FEPORT Position Paper

Automation and Digitalisation

FEPORT represents 1265 private seaport companies and operators which perform cargo handling activities (container, break bulk, liquid and dry bulk, RoRo etc.) and a wide range of other logistics related operations in European ports. FEPORT members employ more than 390.000 port workers paying taxes in the EU and supporting its growth.

Private port companies and terminals are modernizing EU ports by innovating processes, investing (56 billion Euros over the last ten years) in green equipment, digitalization, artificial intelligence, reskilling and upskilling of port workers.

The maritime logistics sector is facing the challenges of the fourth industrial revolution. The digitalization of the sector is in many cases also enabling the use of automation.

There is a significant difference between digitalisation and automation. Digitalisation concerns the digital exchange of information between the different actors of the supply chain while automation refers to the use processes and systems allowing a remote control of equipment. Digitalisation and automation processes can be interrelated but can still be carried out independently: an automated terminal is usually highly digitalised, while a highly digitalised terminal may not be automated.

Digitalization and Data sharing

As users and promoters of digitalisation, FEPORT members believe that the use of digital tools will contribute to efficiency in the transport chain by facilitating communication, reducing the administrative burden and removing bottlenecks. Increasing efficiency will not only mean lowering operational costs and, by extension, decreasing prices for the customer, but also has a great potential to reduce emissions in transport.

A well-developed TEN-T network is crucial for the transport sector in general as well as for the multimodal connectivity of seaport terminals.

FEPORT members favour the development of a digital economy strategy that would further unleash the potential of digitalisation and automation.

By gathering and exchanging real-time information among different parties, logistics processes can be optimised, and transport infrastructure can be used in a more efficient way. Optimised data collection can better steer operations and prevent delays.

Digitalisation can also enhance environmental performance throughout the supply chain via a better use of transport infrastructure and transport means (trucks, trains and ships), and has great potential to increase transparency throughout the supply chain. It can create more awareness with respect to the environmental footprint of a given mode and this can enable shippers and freight forwarders to adjust their transport and logistics strategies.

As businesses throughout the supply chain collect, exchange, and use data on a daily basis, they should be the principal actors steering the process of further digitalisation. Although regulations can, on some occasions, create a facilitating environment.

The European Maritime Single Window Environment Regulation, for example, constitutes a significant step forward that will stimulate the transformation of port community systems into real data-sharing platforms.

Digitalisation will also imply an adequate level of digital connectivity of ports to a high capacity broadband and a good assessment by companies of cyber risks so as to adopt efficient protection systems against incidents or attacks.

When supporting e-communication systems such as port community systems, policy makers ought to try to avoid prescribing specific IT-solutions. The focus should rather be on making different communication systems interoperable. The EU should allow the best e-communication system among the already existing ones to emerge, rather than to make a specific solution mandatory.

Electronic exchange of Business to Government (B2G) information has the potential to increase the efficiency of supply chains. A clear framework on data-sharing for B2G information throughout Europe is needed to increase industry buy-in by ensuring a B2G environment built on open standards and reducing costs for digital communication.

One of the main barriers to further cooperation on digital innovation is the lack of a clear framework on data ownership. This leads to companies being hesitant to share non-personal information as they are unsure of their rights regarding how their potentially sensitive data is used or their obligations regarding data-sharing.

It is therefore important that EU legislators clarify the rules of governance in terms of data-sharing so as to boost the uptake of new technologies and facilitate the exchange of information between different parties of the supply chain.

Automation relies on complex information systems supporting transactions and operations related to ports and maritime shipping. This strategy is often referred to as digitalization for which port community systems and blockchains are salient examples.

Port Community Systems and Blockchains

Port Community Systems (PCS) are an information entity that makes available logistical information among the actors involved in port-related freight distribution, including freight forwarders that act as intermediaries for importers (consignees) or exporters (consignors), terminal operators that are the interface between the port foreland and hinterland, customs, ocean carriers, inland carriers and the port authority itself.

Examples:

The Port Community System (PCS) for the **Port of Hamburg** for import handling Import Message Platform (IMP) and export handling Export Message Platform (EMP) enables all companies and authorities involved in cargo handling processes to handle cargo quickly, efficiently and largely automatically via the seaport, with intermodal hinterland handling also being perfectly integrated.

