

D15.3 CORE Final report on phase one developments of the BSH demonstrator - summary

Executive summary

This document is the final report on phase one developments of the BSH demonstrator of Core Work Package 15, summarizing plans, objectives and progress achieved during the first half of the project. The overall scope of the BSH Electrodomésticos España S.A Living Lab is to make use of CORE's developments in order to improve risk and security monitoring as well as resilience capabilities, i.e. bounce back to stable conditions as soon as a disruption is experienced. More specifically, the innovation concepts that this Living Lab is exploiting concern 1) advanced risk management, 2) global supply chain visibility and finally, 3) using the CORE ecosystem to improve and facilitate B2B and B2G information sharing in supply chains. The trade lane that is considered in the Living Lab consists of import shipments of household appliances from China to Spain BSH in Zaragoza. This initial pilot, reported in this document, has focused on the development of the following services/technologies:

- Simplifying customs transit declarations.
- Improving prevention and detection of risks (e.g. security risks) along the trade lane.
- Improving forecasts of Estimated Time of Arrivals (ETAs) at specific milestones in the trade-lane.
- Enhancing visibility of information of shipments, risks and ETAs' forecasts through a centralized global supply chain visibility tool.

In addition to reporting about the current technical development, this document analyses and reports preliminary qualitative estimations of KPIs and adoption willingness of internal stakeholders. The simplified customs transit declarations are estimated to improve exclusively documentation time as well as necessary expenditures and several complexities that normally are encountered when a customs broker is used. Nowadays, the necessary documentation time has been estimated to roughly 30 minutes per container, while the usage of electronic B2G platforms may reduce this figure to barely 2 minutes, implying a significant time reduction of about 94% per container. Other expected benefits are monetary. Consuming an online service is expected to be far less expensive than using customs brokers or adding a specialized function/department in the company. Similarly, the impacts from the perspective of the customs administrations are also fundamental. It is well known that enabling data exchange through information systems, where several sources of information are used, makes fraud attempts harder. At the same time, reducing number of mistakes minimizes the amount of unnecessary checks and customs inspection. Other functions developed in this Living Lab include the usage of tools for visibility (e.g. vessel/container position information, customs clearance status, arrival at specific milestones etc.) risk monitoring and ETAs forecasts. The impact of these functions is expected to improve several factors: first and foremost the lead times reliability for shipping containers from China to Spain. From the perspective of the lead time KPI, it is expected that OTIF (On-Time In Full) will increase up to 90-95%. However, major side effects can be considered, e.g. better security, reduced inventory costs and overall improved efficiency and lean management.

Finally, improved risk and security analyses, as well as up-to-date ETAs, are expected to result in benefits from the viewpoint of customs administrations too. First of all, enhanced risks and security analysis may facilitate compliance to security-based regulatory frameworks, e.g. AEO. Next, updated

CORE

ETAs may improve customs risk management and, for instance, avoid unnecessary customs inspections or on the contrary raising alerts whenever suspicious events are detected and reported.

Some of the activities related to subtasks in 15.2.1 had to be continued. The shift to a real time pilot unveiled some additional requirements that had to be worked upon in order to ensure the correct integration of ICT systems and communication among stakeholders. Since this is quite normal in any prototype to full scale demo, the team is expected that further changes and improvements will be necessary for the full scale demo too.

Problem, ambition and goal of demonstrator

The BSH demonstrator aims to show the usage of the CORE eco-system in order to:

1. Simplify the procedures necessary for facilitating and expediting customs transit in Spain.
2. Improve prevention and detection of risks along a trade lane, in order to dynamically optimize supply chain operations and transport activities in view of forecasted or unexpected disruptive events.
3. Improve forecasts of Estimated Time of Arrivals (ETAs) at specific destination nodes of the trade-lane.

Nowadays, BSH is experiencing problems in terms of uncertain lead times primarily due to the multiple unexpected events that can take place on the route from China to Spain. These events are being caused by several risks like bad weather conditions, issues with regulatory compliance at the port of loading or arrival, congestion in ports, missed ship at the port of loading, transshipment operations, customs inspections etc. These events result in major discrepancies between the Actual Time of Arrival (ATAs) and Estimated Time of Arrival (ETAs) at several milestones in the BSH trade lane, making it challenging for BSH to align and plan in advance sales and marketing strategies in combination with scheduling and synchronization of transport movements from origin to destination.

Short description of scope of the demonstrator

The main issues addressed in the BSH trade lane consist of the monitoring and response to major risks typically suffered by manufacturing companies placing orders to suppliers abroad and experiencing delays, losses of shipments and unpredictability or highly variable lead times.

There are several risks that could lead to these problems and the following list shows only some of the potential events that could lead the supply chain to a temporary disruption. Hence, several risks are meant to be included, but particular emphasis is meant to be given to security risks like theft, smuggling, customs inspection etc.

