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## **Key Trends and Developments in the European Port Sector: Main Implications for the Port Labour Industry**

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### **Abstract**

The paper presents key trends and developments in the maritime and ports sector, with emphasis on the European ports sector. These trends are grouped around five main categories, i.e. market, business, technology, socio-economic evolution and environment related, based on a series of workshops and interviews with key industry experts. Their implications to the port labour industry are discussed. The aim is to provide a better and deeper understanding of the resulting changes in the nature of port work, thus fostering the identification of the main requirements for shaping future human resource demand profiles, skills and training needs, and to contribute towards a better trained EU port labour force and consequently to more competitive European ports.

*Keywords:* Trends in European ports; port worker training; port labour industry

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## **1. Introduction**

With over 80% of global trade by volume and 70% by value being carried by sea, maritime transport is reasonably being acknowledged as the backbone of global trade, heavily supporting the global economy (UNCTAD, 2016). Over the past two decades, maritime transport volumes have been constantly increasing at an impressive rate, with the exception of 2009 due to the impact of the global financial crisis. Besides the latter however, a number of other emerging market, business, technological, infrastructure and policy developments and trends are imposing significant changes on global seaborne trade structure and growth. Such a rapidly changing business environment has further intensified port competition with relevant stakeholders being under a continuous pressure to increase productivity and reduce costs.

Ports in Europe account for a significant part of its economy, with direct impacts in terms of employment and activity in the port industry, indirect impacts along the supply chain as well as induced impacts in the wider European economy. European ports are important job generators, with 1.5 million direct and 3 million indirect jobs in the 22 maritime Member States exemplifying the European port industry as an extremely crucial sector for strengthening Europe's competitiveness, business and job creation (European Commission, 2013a).

The role of labour in port efficiency is profound. However, employment growth of traditional port workers has hardly followed the growth of cargo volumes. This is partly attributed to the intensified outsourcing of originally port-related services. Indeed, port labour finds itself in a permanent change process (Laventhal et al. 2010). Some decades ago, port work was regarded as one of the toughest jobs in the industry. This is still valid for less-developed ports or difficult-to-handle commodities. Today, however, due to containerization and advanced technology, port work has become much more employee-friendly and can attract a broader spectrum of prospective employees (e.g. female workers, mobility-impaired workers, etc.). Port work has been transformed from pure physical work requiring physical strength in handling heavy goods, into more complex work requiring special skills and knowledge.

With an increasing understanding of the high importance that port labour presents and with the aim to further improve the international competitiveness of EU ports, the European Commission set with its Communication entitled 'Ports – an Engine for Growth' a catalogue of appropriate measures to be undertaken (European Commission, 2013b). The Communication itself as well as follow-up discussions that took place in the European Parliament highlighted the improvement of the conditions of the port worker profession as an increasingly important topic in the European agenda, which can be best addressed through a social dialogue among government representatives, employers and workers. A major challenge in the development of port personnel qualifications however, is the insightful forecasting of future changes in the port industry and the assessment of their associated impact for defining future-proof training needs. Port training should indeed be continuously updated according to real industrial and socio-economic developments, overcoming in that way any concerns of the social impact that the latter may impose. To this end, with a 2030 time horizon, this paper aims to provide useful insights and a deeper understanding of the dynamics that future trends and developments in the port sector present and of their potential impact on human resource demand profiles, skills and training needs. In close consultation with the European Ports Social Dialogue Partners, facilitated through the EU-funded 'EU-PORTRAI'S research project, several such trends and developments were identified grouped around five main categories: (a) market related, (b) business change related, (c) technology related, (d) sociological evolution related and (e) environment related (EU-PORTRAI'S, 2016).

The rest of the paper is structured as follows: the identified trends and developments in the port sector affecting port labour are being described in the 2<sup>nd</sup> section for each of the aforementioned categories, while their main implications on human resources development are being reported and discussed in the 3<sup>rd</sup> section. The 4<sup>th</sup> and last section concludes the paper by summarizing key points and providing recommendations for the way forward, towards a well-trained labour force actively contributing to the competitiveness of European ports.

