SEVENTH FRAMEWORK PROGRAMME

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"Sustainable Knowledge Platform for the European Maritime and Logistics Industry"

D2.4.3.4 Practical examples and experiences of visibility systems deployments

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SE 4.3 Technologies deployed to improve visibility and operational risk management within supply chains

SE4.3.1	Overview of automated identification technologies – advantages and selection criteria
SE4.3.2	Drivers for the deployment of RFID (technological and cost advancements)
SE4.3.3	Sensor technology combined RFID to monitor shipments and transport units
SE4.3.4	**Practical examples and experiences of visibility systems deployments.**

Summary

This study shows different types of cases on technologies deployed to improve visibility and operational risk management within supply chains:

- Pallet case Metro France. The pallet level is the easiest start up, especially in closed loops. Standardised solutions are already available. EPCglobal is leading the development of industry-driven standards for the Electronic Product Code (EPC) to support the use of Radio Frequency Identification (RFID).
- ISO container cases Metro, DoD. Containers are potential targets for RFID identification but there is still a lot of barries for global solutions.
- Non ISO container case SECU
- Temperature measurements with active RFID case Controlmatic
- EPCGlobal and SMART-CM cases demonstrate how organizations can exchange real time event data and track shipments from the third party logistics provider. Also customs authorities will have real-time access to information about products and shipments as they travel along the supply chain.

Practical examples and experiences of visibility systems deployments

Contents

1. Objectives

Review of challenges for shippers to improve the visibility in cases like Metro and Wal-Mart and benchmark for maritime and logistics industry. Logistics service providers´ solutions.

2. Target stakeholders

Technologies for improved visibility and risk management are of interest to all operative stakeholders in the supply chain:

- D2D Service Providers**,** which include ship operators, freight forwarders, logistics providers and Motorways of the Sea (MoS) operators
- Exporters & Importers (shippers)
- European ports, national port bodies and especially small-to-medium ports

Also related organisations have interest on the topic:
- Research organisations, Systems Developers and
- The large number of specialised companies that support the Maritime and Logistics industry; this includes bankers, financiers, designers, builders, providers of Single Window (SW), Port Community Systems (PCS) and Cargo Community Systems (CCS
- The European Commission and national transport ministries

3. Glossary terms

Radio Frequency (RF or RFID): A form of wireless communications that lets users relay information via electromagnetic energy waves from a terminal to a base station, which is linked in turn to a host computer. The terminals can be place at a fixed station, mounted on a forklift truck, or carried in the worker's hand. The base station contains a transmitter and receiver for communication with the terminals. RF systems use either narrowband or spread-spectrum transmissions. Narrow-band data transmissions move along a single limited radio frequency, while spread-spectrum transmissions move across several different frequencies. When combined with a bar-code system for identifying inventory items, a radio-frequency system can relay data instantly, thus updating inventory records in so-called "real time.[1]

[1] CSCMP: Terms and Glossary, March 2009.

4. Approach / methodology

Literature and case studies.

5. Specific issues and topics to be addressed

The implementation of RFID and sensor based applications has been slower than expected as many enterprises have postponed the roll out. The most important reasons are, the uncertainty of standardisation, immaturity of the technology (e.g. vicinity of metal or liquid), and fear that return of investment is not obtained. Other barriers exist such as data security and privacy.

Obtaining supply chain visibility through the use of RFID means identification of a heavy goods vehicles, identification of a driver, identification of the load at gates, other areas, terminals, under loading and unloading areas. RFID enables access also to unmanned unloading areas and automated reporting. Exchange of information between supply chain partners includes interoperable interfaces of IT systems and data transfer technologies and formats such as EDI and XML languages.

The cases selected are

- Pallet case Metro France. The pallet level is the easiest start up, especially in closed loops. Standardised solutions are already available. EPCglobal is leading the development of industry-driven standards for the Electronic Product Code (EPC) to support the use of Radio Frequency Identification (RFID). EPCGlobal is a subscriber-driven organisation focused on creating global standards for the EPCglobal Network. The goal is increased visibility and efficiency throughout the supply chain and higher quality information flow between companies and their key trading partners. http://www.epcglobalinc.org/home
- ISO container cases Metro, DoD. Containers are potential targets for RFID identification but there is still a lot of barries for global solutions.
- Non ISO container case SECU
- Temperature measurements with active RFID case Controlmatic
- EPCGlobal and SMART-CM cases demonstrate how organizations can exchange real time event data and track shipments from the third party logistics provider. Also customs authorities will have real-time access to information about products and shipments as they travel along the supply chain. The case is in start up phase und results will be shown in the updates of this study.