The PCS also supports customs export processing (ZAPP-Sea), dangerous goods processing (GEGIS) and the supply and discharge control of large ships on the Elbe and in the port of Hamburg (PRISE). Corresponding platforms and interfaces enable the booking process with the carriers (eBooking), the transmission of container weights to the carriers (VGM-Portal) as well as the Europe-wide port registration according to the 2010/65/EU directive.

Bremer Hafentelematik (BHT) is the central communication platform for the **Bremen ports**. It supports shipping companies, logistics companies, railway companies, transshipment terminals and weighing companies in meeting the requirements for information flow within the supply chain.

As a data hub in a modern IT infrastructure, Wilhelmshaven Telematics (WHT) ensures the recording and processing of efficient and smooth handling of all goods consignments in the **Port of Wilhelmshaven**.

Blockchains are distributed electronic ledgers shared across a network of servers that records transactions in cryptographic units that are called blocks in a permanent and verifiable manner. They are often referred as digital ledger technologies (DLT).

Terminal automation is integrated into emerging blockchains and other information systems that effectively link together a wide variety of port and intermodal stakeholders such as customs, freight forwarders and carriers. The purpose of digitalization is to effectively link existing databases and management systems through a portal, particularly through the conversion of different formats and the adoption of standards.

The outcome is an improvement in the transactional efficiency along the logistical chain and correspondingly the efficiency of the regional freight distribution system as well as enhanced security and protection from hackers trying to enter IT systems.

. There are thus opportunities to improve performance (costs and reliability) that can be used as marketing strategies by the users.

Digitalization is a process that takes place sequentially. Depending on the existing level of information technology usage, some steps may not be required with the setting becoming a matter of portal development and data interoperability. Therefore, freight digitalization regarding different types of cargo (container, break bulk, liquid and dry bulk, RoRo etc.) can be developed over three major phases:

- Development of key channels. The first fundamental step in digitalization concerns the setting of channels with key port users can exchange digital information they need for their operations.

- Regional digital freight platforms. Once key channels have been created, then the setting of an operational port community system becomes possible, particularly by focusing on maritime shipping and inland freight distribution information channels within an area where a port authority acts as a key driver.

- Global digital freight systems. Once digitalization has been established and is effectively been adopted by ports and cargo users, the next step tries to establish additional multiplying effects and quality improvements.

What does terminal automation mean exactly?

Automation is taking place at different scales, paces and locations. There are various degrees of automation and in many ways, automation is present in a large number of terminals depending on how it is defined and if it focuses on infrastructure (e.g. stacking cranes) or information systems (e.g. yard management or port community systems).

Automation involves the use of mechanic, hydraulic, pneumatic, electric, electronic and computerised elements or systems to control equipment and processes. It is only possible given that there is a systematic and repeated process that abides by rules as well as conditions that can be identified and programmed. This covers both the field instrumentation used for data gathering and the management of that data and the control of operations.

The automation process involves different types of terminals, but container terminals are the most implicated in this evolution because of the unitisation and standardisation of goods.

Container terminals can be categorised in two levels of automation: fully-automated and semi-automated. When the stacking yard and horizontal transfers between the quay and the yard are all automated, the container terminal is considered to be fully automated. Automation that has begun in the stacking yard but has not reached the quay all in one process is considered to be semi-automatic. Quay cranes are the operational elements whose automation is least developed, so accordingly it is predicted that they will be the equipment with the greatest technological advancement during the coming years.

Nevertheless, this categorisation does not consider automated terminal gates and other “softer” forms of automation such as appointment systems and yard planning systems. As portainers become automated the need to provide a more comprehensive perspective about terminal

automation will become even more salient. Therefore, comparing terminals by their level of automation is not a straightforward endeavour.

How automated are container terminals today?

Container terminal automation first started developing in the early 1990's in the Port of Rotterdam, Netherlands. Automated unmanned Rail Mounted Gantry Cranes (ARMGs) and unmanned Automated Guided Vehicles (AGVs) for horizontal quay-yard container transfers are in operation here.

The Container Terminal Altenwerder facility in Hamburg subsequently adopted these in 2002.

Automation costs as well as the resulting operational challenges explain why smaller ports or terminal facilities have been reluctant to automate. Important volumes are indeed needed to amortize investments in automation.