## **2. Key trends and developments in the European port sector affecting port labour**

As mentioned before, the key trends and developments in the European port sector that currently have an impact or are likely to affect the European port sector in the future, and port labour in particular, were identified through a series of structured interviews and meetings with the European Ports Social Dialogue Partners. The identified

trends and developments are being briefly described within the following sub-sections which represent the thematic categories around which the trends were clustered. It should be noted at this point that taking into consideration the growth dynamic of containerization, in comparison to other commodities, as well as the increased penetration and implementation of prominent technologies for containerized cargo, container terminals served as the main focus of the analysis that was undertaken. Other types of marine terminals may require different skills, knowledge, equipment and systems, which are appropriate for the respective commodities that are being handled (e.g. bulk cargo, project cargo, gas, etc.).

### *2.1. Market related trends*

Trends and developments leading to a more concentrated container market and having a direct impact on port work include the introduction of mega vessels; horizontal integration in the container line shipping industry clearly expressed through the formation of large-scale alliances between the world's major container carriers; and the increasing involvement of Global Terminal Operators (GTOs) with large and rapidly expanding international networks.

*Mega container vessels:* In an effort to cut down costs at sea and exploit economies of scale, shipping companies started deploying ever larger container vessels reaching today a capacity of over 20.000 TEUs. The deployment of such vessels has imposed significant changes in the structure of the world's major trade routes with fewer ports serving the main lines and more shuttle and pendulum services connecting these hubs with regional ones and with smaller feeder ports. Such a development has changed the role and hierarchy of ports, reshaping also their market share and cargo volumes to be handled. This in turn has resulted into an increasingly fierce competition between ports in their effort to retain or attract the large container volumes that such vessels are carrying. The increasing operating costs of such vessels has forced shipping companies to exert strong pressure on terminals, in terms of quay productivity making 24/7 operations indispensable. Shipping companies are usually eager to pay higher terminals costs, charged for operations during weekends and at nights, if the latter are compensated by savings in turnaround time. In that case, saving labor costs proves not to be an issue for them

*Strategic alliances:* The deployment of mega container vessels also facilitated the formation of strategic alliances between the world's largest container carriers, enabling in that way the establishment of vessel sharing agreements for filling-up the large capacities mega container vessels are offering and lowering transport unit costs through economies of scale. Alliances in the container shipping industry have passed through a number of formation rounds with three major alliances existing today (2M, OCEAN and THE ALLIANCE). This reality leads to a stronger oligopolistic situation for mainliner trade and hub selection, which goes beyond the influence of the regulating authorities. Strategic alliances can further intensify the pressure that mega container vessels are imposing to ports / terminals since they can contribute towards increasing the vessels' load factors. Such an impact is not only limited to ports / terminals serving those vessels but also to other ports that will be required to serve larger feeder vessels considering the associated cascading effects.

*Global Terminal Operators (GTOs):* With port privatization and deregulation processes being widely implemented during the last decades, barriers to global terminal operations have started to be removed gradually and new operating terminal structures have emerged. A Global Terminal Operator (GTO) is an actor who extends its activities to international terminal operations aiming at establishing globe-spanning network services. It is only through growth strategies that the biggest global terminal operators have advanced from regional to global players. Their large scale of operations has enabled them to create a substantial surplus capital and withstand a highly competitive environment. When GTOs invest in port facilities and provide services for users, they invariably demand changes to employment (e.g. deregulation) and work practices (e.g. flexibility). Of course, in return of uninterrupted and efficient cargo handling operations, port workers worldwide receive guarantees of higher wages and regular pay, regardless of fluctuations in the need for dock labour (Van Hooydonk, 2013). As highly networked and multi-national corporations, GTOs may also impose some behavioural changes on port workers stemming possibly from a different work mentality and to a certain extent from potential cultural differences

### *2.2. Business change related trends*

Business change related trends mainly refer to structural developments that have imposed significant changes on the business environment and have contributed towards making it more concentrated. To this end, specific

attention is being placed on on-going containerization trends, port privatization and dedication of terminals to specific shipping companies or group of companies (i.e. alliances), vertical integration strategies in the port industry, functional integration of terminals into logistics activities, cooperation strategies that ports have developed with inland logistics locations with the aim to increase their competitiveness and attract new customers, as well as transport requirements that ports have to meet in order to improve their hinterland connections.

