Innovative concepts in the maritime supply chain

Edited by Christa SYS, Thierry VANELSLANDER

& Valentin CARLAN

Introduction

Leaving aside containerisation – a classic example of radical innovation – the maritime and port industry is known for its rather conservative attitude towards change. In spite of the potential opportunities offered, the sector generally displays poor innovative strength, as demonstrated in a comparative study by the International Transport Forum (2010). However, the present research finds that the perception that the maritime and port sector is less innovative than other sectors of industry no longer holds water. Innovation, it appears, is now generally accepted to be essential maintaining competitiveness. Case analyses can provide insight into how the industry is preparing for new economic, environmental and social challenges.

In preparation of the second BNPPF innovation event, data was collected on 75 different innovation cases, in a research project conducted under the BNP Paribas Fortis Chair for Transport, Logistics and Ports at the University of Antwerp. In two of the cases studied, namely the 3PL Primary Gate and Port Single Window, the researchers also gauged the opinions of multiple stakeholders, resulting in 84 evaluations of innovation projects. The study was carried out as part of an international research effort involving six universities.

Some key trends

The present document provides BNP Paribas Fortis customers and other interested parties with an overview of innovative concepts along the maritime supply chain, arranged by stakeholder type.

Approximately 85% of the cases are sourced from technological or managerial/organisational/cultural changes at business or market level and impacting across the supply chain. During the data collection, it soon emerged that if a company is innovative and creative, it tends to work on different / continuous innovation initiatives. Deep-sea terminal operators, stevedores and inland terminals were found to be the innovation champions (or initiators) within the research sample. Most of the companies studied were involved in innovation relating to the cargo flow and ICT. The majority of these cases concerned 'incremental' innovation, i.e. gradual change that builds on existing practices.

Most of the initiatives considered in this research were privately funded commercial innovations. The majority were found to be ‘open’ type innovations, while many of the others were indicated by the companies concerned to be evolving from ‘closed’ to 'open'. This is commonly the case, for example, in ICT innovation (e.g. the development of an IT platform). Here, the driver is the expected reduction in development costs through cloud technology, which is also important in the context of future innovation and growth.

On the basis of a set of (economic, environmental and social) objectives, our research set out to assess the degree of success achieved in each innovation case (Acciaro, 2015). A case was considered successful to the extent that its objectives were met (Vanelslander, et al., 2015). For cases where the innovation had already been implemented, we visualize the degree of success per subcategory; for cases where the innovation was at the initiation or development stage, we display the top-3 objectives in order of importance. The innovation stage reached (initiation, development or implementation) is visualized by a progress bar.

Co.Innovation: staying competitive

According to the World Bank, ports across the world face continued pressure to handle higher throughput, adapt to larger and more specialised vessels, improve productivity, and adopt new technology and information systems that can meet the increasingly demanding service standards expected by shippers, logistics companies and shipping operators. This has an immediate impact on the capacity of the transport network and seaports concerned, which continue to be the swivel plate of our economy. Within this context, innovation is a tool that can improve the competitive advantage of port-related stakeholders.

In the run-up to the second BNPPF innovation dissemination event, it is clearer than ever that stimulating innovation along the supply chain provides the best guarantee for a long-term balance between costs and revenues, especially when faced with innovations by (inland) terminal operators, port users, rival ports, and hinterland operators. Collaboration with external supply chain entities might provide an even greater competitive advantage. Moreover, supply chain innovation may benefit port-related stakeholders of all sizes. Hence Co.Innovation, where stakeholders seek to acquire shared knowledge and to create opportunities for collaboration along the supply chain, may hold the future of maritime and port-related innovation.

Antwerp, 2015

Christa Sys, Thierry Vanelslander & Valentin Carlan

1 Innovation @ shipyard p. 6

Dynamic Operation in Dredging and Offshore

Dredge pumps

Flexible spud wagon

Wild dragon

2 Innovation @ carriers p. 10

E-transit

E-gate

Carbon footprint assessment

S-BEND on LPG carriers

Terminal carbon footprint tracking

Emission Scrubber on APL containership

Bulk carrier self-loading/unloading cranes

3 Innovation @ deep-sea terminal p. 14

Advanced Gate Automation

Administration replaced by EDI

Inland terminal

Automated Stacking Cranes

Weighbridges

Tandem lift operations

Straddle carriers from diesel to CNG

Truck Appointment System

Container terminal: bottleneck @ land side

Vado Ligure "Port gate"

Autotrakker

E-freight system "E-port"

Port community system PORTNET

Offshore Single Point Mooring

4 Innovation @ stevedoring p. 21

Central port community system for break-bulk sector

Setting up of KVBG

Heavy cranes

Vans from diesel to CNG

All-weather terminal (NL)

All-weather terminal (BE)

All-weather terminal (ES)

All-weather terminal (FI)

5 Innovation cases @ port authorities p. 25

3PL - Primary Gate of Leixões Port

Port Single Window

Carbon footprint assessment of port

SEAGHA

APCS

6 Innovation @inland terminal p. 28

Paperless Customs flow: import - extended gate up to the end consumer

Paperless Customs flow: import - paperless NCTS pilot

Paperless Customs flow: export - paperless until deep-sea terminal

Expansion OCR capabilities

Portal with clients

Pre-notification deep-sea terminals ROTTERDAM

Pre-notification deep-sea terminals ANTWERPEN

Port Wide Lighter Schedule Port of Antwerp

Barge slots

Corridor management system

Digital CMR

Empty equipment

Transferium

CY Meerhout

Efficiency leadership program

7 Innovation @ inland operators p. 36

Urban distribution using navigation water ways (goods)

Barge heavy lift Ro-Ro hybrid

Urban distribution using navigation water ways (vehicles)

Pallet shuttle barge – PSB

Small Barges and reactivation of small inland waterways

8 Innovation @ land transport modes p. 40

ECO Combi

Transport hub

Platform EuroTransCon (import export + re-use)

Vanhool ECO Chassis

CNG Class 8 Heavy Duty Drayage Truck

9 Innovation @ hinterland p. 44

Metrocargo

10’6” ft. container

SEA45

Modal shift (Beerse)

Modal shift (Beverdonk)

Foldable container

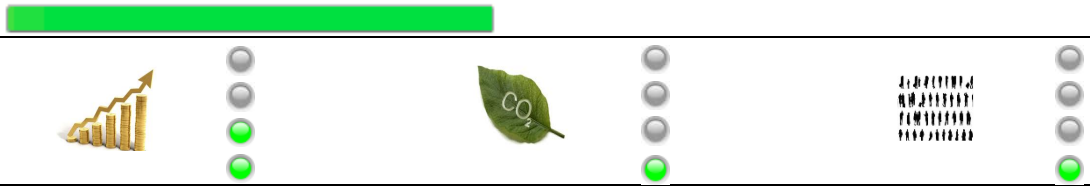
IT data management

Innovation @ shipyard

DYNAMIC OPERATION IN DREDGING AND OFFSHORE (NL)

Dynamic Operation in Dredging and Offshore (DODO) is an innovative concept focused on motional behaviour of equipment. The project offers technological and software solutions to operations management in order to improve operational behaviour, problem occurrence by performing predictions of vessel movement, the operational window and uptime, environment protection by prevention of damage and maintenance costs of equipment. (www.ihcmerwede.com)

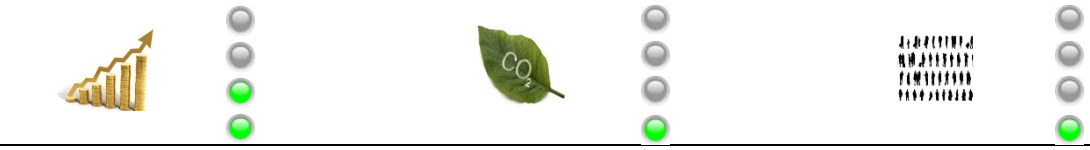
Innovation progress:



DREDGE PUMPS (NL)

Highly efficient dredge pumps are an important part of the dredging process. This innovation project concerns the production of new dredge pumps series with interchangeable parts that can be mounted under the same frame so it can be easily fitted together with other equipment. (www.ihcmerwede.com)

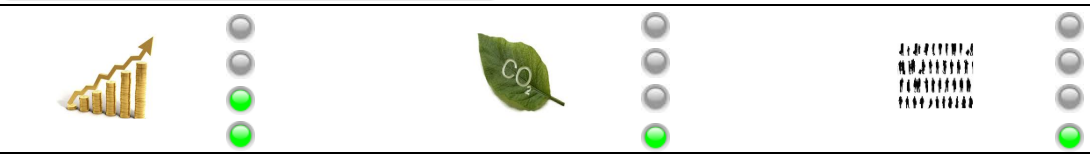
Innovation progress:



Flexible spud wagon (NL)

The flexible spud wagon allows cutter suction dredgers (CSD) to operate in strong winds and high seas. The flexible spud carriage system is a technological device that enhances the production and operational persistence of dredging vessels in heavy weather conditions. Cutter suction dredgers equipped with a flexible spud wagon can cope with severe forces, reducing the need to suspend operations and take shelter in port during heavy seas. (www.ihcmerwede.com)