As a capital intensive and complex process, automation is thus more prevalent among large commercial gateways and transhipment hubs. An overview of existing terminal automation projects underline three main contexts in which automation is taking place:

- When an existing terminal facility has a footprint that is difficult to expand, automation becomes a strategy to increase throughput, cope with higher operating costs and remain competitive.

- When a terminal acts as a major transhipment hub., automation becomes a strategy to increase the transhipment throughput so that the hub can perform more effectively its function, particularly in light of larger containerships.

- When a new terminal facility is developed with the latest automation technology, automation becomes a strategy to attract customers in a competitive environment while reducing the necessity to train a port terminal workforce.

The adoption of automation is risky since it often involves untested systems but can lead to substantial benefits if successful. Once about 25% of the terminals have adopted a form of automation, a rapid diffusion is expected since the technology has proven to be effective from a cost and operational standpoint.

By the time it reaches 50% of terminals, automation will enter a phase of maturity with well-established equipment, standards, and modes of operation. It will cease to be a competitive advantage and simply be a standard mode of terminal operation.

The overall trend is heading towards higher levels of automation that go beyond the borders of terminal yards to involve all operations. In general terms this wider development includes the automation of gates, yards and quay cranes.

The first implemented container terminal automation and the most advanced systems today are those related to the processes that take place at the terminal gates. In this sense efforts are still being made to improve data gathering systems in the terminal-logistics chain interface.

Terminal automation in concrete terms

Both port and intermodal rail terminals can be automated according to similar principles and technologies since automation revolves around handling containers, a standard load unit. The container thus becomes the unit around which physical and information handling systems are built and organized. Automation can be comprehensive, when involving several stages of terminal operations, or specific when only one stage is involved at a time.

For greenfield terminals (new projects), comprehensive automation is becoming standard, while existing terminals are electing to selectively automate part of their operations since comprehensive automation could be highly disruptive and costly. Automation involves three main dimensions: within the terminal (yard), its interface and in the foreland and hinterland.

a. Yard automation

Container yard management has been automated for decades through the use of information systems to manage the stacking of inbound and outbound containers. Automated yard planning allows for more effective positioning of containers and equipment to increase throughput with the same assets.

Yard automation requires container position determination systems that allow to automatically know at any time through sensors the location of all the containers within the terminal. This enables their effective management, namely make them available to be quickly retrieved to be loaded on a ship or picked up for inland distribution.

b. Terminal interface automation

Automated mooring systems are able to quickly dock and undock a ship, improving ship turnaround time. Automated Ship to Shore Cranes (ASSC) are automated versions of standard portainers that are remotely controlled. An operator can control several cranes instead of one. For intermodal terminals, Automated Intermodal Cranes are a modified version of ASC that is usually wider since their services both as loading, unloading and stacking equipment.

Automated gate systems (AGS) have received a wide diffusion because of the substantial benefits they provide for terminal access. They require to have documentation to be electronically provided before pick up or drop at the terminal, which improves processing time and reduces the risk of errors with the associated delays.

c. Foreland and hinterland automation

Relates to automation processes that are not directly linked with terminal automation but can support its benefits. Although automated ships are not to be envisioned within the foreseeable

future, many aspects of ship operations have been automated (propulsion and power monitoring, ballast, etc.), reducing substantially crew size.

The same issue applies to rail transportation (control systems, signalling, crossings, etc.) with automated trains a distinct reality since they operate on their own guideways (automated trains are already common for public transit systems).

The introduction of automated trucks carrying containers or cargo units between terminals and their hinterland is a distinct possibility, particularly along selected high-volume corridors. Warehouses with automated storage and retrieval systems have also been introduced in recent years, which has improved the efficiency of distribution, particularly for e-commerce.

Warehouse digitalization and/or automation play an increasing role in allowing safer and more efficient handling, eradicating paper stock lists, delivery notes, etc…and this concerns all types of cargo: container, break bulk, liquid and dry bulk, RoRo etc.

Automation's driving forces

Nowadays, the shipping world is facing a few notable challenges. The drivers of automation come from financial, economic, and environmental pressures.

Since the early 2000s, maritime transport trends have been mainly determined by the appearance of Ultra Large Container Ships (ULCS) which have compelled terminals operators, and their workforces, to meet the challenges of larger vessels, larger call sizes and the required equipment and productivity for this.

