review and analysis of the following 11 airports that transported a large amount of freight:

- Los Angeles International

- John F. Kennedy International
- Chicago O'Hare International
- Miami International
- Hartsfield-Jackson Atlanta International
- San Francisco International
- Washington-Dulles International
- Newark-Liberty International
- Houston Intercontinental
- Honolulu International
- Minneapolis St. Paul International

Transport Security Administration (TSA) could improve its efforts to ensure air cargo is secure during ground handling and transportation. It was determined that personnel were accessing, handling, or transporting air cargo without the required background checks or training. For example,

- gained access to air cargo at of the facilities visited,
- identified of the drivers tested were handling or transporting air cargo without required background checks, and
- Have identified 23% of the drivers tested did not satisfy the required training and testing requirements.

Despite identifying and reporting similar vulnerabilities, TSA's inspection process has not effectively ensured improved compliance and awareness of TSA's requirements. The process has focused on quantity rather than outcomes and ensuring corrective actions. Automated tools to assist inspectors in analyzing results and focusing their

oversight efforts on high-risk areas in air cargo security were not adequate. As a result, air cargo is vulnerable to the introduction of explosives, incendiaries, and other destructive items before it is loaded onto planes, potentially creating risks for the traveling public.

4.1.2 Air Cargo Security Vulnerabilities

Research conducted by Transportation Security Administration USA and found Air carrier employees or their representatives were accessing, handling, or transporting air cargo without the required background checks or training. During the first three quarters of FY 2008, TSA conducted 6,767 cargo security inspections, of which 2,031 inspections (30%) identified 2,640 air cargo security violations including:

- 254 violations related to access controls,
- 731 violations related to security threat assessments, and
- 1,655 violations of security training and testing requirements.

Audit also identified security violations in these areas.

4.1.3 Access Controls

TSA's security programs require regulated entities to control access to areas where air cargo is stored. In addition to physical security, the regulated entities must have procedures in place for challenging all unknown persons who enter secure cargo areas. However, TSA inspection reports identified 254 instances of access control violations, and we gained unescorted access to air cargo at of the regulated facilities we visited. For example,

- At an indirect air carrier facility, we gained access to air cargo through an unmanned door with a defective lock. Although an alarm sounded, no warehouse personnel responded to challenge our access. We had access to multiple storage rooms, including one which contained cargo that had been screened and was being shipped that evening on a passenger aircraft.

- At another air carrier facility, we gained access to an air cargo storage room through an unlocked door. At the same facility, we encountered a number of individuals but were never challenged. One employee opened a second door allowing us access to the tarmac and runway. A number of other individuals allowed us to walk around without being challenged.

Without regular vigilance, practice, and enforcement of access controls, TSA and the regulated entities provide opportunities for individuals to introduce explosives, incendiaries, and other.

4.1.4 Security Threat Assessments

TSA's security programs require that regulated entities perform security threat assessments (background checks) on all individuals working for or on behalf of the regulated entities who have unescorted access to air cargo. The background checks are to be completed before the individuals begin handling or transporting air cargo. In lieu of the security threat assessment, TSA regulations provide for accepting documents which demonstrate that the individual has undergone a background check. Regulated entities must provide supporting documentation to verify that personnel have received the required security threat assessment or that the individual has an

approved equivalent. TSA inspection reports identified 731 instances where regulated entities either did not conduct or provide evidence that employees or authorized representatives had undergone background checks. It was identified drivers sampled who were handling and transporting air cargo without meeting TSA's security threat assessment requirement. For example,

• A truck driver displayed an employee identification card that had his photo, but a coworker's name. After following up on his identity, we determined the truck driver had never applied for a security threat assessment and had been handling cargo for almost a year and half.

• Five delivery drivers for one indirect air carrier were handling and transporting air cargo without security threat assessments.

• Three drivers from a regulated entity's authorized representative did not have security threat assessments.