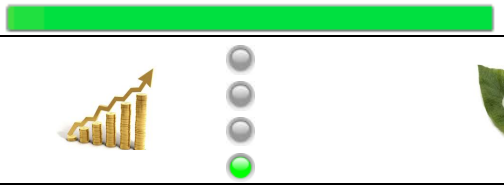
Innovation progress:



Wild Dragon (NL)

This innovation was inspired by the fact that a customer, owner of an IHC Merwede-built TSHD, was experiencing problems with extraordinarily compact clayish sandbanks in the Yangtze estuary. The Yangtze River leads to the Port of Shanghai, one of the world's busiest container ports. Some areas of the river are notoriously hard to dredge. A newly developed draghead concept, called 'Wild dragon', offers a solution to this problem. Unlike other dragheads, this technical innovation allows dredging in special types of soil (e.g. densely packed sand). The patented 'Wild Dragon' concept involves two rows of resistant teeth and a high-pressure water jet, allowing a deeper bite and reducing resistance. The project was developed in response to a warranty claim and disappointing performance of existing equipment. The newly-developed tool boosts production, while reducing fuel consumption, cost and emissions. (www.ihcmerwede.com)

Innovation progress:

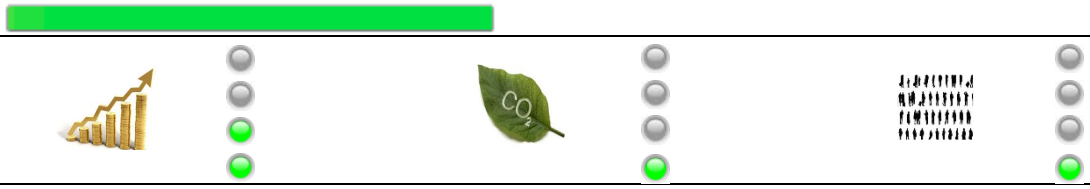


Innovations @ carriers

E-TRANSIT (BE)

E-transit is an IT application designed to make the manifest available to customs brokers for validation and processing upon ship arrival. The underlying idea is to reuse data from the manifest and eliminate the need for manual data input/copying. It allows real-time status control and speedier creation of T1 documents. (www.avantida.com)

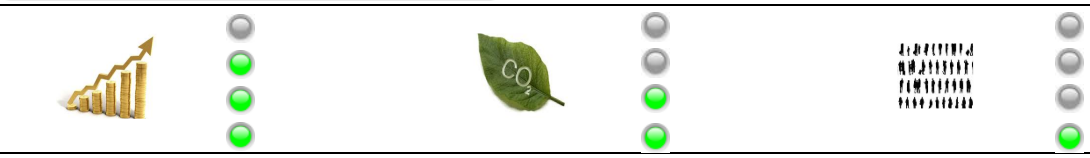
Innovation progress:



EGATE (BE)

The (cross-border) eGate license ensures much faster throughput of containers. It allows the license holder to send import consignments from the deepsea terminal in the port to inland terminals without any accompanying (transit) documentation. The main benefit is that transit time is halved. This innovative process requires the continuous improvement and extension of existing software and depends on approval from customs services.

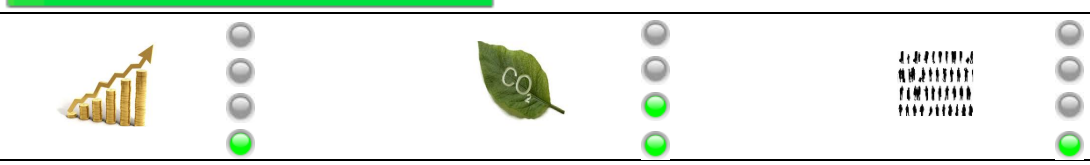
Innovation progress:



CARBON FOOTPRINT ASSESSMENT (GR)

A bulk carrier conducted two full on-board energy audits to assess each vessel's operational pattern and identify potential energy-saving opportunities. Throughout the programme, a combination of technical and operational measures to deliver optimum emissions reduction was also implemented. This included installing PBCF (Propeller Boss Cap Fins) and upgrading all the m/e (mechanical and electric) by installing fuel valves and alpha lubricators. Using an intelligent weather routing system, Starbulk is aiming not only for a shorter and safer route but also the most energy efficient. A monitoring system has also been installed to demonstrate net energy delivered on the propeller.

Innovation progress:

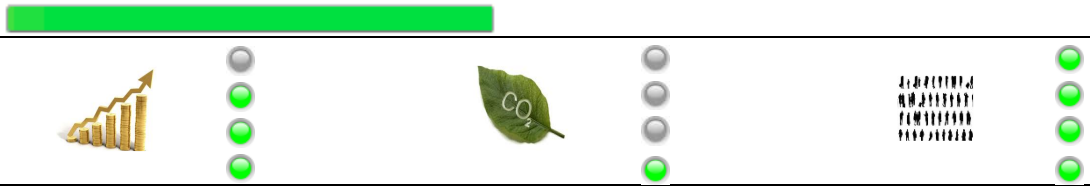


S-BEND ON LPG CARRIERS (GR)

In some ports, shore equipment is constructed to a specific height, which does not necessarily match that of a ship's cargo manifold. As some vessels fail to meet certain terminals' requirements, their trading options and hence potential earnings are limited by such restrictions.

The innovation lies in the design of S-shaped equipment known as an "S-bend" that will effectively fill the variable gap between vessel and terminal manifold, guaranteeing accessibility to all terminals.

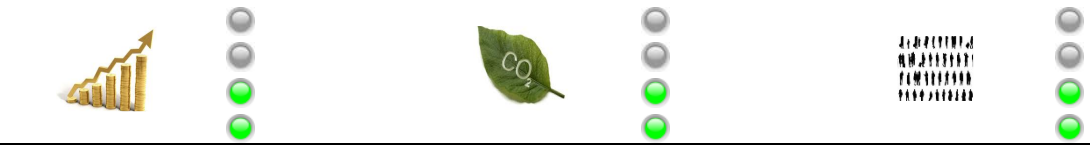
Innovation progress:



EMISSION SCRUBBER ON APL CONTAINERSHIP (US)

The purpose of this innovation demonstration project was to reduce air emissions from a commercial containership in transit using an exhaust gas cleaning device. The motivation behind the project was to find an alternative way to satisfy IMO fuel sulphur limits in designated emission control areas (ECAS). The use of the scrubber reduces emissions of SOx by up to 99% and eliminates up to 70% of particulate matter when using heavy fuel oil. When using marine gas oil as a fuel, emission reductions for SOx and PM amount to 97% and 78%, respectively. NOx emissions are reduced by between 2 and 5% in the case of heavy fuel oil and between 2 and 8% for marine gas oil. Use of the emission scrubber does generate a solid and liquid waste that must be treated and properly disposed of.

Innovation progress:



TERMINAL CARBON FOOTPRINT TRACKING (SN)

Singapore's Jurong Port, a multipurpose port handling bulk, break-bulk and containerised cargo, promotes environmental sustainability. With the terminal carbon footprint tracking, it aims at monitoring carbon emissions at the terminal. It fits within a programme supported by the Maritime & Port Authority of Singapore. The reduction of the terminal carbon footprint is the result of the construction of 'green berths' (i.e. concrete from the existing berths and yards is cut up, crushed and recycled for use in port upgrading; the use of certified green construction materials; etc.) and installing solar panels.

Innovation progress:

Main objectives:

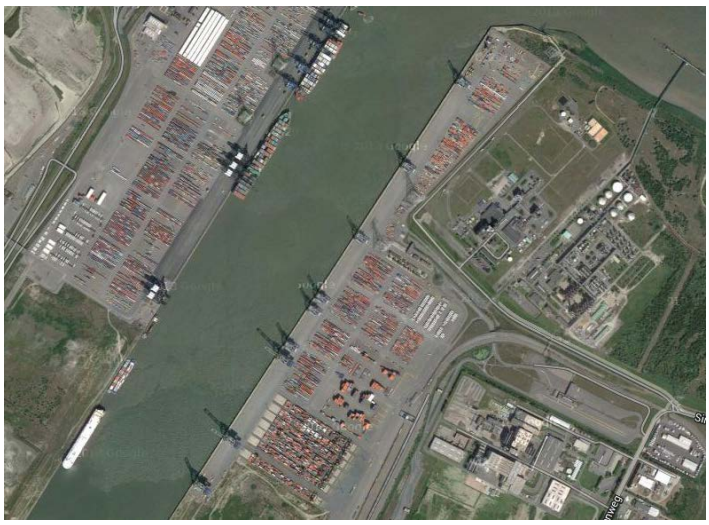
- Impact positively on competitiveness
- Improve energy efficiency
- Comply with environmental regulations

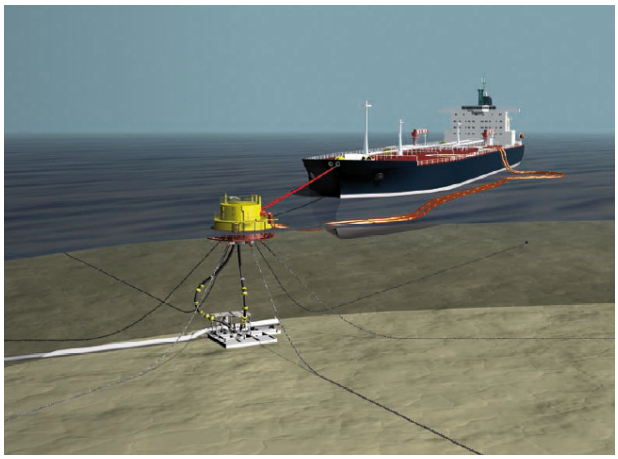
BULK CARRIER SELF-LOADING/UNLOADING CRANES (GR)

The innovation consists in the installation of cranes on bulk carriers for the purpose of self-loading/unloading in ports providing insufficient services. In the specific case considered, the intervention was required in order to operate efficiently in certain ports in the Persian Gulf.