Ship gigantism has been pushing port operators towards the automation of their terminals in order to fulfil the carriers' wishes for a higher productivity (moves per hour). Automation would help avoid port congestion, decrease port storage charges, and reduce demurrage and detention. Although the initial investment to automate terminals is extremely expensive, it is speculated that the investment is worth the future cost reductions it will bring. Some experts project operational cost savings of up to 55%.

Removing the possibility of human error and converting the profiles of the workforce helps to achieve the objective of automation, i.e. to minimize error and increase efficiency.

Automated work sequences are faster and more predictable, therefore less prone to error. Another added benefit of removal of human labour for some specific tasks increases safety, with less injuries and deaths of longshore workers.

Furthermore, due to the heightened concern for our climate in recent times, ports are being pressured to reduce emissions where possible. Automated container terminals reduce the shipping industry's carbon footprint by maximizing efficiency, one example being optimized route planning which prevents empty runs by AGVs.

One of the key benefits of investing in automated operations is achieving speedier cargo moves. E-commerce and next-day delivery are strongly influencing the global logistics chain. Consequently,

operators are obliged to handle containers quickly. Compared to manually controlled cranes and other machines, automated equipment is much more precise and predictable, thus decreasing waiting periods.

For a facility willing to grow and become more efficient over an extended period of time, it is crucial to adopt an intelligent system able to function consistently and maintaining a flexibility to adapt. The integration of AI planning functions and a TOS, working in conjunction with automated machinery, will produce operational output that is more accurate and agile.

Moreover, operators will be able to get a more holistic and transparent overview of cargo-handling activity, enabling them to better manage resources and the movement of containers.

Greening ports

When implemented, automation and digitalization projects are allowing port operators to perform more sustainable operations. As automated equipment also tends to be electrically powered, it reduces local environmental externalities such as pollution and noise.

If an automated system is installed within a terminal, this will run more smoothly and rarely experience delays, decreasing thus fuel consumption.

Terminal operators can expect to drastically decrease the level of carbon emissions that their facilities produce.

Moreover, the use of electrical equipment reduces energy consumption, upgrades conventional port operations and improves the security of systems and automated operations. For example, the use of automated transfer vehicles – such as straddle carrier and AGVs – is an increasing trend which is expected to continue as internal transportation in non-automated terminals is one of the least efficient and most costly processes.

Another environmental advantage is the longer life-cycle of container-handling equipment under automated conditions; if it has to be replaced less frequently, the manufacturing and transportation costs for new solutions can be reduced.

Examples:

Blue Port Concept (Port of Kiel)

Sustainable strategy of the ports of Bremen

The World`s first climate neutral Container Terminal (HHLA Container Terminal Hamburg-Altenwerder)

Evolution of work in ports

The impact of the ULCS and the associated cargo handling automation obviously have a socio-economic effect on ports, specifically on container terminals. As it has been in the past when European terminals have experienced the impact of containerization and unitization, the

automation phenomenon has impacted the employment dynamics within ports, raising issues with regards to labour organisation and leading to more training to improve necessary skills for dock workers.

The highest potential for automation is in low-skilled jobs, which are intensive on predictable physical activities and data processing; therefore, those jobs face a higher risk of being impacted by automation. At the same time, the further introduction of automation will also create a demand for new types of jobs, such as remote operators, worldwide operating maintenance crews and mobility as service providers.

As a result, the demand for labour will evolve and the requirements and skills needed for individual jobs will change. In fact, experience shows that, despite increasing levels of technology introduced during the last decades, there has been no overall decline of employment due to an increasing demand for transportation.

An increased use of remotely controlled equipment with office operators, which are able to control more than one device, may create superfluous staff on the dock side. The transition towards automation and digitalisation is pushing for a shift from low-/medium- to high-skilled jobs.

It is expected that low- and medium-skilled jobs in their current form will not exist by 2040 as jobs will change.

On the other hand, a relatively small portion of jobs (not exceeding 2%) of high-skilled workers is at risk of automation. The high-skilled group has the least estimated job losses resulting from the introduction of automation technologies.