Containerization: Containerization has been, so far, the most dynamic physical component of globalization with a series of containerization waves being observed since the 1950s. At the current moment that containerization is undergoing its 5<sup>th</sup> wave, a peak in container growth can be observed. Container transport industry stakeholders are increasingly interested to get insights regarding the developments expected in the upcoming decades. Globalization is still on-going and especially today with China serving as the world's largest workshop, container handling has doubled worldwide reaching approximately 600 million TEUs in 2012 (van Ham & Rijsenbrij, 2012). In general, containerization leads to a better predictability and regularity of port employment. Despite schedule reliability problems and potential demand peaks linked to the arrival of large post-panamax vessels, many container terminals have a much lower need for casual labour than conventional cargo terminals. With permanent employment, operations are more efficient because regular workers can attain, and retain, much higher levels of technical competency and on-the-job knowledge (e.g. familiarity with equipment).

Port privatization: In general, ports can either be owned by the government or by a private entity with four basic management models being currently in place i.e. public service ports, tools ports, landlord ports and private service ports. Belgian ports, for example, are owned and managed publicly. In the Netherlands, the largest ports are managed by port authorities. As in most northern European countries, Belgian and Dutch terminals are operated privately. In Italy, port authorities own the land of their ports and may lease operations to private operators. Port reform is still underway in Greece, where some ports are still managed by local port authorities. Such a port reform process can impose profound effects on workforce. Prior and during the process, trade unions express a great deal of concern fearing job losses, casualization of labour, negative changes in working conditions, etc.

Dedicated terminals: Dedicated terminals are terminals that are bound to specific shipping companies or group of companies (e.g. alliances) (Sorgenfrei, 2013). This trend is becoming increasingly important for carriers since the benefits they can realize prove to be substantial including efficiency gains, cost reductions, schedule reliability improvements, added value delivery, 'one-stop-shop' service provision to customers, seamless IT-systems and increased profitability. The level and scope of accessibility to a dedicated terminal is being determined by a private agreement between one or more shipping companies and the port operator or authority. From a port authority's perspective, dedicated terminals serve as a means for developing integrated services while they also ensure the commitment of major shipping companies calling at the port. Furthermore, they can also provide opportunities to put pressure for more investment at the port. Indeed, losing or gaining a large customer can exert a major impact at the port with direct implications on the number of port workers required. Consequently, numerical adaptations to the port labour force are increasingly stepwise instead of incremental (Notteboom, 2010).

Consolidation in the container port industry: Consolidation in the container port industry is a relatively recent and radical trend which can be achieved through vertical or horizontal integration as well as through specialization. With vertical integration, terminal operators have been transformed into logistics organizations offering warehousing, distribution or value-added-services. Through horizontal integration strategies, they began striving for more market power. The high fixed costs characterizing container handling as well as the lack of service differentiation created significant opportunities for improving the existing levels of service through cooperation. However, loose cooperation resulted into mergers and acquisitions. The effect of consolidation on market structure is substantial. On the one hand, it is a means to counterbalance the power of carrier cooperation in liner shipping and to realize economies of scale. On the other hand, national governments and international organizations monitor consolidation processes very closely so that they can prevent the abuse of market power as a result of the formation of regional or local monopolies in cargo handling.

Functional integration of terminals into logistics activities: The container shipping industry is often using terminals as an intermediate storage site for goods in transfer from / to hinterland origin / destination points. In their new role as a buffer in the logistics chain, terminals are increasingly engaging into value-adding activities,

such as quality control and packaging at fruit terminals, pre-delivery and inspection activities at car terminals or packaging of project cargo at general cargo terminals. The increased integration of terminals into logistics chains has resulted into customers demanding agility and flexibility in dealing with cargo flows. Therefore, it becomes increasingly challenging to efficiently plan terminal operations and be able to cope, at the same time, with peaks and drops in cargo handling. Such challenges cannot be successfully addressed without the implementation of advanced and modern IT systems in combination with dock labour dispatch systems (Notteboom, 2010).