Innovation progress:

Innovation @ deep-sea terminal

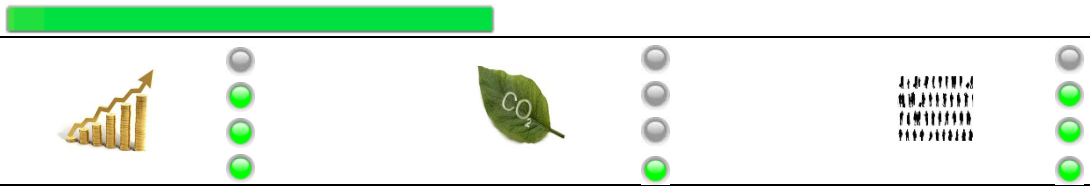




ADVANCED GATE AUTOMATION (BE)

Advanced Gate Automation integrates a wide variety of software and hardware installations that are connected to the Terminal Operations System (TOS). The online truck appointment systems, time slot management and online payment systems are examples of such software applications. The main purpose of this automation is to reduce the need for human intervention.

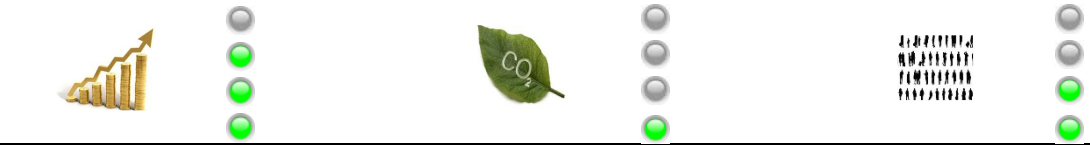
Innovation progress:



ADMINISTRATION REPLACED BY ELECTRONIC DATA INTERCHANGE (BE)

Electronic data interchange (EDI) has transformed the way in which interorganisational transactions are carried out. It is also crucial for the optimisation of operations in the maritime supply change. This innovation case aims at replacing all physical administrative documents with electronic versions through EDI. EDI is a tool that facilitates computer-to-computer exchange of business documents and data between two or more businesses, according to predefined information formats and rules recognised both nationally and internationally. This framework is designed in such a way that human interference is minimised, particularly in repetitive business processes involving large volumes of documentation (Narayanan, Marucheck, Handfield, 2009, pp. 3-4).
Increasingly, EDI is being incorporated into the digitalisation of the transportation supply chain. The challenge lies in its efficient application for more complex tasks, rather than relatively easy or repetitive ones.

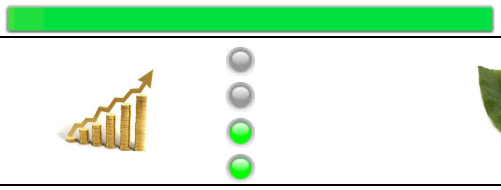
Innovation progress:

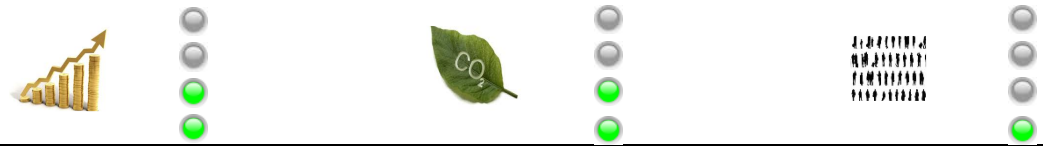


INLAND TERMINAL AS A TRANSFERIUM (BE)

This initiative endeavours to change the role of an inland terminal, transforming it into a 'transferium' (for inland shipping and road haulage). The transferium is a public-private partnership. It offers the benefit of concentrating the container flows currently transported by road haulage. Higher capacity modes of transport are then used to connect the transferium with the port terminal.

Innovation progress:

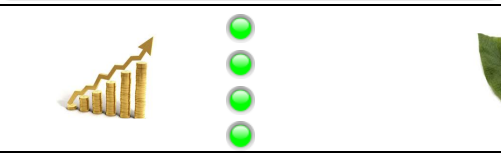


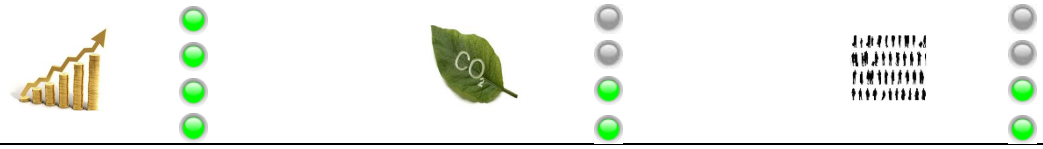


AUTOMATED STACKING CRANES (BE)

The use of Automated Stacking Cranes (ASC) aims at improving the stacking density of the terminal yard. Moreover, its features optimise the stacking sequence and allow automatic loading and unloading operations, both at sea and land-side of the terminal. ASCs are used for yard stacking and in-stack transportation of containers providing fully automated management of container stack yards and being an efficient link between quayside and landside equipment such as ship loading and unloading cranes, vehicles for horizontal container transport and road trucks. The ASCs enable high stacking density, container stack yards management and shorter access times to the desired container.

Innovation progress:





Weighbridges (BE)

Under-declaration of container weight is an issue for a growing number of carriers, as they are increasingly confronted with incidents caused by overloaded containers (Cf. the sinking of the MSC Napoli in 2007). Anticipating on the new UN code of practice, more and more deep-sea terminals are investing in equipment to verify the weight of loads dispatched, as will be mandatory from July 2016 onwards. Henceforth, the onus will be on shippers to ensure that the containers they transport are not overloaded.

Innovation progress:

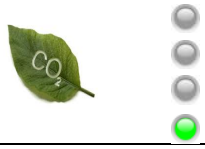
Main objectives:

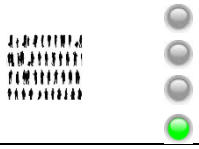
- Differentiate from competitors
- Reduce number of accidents
- Tax in a fair way

TANDEM LIFT OPERATIONS (BE)

Containerised transport flows continue to grow as ships are built ever larger, and hinterland operators must constantly seek new solutions to these challenges if they are to avoid bottlenecking. The solution of coupling two or more containers in a single lift has previously been implemented in Asian ports; now, twin and tandem capabilities are also becoming established in Northern European ports. Tandem lift operations speed up the process of container loading and unloading, significantly enhancing the efficiency of berthing operations. The introduction of tandem lift cranes sets a new benchmark for lifting capacity in Northern European ports.

Innovation progress:





STRADDLE CARRIERS FROM DIESEL TO CNG (BE)

Straddle carriers operate 50% of container movements in deep-sea terminals and container stacking yards. They are generally powered by diesel engines. However, as environmental awareness grows, new straddle carriers are being designed to run on alternative fuels. Hence, diesel engines are to be phased out and replaced with engines powered by compressed natural gas (GNG). Environmentally-friendly equipment offers the benefit of reduced cost (due to lower fuel consumption) and lower emissions.

Innovation progress:

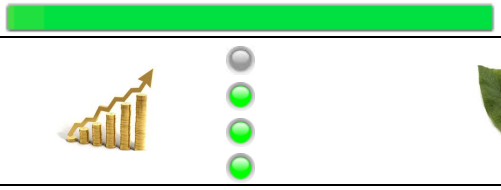
Main objectives:

- Reduce costs
- Improve energy efficiency
- Reduce air pollutants

TRUCK APPOINTMENT SYSTEM (BE)

Truck Appointment Systems (TASs) are not new in port or terminal operations. The main objective of such systems for advance notice of container arrivals at terminal is to reduce vehicle waiting times through more accurate scheduling. TAS is also conducive to more efficient handling. Furthermore, it may include automatic recording of the RFID tag with which containers are sealed. Prior to their collecting or delivering containers, truck drivers must provide administrative details. Moreover, the e-portal makes it possible to check whether or not a container has been released, thereby avoiding unnecessary trips. TAS is not operational yet for IMDG containers, tanktainers and containers with excess height and/or width. (www.dpworld.com)

Innovation progress:



CONTAINER TERMINAL: BOTTLENECK @ LAND SIDE (BE)

Increasing ship sizes and low schedule reliability in the container liner shipping industry lead to peak loads at terminals, causing landside bottlenecks and thus longer waiting times for trucks. To resolve this problem, a deep-sea terminal developed its own container management system. This newly-designed system has the aim of improving the efficiency of container handling, while satisfying increased security requirements in global door-to-door intermodal container transport chains. In more general terms, mobility is expected to increase and waiting times are estimated to decrease. The system offers the possibility of monitoring containers within the terminal, of helping reduce clearance times for customs checks and of accessing the container-related information from different sources. This should result in better planning and operations management.