Living lab methodology

To realise results with this demonstrator, a Living Lab methodology is applied, which follows a cyclical approach. Through this cyclical approach, several solutions can be tested and re-adjusted/improved to fit the needs of the real-life environment.

Summary of Set-up phase

The month 18 report covers the following sub-tasks:

- ST15.1.1 Specifying the current Supply Chain for BSH
- ST15.1.2 Data Collection

CORE

- ST15.1.3. Data Analysis, Risk Assessment, and Guideline for the Implementation of the CORE Approach
- ST15.2.1 Assessment of the ICT Capabilities of the Stakeholders and Integration of Different ICT Systems

ST15.1.1 Specifying the current Supply Chain for BSH

The supply chain baseline has been mapped with a focus on physical flows of containers from suppliers in China to BSH warehouse in Zaragoza. The mapping included a list of all stakeholders involved, the documentation exchanged between them and the liabilities during the transport mission (Arto, Gomes, Urciuoli, Borbon-Galvez, & Freixanet, 2015).

An initial screening of the security requirements of the main stakeholders have led to an analysis of the certification programmes that are being adopted. Also we discuss the importance of Mutual Recognition Agreements in order to facilitate the interaction between companies operating in Europe, China and ultimately in international waters when moving on sea vessels.

Problems related to data capture and data accuracy were identified and discussed already at Month 12.

ST15.1.2 Data Collection

Data collection has preliminary started and reported in M18, mostly in terms of description of data formats and available interfaces between systems.

A web-portal with traceability of all the events happening in the port and alert system was created. If the shipper was included in the B/L there is visibility from the port of origin. There are available interfaces to their system with EDIFACT messages. PORTIC has already access to specific APIs in order to receive events from the Port of Barcelona and the INTRRA network. At the port of Barcelona, several data elements can be accessed through the existing track and trace APIs. The following data elements can be retrieved from the INTRRA network and may enable monitoring of shipments along the route from China to Spain:

- Gate in/Gate Out
- Arrival/Departure time/Date
- Load/Discharge
- Vessel Number

APIs to communicate with the CORE ecosystem need to be developed. Other options for communicating with the CORE ecosystem could consist of using FTP connections or push messages from PORTIC. Queries formats and specifications to retrieve necessary data from INTRRA have also been specified in M18. Additional data was going to be provided by BSH and other public sources of information that ENIDE has been exploring. More information and status about this necessary task is given in the deliverable.

Key performance Indicators for this trade lane have also been collected and preliminary measured.

Due to the fact that BSH has, during the last months, been implementing a new internal IT system, it has not been possible for them to provide the initial measurements of the precise KPIs that we wish to use for this Living Lab for the time of delivery of this report. The system will be up and running in the next couple of months and therefore we will soon be able to provide the requested data.

Data collection activities have been carried for several activities performed up to M18. These were the following:

1. Process flow mapping (interviews)
2. Risk analysis (interviews)

CORE

3. Container data (BSH database)
4. Order / Purchasing statistics (interviews and BSH database)

ST15.1.3. Data Analysis, Risk Assessment, and Guideline for the Implementation of the CORE Approach

A risk analysis has been performed by collecting and evaluating risks at different stages of the supply chain, from the supplier in China to arrival of containers at BSH warehouse in Zaragoza, Spain. The interview guide for the risk analysis has been coordinated with eBos and based on the MTVA concept that is being developed in work package 4. Current security practices and available security standards in the supply chain have been screened by means of desk research and review of official documentation put at disposal by competent authorities, e.g. ISPS, AEO and TAPA EMEA.

Procedures for simplified customs operations have been reviewed by PORTIC and used for the development of the customs transit declaration service to be put at the disposal of BSH.

Guidelines for implementation of CORE's concept and technologies have been summarized in the use cases provided in M18 deliverable. For this Living Lab one function has been identified: import of finished goods. In addition, the following use cases have been reported:

1. Provide Expected Time of Arrival of goods at Barcelona Port (Data from INTTRA)
2. Provide Expected Time of Arrival of goods at Barcelona Port (Data from PORTIC)
3. Provide Expected Time of Arrival of goods at Zaragoza– data from JCV
4. Provide automated customs transit declaration

ST15.2.1 Assessment of the ICT Capabilities of the Stakeholders and Integration of Different ICT Systems

The assessment of the ICT capabilities of the stakeholders was initiated and therefore partially reported in M18, par. 4.4.6 (Gurbuz et al., 2015). The preliminary screening performed unveiled the key ICT systems used by the stakeholders and the data elements that are necessary to be exchanged. In addition, the report expounds how the interfaces need to be built between the stakeholders in order to allow communication. The work that was initiated before M18 was continued and refined up to M24. Therefore, additional information is reported in this deliverable.

Current status of the demonstrator in the Living Lab methodology

The main system that is expected in this Living Lab has been developed and tested. It consists of the following main features:

- E-Customs transit declarations.
- ETAs' forecasts when cargo is moving from Yantian to final destination in Zaragoza.