Linkages of seaports with inland locations: With logistics activities in and around terminals increasing and with no or scarcely available area to expand, seaports often look for opportunities beyond their borders. Seaports are increasingly cooperating with inland ports in order to improve their competitiveness and attract new customers. However, such a shift of logistics activities from seaports to inland ports has resulted into increased employment opportunities being offered in inland locations. Therefore, seaports need to pay increased attention on providing favorable labour conditions since otherwise their local logistics function as well as the direct economic impact they are imposing on the region will be weakened.

Inland transport requirements: With the introduction of the container in the 1960s, the function and layout of terminals changed fundamentally, from direct transshipment of cargo to inland transport modes to more indirect transshipment with, as mentioned before, large storage areas acting as a buffer between sea and inland transport. A modal separation also took place in terminals, with each transport mode receiving a specific area so that their respective operations do not obstruct one another. Besides their spatial separation, each mode also follows its own time schedule and operational throughput. Such a modal separation in ports resulted into waterside and landside terminal operations being disconnected, also with regard to working hours. Furthermore, ports are also paying increased attention in offering advanced facilities for all other hinterland transport modes besides road transport i.e. rail and inland navigation supporting in that way a more balanced modal split in favour of sustainability.

### 2.3. Technology related trends

A wide range of new and innovative technologies are being introduced in the port sector. They present different maturity levels and are currently at different stages of market penetration and deployment. These mainly include technological advances in container handling equipment, new ICT systems in container terminals, fully automated container terminals as well as Internet of Things (IoT) applications in container terminals.

Advances in container handling equipment: Containerization imposed significant changes on the function and layout of terminals but also resulted in the introduction of new cargo handling equipment (e.g. gantry cranes, straddle carriers, rail-mounted gantry cranes, etc.) to efficiently accommodate the ever increasing container volumes in a timely manner. To this end, the need for skilled port workers with qualifications and experience to handle such specialized terminal equipment increased and a transition process from unskilled port work, requiring no or little training, towards skilled and multi-skilled work with specialized technical knowledge was initiated. Such a process was also driven by the increased attention port customers started to place on precision, damage prevention and service quality. The introduction of mega container vessels also set higher requirements in ports in terms of port machinery characteristics (e.g. quayside gantry cranes). Remote controlling is a more recent trend in cargo handling equipment. Taking the driver off a gantry crane is considered by many to result into improvements in the cycle time, since speed and acceleration on manned cranes are mainly governed by driver safety and comfort factors

Information and Communication Technologies (ICT): ICT will probably present the highest rate of development in the coming decades. Automation opportunities in container terminals can only be possible if powerful hardware and software are installed. This specifically counts for controlling the movement of terminal equipment and the processes of handling systems thus efficiently tackling all other related issues such as equipment management, assignment, sequencing as well as tracking-and-tracing of containers at the terminal. Data exchanges, especially in large terminals where more than 1,000 container movements are being undertaken per hour on average, require high-speed and reliable data communication systems which must be fixed both in terminal offices as well as, via radio, on mobile equipment (van Ham & Rijsenbrij, 2012). Planning systems used for berth allocation, quay crane assignment, yard management and equipment scheduling, etc. have nowadays been widely developed contributing towards improved terminal productivity thus offering better services to shipping companies and hinterland transport operators. On the landside, for example, ICT developments have

enabled the complete automation of the terminal gate processes, reducing to a significant extent the turnaround time of trucks inside the terminal.