Innovation progress:

Main objectives:

- Optimise operations
- Increase the scale of operations
- Reduce congestion

VADO LIGURE "PORT GATE" (IT)

The Vado Ligure 'Port gate' is a new port-gate system designed to integrate different procedures for all the terminals located in the Vado Ligure seaport area. The project aims at optimising the traffic of all the cargoes managed by three different terminals (container – ro/ro - bulk) and the physical spaces as well as administrative processes/procedures. The new port gate will involve 15 (according to the preliminary project) reversible lanes dispatching trucks 'in line', both at Port and Terminal Gate, assuring a safety and efficiency improvement as compared to the traditional gate set-up.

Innovation progress:

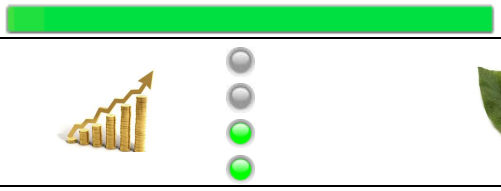
Main objectives:

- Optimise operations
- Efficient use of resources
- Reduce congestion

AUTOTRAKKER (BE)

Autotrakker is a solution for accurately measuring break-bulk cargo as it arrives at a multipurpose terminal. It is an IT system that relies on low-powered (eye-safe) lasers/scanners. The main purpose of the application is to accurately measure cargo in order to avoid inaccurate billing. Incorrect cargo measurements can also cause accidents or damage to cargo or ship during loading and unloading, often leading to delayed departures, customer insurance claims, or even injuries or fatalities among personnel.

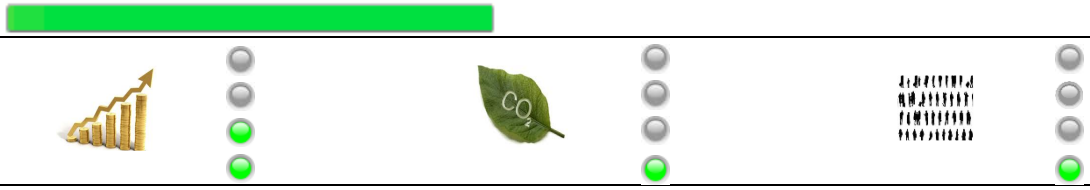
Innovation progress:



E-FREIGHT SYSTEM "E-PORT" (IT)

The eFreight system "E-port" integrates all information connected to freight passing through the port of Genoa. The main goals are the optimisation of administrative procedures and the maximisation of information-sharing capability.

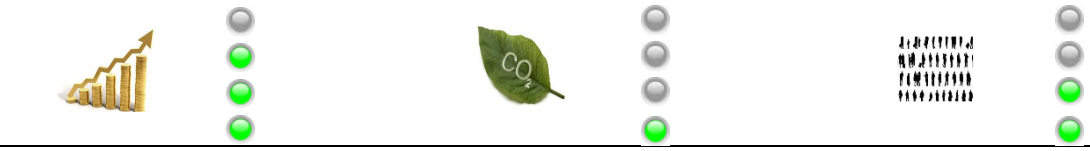
Innovation progress:



PORT COMMUNITY SYSTEM PORTNET (SN)

PORTNET is PSA's port community system. This IT platform is the world's first nation-wide business-to-business (B2B) port community system and positions PSA at the forefront of e-business operations in the port and maritime industry. Its constant technological innovation allows PSA to develop technology-based operational solutions for its clients in the port and shipping community. Such a single sign-on portal network improves the overall efficiency of information flows. The advantages are threefold: it connects shipping lines, freight forwarders, hauliers and government agencies, it helps these stakeholders to better manage information and it synchronises their complex operational processes. (www.portnet.com)

Innovation progress:



OFFSHORE SINGLE POINT MOORING (IT)

This innovation project at the Porto Petroli di Genova envisages a radical upgrade of the current terminal and will determine a re-organisation of dedicated oil operations. The system depends on a CALM (Catenary Anchor Leg Mooring) mooring buoy, a type used mostly in high seas. Its stability is maintained through a system of six anchors and chains. The platform hosts the head-mooring of a single ship and it has two floating hoses to connect the platform to the manifold of the ship.

Innovation progress:

Main objectives:

- Efficient use of resources;
- Minimise the impact on proximity territory;
- Improve relations with local communities.

Innovation @ stevedoring

CENTRAL PORT COMMUNITY SYSTEM FOR THE BREAK-BULK SECTOR (BE)

In comparison to the container sector, where port community systems are sufficiently well-integrated, the break-bulk sector is lagging behind, possibly due to the greater complexity involved. This innovation project has its roots in the desire of the break-bulk sector to go digital. Individual stevedoring companies took the initiative by digitalising data on cargo handled at their terminals. The date is made available to other stakeholders via the port community system.

Innovation progress:

Main objectives:

- Reduce costs
- Integrate with other stakeholders
- Facilitate transfer of documents

SETTING UP OF KVBG (BE)

The main objective of the KVBG (or Royal Association of Traffic Flow Controllers) is to enhance the economic performance of its members. To this end, several stakeholders have agreed to notify and pre-send data regarding incoming freight.

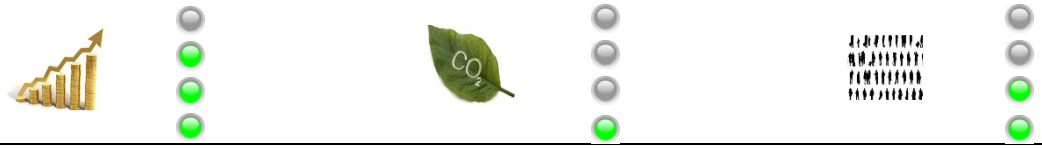
Innovation progress:

- *Main objectives:*Reduce costs
- Integrate with other stakeholders
- Facilitate transfer of documents

HEAVY CRANES (BE)

Instead of hiring heavy cranes from a port company, the stevedoring company decided to invest in specialised terminal equipment, namely 2x 200-tons G HMK 8710 Terex Gottwald cranes. In comparison to one 800-ton crane, the two mobile shore cranes increase flexibility at the terminal.

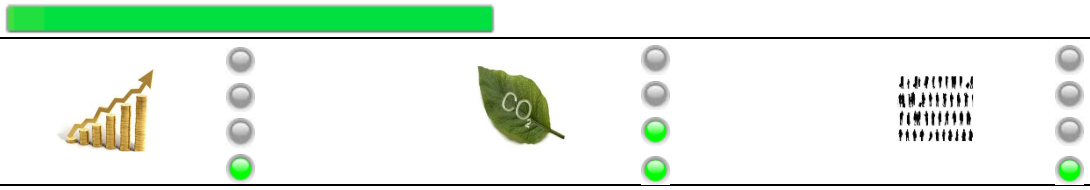
Innovation progress:



VANS FROM DIESEL TO CNG (BE)

Often the employees, located in the city, need to visit the terminal. The fleet of vans at their disposal is replaced with CNG vans. The switch also represents a mental shift for most of the employees concerned.

Innovation progress:

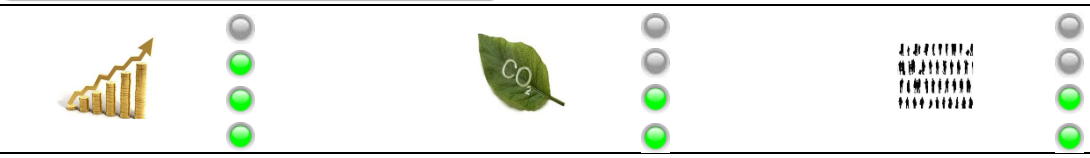


ALL-WEATHER TERMINAL (NL)

An all-weather terminal allows handling of moisture and weather-sensitive products (such as paper and pulp products, steel coils and aluminium) irrespective of meteorological conditions. This innovative concept reduces the risk of damage to the cargo of coastal vessels and river barges transporting such goods. It also creates a safer operational environment. The first such covered terminal was built in the Netherlands (1998) without external financial support, as the project was deemed too risky. For the stevedoring company concerned, it generated growth in the volume of weather-sensitive cargo handled. Encouraged by the positive reaction of shippers, the company constructed a second facility in 2002, this time with backing from financial institutions. The new all-weather terminal integrated state-of-the-art technology and built on lessons learned from the previous experience. A third all-weather terminal was added in 2007 to provide extra capacity for the stevedoring company. By now, the firm experienced no trouble whatsoever finding necessary funding. The fourth covered terminal is presently under construction as the company continues to expand its capacity. This innovative concept generates an increased flow of breakbulk cargo, generating value added services and transit in a multi-purpose port.

All-weather terminals are a good example of innovation initiatives where experiences are being shared. To this end, a European network was established of individual companies operating all-weather terminals (http://www.allweatherterminals.com).

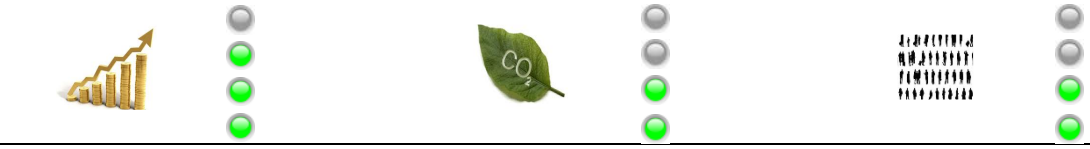
Innovation progress:



ALL-WEATHER TERMINAL (BE)

The pioneering Dutch initiative was also emulated in Belgium, where an all-weather terminal was built to handle break-bulk steel for inland barges and coasters of up to 10,000 tons.