5.1.1 METRO Pallet case

METRO Group is expanding its store-level RFID activities into France, and has contracted with logistics provider DHL to tag and track pallets delivered there. The companies announced DHL will begin tagging 1.3 million food pallets used for delivery to all 89 METRO self-service wholesale stores in France, where DHL is METRO's exclusive logistics provider.

The announcement's significance goes beyond an 89-store retail supply chain rollout. This is believed to be the first time METRO has enlisted a logistics provider to apply RFID tags to shipments. DHL is equipping five food distribution centers with RFID systems to supply METRO Cash & Carry.

DHL and METRO Group say the rollout is the largest RFID project in the French retail industry. DHL will tag food pallets at its distribution centers, read them as the pallets are loaded onto delivery trucks, and transmit the shipment data to METRO Cash & Carry. The pallets will be read again when they are received at the retail stores, and the tag read data will be compared to the previously-sent order and shipment information to verify delivery accuracy.

To ensure uniform conditions, the implementation of the technology was planned in four successive phases:

1. In the first step, the companies evaluated the possible hardware and software. Criteria included handling and the compatibility among the individual components as well as performance. To determine these factors, the partners carried out tests at the METRO Group RFID Innovation Center in Neuss, Germany. While METRO Group chose the hardware provider Checkpoint Systems for its incoming goods portals, DHL used a solution from the supplier NBG ID. In terms of transponders, the model 'Dogbone' from UPM Raflatac was select ed. It complies with the EPC Class 1/Gen. 2 standard and worksin the ultrahigh-frequency range. Even when used on metals and fluids, it delivers good read rates.
2. During the second phase, the partners conducted tests to assess the function of the hardware and software in practice.
3. A third step involved the launch of a pilot implementation in southern France.
4. In fall of 2008, phase four begins: RFID deployment throughout the country.

http://www.rfidupdate.com/articles/index.php?id=1664

5.1.2 METRO container case

In 2006, METRO Group started testing RFID in international logistics. The objective of Advanced Logistics Asia (ALA) is to use the technology to optimize the goods flow between China and Germany. Different pilot projects and test scenarios are planned and are to focus on shipments from Hong Kong and the Pearl River Delta to Germany.

One example is the pilot project "Cross border Visibility". In this project, the cross-divisional service companies MGI METRO Group Information Technology, MGBI METRO Group Buying International and MGL METRO Group Logistics are cooperating with partners like Intel, the logistics service provider Fat Kee Stevedores Limited and the standards organization GS1 Hong Kong. Fat Kee Stevedores Limited pools products from different manufacturers, prepares them for shipment and tags them with RFID transponders. An RFID reader at the outgoing goods portal of the exporter records the consignment and automatically checks that it is complete. After that, MGBI METRO Group Buying International ships consignments to Germany via different ports. Once the goods have arrived at the METRO Group distribution center in Unna, they are again checked using RFID. In a matter of seconds, a reader at the incoming goods portal checks whether all products ordered have arrived. After that, the items can be distributed to METRO Group stores.

HTTP://WWW.FUTURE-STORE.ORG/FSI-INTERNET/HTML/EN/1592/INDEX.HTML

5.1.3 DOD / SAVI case

Knowing where the goods were throughout the supply chain, matching them to requirements in the field, and getting personnel and materiel to the right place at the right time were the issues facing US Department of Defense (DoD) during the first Gulf War called Desert Storm. The deployment of supplies during Desert Storm highlighted the consequences of not having complete visibility of the supply chain and what was in the pipeline. More than 25,000 of 40,000 containers shipped to Saudi Arabia, during the first Gulf War, were opened to determine the contents. Millions of dollars of duplicate goods were shipped, which not only significantly increased the cost of military operations to US taxpayers, but it also created bottlenecks at distribution points and congested points of debarkation. At best, the right product was delivered to the right

place but at the wrong time. At worst, the wrong products were delivered to the wrong place at the wrong time.