Fully automated terminals: A higher degree of automation is expected to characterize container terminals in the future. However, such a development is not a 'one-fit-solution' for all ports and relevant decisions should be taken following a detailed analysis and assessment of the impact that automation opportunities will impose on a variety of different aspects. Financial considerations of labour costs and workforce availability are the key factors driving terminal automation. That is valid especially for ports in Europe, North America, Japan and Australia. In other parts of the world, where port labour costs are still low, terminal automation seems not to be an increasing priority for the moment. Proponents of automation indicate that predictability is another important driver of terminal automation since unpredictable events along with potential delays can contribute towards lower handling rates. However, fully automated terminals, do not only present only advantages. While they provide a greater uniformity in terms of service, they are less flexible to respond to changes in operational demand.

Internet of Things (IoT) applications: IoT applications in ports are currently limited mainly to container RFIDs, electronic seals, port equipment condition monitoring, engineering equipment asset management and wireless automatic meter reading (Xisong et al., 2013). Ports prove to have not yet utilized the full potential of IoT. However, realizing the important benefits that the full deployment of such technologies can lead to, ports are increasingly interested to improve their wireless infrastructure and move towards more integrated solutions. Through an increasing number of connected devices, embedded sensors and analytics technologies, ports can be integrated into a IoT network and enjoy unprecedented visibility in several aspects of their business establishing, in that way, new opportunities for value creation (Lacey et al., 2015). Increasing IoT applications in ports and container terminals in particular, can substitute manual data collection efforts and eliminate potential human errors requiring however, at the same time, more skilled port personnel who will be able to efficiently handle large amounts of data coming from an ever increasing number of connected devices, sensors, etc. as well as big data analysts who will be in charge of processing these data so that valuable information can be provided to decision makers for identifying potential bottlenecks and inefficiencies and taking appropriate actions that can further optimize existing operations

#### *2.4. Sociological evolution related trends*

Behavioural issues may arise from the ever increasing pressure to improve port productivity as well as from the effects that other related trends and developments in the port sector are imposing to the working environment in ports. Specific attention is being placed on how such issues have evolved over time, and in what direction, as well as on how they have changed the organization of work in a port or terminal. Relevant trends include increased age of retirement, changing skill requirements and job profiles, job flexibility and career advancement.

Increased age of retirement: Currently, in most European countries, especially in Italy and Greece, the age of retirement is 65 or even 67 years. This has an impact on the organization of port work, the development of training programmes, the deployment of new technological solutions as well as on the services that port authorities and terminal operators are offering to their customers. Since in most countries governments will not be able to lower, in the near future, the current age of retirement to 55 or 58 years, as it was in the past, targeted solutions for those employees should be developed, exploiting their long working experience and knowledge, to the benefit of employers, thus ensuring the development of job profiles that best fit their age and abilities.

Changing skill requirements and job profiles: The increased introduction of new technological solutions in the port sector, especially in container terminals, in an effort to further optimize existing operations and be able to respond to new market and business changes is altering training needs, which should be properly adapted to the changing, more technologically advanced, port environment. To this end, port workers will be required to develop new skills so that they are well-qualified to perform new operational processes and handle new terminal equipment and relevant ICT systems. In particular, automation opportunities in ports are likely to significantly transform traditional job profiles, increasing current levels of complexity and requiring new sets of competences to be developed. Such new job profiles, transiting more towards white collar port workers, can open-up employment opportunities to a wider range of prospective employees including women, mobility impaired people, etc.

*Job flexibility and career advancement:* Employees in the port industry today are in general better educated than in the past. They expect more independency and flexibility in their jobs, a better balance between work and private life and more opportunities for further advancing their career (i.e. line of work, employer, sector, etc.). As mentioned before, the increased penetration of new technologies in the port environment has increased the number of highly educated workers (e.g. IT specialists) who prove not to be attracted by port workers' unions leading in some cases to distortions in competition. The introduction of modern technologies as well as the increased adoption of automation opportunities also delimit, to a great extent, job rotation which is of increased importance especially for ageing port workers engaged in jobs requiring more physical strength (e.g. lashing).

## *2.5. Environment related trends*

Various policies, strategies and technologies have been deployed in ports, to address the main environmental challenges they are currently facing in an effort to move towards meeting zero emission goals, reducing energy consumption and making a greater and more efficient use of alternative energy sources, improving in that way the quality of life within the ports and in their surrounding urban areas.