Necessary data elements for the above features have been collected and included in the system. In addition, APIs' for allowing information exchange between main stakeholders and the main back-end infrastructure have been developed. A more detailed description of data elements and APIs is provided in the next chapter. The main bottleneck experienced is the lack of information about containers flows being loaded in Yantian by BSH. BSH has delayed the interaction with the LL system since their IT team was busy with an internal project, i.e. integration of a warehouse IT system. The Living Lab has tried to cope with the delay by: 1) keeping the interaction with BSH in terms of requirements collection/specification, and 2) continuing the technical development and preparing the system (data specifications and interfaces) to accept the information flow as soon as these will be available. As a result, the IT system has been developed and tested with dummy messages. When BSH will be able to send containers' data no major issues are expected. Finally, another consequence of this delay is that the KPIs' estimations could be performed only qualitatively.

CORE

After the deliverable M18 was handed in the beginning of November 2015, additional meetings and phone conferences were held on separate occasions by the partners. The groups meetings were split in terms of the solutions that were being developed for the BSH demonstrator:

1. Working Group: e-Customs transit declaration.
2. Working Group: improved ETAs' forecasts.

PORTIC has been leading the meetings and setups related to the working group developing e-Customs transit declaration. ZLC and ENIDE are instead leading the second working group working with developing and implementing solutions related to ETAs' forecasts. In these activities, ZLC in cooperation with experts in the US have been looking specifically at risk and security issues in the supply chain. Both the groups have been constantly interacting with INLECOM, FOI CLMS. These partners have been responsible to ensure the know-how transfer of concepts and tools developed in CORE's horizontal work packages into this Living Lab. In addition, to the above activities, the team planned and executed two additional meetings with all the stakeholders involved in this Living Lab:

- 26 November 2015
- 10 February 2016

The purpose of these meetings was to update, review and discuss with all the partners any decision and significant information coming from the working group. In addition, these meetings were fundamental to ensure that technical requirements were well captured.

In relation to Figure 2-1, the Living Lab moved from planning to small scale implementation (pilot). The results of the small scale implementation opened up an initial qualitative estimation of the KPIs, adoption willingness and ultimately additional actions and ideas to account for in the large scale demo in M48.

Actions performed since last report

Actions performed are reported by using the general partners' meetings as key milestones, when main outputs and updates were discussed as well as key decisions made.

Actions November - February

On the occasion of the first meeting on 26 November 2015, the management team updated the status of the M18 deliverable handed in to the project coordinators. Since the deliverable had been accepted by the internal review, the team could now start moving on to prepare and arrange necessary work for M24 deadline.

In relation to BSH's trade lane, the partners discussed the technical problem of enabling the booking of BSH's containers into the INTTRA system. An important milestone was to arrange and perform a meeting PORTIC-ENIDE-ZLC with BSH's IT department. As a starting point, BSH suggested starting with only Chinese suppliers that are using INTTRA, and later possibly including more suppliers. Also, starting with just a few suppliers would facilitate the identification of bottlenecks and problems for the full scale. The overall idea is that BSH, through its suppliers, introduces data in INTTRA China; then, PORTIC would only need to be informed about the booking with suppliers (and some necessary data, e.g. vessel info). Once they receive the BSH booking info, PORTIC can track the container and status change (for real time positioning they might need availability of GPS info). Much of this information is going to be passed to ENIDE and visualized in the Supply Chain Awareness Tools and Maps (also called Global Supply Chain Visibility Tool), as well as used for the risk analysis and ETAs forecasts.

For the work necessary for the ETAs forecasts, the group discussed the scope of additional risk management tools to be included in the demonstrator. The horizontal work packages provide sets of know-how and capabilities grouped under the Real-time Lean Agile Resilient Green Optimised (LARG+O). Partners in the Living Labs (that also work in horizontal work packages) proposed the

CORE

adoption of the MTVA and Supply Chain dynamic Risk Mitigation tool. The MTVA method would have the main objective to perform dynamic risk analysis in the trade lane, while the risk mitigation tool will propose preventive and mitigating actions.

In relation to CORE's connectivity infrastructure, interaction and discussion with CLMS supported the development of the back-end infrastructure in the Living Lab. However, due to time constraints and other compelling issues to be solved in the Living Lab, it was decided to postpone the full implementation of CORE's concepts to the final full scale demo in M24.