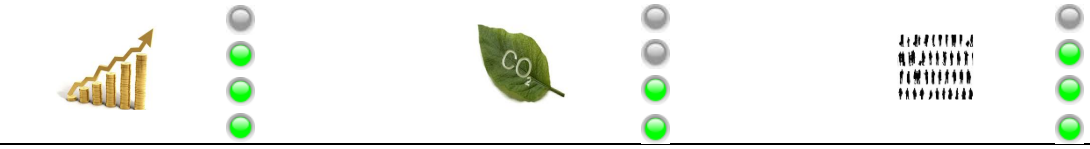
Innovation progress:



ALL-WEATHER TERMINAL (ES)

This project for the construction of an all-weather terminal was undertaken by a consortium involving a stevedoring company and a port authority, and it was the first such initiative in Southern Europe. The facility is used mainly for transferring wood pulp. The purpose of constructing a covered all-weather terminal was to increase operating time and to avoid damage through moisture.

Innovation progress:



All-weather terminal (FI)

The construction of a covered terminal in the port of Kokkola was the first development of its kind in the Baltic and Northern Europe. This all-weather terminal was built in collaboration with the municipality, which contributed half of the total cost. Despite some initial uncertainty over demand, the terminal is now used at between 75 and 90% of capacity.

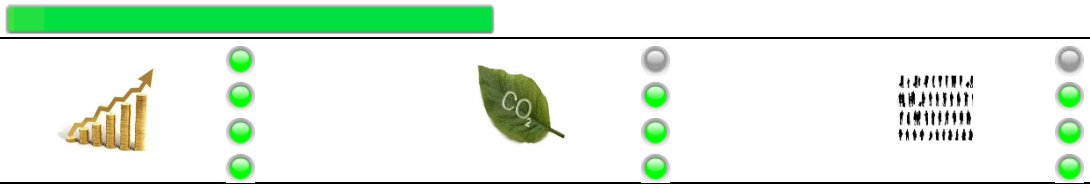
Innovation progress:

Innovation cases @ port authorities

3PL - PRIMARY GATE OF LEIXÕES PORT (PT)

This innovation initiative has created a one-stop shop for trucks delivering or picking up cargo at the port. The main objective is to minimise and optimise the administrative procedures for road hauliers accessing the port area.

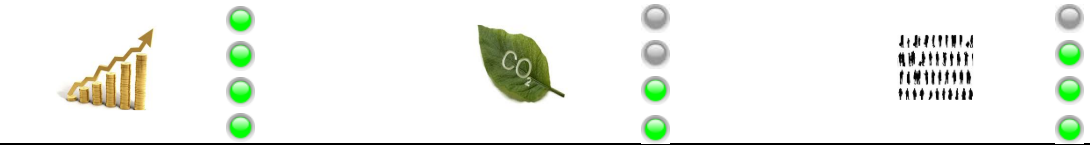
Innovation progress:



PORT SINGLE WINDOW (PT) (Sines, Lisboa, Leixoes)

The Port Single Window, implemented nationally in Portugal, is an open, web-based platform currently in its second version. It streamlines the communication and flow of information among all supply chain agents and authorities. This initiative was originally launched by Portugal's Ministry for Economic Affairs.

Innovation progress:



CARBON FOOTPRINT ASSESSMENT OF PORT (GR)

Assessing the carbon footprint of an organisation is the first step towards putting in place the necessary processes for improving its environmental impact. Although environmental protection is an integral part of the strategic agenda of the port concerned, rational and sustainable energy use are relatively recent points of action.

Innovation progress:

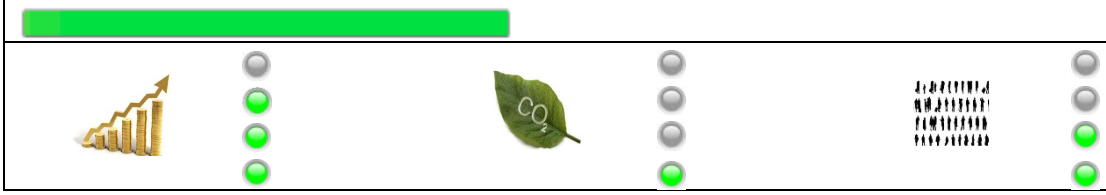
Main objectives:

- Improve energy efficiency
- Reduce air pollutants emissions
- Reduce costs

SEAGHA (BE)

SEAGHA was a system for electronic data exchange. This innovation case was an example of the continued development of a past innovation. Over the 1986-2007 period, the system concerned was key to electronic integration and the development of software applications. The focus was primarily on cost and error reduction.
Some name changes further, APCS makes applications: business to government (B2G), business to business (B2B) and between government agencies(G2G).

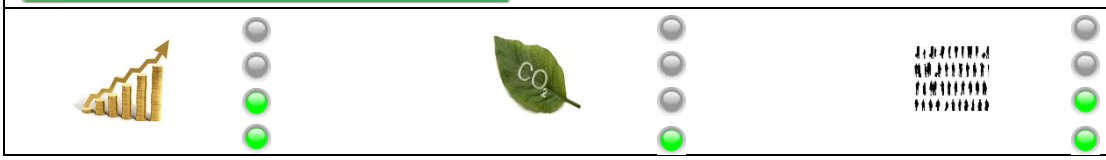
Innovation progress:



APCS (BE)

APCS (Antwerp Port Community System) is an initiative of the port authority, private port association and customs that aims at providing well-structured information (standardised exchangeable messages) within the port. The electronic message standards are based on the Edifact standards of the United Nations. The system was developed for the purpose of enhancing the administrative activities and cargo flow to the fore- and hinterland. APCS supports all types of goods and transport modes and connects all stakeholders, namely the port authority, customs, shippers, shipping companies, shipping agents, forwarders, terminal operators, road and rail carriers, barge operators and logistics service providers.

Innovation progress:



Innovation @inland terminal

PAPERLESS CUSTOMS FLOW: IMPORT - EXTENDED GATE UP TO THE END CONSUMER (BE)

In co-operation with Portmade, the inland terminal wishes to offer its customers (i.e. import industries) an entirely paperless procedure from deep-sea terminal to the warehouse. The commonly used current method known as an Extended Gate works paperless only up to the inland terminal, where, specifically in the case of transit goods, new documents need to be drawn up. With this new initiative, this part of the process will also become paperless.

Innovation progress:

Main objectives:

- Optimise operations
- Facilitate the transfer of official documents
- Reduce fraud

PAPERLESS CUSTOMS FLOW: IMPORT - PAPERLESS NCTS PILOT (BE)

With this innovative concept, the inland terminal concerned intends to replace all printed documents with electronic forms for the benefit of barges and trucks operating between its inland and deep-sea terminals in Antwerp. In a bid to strengthen its market position, the company launched a pilot project called "Paperless Customs Flow for Imports". The goal of this project is to replace the T1 document with an electronic form. To this end, the current New Computerised Transit System (NCTS) software needs to be modified.

Innovation progress:

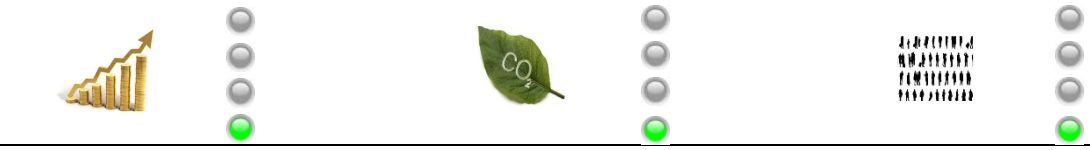
Main objectives:

- Optimize operations
- Facilitate the transfer of official documents
- Reduce fraud attempts

PAPERLESS CUSTOMS FLOW: EXPORT - PAPERLESS UP TO DEEP-SEA TERMINAL (BE)

The pilot project "Paperless customs flow for exports" envisages the full digitalisation of the document flow in exports. In other words, the physical paper document presently accompanying containers is to be replaced with a digital version, more specifically a pdf file delivered by email. The same principle is also applied for the import document flow. Through barcode scanning, all the required data can be entered automatically into the terminal operating system. From this point the information is communicated to the deep-sea terminal. Hitherto, data are entered into the system manually. The new system will make the process easier, faster and less prone to error. (D'Agnolo & Vansteenbeeck, 2014)

Innovation progress:



EXPANSION OCR CAPABILITIES (BE)

Optical Character Recognition (OCR) is the process of converting a hand-written or printed text into computer-readable text. This can be helpful for text input or for the capture of texts. The intended goal of expanding OCR capability is to enhance the efficiency of the document flow for Dangerous Goods Declaration (DGD). This innovative OCR application also needs to be integrated with existing applications.

Innovation progress:

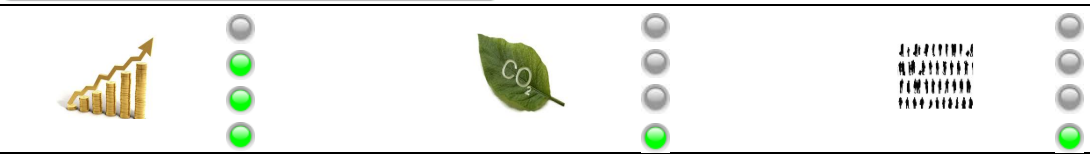
Main objectives:

- Use resources efficiently
- Facilitate the transfer of official documents
- Improve the efficiency of security requirements

PORTAL WITH CLIENTS (BE)

An e-portal application is primarily used for electronic transfer of documents from shipping agents to clients, authorities or other agencies. Electronic document submission offers shipping agents greater flexibility, as it is quicker and can be performed from any geographical location.