*Environmental policies and management systems:* As an integral part of their overall policy, several port authorities worldwide have set-up environmental or 'green' as they are often called, policies declaring their commitment to continuously improve the environmental performance of their port and successfully meet the environmental targets that they have set. Such a commitment derives from an increased understanding that quality environmental management is essential for achieving best work practices and a successful business performance. Environmental management systems (EMS) are important tools for assessing and monitoring the environmental performance of a business. The whole aim of a port being certified by an EMS is to voluntarily present to its internal and external stakeholders that it is taking the right proactive steps towards improving its environmental performance and complying with all national, European and international regulatory frameworks thus meeting its customers' requirements. The most well-known and more widely implemented in the port sector EMS include the ISO 14001, the Eco-Management and Audit Scheme (EMAS) and the Port Environmental Review System (PERS).

*Environmentally friendly technologies and equipment:* Considering the worsening climate and environment, as well as the negative environmental impact that ports are imposing on their surrounding communities, the 'greening' of ports is reasonably being acknowledged as an inevitable trend. European ports undertake several efforts towards their green and sustainable development, besides the environmental policies and the implementation of EMS. They are adopting a number of new technologies and equipment, both on the land side and the sea side operations, aiming to significantly improve air quality and reduce energy consumption in the port area, but also to generate important environmental benefits for the surrounding urban communities. Such technologies and equipment include power generation from renewable energy sources (i.e., wind, solar, etc.), LED lighting, alternative fuel vehicles and cargo handling equipment, cold ironing.

*Port energy management plans and systems:* The benefits to be realized from the successful adoption of the technologies described in the previous sub-section can be even greater if a more integrated approach towards energy management in ports or terminals is in place. To this end, the development of port energy management plans and systems is of increased importance towards improving the energy efficiency of ports. The international ISO 50001 standard as well as other methodologies, such as the one recently developed within the context of the GREENBERTH EU-funded research project, can support ports into following a more systematic approach towards improving, on a continuous basis, their energy performance (IMO, 2016).

## **3. Main implications on the European port labour industry**

The diverse ongoing developments in the port sector have changed the nature of port work. In general, the tendencies observed include moving from general labourers to multi-skilled professional workers; from labour intensive to capital intensive operations; from break bulk handling to specialized operations; from casual hiring to permanent employment; from gang working to team work; from on-the-job training to certified training; from male workforce to diversified labour force (Turnbull, 2009). The main specific implications of the trends and developments noted in the previous section on port labour are summarized in the following table.

Table 1. Main implications of key trends and developments on the port labour industry