The DoD requirements are to provide in the box, nodal, and on demand visibility of materiel moving through the DoD supply chain from point of origin to destination. To meet these requirements, the DoD mandates that all container, air pallets, and large airframe and vehicle component containers be equipped with active RFID tags by the shipper. To facilitate this mandate, the DoD installs Savi products to create, read, update, and delete data from the Savi's active RFID tags, at all points of origin that ship containers, air pallets, and component containers.

At the points of origin, the shipper writes the format to the active RFID tag and sends the write record to the ITV network of servers. The DoD installed Savi readers to collect the RFID tag identification (ID) number as the shipment departs the point of origin location. The DoD has also installed Savi active tag RFID readers at all aerial and sea ports used to move DoD cargo to ultimate consignees. As these tagged shipments arrive and depart these nodes, the tag ID is automatically collected and sent to the appropriate ITV server. When the shipment arrives at the consignee, the tag ID is again automatically collected and recorded in the ITV server. The DoD logisticians use the collected tag ID date to manage, monitor, and redistribute DoD assets to fulfill the warfighter's requirements.

The DoD RFID Network is implemented at over 800 locations in 45 countries with over 1,300 worldwide locations including rapidly developed contingency sites.

http://www.savi.com/assets/DOD-ITV-Visibility.pdf

5.1.4 Stora Enso SECU

Stora Enso produces approximately 20 million tons in European plants, of which approximately 17 million tons are sold to European customers. Stora Enso aims at providing exceptional customer service. In order to achieve a customer demand-driven, quick response logistics operation, Local Distribution Centres (LDCs) have been established close to customers. The LDCs act as buffers in the supply chain such that customers may be served immediately upon request. Stora Enso has decided to base the logistics operation on a multimodal supply chain, except in the very few situations where direct truck transport from mill to customer is required for satisfying customer demands.

Density of cargo is one factor in achieving low cost of transport. Use of rail is therefore an attractive alternative for Stora Enso. To achieve the desired density of cargo, and to automate a number of the handling operations in the supply chain, the Stora Enso Cargo Unit (SECU) was introduced (***Figure 1***) The SECU is not easily transported on the rail network in continental Europe. As a consequence, a waterborne alternative between the Nordic countries and Europe was required.

In order to secure the best possible customer service and to properly manage the supply chain, each unit (paper roll being one example) is assigned a unique bar code identity. Each SECU also has a unique identity, both in written codes as well as active RFID.

These identities are being used in a software system (info logistics system in Stora Enso terminology) for providing complete supply chain visibility.

The SECU is a weather protected cassette ISO certified for 93,5 gross tonnes. It has the ability to accommodate more cargo than a conventional rail car, handling a 40 foot ISO container.

The dimensions of the SECUS are 3,6x3,6x13,8 m, and are thus adapted to Sweden's new and larger rail profile "C" with a maximum permitted axle weight of 25 tonnes. A new type of railway bogey has also been developed to accommodate the SECU (***Figure 2***).

Figure 1. SECU on rail.

Figure 2. SECU box with standard containers.

The Stora Enso supply chain concept was first implemented for transport between the mills in Sweden and customers in continental Europe. Baseport was initiated in the middle of the 1990s and was designed as an efficient multimodal transport system that integrates Swedish rail and North Sea traffic, carrying paper and board from Sweden to Europe and other continents. The new cargo handling technique for rail transport is based on the SECU. Combined with the shipping operation between the ports of Gothenburg and Zeebrügge in Belgium this provides both an environmental friendly and cost effective solution for Stora Enso transport. In Baseport, three vessels operate with six sailings per week in both directions. This provides an adequate frequency and transport capacity for Stora Enso's Swedish mills. Three rail routes, the Dalarna, Värmland, and Hylte lines, are used to transport goods to the Port of Gothenburg.

Gothenburg is Stora Enso's port hub in Sweden for shipping of paper and board. For Baseport, the terminal area at the port was expanded with a new loading quay and rail link for handling the SECUs and trailers (57.000 m^2). Loading and unloading of the vessels takes place at the stern and can be carried out with the aid of double roll-on/roll-off ramps. The time to load and unload the vessels is less than six hours, which reduces the layover-time and increases the sea-time.