4.1.5 Cargo Security Training

• TSA's security programs require that all personnel working for or on behalf of a regulated entity who have unescorted access to air cargo complete initial and recurrent security training, and pass an exam with a score of 85% or better. Regulated entities' employees or authorized representatives either did not take the initial or annual recurrent security training and pass the required examinations or could not provide evidence of meeting these requirements.

- TSA inspection reports identified 1,655 violations related to the security training and testing requirements. We determined that 24 of 104 (23%) truck drivers had not completed or could not provide evidence to satisfy this requirement. For example, drivers at one indirect air carrier had taken only the initial training and testing. The security coordinator for another indirect air carrier did not test his employees on the annual recurrent training.

The security training and testing violations occurred in part because regulated entities were unaware of the requirements, including the requirement to have supporting documentation available upon TSA's request. A security manager at one location explained that he was unaware of the annual recurrent training requirement. The indirect air carrier's security coordinator received a letter from TSA with revisions to the security program requirements; however, he thought the change applied to the annual recurrent training requirements. According to some TSA inspectors, although inspectors are expected to conduct outreach in their area of responsibility on an ongoing basis to provide guidance regarding transportation security, they have limited time for in-depth discussions pertaining to training or any other security measures.

By not ensuring that regulated entities' employees or authorized representatives take or pass the required security training, TSA limits personnel from effectively safeguarding air cargo against the introduction of explosives and other destructive items into cargo, posing a risk to the industry and traveling public.

4.2 Research on Air Freight Industry Growth by J. Petersens of Georgia Institute of Technology in 2007

4.2.1 Volume

According to the 2006-2007 Boeing World Air Cargo forecast in 2005 there were 178,122 million tons of freight ton-kilometers flown globally. The growth of air cargo globally has averaged a 5.1% annual growth rate since 1995 (see Figure 3). Not surprisingly, the majority of this growth is attributable to growth in Asian markets, particularly China.

According to Boeing, the total volume of air cargo is anticipated to grow at an average annual rate of 6.1% through 2025. Among this growth, Asia is expected to lead the way.

• Boeing is forecasting annual growth of all cargo in domestic China go grow at 10.6% per year until 2025

• Intra-Asian routes are anticipated to grow at 8.6% annually

• Asian-North American routes are expected to grow 7.1% annually; and Asian-European at 6.9%.

4.2.2 The Geography of Freight Movement

Figure 3 summarizes the average annual growth rates from 1995-2005 and the projections from 2005-2025 according to Boeing among major cargo lanes are:

North America – Asia

North American-Asian routes have boomed from the coupled effect both globalization and strong domestic growth. Thanks to the two the continued economic expansion of China, it is now the second largest trading partner with the U.S. as it has overtaken

Japan as the largest Asian trading partner. 33% of all air freight movement between the U.S. and Asia is with China whereas Japan accounts for 24%. The growth of air freight has been so pronounced, many major Asian stations have either insufficient capacities or other inadequate infrastructure to support the continued growth of cargo activity.