Key trends and developments in the European port sector	Main implications for the EU port labour industry
<b>Market related</b>	
Increasing size of container vessels	<ul style="list-style-type: none"> <li>• Increased pressure to improve port / terminal productivity (24/7 port operations) in major hubs</li> <li>• Handling of larger volumes within shorter time windows</li> <li>• New terminal equipment (e.g. gantry cranes with longer outreach) introduced for serving larger vessels</li> <li>• Larger feeder vessels required to be handled by regional hubs and feeder ports due to cascading effects</li> </ul>
Strategic alliances in the container shipping market	<ul style="list-style-type: none"> <li>• Further intensification of the pressure to improve port / terminal productivity (increased mega-vessel capacity utilization rates)</li> </ul>
Global terminal operators (GTOs)	<ul style="list-style-type: none"> <li>• Changes in employment (e.g. deregulation) and work practices (e.g. more flexible working schedules)</li> <li>• Higher wages and regular pay regardless of fluctuations in the need for dock labor</li> <li>• Port workers need to familiarize themselves with new organizational structures and GTOs need to better understand the local context and conditions prevailing around a new terminal joining their network</li> <li>• Possible behavioral changes of port workers stemming from a different work mentality of GTOs and, to a certain extent, from potential cultural differences</li> </ul>
<b>Business change related</b>	
On-going containerization	<ul style="list-style-type: none"> <li>• Direct port labor demand has been reduced but non-direct port labor demand (e.g. in the logistics industry) proves to have increased</li> <li>• Better predictability and regularity of port employment (i.e. container terminals present a lower need for casual labor compared to conventional terminals)</li> <li>• With permanent employment, port workers can attain and retain much higher levels of technical competency and on-the-job knowledge</li> </ul>
Port reform processes	<ul style="list-style-type: none"> <li>• Such processes can impose profound effects on workforce. To this end, before and during the time they are undertaken, trade unions express a great deal of concern fearing job losses, casualization of labor, negative changes in working conditions, etc.</li> </ul>
Dedicated terminals	<ul style="list-style-type: none"> <li>• Losing or gaining a large customer in a dedicated terminal can exert a major impact at the port with direct implications on the number of port workers required. Numerical adaptations to the port labor work force prove to be increasingly stepwise instead of incremental</li> </ul>
Consolidation in the container port industry	<ul style="list-style-type: none"> <li>• More streamlined port worker training procedures</li> <li>• Emphasis on multi-skilling</li> <li>• Increased opportunities for employment in the broader logistics industry</li> </ul>
Functional integration of terminals in logistics	<ul style="list-style-type: none"> <li>• Pure stevedoring and logistics activities get mixed redefining and broadening, in this way, port labor</li> <li>• For efficiently planning terminal operations and being able to cope with peaks and drops in cargo handling, advanced IT systems should be combined with dock labor dispatch systems</li> </ul>
Linkages of seaports with inland locations	<ul style="list-style-type: none"> <li>• Increased attention should be paid on providing favorable labor conditions for logistics operations in seaports, as otherwise a shift of value-added logistics activities to inland locations may be facilitated.</li> <li>• Labor force proves to be a key factor for extracting more added-value from the cargo passing through the port</li> <li>• In many cases, such a shift of logistics activities from seaports to inland ports has resulted into an increase of employment opportunities being offered in inland locations</li> </ul>
Inland transport requirements	<ul style="list-style-type: none"> <li>• The disconnection of waterside and landside terminal operations, as a consequence of modal separation, has resulted into the reach of port work becoming unclear in some ports (i.e. some ports regard only ship loading-unloading as port work while others consider all forms of cargo handling)</li> </ul>
<b>Technology related</b>	
Advances in container handling equipment	<ul style="list-style-type: none"> <li>• The introduction of new cargo handling equipment, resulting from the ongoing containerization as well as the deployment of larger container vessels, has created the need for more skilled port workers with qualifications and experience to handle such specialized terminal equipment. To this end, a transition from unskilled port work, requiring no or little training, towards skilled and multi-skilled</li> </ul>



work with specialized technical knowledge is taking place

- Remote-controlled cargo handling equipment can replace the non-ergonomic, unhealthy seating position of the driver with an office environment, making such a job not only safer but also appealing to a higher number and diverse range of prospective employees (e.g. wheelchair users)
- Remote-controlled cargo handling equipment can also facilitate bringing together, in one office location, crane operators and terminal planners, supporting in that way team bonding and the establishment of a much better working environment
- It remains to be seen to what extent such an office environment will be attractive to people interested in working at the port
- Terminal operators might face the opposition of port workers in case they try to compensate part of the required capital investments by reducing the number of port workers in a gang or number of gangs per vessel without at the same time employing and training port workers for other port functions / operations.
- The introduction of ICT systems, especially when combined with automated operations, is likely to erode the demand for manpower at ports
- Automation in container terminals may lead towards a reduced number of equipment operators who, through a central control room, will be able to handle all equipment that is available at the terminal. However, it is not a ‘one-fit-solution’ for all ports and should be accompanied with an ex-ante analysis assessing in detail the relevant consequences on employment, working conditions, economic profitability, productivity, flexibility, etc.
- Increased outsourcing of IT services can result into losing in-house know-how which is important for controlling increasingly complex logistics processes where information management is of utmost importance
- Financial considerations of labor costs and workforce availability are the key factors driving terminal automation. In parts of the world, where port labour costs are still low, full terminal automation seems not to be an increasing priority for the moment
- Predictability is considered to be another important driver of terminal automation. Avoiding unpredictable events (e.g. absence of port workers due to illness, not consistent handling performance, etc.) facilitates the planning of container flows and consequently a more accurate estimation of the time a vessel has to spend at a port
- Fully-automated terminals create an employment gap as no port worker is needed within the terminal’s operating areas
- While automation provides a greater uniformity in terms of service, it is less flexible to respond to changes in operational demand. The human factor is still, therefore, a prerequisite in fully automated terminals with a changing, however, line of work (i.e. monitoring and intervening only when exceptions occur)
- IoT applications in ports and terminals can substitute manual data collection efforts and eliminate potential human errors requiring however, at the same time, more skilled port personnel who will be able to efficiently handle large amounts of data coming from an ever increasing number of connected devices, sensors, etc. as well as big data analysts who will be in charge of processing these data so that valuable information can be provided to decision makers