Finally, the team discussed the option of opening two parallel developments led in turn by TMZ and Transport Sese. As already indicated in previous reports, after Decathlon left the Living Lab, it was not possible to integrate these two stakeholders in the BSH trade lane. The initial plan discussed was to have one additional demo, where both Sese and TMZ were involved in the shipment of OPEL Mokka flows, modular units from South Korea to GM plant outside Zaragoza (Spain). The preliminary idea was to use the same solutions that were being developed in the BSH trade lane: i.e. e-customs transit declaration and improved and more accurate ETA forecasts. Sese emphasized the importance of tracking containers from Barcelona port to GM plant. TMZ would work on the electronic customs transit declaration and possibilities to monitor in real time rail cargo from Barcelona to TMZ terminal in Zaragoza. Sese could access tracking data in real time and thereby optimized scheduling of their trucks for the last mile delivery to GM plant. Reverse logistics and sequencing of empty containers from GM plant to TMZ terminal in Mercazaragoza were also discussed as potential add-ons to the demo.

Actions February – April 2016

In relation to the e-Customs transit declaration, partners gathered the technical requirements and discussed the potential content of the pilot. In particular, the pilot scenario was planned to be limited to the analysis of lead time improvements from the moment when the vessel approached the port of Barcelona, until the containers arrived at the Zaragoza warehouse. For KPI measurements, the team needed to expose potential users, BSH logistics department, to the dashboard and let them interact with it. As an output, potential KPIs may be qualitatively estimated.

In relation to the ETAs' forecasts the pilot was to follow the same principle, i.e. let users interact with the dashboard. The scenario included the movement of containers from China port, Yantian, to Zaragoza warehouse. ENIDE helped in collecting data from different sources and ensuring that this data would be visible in Inlecom's platform. Technical partners as FOI, eBOS, ENIDE and ZLC have defined the risk analysis and scoring. BSH has provided information about containers being moved in the trade lane as well as historical data related to ETAs vs ATAs gaps. With this key information, the KPIs have been qualitatively estimated and reported in this deliverable.

At this stage, the team is still moving in parallel the work carried out by TMZ and Transport Sese. However, Transport Sese has proposed to change the trade lane to activities carried out in Mexico, which implies that TMZ cannot be involved in the trade lane anymore. Hence, TMZ has continued working on the development of the customs transit declaration. TMZ has the objective to offer simplified customs transit procedures to their customers having containers arriving in Barcelona and needing transit to Zaragoza. In the meantime, Transport Sese is reviewing internally how their contribution can be aligned to CORE's objectives.

Decisions made since last report

Several decisions were made during the last six months and on the occasions of the partners' meetings held in November 2015 and February 2016. On the occasion of the partners' meeting in **November 26, 2015**, the following decisions were taken:

- BSH demo

CORE

- Meeting with **BSH IT department** will take place in December 2015. ZLC organized and performed this meeting in December together with PORTIC and ENIDE.
- **BSH** to select 1-2 suppliers that can be used for the pilot test. Once selected BSH will send confirmation to ZLC-PORTIC and indicate from which city in China the containers are being loaded and shipped.
- **BSH** to draft what is the information (as definitive as possible) they wish to have in their Dashboard (the Global Supply Chain Visibility Tool). This is quite crucial to guide Inlecom on the collection of required information. As a start Inlecom would need a simple list of the data items they would be interested in, and at a later stage the desired layout.
- **PORTIC**: once data is accessible in INTTRA, PORTIC will start communicating shipment data to Inlecom (via FTP communication protocol). Inlecom to setup the necessary arrangements to receive the data and log it.
- **ZLC**: meeting planned with TNO will shed light on how to use risk management tools to be adopted in the trade lane. After meeting with TNO/ATOS, ZLC will propose actions.
- Regarding the new trade-lane OPEL Mokka:
 - SESE will discuss internally the possibility to use the OPEL Mokka flows and demonstrate them; once confirmed to partners, ZLC will facilitate a meeting with TMZ and Inlecom in order to initiate the work aiming to gather and specify business and technical requirements.

On the occasion of the partners' meeting in **February 10, 2016**, the following decisions were taken:

- Enabling transfer of information and reporting in the global supply chain visibility tool. Partners including PORTIC, ENIDE, Inlecom and CLMS will ensure that necessary information related to customs status at the Port of Barcelona is monitored, transmitted and visualized in the visibility tool.
- BSH is going to gather information related to containers cleared in Barcelona and transferred from the ship container to train. Focus will be on times of arrivals, delays in port of Barcelona.
- ZLC to review the existing data, prepare the pilot scenario, review the KPI definition and compute estimations.
- BSH will start to send information about containers being shipped from Yantian to Barcelona through INTTRA platform.
- ENIDE is initiating the work necessary for enabling exchange of information between PORTIC events and ETA engine.
- ZLC to apply the MTVA concept in the survey aiming to gather risk scores related to the BSH trade lane.
- ZLC, FOI and ENIDE to start elaborating the ETA engine. FOI will focus on the data fusion on the trade lane and probabilistic assignments to different milestones. ZLC will develop the algorithm returning estimated ETAs, while ENIDE is enabling data communication and exchange with public sources, PORTIC, BSH and Inlecom's dashboard.