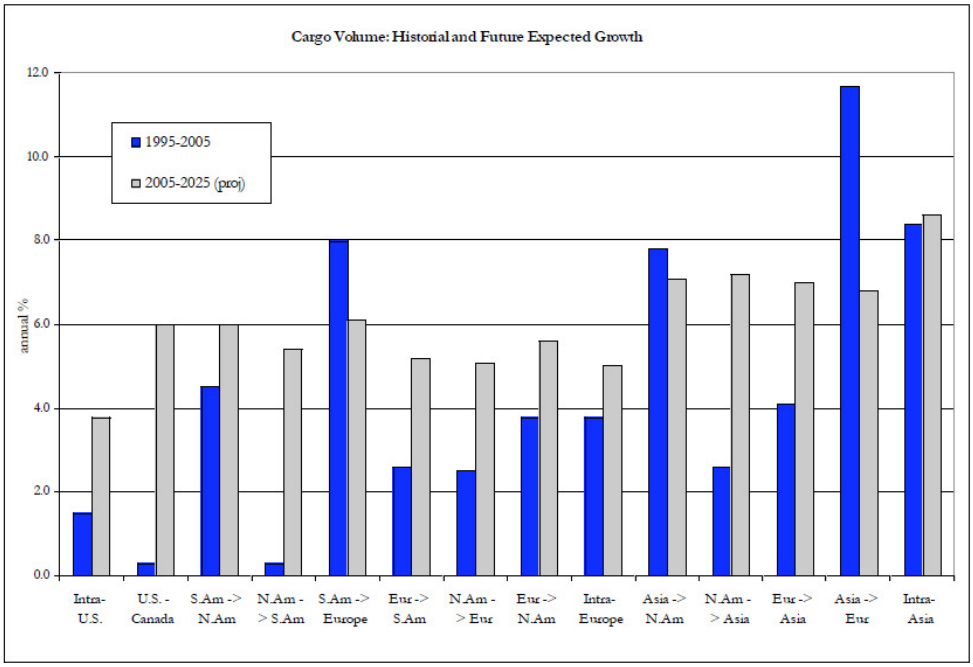


Figure 3: Growth of Air Cargo Globally 1995 - 2005

4.3 Research on Security in Physical Distribution Networks by Luca Urciuoli of Lund University 2010

4.3.1 Objectives of study

The objective of this study is to understand what factors influence the security of physical distribution networks. Thereafter it aims to bring to light what security measures exist today to enhance security and finally how to determine the profitability of security investments.

Overall this investigation offers an overview of the research driven within the supply chain and transportation security area between 2008 and 2009. A total of 14 articles are identified and classified into 5 areas: recommendations to enhance security, factors influencing security, security impacts, research agendas and supply chain risk management.

4.3.2 Findings Summary

Statistics indicate that today physical distribution networks are highly exposed to antagonistic threats, turning them into high-revenue targets. Every day cargo is stolen, hijacked, and counterfeited, and personnel working in transportation companies are exposed to the risk of being seriously injured. Less often, we also witness episodes of terror attacks or food and pharmaceuticals contamination that have horrendous consequences on our communities.

Logistics, transportation as well as security managers have wide access to handbooks, certification programs (AEO, ISPS, ISO 28001), advanced security technologies etc., to enhance the protection of their assets. Nevertheless, for various reasons, consistent actions are not being properly taken by companies, resulting in an escalation of security incidents that today we may observe in available statistics. Since this situation is not believed to be sustainable from either an economic or a social responsibility viewpoint, this study wonders how companies are coping with the protection of their assets. More specifically, this study has the ambition to enhance the understanding of:

1) What factors influence the security of physical distribution network;s

2) How security in physical distribution networks may be enhanced and;

3) How existing investment and risk models may be exploited to estimate the profitability of security solutions.

4.3.3 What factors impact physical distribution security?

By performing an explorative study involving a literature review, observations, unstructured and semi-structured interviews, eight actors interacting in an integrated Physical Distribution Security System (PDSS):

i) The Law Enforcement Agency,

ii) Distribution and transport operators;

iii) Business Security Certifications;

iv) Insurance Companies

v) Security Providers;

vi) Criminals;

vii) Contract Regulatory Associations;

viii)Authority.

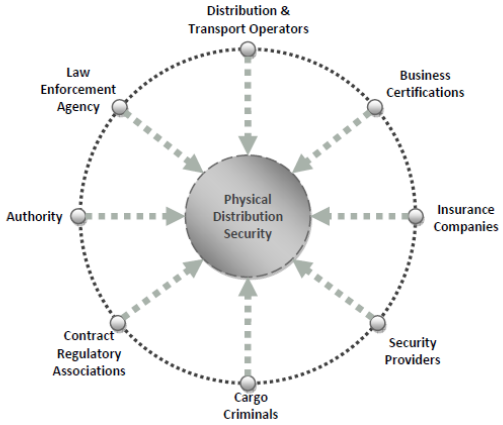


Figure 4: Physical Distribution Security System (PDSS)

