

Chapter 3

Improving Security and Efficiency of Multimodal Supply Chains Using Monitoring Technology

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ABSTRACT

Multimodal supply chains are characterized by multiple changes of transport modes, vehicles, and transport operators, and hence, the risks for theft, untimely delivery, and freight quality deterioration increase. There is a growing need to manage the security and efficiency of consignments. Tracking and tracing services, which are on the market, mainly concentrate on a single mode of transport, such as road vehicles, or transport units, such as containers. This chapter describes a concept for managing the security of multimodal supply chains using monitoring technology. A profound risk analysis was performed to identify threats and vulnerabilities during the different phases of the supply chain and key threat scenarios. A security service concept was developed to cope with the risks using monitoring technology. The technological solution depends on the needs of the supply chain actors and on the supply chain properties. The service concept was tested by monitoring different international shipments leaving from Finland. Intelligent monitoring devices, which were attached to the consignments, collected information on location and environmental parameters and transmitted in real-time to a background system. The chapter gives an overview of the framework, service concept, and the analysed results of multimodal shipments.

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INTRODUCTION

Logistics is the part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements (Ballou, 2004). The aim of logistics is to execute the delivery process productively, economically securely and safely, taking into account the client's requirements. A disturbance free supply chain is efficient, reliable, visible, resilient and economical. This means that the supply chain is able to deliver the shipments as planned and not deteriorating the quality of goods. The vulnerability of one point will decrease the total performance of the supply chain and it should be viewed in the overall context of the business needs (CIPS 2006).

The configuration of transport networks leads to the need for security measures in different forms, depending on the exact function and appearance of each node and link. Multimodal supply chains are characterised by changes in transport modes, vehicles and transport operators. This poses risks on both security and the timely delivery of the goods, and challenges on tracking of door-to-door shipments. The different actors in the supply chain make their decisions, on e.g. the actual timing and route, independently, without communicating them to the other actors in the supply chain. Hence, often no actor has a complete view of the actual supply chain, and hence on the control of the security. The availability of fast and accurate information exchange plays hence a key role in improving efficiency and security (Zhenxin Yu & al., 2001; Nilsson & Waidringer, 2010).

The product damages are often caused by interaction of various factors and damage mechanisms may be complex. "Undesirable" events include late (or too early) delivery, non-delivery (the chain breaks), delivery of faulty, perished, damaged, wrong or wrong amount of the products or

delivery at the wrong location. Intelliflex estimates that the cost of losses of perished food in the cold supply chain in the U.S amounts to 17 Billion \$ each year (Intelliflex 2013). The frequency of security incidents as well as their consequences is increasing. The total loss of value caused by theft of cargo and freight vehicles is about 8.2 Billion Euro each year in Europe, or about 6.7 Euro per loaded trip (van den Engel & Prummel, 2007). The management of supply chain security is a topic which is hence high on the agenda of logistics operators and governmental agencies (Salmela & al., 2010; Urciuoli, 2010; Voss & al., 2009).

The use of sensor and communication technologies allows monitoring consignments in real time, and hence provides the possibility to take immediate actions to mitigate the supply chain risks.

However, the best solution for improving security and monitoring, both in terms of information exchange, performance and economics, depends on the specific needs of the actors involved. Different models can be identified regarding the amount of information in supply chains exchanged between the different stakeholders (Pilli-Sihvola 2012):

- **Black Box Model:** No information is shared between the supply chain partners during transport or other logistics processes. Problems are noticed and actions are taken with a significant delay.
- **Notification Model:** In which information is exchanged at nodal points of the supply chain, where goods are handled.
- **ID Model:** This model uses identification technologies such as OCR, barcode and RFID to enable collection and transmission of tracking and monitoring information.
- **Continuous Monitoring Model:** This model uses real time wireless communication together with sensor technologies enables significant development of the supply chain monitoring and tracking solutions.

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