As a result of the current status and ongoing developments, the following deviations from plan as described in previous report are recalled:

- **Ambition**: the ambition of the pilot had to be slightly dimensioned to a scenario case (small case). Also, the team needs additional time to gather necessary data for the probabilistic

CORE

assignments for the ETA engine. Also, Transport Sese and TMZ are not part of the main trade lane and therefore their ambition in the project has also been scaled down.

- **Scope:** as the Spanish Customs are not in the Living Lab anymore, the scope of this demonstrator is primarily to demonstrate how customs compliance can be improved with simplified e-Customs transit declarations, as well as how ETA predictions can be improved with better analysis of risks (particular focus given to security risks). While having a primary private perspective, it is still believed that real time visibility and improved risk monitoring can indirectly support customs risk management and therefore societal security as a whole.
- **Way of execution:** the pilot will be executed as a live setup. Hence, in an online session of 1-2 hours, companies will generate messages and exchange with each other's, in order to demonstrate the system functionality and robustness. Results of the pilot, including success and bottlenecks to solve will be thoroughly reported.

Dissemination activities performed during past months

In regard to dissemination activities the following peer reviewed journal papers have been prepared and presented to relevant and international journals:

1. Urciuoli, L. (2016), "What are the causes of transport insecurity? Results from a survey with transport operators", *Transport Policy*, DOI 10.1016/j.tranpol.2016.01.012.
2. Urciuoli, L. and Hintsä, J. (2016), "Differences in security risk perceptions between logistics companies and cargo owners", accepted for publication in *International Journal of Logistics Management*.
3. Urciuoli, L. (2016), "Port security training and education in Europe—a framework and a roadmap to harmonization", *Maritime Policy & Management*, 10.1080/03088839.2015.1134830, pp 1-17.

Furthermore, the BSH Living Lab activities were presented in the following peer reviewed conference:

1. Ringsberg, A. H., and Urciuoli, L. (2015) Consumers' Information preferences for Visible Traceability information on packages, Proceedings of the EUROMA conference, 2015 Jun (pp. 28-30). June 26th - July 1st, 2015, Neuchatel, Switzerland.

In addition, the activities have been presented in magazines such as:

1. Spayd, P., Urciuoli, L., and Miles, S. (2015), Comments and Letters: Living Labs for APIs, *American Shipper*, December 2015.
2. Urciuoli, L. (2015), Tying Risk and Resilience to Supply Chain Performance, *MIT Supply Chain Frontiers* #59, November 2015.

Finally, ZLC has also presented the activities as invited speakers at seminars, conferences and workshops:

1. Urciuoli, L. (2015), A Secure and Efficient port-hinterland containerized supply chain, Transport and Logistics conference, Antwerp Belgium, November 2015.
2. Urciuoli, L. (2016), The CORE approach in the era of supply chain digitalization (preliminary title), The Global Supply Chain Research Forum, MIT Global Scale, May 2016.
3. Gürbüz, M.C. (2016), supply chain visibility – the CORE innovation tool (preliminary title), The Global Supply Chain Research Forum, MIT Global Scale, May 2016.
4. Urciuoli, L. (2016), title to be defined, supply chain & Logistics Summit & Expo, Barcelona June 2016.

CORE

Qualitative description of the demonstrator results

The trade lane is characterized by the following legs:

- Road shipment from factory in China to Yantian port, China.
- Loading on Sea-Vessel at Yantian port.
- Sea shipment from Yantian port to Barcelona port.
- Unloading and wait for customs clearance.
- Loading on railway flatcar.
- Railway shipment from Barcelona to Zaragoza ADIF.
- Unloading in Zaragoza ADIF and temporary storage in Zaragoza terminal warehouse.
- Road shipment to retailers' distribution warehouses in several cities in Spain.

The trade lane starts with BSH organizing marketing campaigns and preparing sales forecasts of washing machines. The company, then, sends the order to a factory in China manufacturing washing machines. It can be assumed that the manufacturer has always inventory available and in about 1 day is able to prepare the shipment and necessary documentation and send the cargo by road to the Port of Yantian. Historical data 2013-2015 is provided in a separate excel file available for this project. The products are loaded in 20 ft. containers (TEU Containers).

A Logistics Service Provider contracted by the manufacturer in China takes care of the transportation by road and submits the necessary documentation for the export declaration. BSH contracts a shipping company, MSC, in charge of moving the containers by sea. The company offers two routes, the Dragon route (about 28-30 days lead time) and the JADE route (20-25 days lead time). The sea vessel frequency is of once a week. It can be assumed that capacity is always available except in the beginning of February, end of Chinese year, where the company encounters delays and containers left in the port for about 10% of their containers; if left in the port area, these containers can be charged (i.e. demurrage and detention fees). In the context of the pilot scale, our focus is exclusively on the JADE Westbound route.