4.4 Studies on "The Linkages among Inflation, Unemployment and Crime Rates in Malaysia" by Chor Foon Tang of University Science Malaysia

4.4.1 Background of studies

This study investigates the linkages among inflation, unemployment and crime rates in Malaysia through integration and causality analyses. The Johansen's test reveals that the macroeconomic variables, inflation and unemployment were coalescing with crime rate to achieve their steady-state equilibrium in the long run, although deviations may occur in the short run. In this study, the normalized coefficients for inflation and unemployment rate are positively related to crime rate in Malaysia over the sample period of 1970 to 2006. This implied that inflation and unemployment are two importance criminal motivation factors in Malaysia. Furthermore, the empirical evidence implies that Malaysia's crime rate is Granger caused by inflation and unemployment. This empirical evidence may throw some light that the policymaker could reduce the crime rate Malaysia by controlling the two macroeconomics evils – inflation and unemployment. In addition, supply-side economy may be a good policy to simultaneously reduce both inflation and unemployment rates and ultimately, reduces the crime rate in Malaysia.

4.4.2. Limitation of Studies

Nothing is perfect; this study has no exception too. There are few limitations that confined to this study and will be presented as follow. First, as inflation and unemployment rate are the only the variables employed in this study, the results may not thoroughly capture the criminal behaviour in Malaysia. There are some other

potential variables such as the proportion of government spending on internal security and the benefit or cost of commit crime. However, the use of inflation and unemployment rate is in line to the purpose of this study and thus they should not be discarded as an irrelevant policy instrument in curbing crime rate. Second, the disaggregate analysis on crime rate such as property and violent crimes may be more comprehensive and interesting.4 Nevertheless, this is beyond the scope of this study, thus the future study can be extended by analyzing the effect of inflation and unemployment rates on different categories of crime rates – property and violent crimes. Third, according to economic theory, there is a strong trade-off relationship between inflation and unemployment rates (see Tang and Lean, 2007b for the case of Malaysia). This is also known as the Phillips curve phenomenon. Therefore, the inclusion of both inflation and unemployment variables into the crime function may cause the multi colinearity problem. For this reason, Tang and Lean (2009) suggest to employ the misery index to overcome this problem.

4.5 A research agenda for supply chain security and productivity by Chelsea C. White, Alan L. Erera & Martin W.P. Savelsbergh of Georgia Institute of Technology August 2004

4.5.1 Background

A one and one-half day workshop was held in Atlanta on 4 and 5 February 2004 that was supported by the National Science Foundation and the Trucking Industry Program and was hosted by Georgia Tech on the Georgia Tech campus. The workshop *purpose* was to identify key research and educational issues, problems, and opportunities

associated with the security and efficiency of the freight transportation system. Perspectives from all of the various stakeholder groups were sought, where the stakeholders considered were the regulators, technology providers, users, and providers of the international freight transportation system. The assumption was that these key issues might have implications at several levels, e.g., operational, firm, and policy. The targeted research community was the operations research and industrial engineering community. The intent was to engage this highly resourceful, and talented community to address the security-related issues, problems, and opportunities that the nation is facing and will likely face in the future.

4.5.2 Design of resilient supply chain infrastructure: the perspective of society

Societies clearly have a role to play in providing protection and prevention mechanisms to reduce the risk of both supply chain disruptions, and the risk of indirect consequences from supply chain exploitation. Many questions may appear quite difficult to analyze quantitatively. At the same time, it is important that crucial societal (and therefore, political) decisions regarding appropriate infrastructure protection mechanisms be made on the basis of strong quantitative analysis.

The design of resilient supply chain infrastructure is especially difficult for two reasons. First, it is important to understand the market response of independent firms to infrastructure changes before making investments in resiliency. As a simple example, suppose a government in an effort to improve the security of major inbound container trade lanes identifies the top few ports exporting containers to the U.S. and implements

added security practices at these locations. If the security practices reduce the efficiency of the supply chains using those export ports, profit-maximizing firms may choose to source material from alternative locations that may now provide higher levels of efficiency. In an extreme case, due to market response, a system design that was intended to increase system security might indeed have the opposite effect.

