

## SPECIAL ISSUE ARTICLE

# Innovation and labor in the port industry: A comparison between Genoa and Antwerp

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## Abstract

With the advancement of innovation initiatives in the port industry, port labor has fundamentally changed in terms of new tasks, skills required, professional profiles, training, employment relations, work organization, and number of jobs. Current literature often focuses more on the assessment of investments in this particular sector rather than on the evaluation of innovative processes and the interaction with employment issues. In this article, the authors assess the relationship between innovation and employment in the port industry by comparing two distinct case studies—the ports of Antwerp and Genoa—which are characterized by partially common features and different socio-institutional contexts. Based on qualitative research conducted between 2016 and 2019, the comparative study finds that incremental innovative solutions produce a polarized port labor market in both cases, as previous studies assess. Nevertheless, the findings show that, in the case of Antwerp, a mediated and structured bargaining system interacts positively with employment issues and incremental innovative solutions, while in the case of Genoa, a disarticulated and less structured context reflects a weaker ability to influence virtuously the intertwine between innovation and employment.

## KEYWORDS

container terminals, employment relations, port labor systems, work organization

## INTRODUCTION

Innovation is a key element of economic activities to foster long-run growth. According to Schumpeter (1939), the concept of innovation refers to doing things differently in the realm of economic life, where new combinations of resources bring about five different types of innovation: (1) new products or a new quality of a product, (2) new methods of production, (3) new markets, (4) new sources of supply of raw materials and intermediate goods, and (5) new methods of organizing the economic process.

Most of these types of innovation are still identified in the Guidelines for Collecting and Interpreting Innovation Data (Oslo Manual, OECD & EC, 2018).

In the last decades, many innovations have been introduced in the maritime port industry, revealing that innovation is essential in this highly dynamic and competitive sector. Innovation initiatives have been documented in sectorial literature and partly also in scientific publications. Examples are in container terminal optimization (e.g., Ambrosino et al. 2013; Gharehgozli et al. 2016; Kaveshgar & Huynh, 2015), container logistics (e.g., Zhang

et al. 2018), environmental management in seaports (e.g. Aydogdu & Aksoy, 2015; Klopott, 2013), ICT (e.g., Airries, 2001; Keceli, 2011; Min et al. 2017), hinterland chain planning (e.g., Ambrosino et al. 2018; Lam & Gu, 2013), port-centric logistics (e.g., Kramberger et al. 2018; Wei et al. 2018), and maritime logistics hub development (e.g., Lee et al. 2018; Yang et al. 2013).

Other scholars have analyzed how supply chain management is profoundly impacted by automation processes, technological innovations, digitalization in the forms of artificial intelligence (AI), and robotics applications (Bell & Griffis, 2011; Frey & Osborne, 2017; Klumpp & Zijm, 2019). International research involving various universities in Europe questions how innovation enables to answer the key challenges of the port industry (Arduino et al. 2013). The main objectives are to determine discrepancies in terms of innovation between different regions across the globe, to test whether innovation success is company-specific or rather context-specific.

The past research on innovation initiatives in seaports aimed at understanding patterns and characteristics, and factors of success and failure, considering the context of the respective challenges that prevailed when they emerged (Sys & Vanelslander, 2019). Current literature often focuses more on the assessment of investments (Zheng & Negenborn, 2017) rather than on the evaluation of innovative processes and the interaction with employment. Nevertheless, while all these studies focus on specific characteristics related to a particular innovation goal (or process), only few other papers analyze the role of seaports in regional employment and the relationships between innovation initiatives and labor relations (Barton & Turnbull, 2002; El-Sahli & Upward, 2017; Notteboom & Vitellaro, 2019; Seo & Park, 2018; Bottalico, 2020). Notwithstanding the large body of literature on innovation, few studies have investigated the impact of maritime and port-related innovation projects on labor dynamics. Several studies investigate specific innovation cases or investment patterns, focused on technical advancements, whereas not many studies focus on the interaction between innovation and labor.

This paper seeks to fill this gap by analyzing in comparative perspective, the relationships between innovation initiatives and labor relations in the port industry. Work organization in ports has been strongly affected by innovation initiatives in the last decades, producing a contraction of the number of dockworkers. Notteboom (2012) observes that since the 1960s, European ports have experienced a contraction or stagnation of workforce. Innovative solutions, increased containerization, intermodal transport, and the integration of container terminals in global supply chains are just some of the elements that have characterized this ongoing process of transformation. With the

advancement of innovation processes, the organizational structures, job profiles, skills, and the professional and social status of the port labor have deeply changed, moving from less use of muscles to more use of the brain: less respected as a very heavy job, less attractive among young people, port labor is still perceived as extremely arduous work and old-fashioned.