We therefore see an evolution of workers' technical knowledge as the complexity of the performed tasks increases and multitasking develops. The shift of control from the dock site to an external control room requires different skills such as the essential technical knowledge of the equipment and IT. Because new technologies can generally be more easily acquired by those who are highly skilled and educated, the demand for such workers has been rising in recent decades in parallel with the increasing use of technology in the workplace. Modern port work does not involve monotonous manual labour, but rather the supervision and operations of complex and sophisticated machinery and equipment.

The increasing prevalence of automation and mechanisation in ports, for example, has led to port workers working from secure compartments and control rooms and the removal of personnel from the quay front and subsequently creating a lower risk work environment. For port operators, efficiency and safety are two sides of the same coin. It is not a coincidence that Europe has some of the most efficient and cutting-edge terminals in the world, but also the safest terminals in the world.

The sector is continuing to adapt and training for port operations is viewed as continuous. The port industry is continuing to invest in training and personnel to ensure that port operations will continue to operate with ever increasing efficiency and safety. This being said, ports do not develop

in silos, and are exposed to outside influences. Some of the trends that will impact upon training in the future are already visible in modern port operations.

Thanks to the reskilling and upskilling of port workers, many jobs are moving from the quay side to the control room, so that job loss remains at a minimum and expertise can be retained. Automation is an opportunity for senior workers to engage in safer and less physically burdensome tasks. In fact, a clear advantage of automated operations in ports is the increased safety that accompanies automated or unmanned processes.

The digitalisation process is increasing the attractiveness of jobs in ports and terminals. The sector is thus becoming a more interesting job reservoir and the need for higher skilled tasks is also drawing other segments of the work force, such as young people and women.

As previously mentioned, automation and digitalisation processes are costly and, to leverage these investments, having skilled individuals to manage operations in a safe and efficient manner within a port is a prerequisite. This is why European port operators also invest significant resources in developing specific training programmes tailored for their respective operations and business models.

The role of the EU Social Dialogue for Ports Committee

The implementation of automation requires a good cooperation between employers and employees. Constructive discussions between Trades Unions' representatives and employers not only allow exchanges about reskilling and upskilling needs but also to find solutions for low- and medium-skilled employees whose job may become redundant.

It is important that those negotiations remain autonomous and in the hands of the local social partners to find the most suitable solution to the specificities of the automation project.

A European "one-size-fits-all" solution is not desirable as automation and digitalisation are taking place at very different scales and paces depending on the specificity of the terminals.

Automation and digitalisation challenges are also discussed among EU Social Partners at European level in the framework of the Sectoral Social Dialogue Committee for Ports (SSDC). Launched in 2013, it is a relevant platform for employers (FEPORT, ESPO) and unions (ETF, IDC) of the port sector to sit together and discuss relevant issues with officials from the European Commission (DG Empl, DG Move and DG Comp).

How to attract diversified profiles in the port sector

Terminal operators are investing in training to enhance the skills of the work force. Nevertheless, finding good profiles with a knowledge of the port sector remains challenging even if the introduction of digitalization and automation allows port terminals to attract workers with different profiles and backgrounds for instance in IT.

Given the rapid social and technological changes already underway in the types of skills demanded by the labour markets of the fourth industrial revolution, the arguments for taking action now are compelling for individuals, employers and policymakers.

To make reskilling real and prepare for accelerated structural change of the labour market, a wide range of stakeholders - governments, employers, individuals, educational institutions and labour unions, among others - will need to learn to come together, collaborate and pool their resources more than ever before.

This is why support through ERASMUS+ and the Blueprint for sectorial cooperation on skills would, for instance, be as welcomed as EU funded surveys to identify the needed skills.

The social dialogue for Ports has been profusely discussing the changes in the sector and the most appropriate initiatives to keep the port sector competitive and an attractive place for work. When it comes to port work, the Social Dialogue should remain the appropriate European body commissioning studies assessing reskilling pathways and job transition opportunities.

Training programmes for port work in the European Union are extremely diverse. National, regional, and company level training programmes are prevalent throughout the Union. There is nothing to suggest that any certain method of training leads to greater efficiency or safety and levels of efficiency and safety in European port operations are high. Thus, port operators are to be granted a flexible approach to training which takes into consideration local circumstances.

The quantification of reskilling efforts, different scenarios of changing demand for jobs, job transition models (e.g., a job transition model that looks to the effects of automation) and gender perspectives on job transitions are among the concrete topics that could be explored in future reports that could be funded by the European Commission.