Second, it is likely to be very difficult to develop appropriate measures of the indirect risks of vulnerable supply chain infrastructure. While such indirect risks may indeed be the most important from the perspective of society, they are likely to be the most difficult to quantify and include in analyses. Some guidance and ideas from the hazardous materials transportation and the natural hazards fields, such as earthquake engineering, may be appropriate to consider.

4.6 Research on "Current and Emerging Air Cargo Security and Facilitation Issues" By Maria Buzdugan; Institute of Air and Space Law, McGill University Montreal; August 2005

4.6.1 Introduction

This study explores possible approaches to harmonizing air cargo security standards and potential implementation challenges that should be taken into account when designing such common approach. The first part of the study provides a background of air cargo industry characteristics which will assist in understanding the nature of the security threats in this industry, followed by a review of selected air cargo security risks

and vulnerabilities identified by government and industry reports, as well as potential measures to mitigate the risks and address the vulnerabilities.

The second part of the study summarizes the status of relevant international, regional, and national regulatory initiatives aimed at ensuring air cargo security while taking into account trade facilitation issues. It should be pointed out that this review does not intend to provide an exhaustive analysis of the wide variety of security and facilitation measures already in place; instead, it focuses on modern regulatory trends in the area of cargo security and facilitation.

The third part of the study addresses the feasibility of an international approach to air cargo security and facilitation and makes several proposals which integrate, according to the author, the best practices identified in national, regional, and international regulations with the potential for universal application. In this context, the estimated benefits and costs of, as well as challenges to the implementation of such measures are discussed.

Such an analysis should prove useful not only to academics interested in recent developments in the field of air transport security, but also to the policy-makers and managers of the air cargo industry by providing them with an overall picture of the current state of regulations and challenges in this important economic area, as well as with suggestions for designing an internationally acceptable set of standards to govern air cargo security.

4.6.2 Potential Approaches to International Security and Facilitation Standards

Since inspecting 100 per cent of air cargo is currently impossible due to limited technology and infrastructure, "flow of commerce" and finite resources, many experts agree that the most practical approach would be based on a risk management technique which enables the authorities to identify high-security risk shipments on which to concentrate control. In this context, the objectives that would enhance air cargo security may be formulated as:

(1) ensuring the trustworthiness of the cargo flowing through the system;

(2) ensuring the trustworthiness of workers who operate and provide the vehicles and handle cargo;

(3) ensuring the trustworthiness of the private companies that operate in the system, such as the carriers, shippers, agents, and brokers;

(4) ensuring the security of the area around transportation facilities and vehicles in operation.

Based on some of the best cargo security and facilitation practices adopted or proposed at the international, regional, or national level, reviewed in Part II of this thesis, one may identify several technological and procedural best practices to enhance air cargo security. These measures include technologies and operational practices. In order to determine the feasibility of such measures to become an international standard or best practice, each of the potential measures needs to be weighed against other factors such as the cost of its implementation and effect on the flow of cargo.

A review of such measures and their potential benefits and drawback as follows:

1. Technology-Based Measures to Improve Cargo Security

1.1. Screening Technologies

1.2. Intrusion-Detection Technologies

1.3. Hardened Cargo Containers

2. Operational Measures to Enhance Cargo Security

2.1. Procedures to Ensure Physical Security of Air Cargo Facilities and Operations

2.2. Advance Electronic Cargo Information Requirement

2.3. Government-Business Partnerships, the "Authorized Economic Operator" and "Secure Supply Chain" Concepts

3. Comparative Table of Cost-Benefit Analysis of Possible Measures

4. Long Term Solution: A Comprehensive Risk-Management Approach

5. Funding the Adoption of Air Cargo Security Standards

6. Other Possible Implementation Challenges

5. TAPA (Transported Asset Protection Association) in Combating Cargo Crime

5.1 Introduction

TAPA is a non-profit organization set up in 2000 by representatives from the various electronics and semi-conductor manufacturers, high tech industries, freight forwarders, and professional consulting companies. TAPA is an association of security professionals organized for the purpose of addressing a variety of security threats common to the technology industry by leveraging on best practices and common experiences of its membership. TAPA (Transported Asset Protection Association)