Innovation progress:



PRE-NOTIFICATION @ DEEP-SEA TERMINALS IN ROTTERDAM (BE)

Pre-notification relates to the import flow of containers and refers to a message of the carrier notifying the terminal operator about loading and/or discharging assignments. Containers imported from overseas are discharged at deep-sea terminals. Subsequently, they are transported to the hinterland by truck, barge or rail. If a deep-sea terminal does not know in advance when the containers will be arriving or with which type of transport mode, it will stack the containers randomly and hence inefficiently. This problem can be resolved by improving communication between inland and deep-sea terminal, so that the latter is provided with information (e.g. a list of containers to be delivered or picked up by a specific barge within a given timeframe) prior to the arrival and unloading of the cargo. The communication may also contain information about whether a container is ready for loading onto a truck or barge or whether sufficient capacity is available to receive the load. It might also specify whether the necessary customs documents have been cleared. With this information, it becomes possible to stack specific containers strategically at the loading quay.

Innovation progress:

Main objectives:

- Optimize operations
- Integrate among port stakeholders
- Differentiate from competitors

PRE-NOTIFICATION OF DEEP-SEA TERMINALS ANTWERPEN (BE)

Pre-notification of arrivals at deep-sea terminals is organisationally important, not only for the deep-sea terminals themselves but also for the connecting inland terminal. The innovation of this particular project lies in the application of EDI software (e.g. Container Pick-up Notice or COPINO). Its operational integration will reduce the need for direct human involvement, thereby benefiting speed and reducing cost as well as the likelihood of error.

Innovation progress:

Main objectives:

- Optimise operations
- Use resources efficiently
- Integrate among actors

PORT-WIDE LIGHTER SCHEDULE PORT OF ANTWERP (BE)

The Antwerp Port Authority has invested heavily in the development of all kinds of electronic communication that allow optimal control of the supply chain, as well as in a system designed to facilitate collaboration between sea vessels and inland barges. Nearly 40% of transport to and from the port of Antwerp happens by barge. BTS, short for Barge Traffic System, is a free web application that simplifies the handling of container barges in the port. Launched in 2007, it operates as an online platform that allows barge operators to make terminal planning requests and check which terminals are available when for loading and unloading of containers. Since then, the early versions of BTS have already been enhanced.
Previously, barges would request a call at their preferred terminal at a moment best suiting them. Moreover, there was little or no interaction between terminals, which often resulted in idle time on cranes. This has changed with BTS 3.0, as this updated version provides greater transparency and better quality of data thanks to an enhanced user interface. It is a powerful tool that provides for more efficient interaction between container barge operators, terminal operators and various port services. (www.portofantwerp.com)

Innovation progress:

Main objectives:

- Optimise operations
- Use resources efficiently
- Integration among actors

BARGE SLOTS (BE)

This inland terminal wishes to offer its customers an opportunity to make last-minute bookings of barge slots at a reduced rate of around 46% of the standard rate. Only a limited number of last-minute barge slots will be available on every lighter, depending on agreements between barge and terminal operators. The innovation lies in the fact that this option was previously unavailable in inland shipping, unlike in road haulage.

Innovation progress:

Main objectives:

- Gain market share
- Use resources efficiently
- Integrate with other actors

CORRIDOR MANAGEMENT SYSTEM (BE)

Co-operation between inland terminals leads to the bundling of freight flows to the hinterland of major ports. A service network design model for intermodal barge transport is developed and applied to the hinterland network of the port of Antwerp in Belgium. The scope of this solution is to efficiently manage barge traffic on Albertkanaal by integrating the locks and the barges request in a single system. The aim is to reduce congestion and enhance the schedule of barges along the canal.

Innovation progress:

Main objectives:

- Reduce costs
- Optimise operations
- Integrate with other actors

DIGITAL CMR (BE)

The need for integrated processes and electronic information flows between stakeholders continues to grow. This inland terminal aims at replacing the pre-printed CMR by a digital form. However, Belgium is one of seven countries that have not signed up to the additional protocol of the e-CMR. This is delaying testing of the application of the digital CMR in transfers between inland terminal and road haulage.

Innovation progress:

Main objectives:

- Minimise cost
- Optimise operations
- Facilitate transfer of official documents

EMPTY EQUIPMENT (BE)

Unbalanced cargo flows necessitate the movement of empty containers. Obviously if more containerised goods are imported than exported (or, as the case may be, vice versa), then empty containers will need to be moved for reloading. To tackle this complex problem, the inland terminal has initiated a novel empty container management programme. Among other things, upon a request for the relocation of an empty container, the programme will check whether any alternative container is available from a terminal nearer by. This guarantees the quickest possible response and an improved service by inland terminals operating as a network.

Innovation progress:

Main objectives:

- Minimise cost
- Use equipment efficiently
- Integrate with other stakeholders

TRANSFERIUM (BE)

Intermodal services of inland terminals tie in with growing demand for more sustainable transport solutions. Transferium terminals are key to reducing the number of truck movements into port areas and hence contribute to transport sustainability. In the case of steady, substantial commodity flows, regular liner services may be set up. Additionally, in accordance with the pull system, this approach allows customers, 90% of whom are located within a 30km radius, to call for containers depending on their own requirements.

Innovation progress:

Main objectives:

- Minimise cost
- Optimise operations
- Use resources efficiently

CY (CONTAINER YARD) MEERHOUT (BE)

As container volumes and ship capacity continue to increase year on year, terminal areas must constantly adapt. As the physical area of container handling yards in ports can often not be expanded, the answer generally lies in the more efficient use of available transport modes. In this instance, the solution pursued involved better stacking, tracking and management of all containers. This was achieved by implementing a container yard management system that deals efficiently with every component of the inland terminal. This system is also linked up with an appointment system.

Innovation progress:

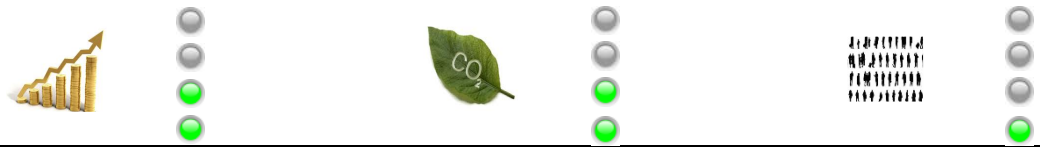
Main objectives:

- Gain market share
- Impact positively on competitiveness
- Optimise operations

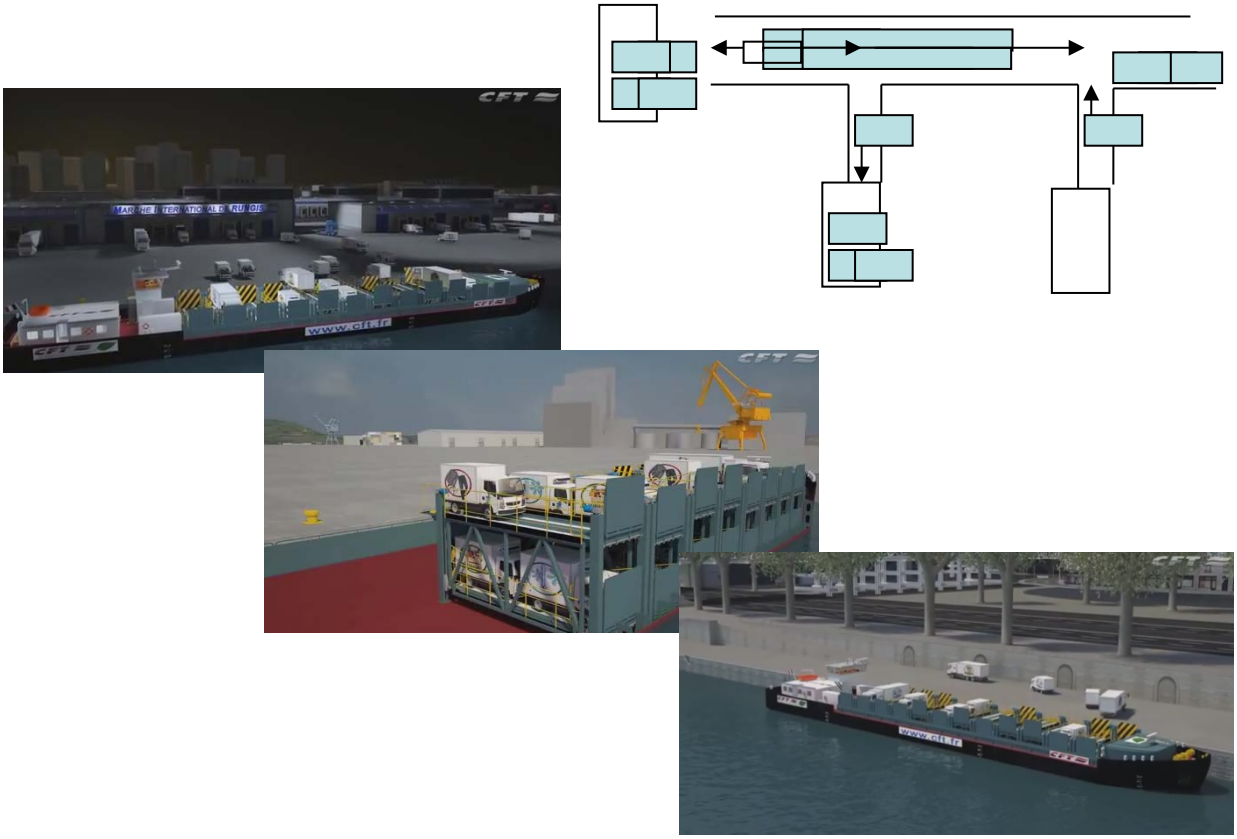
EFFICIENCY LEADERSHIP PROGRAMME (SN)