Source PROMIT see D5.1 http://www.promit-project.net/

5.1.5 Case ControImatic TempNet

TempNet is automated, wireless sensor network solution for remote cold chain monitoring of transportation and storage. TempNet provides a solution to verify that the cold chain has been intact throughout the transit. By using fully automated temperature monitoring system the user is able to react to problem situations and provide high quality products
TempNet is wireless cold chain monitoring system that complies with the EU regulation for transport, storage and distribution of food. TempNet is also an end-to-end solution to monitor and authenticate temperatures automatically in real time. The system includes customizable temperature sensors and control systems for the transportation equipment. The wireless system is easy to install and it can be extended to more trucks without any changes to current vehicle or terminal settings.

System consists of wireless temperature sensors inside containers, units in truck cabins, masters in terminal areas, database and user interfaces. The interface is Web based. The systems uses both passive and active RFID technology. Implemented Case consists of wireless sensing and controlling system to 800 trucks, trailers, containers and 10 terminals (***Figure 3***).

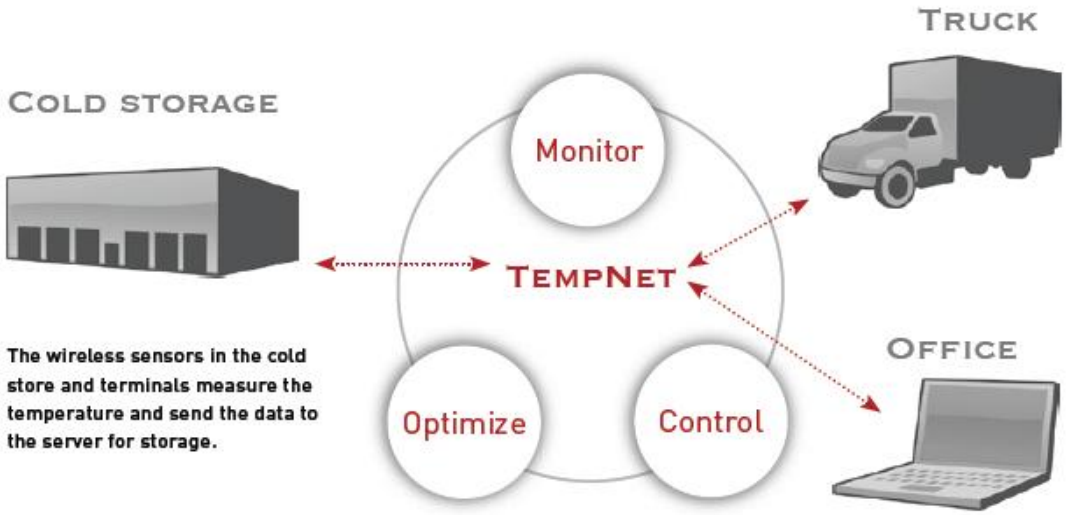

Figure 3. Tempnet system.

http://www.controlmatic.fi/

5.1.6 GS1/EPCGlobal Transport and Logistics Phase 3 Pilot Program

GS1 / EPCglobal has launched the third phase of the Transportation and Logistics Pilot Program. Global Transport and Logistics Pilot Program will show end-to-end visibility between Japan and the Netherlands based upon GS1 EPCglobal standards.

The Transportation and Logistics 3 Pilot Program will demonstrate how organizations across a global supply chain can exchange real time event data and track shipments from the third party logistics provider in Japan to the distribution warehouse in the Netherlands. Supply chain partners and customs authorities will have real-time access to information about products and shipments as they travel along the supply chain.

The TLS 3 Pilot Program focuses on testing out the use of EPCIS to track the progress of physical products in cartons, containers and pallets across the supply chain using the trade lane from Tokyo to Amsterdam. EPCIS is the GS1 EPCglobal standard which will provide a common set of data elements, a common language for communication, and a set of defined messages for trading partners to use for storing, accessing, and communicating data on objects moving in the supply chain.

The EPC tags will be read by fixed readers. The use of active EPC/RFID (Extended Conveyance Asset Tag (XCAT)) and e-seal tags on sea containers as well as the application of active tags on pallet level will also be tested within the framework of the TLS 3 Pilot Program. These tests will serve to drive the development of standards for conveyance asset tags and passive e-seals. “Through the use of GS1 EPCglobal standards like UHF Class 1 Generation 2, Reader Protocol, Application Level Events (ALE) for Filtering and Collection and EPC Information Services (EPCIS), the

transport and logistics companies, customs authorities and other interested parties that are authorized will be able to track events throughout the supply chain.