Freight Security Requirements (FSR) have being established to ensure the safe and secure in-transit storage and warehousing of any TAPA member's (Buyer's) assets throughout the world. The FSR specifies the minimum acceptable standards for security throughout the supply chain and the methods to be used in maintaining those standards. The FSR outlines the process and specification for Suppliers to attain TAPA certification for their facilities and transit operations. It is the intention of TAPA members to select Suppliers that meet or exceed TAPA certification requirements.

5.2 TAPA Freight Security Requirements (FSR)

Freight Security Requirements (FSR) have been established to ensure the safe and secure in-transit storage and warehousing of any TAPA member's (Buyer's) assets throughout the world. The FSR specifies the minimum acceptable standards for security throughout the supply chain and the methods to be used in maintaining those standards. The FSR outlines the process and specification for Suppliers to attain TAPA certification for their facilities and transit operations. It is the intention of TAPA members to select Suppliers that meet or exceed TAPA certification requirements. The successful implementation of the FSR is dependent upon Suppliers, TAPA Certified Auditors and Buyers working in concert.

However, the safe and secure in-transit storage and warehousing of the Buyer's assets is the responsibility of the Supplier, its agents and sub-contractors, throughout the collection, transit and delivery to the recipient, as specified in a Release. Suppliers must have written and verifiable processes for the selection of subcontractors. Periodic reviews of sub-contractor processes and facilities must be conducted based on risk.

The FSR will be referenced in any contract between the Supplier and Buyer, and into the Supplier's own security program. The result of the Supplier's failure to implement any part of the FSR shall be part of the contract between Buyer and Supplier for freight services, and the provisions of that contract shall govern the rights and responsibilities of the parties in this case.

5.3 Storage/Warehousing Building Classification Assessment

The Building Classification Assessment is designed to categorize the facility into one of three categories, "A" being the highest security requirement and "C" the lowest. For facilities not previously classified, the Supplier must complete a classification assessment before the effective date of the contract and give results to the Buyer. Separate TAPA audit forms for A, B, & C facilities exist. The Supplier, in cooperation with the TAPA auditors, shall complete the final classification assessment within 30 days of acceptance of contract. The TAPA Certification body shall periodically complete their own classification assessments and ultimately make the decision on the final classification to be assigned to each of Supplier facilities handling or storing of Buyer's assets. The Supplier or Buyer can request the facility to be re-assessed if either party considers the assessment category to have changed.

For the duration of the contract the Supplier will conduct security audits of their facility or their subcontractor's facility in line with the audit schedule published below. The format of the audit is to be agreed upon with the Buyer. It is suggested the Supplier use the same audit format as the Buyer will use. Results of Supplier self-audits shall be forwarded to the certifying body within 2 weeks of the self-assessment. A self-

assessment is to be conducted annually within the anniversary month of the independent audit.

Supplier will allow Buyer to conduct audits when pre-arranged. Supplier will, at a minimum, audit the Supplier's facilities in line with the audit requirements published below. The Buyer or the TAPA Certified Auditor reserves the right to increase or decrease the frequency of the audits by giving prior notification to the Supplier. The format of the TAPA audits will be to use the standard audit format.