Once loaded on the vessel, the journey to Barcelona port begins. At arrival in Barcelona port, the container is unloaded and temporarily moved to the Zona Franca (free trade zone). At this point, a customs broker hired by the company collects the necessary documentation and initiates the necessary import procedure. According to available data, this process may take approximately 1-3 days. However, containers could be selected for inspection (approx. 10% of containers) and increase delays by 2 days on average.

Once the customs clearance is granted, the containers are moved to the marshalling yard in Can Tunis, where they eventually are temporarily stored waiting for the railway departure. The train set has a capacity allocated for BSH of 14 containers and a travelling frequency of 2 departures per week with an average lead time of 1 day. The train set is composed and moved to Plaza in Zaragoza.

The containers are moved from the train set, opened and the products unloaded in the company warehouse. Thereafter, road transportation is arranged from the Zaragoza warehouse to the final customers across Spain.

BSH Simplified Transit Automation Pilot Action

The aim of the BSH Simplified Transit Automation Pilot Action is to prove and evaluate the impact of savings of cost of the automation of the transit (customs procedures) and its integration with the CORE Ecosystem. The pilot action is conducted mainly by PORTIC and is focused on the BSH Supply Chain from China to Zaragoza. The pilot covers a part of the whole transport chain but it would be more than enough to demonstrate the impact of the automation and the collaboration among systems.

CORE

Global Supply Chain Visibility Tool

The main Dashboard has been developed and customized to address the needs of the BSH Demonstrator. The primary goal is to create a consolidated view of BSH's Shipments, visualizing both route and risk elements, side by side with logistic details and operational and incident events. More specifically the tool allows:

- Monitoring shipments positions in real time.
- Provide information about the customs transit status.
- Provide ETAs forecasts.

In further detail, the Dashboard is divided in three major areas:

1. Filtering & Layer Area
2. The Map View.
3. The Filtering Results details areas on left and right panels.

Filtering & Layer Area

In the upper part of this area, the user is able to setup the search/filtering criteria by which he will narrow down the focus on the consignments of interest based on: Container number, Estimated Departure date/time from Port.

The section below, allows the user to identify the type of incidents he is interested in, to visualize on the map: Security, Operational and Other along with an additional level of details, depending on the criticality level of each incident (low, medium, high).

Last, but not least, at the very bottom of this section, the user will be provided with a number of visibility layers, allowing for enhanced information being visualized on the map. Examples of such layers could be: weather conditions, risks areas, ports, airports, etc.

Map View

In Visibility tool's centre area, the requested information (based on the filtering and layer criteria set) will be visualized to allow for quick and in-depth understanding of the selected container (current position, planned route, planned stops, etc.) in conjunction with risk factors (like black spots, dangerous weather conditions, reported incidents, etc.). For this pilot weather conditions are displayed as risk factors. In particular, the weather forecasts are combined with ship positions at 24h/48h from the current position received. Additional information is provided in the right frame of the tool.

By selecting the vessel additional information appears:

- IMO number.
- Route.
- Speed.
- Status.
- Timestamp.

Filtering Results

On top of this area, there is a textual summary of the Filtering criteria defined on the left side, to facilitate better understanding of what is visualized, and how the identified containers below were selected. The Container list below is exactly the result of those criteria, and is intended to allow for an additional drill-down level, by giving the user the option to select one of them. One important element of this list is the Estimated Time of Arrival (ETA) identified along with the Planned Delivery date/time

CORE

for each of the filtered containers. In case of an ETA violating a predefined time-threshold, the particular line will be flagged to raise the attention of the Operator.

Having selected one of the containers from the list, all the information below will refer to the specific container. In particular, the user will be able to see details such as the sender, the receiver, the bill of landing, booking number, content, and vessel name.

Furthermore, there would be two more tables below, which consolidate in a list-view, all information related to the Container's Operational events and Alarms raised during the shipment.

KPI values on (technical) solutions tested in the demonstrator the demonstrator

This section is split in order to report on the KPIs for the three main solutions that are being developed in the BSH Living Lab:

1. The BSH Simplified Transit.
2. The Risk based ETAs forecasts.
3. The Global Supply Chain Visibility Tool
 - Qualitative estimation of KPIs for BSH Simplified Transit

KPIs were measured by qualitatively estimating the impacts of the solutions developed. This was done in correspondence with the workshops with main stakeholders in the Living Lab. The simplified customs declaration is estimated to improve exclusively documentation time as well as necessary expenditures and several complexities that normally are encountered when a customs broker was used. In addition, it is well known that paperwork may generate mistakes, hence, inducing inspections, delays and even sanctions.

Hence, for the pilot of this service/function, the only measurable KPI is the documentation time per container that can be reduced to few minutes. The only processes that the operator needs to perform will only be:

1. Controlling/reviewing the transit declaration
2. Confirming and submitting.

Similarly, the impacts from the perspective of the customs administrations are also fundamental. It is well known that enabling data exchange through information systems, where several sources of information are used, hardens frauds attempts. At the same time, reducing number of mistakes minimizes the amount of unnecessary checks and customs inspection. Hence, customs administrations may ultimately improve and optimize the usage of their resources, the customs officers.