The cost-saving Efficiency Leadership Programme is a comprehensive programme aimed at enhancing cost efficiency and financial performance of a liner shipping company. The programme covers two major areas – shipping efficiency and shore-based efficiency. The shipping efficiency scheme, coupled with a fleet modernisation programme, includes more efficient fleet management measures such as slow steaming and optimal ship scheduling. Shore-based efficiency is pursued through various operational and management measures, such as the streamlining and minimisation of paper work processes. Overall, the programme is intended to strengthen the firm's competitive position in the container liner shipping industry.

Innovation progress:



Innovation @ inland operators



URBAN DISTRIBUTION USING NAVIGATION WATER WAYS (FR)

This projects aims at making a change in the current freight distribution chain by switching back from road distribution to small navigation channels in highly urbanised areas. (www.cft.fr)
In fact, the idea reverts to mediaeval transportation strategies, when goods could only be brought to city by waterways. Eventually, waterway transportation was superseded by road transport. However, increasing road congestion, challenges of further urbanisation (including an anticipated rise in freight transport demand by some 80% by 2050), advances in barge design, etc have prompted riparian cities to reconsider the potential of waterways in urban freight logistics. The key notion is to reduce congestion on urban roads and to use the extra capacity offered by the navigable waterways available inside city centres.

Innovation progress:

Main objectives:

- Gain market share
- Reduce volume of air pollutants
- Integrate with other stakeholders

RO-RO HEAVY LIFT BARGE (FR)

Roll-on roll-off heavy lift barges are especially designed to carry heavy packages (steam generators for nuclear plants or large transformers, for example), cars, household waste containers, etc (www.cft.fr). The aim of the hybrid heavy ro-ro lift barge is to increase the overall transportation capacity of inland barges. The term 'hybrid' refers to the combination of two innovative technologies, namely the ro-ro barge and the submersible barge. One important advantage of this innovative concept is that it offers greater flexibility in respect of quayside facilities and infrastructure, as well as safer loading/unloading and transportation.

Innovation progress:

URBAN CAR DISTRIBUTION USING NAVIGABLE WATERWAYS (FR)

In another experiment in urban transportation, a river transport operator carries vehicles on the Seine to supply the Paris basin. The innovation uses the technology of dedicated barges for vehicle transportation to meet the need for vehicles to reach inaccessible locations. For example, this can offer an alternative way of delivering vehicles to motorcar showrooms situated in the centre of the cities. The new distribution system requires merely minor adaptations to existing barges and no additional quayside modifications.

Innovation progress:

Main objectives:

- Gain market share
- Reduce congestion
- Integrate with other stakeholders

PALLET SHUTTLE BARGE (BE)

Growing congestion and the prospect of road pricing have led to this new concept in Belgium. The Pallet Shuttle Barge (PSB) is a 50m-long catamaran with a large open deck, capable of carrying 300 tons of goods on pallets or in big-bags. It has its own on-board lifting equipment and benefits from high manoeuvrability thanks to its rudder propeller and bow thrusters. This allows it to operate flexibly along waterways. The new system offers the following advantages: goods are carried on deck rather than in a hold, resulting in a shorter, safer loading/unloading process adaptable to the specific requirements of users; use of smaller sized barges, resulting in lower operational costs; no need for (living) accommodation on barges; and the use of a single crew.

Innovation progress:

Main objectives:

- Minimise cost
- Increase energy efficiency
- Reduce emissions of air pollutants

SMALL BARGES AND THE REACTIVATION OF SMALL INLAND WATERWAYS (BE)

As Belgium's fleet of small inland barges shrinks, its network of minor inland waterways is also being used less and less intensively. This initiative puts forward a new conceptual framework for inland navigation whereby the country's small inland waterway network could be reactivated. By determining the optimal network and vessel design, it looks into the possibility of implementing, in an economically viable way, the small barge convoy system for specific businesses. The project is an example of how academic research can contribute to innovative business approaches.

Innovation progress:

Main objectives:

- Minimise cost
- Increase scale of operations
- Reduce emissions of air pollutants

Innovation @ land transport modes

ECO-COMBI (BE)

Eco-combi or LHV (Long Heavy Vehicle) is a modular concept based on the notion that, by coupling two to three trailers to the same truck, one is able to transport heavier loads at a lower fuel consumption than would be the case if one were to distribute the same load over several conventional trucks.
An Eco-combi is 25.25m long and can have a total weight of up to 60 tons. Two ecocombis have the capacity of three traditional vehicles, meaning that they can transport approximately 30% more without a significant rise in CO2 emissions. The concept is already applied in other countries. However, it would be impossible to copy blindly in Flanders, given the specificities of the region's spatial planning, including its busy roads, often with unseparated cycle lanes. A pilot project for its adapted implementation, including additional brake tests for the whole combination and for each axis separately, is currently under way.

Innovation progress:

Main objectives:

- Optimise operations
- Use equipment efficiently
- Reduce emissions of air pollutants

TRANSPORT HUB (BE)

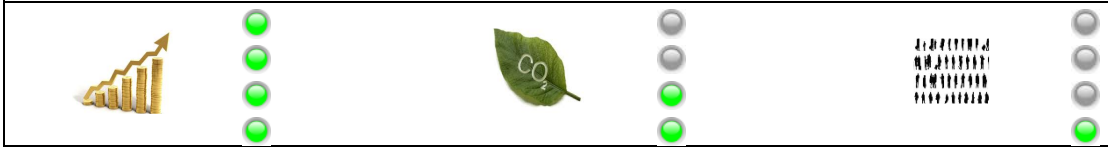
The idea of setting up a transport hub inside the port of Antwerp represents an extension of trucking company services. With the transport hub, the trucking company concerned is also able to offer 25,000m² of temporary storage for containers for urgent delivery to ships or customers, alongside additional services such as container transhipment between different chassis, supply with empty containers, cleaning and/or repairing of containers, and attachment and removal of liners. Moreover, with this concept, the storage costs on the quay are reduced to a minimum, while the customer can still be supplied on demand. This concept allows the optimisation of port traffic and terminal capacity.

Innovation progress:

PLATFORM EUROTRANSCON (IMPORT EXPORT + RE-USE) (BE)

After investing in new fuel-efficient tractors and a fleet of 30 trailers, Transport Joosen examined the possibility of combining import and export containers in order to cut unproductive mileage. This resulted in the development of the EuroTransCon platform, an initiative involving several transportation companies in the Antwerp region, whereby container rides are exchanged in order to arrive at efficient collaboration and communication on the supply side. (http://www.eurotranscon.com/)
Through EuroTransCon, part trips with containers can be joined together. This way, empty containers are not sent back to the inland port depots, but are reloaded in the vicinity of where they were unloaded.

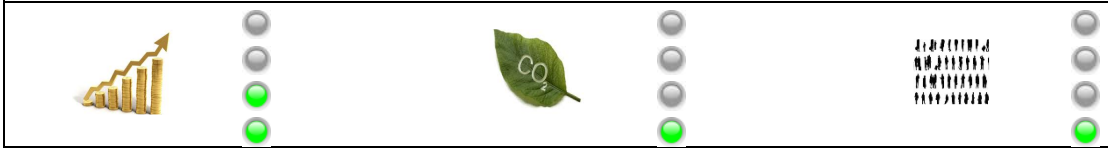
Innovation progress:



VANHOOL ECO CHASSIS (BE)

Developed in collaboration with VanHool, this new type of chassis enhances the flexibility with which a transport company is able to respond to transport orders. For safety reasons, combinations of full and empty containers in the same trip are subject to special regulations.