Information and Communication Technologies (ICT)

Fully automated container terminals

Internet of Things (IoT)

Sociological evolution related

- The increasing age of retirement impacts the organization of port work, the development of training programmes, the deployment of new technological solutions as well as the services that port authorities and terminal operators are offering to their customers
- Targeted solutions for older workers should be developed, fostering the efficient exploitation of their long working experience and knowledge, to the benefit of employers, thus ensuring the development of job profiles that best fit their age and abilities
- Training needs of port workers should be properly adapted to the changing, more technologically advanced, port environment
- Soft skills like concentration, consistency, precision or effective communication are all vital to help maintain the high levels of efficiency required in container terminals. Best-practice training programmes reveal the importance of soft skills, competency-based learning and practical on-the-job experience
- New job profiles in the port sector, transiting more towards white collar workers, can open-up employment opportunities to a wider range of prospective employees including women, mobility impaired people, etc.
- Modern technologies as well as the increased adoption of automation opportunities delimit, to a great extent, job rotation which is of increased importance especially for ageing port workers engaged in jobs requiring more physical strength (e.g. lashing).

Environment related	
Port environmental policies and management systems	<ul style="list-style-type: none"> <li>• Environmental awareness raising and training programmes for port employees with the aim to create a better understanding of all environmental aspects and impacts that are associated to their job and develop a more environmentally-friendly working mentality</li> </ul>
Environmentally-friendly technologies and equipment	<ul style="list-style-type: none"> <li>• Proper training of port workers involved in renewable energy production facilities so that they can successfully and safely perform all required actions with regard to their operation, management and maintenance</li> <li>• Targeted training for drivers and other port workers associated with the operation of alternative fuel vehicles in the port/terminal area (i.e. eco-driving, familiarization with charging/refuelling equipment, vehicles' driving range and behaviour, etc.)</li> <li>• Targeted training of port workers operating alternative-fuelled cargo handling equipment as well as handling new technologies on the seaside (i.e. cold ironing)</li> </ul>
Port energy management plans and systems	<ul style="list-style-type: none"> <li>• Proper training of all port employees so that they can have a better understanding of the requirements energy standards set and the relevant procedures that should be followed thus familiarize themselves with the new responsibilities and roles they will have to undertake</li> </ul>

#### 4. Conclusions

European ports are important employment generators offering direct and indirect port-related employment. The efficiency and effectiveness of cargo handling operations are crucial for a port's competitiveness as well as for its ability to generate larger economic effects in its region in terms of employment and value-added creation. There are currently new requirements on port labour stemming from a number of market, business, technology, sociological evolution and environment related trends. Market players are increasingly demanding new job profiles and an optimisation of port labour. To achieve this, training of the workforce in ports is essential. Training is a key element in improving social conditions and enhancing not only the social status but also the professionalism, motivation and commitment of port workers. Due to sophisticated technology in cargo handling, training focuses primarily on technical skills. However, soft-skills like teamwork, problem solving, dialogue, environmental awareness, etc. are becoming more and more important. The demand for specialized skills is also continuously increasing. A well-trained workforce heavily supports the creation of a high quality customer service strengthening, in this way, port competitiveness.

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