The first phase validated the use of both passive and active UHF EPC tags for sea-shipment of cartons and containers between Hong Kong and Japan whereas the second phase demonstrated the impact of GS1 EPCglobal Standards on providing visibility of goods on a global level between source factories in China and distribution centers in the US, flowing through the ports of Shanghai and Los Angeles.

The Transportation Working Group in the TLS IAG has focused on a technology standard for a single conveyance tag. Through the work of the group, a defined set of conveyance types was created, transportation specific use case scenarios were built, functional requirements were gathered, and a new tag name was produced: The Conveyance Asset Tag (CAT).

E-seals combine C-TPAT, ISO 17712 mechanical bolt seals with UHF Gen 2 RFID tags that are read at points along the supply chain. If the e-seal is tampered with when doors of e-sealed freight containers are forcibly or improperly opened the RFID tag can no longer be read.

The Global Shipment Identification Number (GSIN) enables the identification of grouped transport units travelling under one commercial order from origin to destination and perfectly suits to the needs of Customs Organizations which day after day process thousands of national and international transactions, most composed of multiple transport units containing a number of containers, pallets, and more, all travelling under one single purchase order.
http://www.epcglobalna.org/

5.1.7 SMART Supply Chain management project

The project is an urgent respond of key players along the logistic supply chain to make trade and transport more efficient, secure, visible and competitive not only in the EU but across the world in a global intermodal context, while respecting existing initiatives and pilot projects in the context of AEO and Green Lanes implementation.

Two real-life demonstrators will validate all innovative organizational processes and technologies at an early project phase, using existing on board container technologies and dedicated management platforms in a door-to-door chain:
- Corridor A: Europe-Middle East (Antwerp-Port Said feeding service to Thessaloniki – Dubai - NAVA SHEVA/Mundra).
- Corridor B: Europe-Asia/Pacific (Antwerp-Singapore) - feeder service to Laem Chabang in Thailand and Ningbo in China.

The project will test novel on board container technology which include both satellite and RFID technology on board. Main purpose of the RFID integration is to facilitate the operations of the handling companies. Trough the RFID handling companies can be provided with necessary data (Container nr, Weight, Type of container) when a

container enters the platform. This will enhance the handling companies operations. The EDC unit will always use its satellite network to communicate the status information; the RFID integration has the purpose to feed data to parties who are demanding for other information than the security related data.
http://www.smart-cm.eu/

5.1.8 ODIN Self-inventorying SMART container

RFID readers are commonly placed at fixed locations, with readers installed at forklift trucks as a novel feature; if mobility is demanded, handheld readers are generally used. There has been an effort in developing RFID readers, which can scan the contents of maritime containers or truck loads, but none have yet come to the market.

The first RFID-reader integrated in a maritime container is marketed by ODIN. In ODIN's Self-inventorying SMART container concept an RFID system can be installed in a rapid way in a container.

In the SMART container a communication unit (including GPS) and two integrated reader-antennas. The SMART Container automatically reads the tagged items from suppliers as they are loaded or unloaded from shipping containers of various sizes and configurations. The components can be installed in less than a minute, using magnetic fixtures. The containers are in use at US Navy.

(http://www.odintechnologies.com/index.php?option=com_content&view=article&id=181)

6. Conclusions

The implementation of RFID and sensor based applications has been slower than expected as many enterprises have postponed the roll out. The most important reasons are, the uncertainty of standardisation, immaturity of the technology (e.g. vicinity of metal or liquid), and fear that return of investment is not obtained. Other barriers exist such as data security and privacy.

7. References

http://www.epcglobalinc.org/home

http://www.rfidupdate.com/articles/index.php?id=1664

HTTP://WWW.FUTURE-STORE.ORG/FSI-INTERNET/HTML/EN/1592/INDEX.HTML

PROMIT D5.1 http://www.promit-project.net/

http://www.savi.com/assets/DOD-ITV-Visibility.pdf

http://www.smart-cm.eu/

http://www.controlmatic.fi/

(http://www.odintechnologies.com/index.php?option=com_content&view=article&id=181)