5.4 Elements and audit process of TAPA FSR

There are 8 elements in TAPA FSR documents or audit form. Every element will have scoring matrix and TAPA auditor will verify the sites to be audited using this scoring matrix. There are also various mandatory items which need to be complied and failing any of the mandatory items will eventually fails the audit. Once the audit has been completed successfully, the certification bodies approved by TAPA will issue certification to the sites. The following are the elements found in the TAPA FSR scoring matrix as follows:

1. Perimeter Security
2. Access Control – Office Area
3. Facility Dock and Warehouse
    a. Access Control Between Office & Dock / Warehouse
    b. Limited Access to Dock Areas
    c. High Value Storage Area
    d. All External Docks and Warehouse Doors Secured

    e. CCTV Coverage
    f. Motion Detection Alarms
4. Security System
    a. Monitoring of Security Systems
    b. Intruder Alarm System
    c. CCTV System
    d. Electronic Access Control System
5. Security Procedures
    a. Documented Security Procedures
    b. Background Check (Vetting)
    c. Terminated Employees and Contractors Procedure
6. Standard Security Requirements
    a. Cargo Truck Security
    b. Route Risk Assessment
    c. Loading / Unloading
7. Pre-Alerts
    a. System of Pre-alerts
8. Enhanced Security Requirements
    a. Driver Training
    b. Trucks Escort
    c. Vehicle Tracking

6. Conclusion

The security of cargo in the supply chain has become one of the major global security concerns given its recognized vulnerabilities which make cargo possibly the easiest target for terrorists. In recent years, a variety of national, regional and international regulatory and policy initiatives have taken place in an attempt to counter the perceived risks and vulnerabilities in the industry. Since it is agreed that screening of all cargo is not currently feasible due to limited technology and infrastructure, “flow of commerce” issues and finite resources, the most practical security approach would involve a risk management technique which enables the authorities to identify high-risk shipments on which to concentrate their control. Several technology and operational measures have been identified to better address the threats to cargo security. Among the procedural initiatives are the requirement for advance cargo information, expanding the use of “authorized economic operator” and “secure supply chain” mechanisms.

An internationally agreed approach is necessary in order to adequately respond to the international nature of cargo security risks and to avoid a patchwork of national and regional initiatives that may impede the flow of international trade. A viable international initiative should be based on best security practices identified by governments and international organizations and should aim at defining basic standard requirements for cargo security and facilitation with the broadest geographical scope.

Solutions should be developed with due consideration for their impact upon cargo transportation and trade. Future security measures should be effective and affordable

and should be tested by practical experience. Only such measures, coupled with a workable authorized economic operator and a secure supply chain mechanisms can provide reliable guarantees of effective security in the cargo system. Setting up and implementing such a risk-managed approach would require close cooperation by all governmental authorities involved in international transport and trade. The use of automated risk-assessment systems, including mutual recognition of authorized economic operators, high standards of official and commercial integrity at all stages and agreed international security standards for all cargo operations and related satisfactory methods of certifying and monitoring performance are essential requirements of such approaches.

Another major issue that must be taken into account is that, while designing a set of international security and facilitation cargo standards may take long time, the major challenge will be to obtain international acceptance and implementation of these standards. The proper pace of implementation will ensure a better cargo security.

Contemporary realities suggest that the adoption and implementation of security measures described above will be attained at different speeds in different regions. Several factors will determine the pace and scope of progress in various countries, e.g. the efficiency and integrity with which regulatory provisions are interpreted and applied in a given country, the quality of that country's infrastructure and resources, the political stability and the will necessary to implement international standards, the commitment to

compliance by traders involved in international transportation of cargo and the quality of government-business partnerships with regard to trade facilitation.

To summarize, although there is a clear and present need for a uniform approach to cargo security and a global enforcement system in combating crime, it will most likely take years to establish and properly implement adequate international standards and installed the required monitoring systems.

7. Abbreviation

AEO – Authorized Economic Operator

CSI – Containers Security Initiatives

CTPAT – Custom Trade Partnership against Terrorism

FSR – Freight Security Requirements

ISPS – International Ship and Port Facility Security

ISO – International Standard of Organization

TAPA – Transported Asset Protection Association

ULD – Unit Loading Device

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