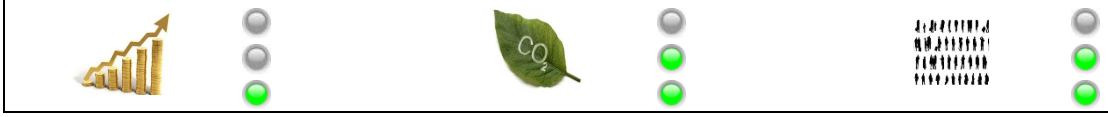
Innovation progress:

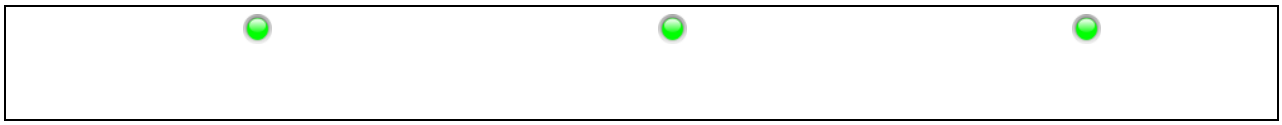


CNG CLASS 8 HEAVY DUTY DRAYAGE TRUCK (US)

In this project, Cal Cartage, in coordination with the port concerned, set out to demonstrate the viability of compressed natural gas as a fuel for dray fleets serving the port. It was concluded that CNG-fuelled trucks completed dray service equally as successful as diesel vehicles. The fuel cost savings were estimated at $2,085 per vehicle over the six-month period given the current rates of CNG and diesel fuel. Most drivers rated the performance of the trucks to be equivalent to that of diesels. Some drivers did however feel that the CNG trucks performed worse on climbing steep grades. The vehicles may also have required more maintenance.

Innovation progress:





Innovations @ hinterland

METROCARGO (IT)

Across Europe, rail freight is losing market share to road haulage in moving cargo to and from seaports, even though the distribution of cargo between the two modes varies from country to country. Metrocargo is an innovative concept for intermodal door-to-door transport. It has been conceived by I.LOG, a company operating in innovative logistics, with the engineering support of Metrocargo Automazioni, a specialized firm in design and manufacture of equipment and automated handling system.

Innovation progress:

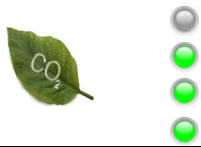
Main objectives:

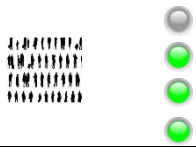
- Use resources efficient
- Differentiate from competitors
- Integrate with other actors

10'6" FT. CONTAINER (BE)

The innovation case, a specially designed 45'/10'6" (99 cbm) container, is an intra-European alternative to high cube loads of Bosch-Siemens Household Appliances (BSH), which are transported in mega trailers. These trailers were increasingly caught up in traffic jams. Looking for an economical, environmentally-friendly solution, BSH wanted to shift its transport towards Shortsea Shipping without changes to its production process. The use of mega trailers (100 cbm) was indeed integrated in the BSH production process. Due to the physical characteristics, dimension and weight, the standard container was not a solution, as it would not have been used at its full capacity. This new type of container, with an interior height of three metres, can load washing machines in three rather than just two layers. The new oversized container is transported by special truck. This multimodal transport concept is funded under the Marco Polo programme.

Innovation progress:

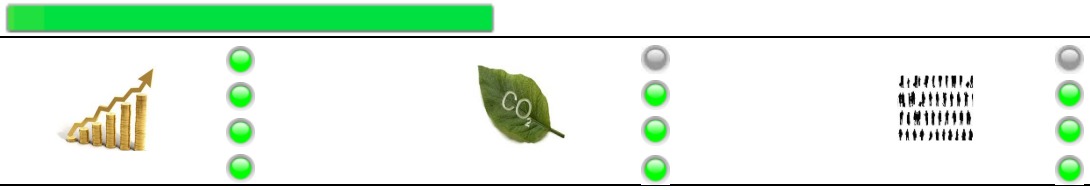




SEA45 (BE)

SEA45 is an alternative solution to the number of trucks transiting central European countries. The acronym SEA45 refers to an NVOCC (Non Vessel Operating Common Carrier) shortsea service in the logistics connections between North-Western Europe and Greece/Turkey using 45' containers. It combines environmental and economical advantages of shortsea shipping with the loading capacity of a standard trailer (33 europallets or 26 UK pallets)

Innovation progress:



MODAL SHIFT (Beerse) (BE)

The purpose of constructing a privately-owned container transhipment terminal was to consolidate the freight flows of all the partners involved and thus to reduce costs. However, the idea of inducing a modal shift was initially not realised, as the project faced delays in the construction of a road infrastructure segment and changes to the volumes transported by the various partners. The project was therefore reconceived as a public inland container terminal, which has since proven more successful.

Innovation progress:

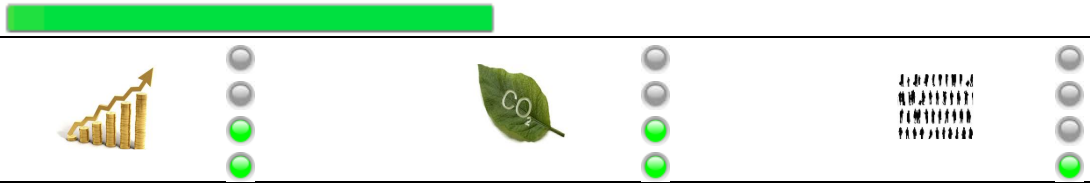
Main objectives:

- Optimise operations
- Minimise cost
- Integrate with other stakeholders

MODAL SHIFT (BEVERDONK) (BE)

The modal-shift freight terminal at Beverdonk was conceived after the failure at Beerse. The project is now fully implemented.

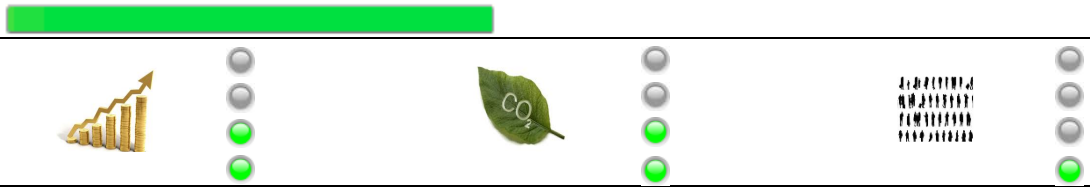
Innovation progress:



FOLDABLE CONTAINER (NL)

From a supply chain perspective, the foldable container may represent a revolution in transport logistics. This innovation was inspired by a desire to reduce the cost associated with the storage and repositioning of empty containers. The implementation of the new concept may offer a competitive advantage in the intermodal transport chain. Whereas previous designs of the foldable container have turned out to be failures, 4Fold has attained ISO certification.

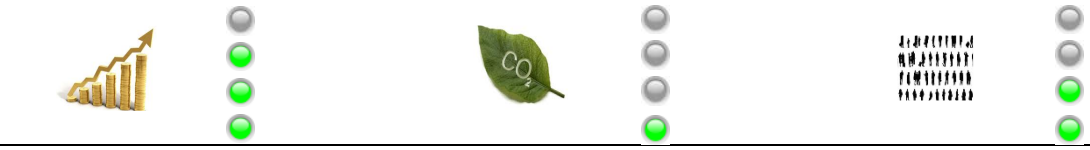
Innovation progress:



IT DATA MANAGEMENT (BE)

This innovation case is initiated by a freight forwarder and it concerns an IT data management platform designed to offer smooth and efficient data exchange between interested parties. The initial instrument was conceived as a track-and-trace tool, but it has since evolved into a useful and reliable IT data source that helps avoiding delays and facilitates cargo transfer.

Innovation progress:



UNVERSITIES INVOLVED

University of Antwerp

University of the Aegean

University of Genova

University of Lisbon

Nanyang Technological University

University of South-California

INDUSTRIES INVOLVED

Industry	
Shipyard	IHC (NL)
Carriers	MSC Belgium (BE), NOL (SN), Star bulk (GR), Eltsons (GR), APL (USA)
Port Authorities	Ports of Sines (PT), Lisboa and Leixões (PT), Piraeus Port Authority (GR), Port of Antwerp (BE)
Terminals operators	DP World (BE), APMT (IT), AET (BE),Terminal Bruzzone (IT), Jurong Port (SN), PSA (SN) Porto petroli di Genova (IT)
Stevedoring	Wijngaardnatie (BE), Zuidnatie (BE), Waterland (NL), Gruppo Nogar (ES), Port of Kokkola (FI)
Barge operator	CTF (FR), Blue line logistics (BE), UA research: small barges (BE)
Inland terminal	BCTN (BE)
Road operator	Transport Joosen (BE), Calcartage(USA)
Other	Caru container (NL), Chartwold Shipping Corporation (GR) Software developer consultant (PT)
Logistics	Arcelor Mittal Logistics (BE)
Rail operator	Metrocargo (IT)
Forwarding agent	ACB agency (BE)
Shippers	Metallo (BE)
Customs	Ports of Sines (PT), Lisboa and Leixões (PT)
Container broker agency	Caru container (NL)
Research	UA (BE)
Software	Software developer consultant (PT), Software houses (BE)
Shipping corporation	Chartwold Shipping Corporation (GR)

REFERENCES

Acciora, M. (2015, April 23th) Innovation in the maritime sector: aligning strategy with outcomes. Paper presented at second BNPPF innovation event, Antwerp.

D'Agnolo, L. & Vansteenbeeck, M. (2014). Paperless customs flow: export - paperless until Deep sea terminal. Final report, seminar Maritime technology, University of Antwerp.

International forum on Transport (2010). Transport and Innovation: Unleashing the Potential. Paris: OECD.

Narayanan, S., Marucheck, A., Handfield, R. (2009). Electronic Data Interchange: Research, Review and Future Directions. *Decision Sciences*, Vol. 40, No. 1, pp. 121-163

Vanelslander, T., Sys, C. & V. Carlan (2015, April, 23th) Innovation among seaport operators: a QCA approach for determining success conditions. Paper presented at second BNPPF innovation event.Antwerp.