- Qualitative estimation of KPIs for Risk based ETAs forecasts

The risk-based ETA forecasts primarily aim at improving lead times for shipping containers from China to Spain. However, major side effects can be accounted, e.g. better security, reduced inventory costs and overall improved efficiency and lean management.

The ETAs forecasts rely significantly on the monitoring of risks in the trade lane. Partners agree that improved understanding about what factors are influencing delays may also facilitate distinguishing random occurrences from security acts. As a result, also tailored mitigating actions can be easily designed and implemented.

Improved ETA predictions result in better synchronization of transport activities as well as planning of marketing and sales campaigns. During marketing and sales campaigns, if ETAs are uncertain, companies need to be careful in determining due date deliveries, prices, as well as planning inventory stocks. In particular, long delivery dates can be less desirable by customers, as well as risks for stock

CORE

outs may force companies in inflating inventories, hence, leading to additional costs for pipeline inventories and capital tied up. In addition, in case the delivery due date agreed in contracts is violated; companies may be forced to pay penalties. From the perspective of the lead time KPI, it is expected that On Time In Full (OTIF) will increase up to 90-95%. The monetary benefits of the improved situations are difficult to estimate, but are expected to be significant in terms of how companies will improve contract agreements, sales and marketing as well as reduce stock outs.

Finally, improved risk and security analysis as well as up-to-date ETAs result in benefits from the viewpoint of customs administrations. In this Living Lab, the team is not directly interacting with governmental agencies but the links and expected contributions are straightforward in case in the future the ETAs analyses will be shared with customs administrations. First of all, enhanced risks and security analysis may facilitate compliance to security-based regulatory frameworks, e.g. AEO. Updated ETAs may improve customs risk management and, for instance, avoid unnecessary customs inspections or, on the contrary, raise alerts.

1. ETAs forecasts are based on risk events in the trade lane. Reporting risk events may support customs in discarding suspicious delays that could be caused by operational risks.
 2. A transshipment causing containers travelling through high risk countries that were not initially planned, may instead trigger alerts.
- Qualitative estimation of KPIs for Global Supply Chain Visibility Tool

Visualizing information in real time has the overall benefits to improve communications of alerts, risk monitoring as well as status of the shipment. Since the Global Supply Chain Visibility Tool will visualize information related to the simplified transit as well as the risk-based ETA forecasts, it is expected that the KPIs benefits will be simply inherited from these two services.

Stakeholder acceptance: Qualitative level of “adoption willingness” of internal stakeholders

This section provides an explanation on whom the internal and external stakeholders are and why one stakeholder is further in his/her level of acceptance than the other. For example, do some stakeholders experience difficulties with the concept, the maturity level of the proposed solution, have different stakeholders been approached differently resulting in different levels of acceptance, or do other factors influence the adoption willingness of certain stakeholders, e.g. interpersonal dealings.

The internal stakeholders are the companies working in the Living Lab. The overall perception of the pilot development is very positive and it contributes differently to different partners.

- **ENIDE.** Given the past experience in this field in other logistics projects, ENIDE believes that the solution developed in WP15 would be of high interest for a significant amount of transport/logistics providers as well as manufacturing industries. ENIDE is willing to adopt this technology in order to have a solution to be offered to other potential similar clients, as ENIDE sees a high potential in using the solution in WP15 for commercial purposes with ENIDE's clients.
- **Zaragoza Logistics Center.** The solutions offer prominent cases related to successful management of supply chains, once simplified customs procedures, better risk analyses and security, information exchange and improved forecasting are enabled. ZLC sees a huge potential for high impact research publications as well as teaching cases that could be developed using the result of this Living Lab as a basis.
- **PORTIC.** The knowledge and prototypes developed by PORTIC in order to feed the CORE ECOSYSTEM would be able to be commercialized as PORTIC Services. These news services would be offered to big importers as “stand alone services” or continue informing the CORE ECOSYSTEM in the future.

CORE

- **CLMS.** CLMS plans to further extend and develop the Connectivity Infrastructure in order to offer a complete integration solution to our clients.
- **INLECOM.** BSH feedback, on ILS offering has been very positive, since it addressed key business needs for deeper awareness on the container's ETA, current position/status, as well as potential threats during transport.
- **FOI.** The work done in the demonstrator is aligned with the research interests of FOI and we see a great benefit in exploiting the results in the research and applied projects towards our internal and external customers.

Stakeholder acceptance: Qualitative level of “adoption willingness” of external stakeholders

The measurement of external stakeholders' adoption willingness was performed by means of a survey. A short description of the main technical achievements of the Living Lab were published in Linked-In groups and the public was invited to reply to an online survey. The survey instrument was made of merely two blocks:

- **Demographics.** General company information, size of company, sector and annual turnover for 2015.
- **Adoption willingness.** The following items were measured on a 7 points Likert scale (1 – Strongly Agree to 7 Strongly Disagree):
 - **Product Service Benefits.** I am convinced of the benefits I could get if my company adopted this product/service
 - **Trade-off Perceptions.** I understand what the trade-offs are among the costs and benefits of using this product/service.
 - **Procedures and Operations changes.** I will need to change my company's operations and procedures significantly to attain the potential benefits of this new product/service.
 - **New service.** Using this new product/service would allow me to do things that I can't easily do now.

After about one week 7 replies were gathered. Companies/organizations were from the following sectors: 2 manufacturing companies, 2 transportation and storage, 1 non-profit and 2 from education. Of the seven replies only 5 could be used for the adoption willingness analysis.

The average scoring of the above item is the following (Figure 4-12):

- **Product Service Benefits (M=1.4).** Overall the respondents agree well on the fact that there are concrete benefits that could be gained by companies adopting the system.
- **Trade-off Perceptions (M=2.8).** While respondents could perceive that the system could be beneficial, trade-offs are slightly less easy to perceive. Yet, the respondents somewhat agree on the perception.
- **Procedures and Operations changes (M=3.2).** Respondents believe that some changes will be necessary in the company in order to accommodate/adopt the system. However, the scoring show that respondents do not strongly agree with the statement, but only partially.
- **New service (M=1.8).** Finally, respondents agree that today risk management as well as interactions with customs are difficult to perform in their organizations. Therefore, the system would contribute to strong improvements.

The overall interpretation of the results show that respondents agree mainly on two facts: the service/product developed will definitely bring improvements in companies' operations. The only issues that will need to be clarified in the future concern the perception of costs/benefits trade-offs

CORE

as well as the necessary changes to implement in companies adopting the product/service. As a consequence, in the future developments this Living Lab will focus on in-depth studies of costs and benefits associated with the system. In addition, it is recommended that the analysis will include an overview of procedures and operations that need to be changed in companies, and thereby propose strategies for achieving maximum benefits.

Conclusions and next steps

Conclusions

The objectives of the BSH demonstrator aims to show the usage of the CORE eco-system in order to:

1. Simplify the procedures necessary for facilitating and expediting customs transit in Spain.
2. Improve prevention and detection of risks along a trade lane, in order to dynamically optimize supply chain operations and transport activities in view of forecasted or unexpected disruptive events.
3. Improve forecasts of Estimated Time of Arrivals (ETAs) at specific destination nodes of the trade-lane.

The system built and described in section 4 is a first test of the decision support system that this Living Lab aims to develop. Overall, the system is running and the pilot shows the following capabilities:

- Data specifications have been strongly improved and information exchange among main stakeholders is now enabled.
- The team can preliminary run data fusion algorithms and perform probabilistic computations of delays on the shipment route Yantian – Barcelona.
- By combining vessel number, position, and probabilistic analysis of time delays, the system can generate and display ETAs estimations.
- A dashboard is available to display relevant information and allow users interaction with the information displayed.
- Information exchange PORTIC – CUSTOMS in Spain is enabled. Related Customs release information can be displayed in the dashboard.

Experience from the development of the system has opened up discussions about promoting the system to additional stakeholders. At the moment, we expect to promote and enable trial of the system to additional manufacturing companies based in Spain. In the event of enabling other companies to use the system the following activities are expected to be carried:

- Building interface company – PORTIC (through booking in INTTRA).
- Data collection and analysis of risk along the routes used by shippers used by the company.
- Review and update of algorithms for data fusion and ETAs' predictions.

Extending the solution to retailers is also a potential option but the team believe that could be technically more intensive to realized. Hence, preliminary the focus is to add additional users with profiles similar to BSH's.

The following is a summarizing table of chapters 3 and 4 of this report and it shows which topics are going well (successes) and which issues (barriers) need to be addressed regarding the Living Lab process and the solutions tested in this Living Lab.

Adoption willingness of external stakeholders are being carried out and will be reported in the final version of the report, due end of April.

CORE

Next steps

The following activities will be carried out as next developments of the Living Lab:

1. Finalize dashboard.
2. Solve a bug conversion days – hours in ETAs forecasts.
3. Input BSH containers to be used for the full scale demo.
4. Increase sample size used in the probabilistic assignments of ETAs forecasts.
5. Design and develop the risk-based approach for dynamic ETAs updates and alerts.
6. Develop custom messages (red-green lanes) connectivity between PORTIC application – ENIDE back end infrastructure – Global Supply Chain Visibility Tool (eBOS).
7. Full integration with CORE ecosystem.
8. Enhance risk management capabilities through implementation/coordination with T5.3, i.e. Supply chain Dynamic Risk Mitigation Tool.
9. Improve impact analysis estimation with several containers.