Based on qualitative fieldwork conducted between 2016 and 2019, the paper contributes to the literature on port labor studies by focusing primarily on the interaction between innovation initiatives and employment relations in the port industry, and answering the following research questions: *How do jobs and employment relations in ports change as a result of innovations? How do they interact?*

To this end, a comparative analysis between two case studies, Antwerp (Belgium) and Genoa (Italy), selected according to the most different system design criteria, is realized. These two ports were selected for their representativeness among the key European ports. They have similar features (i.e., the presence of a dock labor pool, the same global terminal operator for container handling, governance based on the landlord model) but at the same time they have dissimilar properties, being inserted in distinctive socio-institutional contexts, with two distinct port regulations, different models of employment relations, training systems, governance, and work organization. The comparative perspective allows us to highlight how the workforce is governed in these ports situated in different geographic ranges in Europe, and what the specific similarities and differences concerning the interaction between innovation and employment are.

The paper is structured as follows: the next section presents a review of the literature on innovation initiatives and employment issues in the port industry. The third section defines the validation approach and criteria of selection and case building for the comparative study. The fourth, fifth, and sixth sections provide the empirical analysis of the comparison and a discussion on the results. Finally, the conclusions summarize the key arguments and discuss the findings, by stressing further research in this direction.

## INNOVATION INITIATIVES IN THE PORT INDUSTRY

In studies on the maritime port industry, innovation initiatives can be separated in two distinct categories: incremental and radical, depending on the possibility of having marginal adjustments caused by the innovation or drastic changes in the market (Acciaro et al. 2014; Verspagen, 2005). Vanelslander et al. (2016) added two more categories that might differentiate effects of innovations:

systemic (integrating multiple independent initiatives that must work together to perform new functions or improve the overall performance) or modular (bringing about a meaningful change in concept within a component, but links to other components or systems remain unchanged and the impact is low).

Innovation therefore relies on the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations (Arduino et al. 2013).

Vanelslender et al. (2019) investigated innovation in the maritime and port industry, proposing a typology to enhance the way of analyzing and classifying port-related innovation. Data for eighty-four innovation cases were collected. The results show that a major part of the cases features a technological or managerial, organizational, and cultural change at the level of the business or the market with an impact across the entire supply chain. Pure technological innovations take up only 10% of the cases, and do not occur that often. The findings indicate that multibackground innovation is common in the port-related industry. Market change is rather widespread, given that combined technological and managerial innovation clearly occurs more often than purely technological innovation. The change often occurs for an entire product market and is not limited to a particular location or firm. This finding is aligned with the international and network nature of the port and maritime industry. With respect to the actors involved, the innovation champions are the deep-sea terminal operators, stevedores, and inland terminals. The bulk of the companies put innovation cases that are related to the cargo flow and IT high on the agenda. In terms of magnitude of impact generated by the innovation, most of the cases are of the “incremental” innovation type, which means that they are not based on new initiatives or technologies, but rather further developments of existing practices.

Innovation is therefore strategic for competitiveness (Jenssen, 2003). This is even more so considering the impact of COVID-19 on maritime-logistics chains. Flynn et al. (2011) proposed the “fifth generation port” (5GP) with the introduction of a “port ladder” for a customer-centric, community-focused port, considering the new developments that challenge the port sector beyond commercial and economic criteria, in the pursuit of better environmental performance and sustainable development (Lee et al. 2018; Lee & Lam, 2016). The “Smart Port” concept identifies a port that uses automation and innovative technologies to improve its performance. As technological innovations develop, ports might become a “digital node” within the global supply chain (Port Technology, 2019).

We will explore further to what extent these dynamics interact with employment.

## **Innovation and employment in the port industry**

To a certain extent, the port industry follows the same pattern as other manufacturing sectors in terms of labor market polarization. Industries with faster ICT growth shifted demand from middle-educated workers to highly educated workers, consistent with ICT-based polarization (Michaels et al. 2014). Autor and Dorn (2013) hypothesize that recent computerization has substituted for low-skill workers in performing routine tasks, while complementing the abstract, creative, problem-solving, and coordination tasks performed by highly educated workers. Job polarization is pervasive across European economies and has within-industry and between-industry components that are both important (Goos et al. 2014). Autor (2015) predicts that employment polarization will not continue indefinitely and highlights the strong complementarities between automation and labor that increase productivity, raise earnings, and augment demand for labor. Jobs are in fact made up of many tasks, and while automation and computerization can substitute for some of them, understanding the interaction between technology and employment requires thinking about more than just substitution.

By observing the maritime and nonmaritime cluster of the port of Antwerp, Esser et al. (2019) examined how technological innovation has an impact on future professions and specializations. The results show that introduction of ICT and automation will boost a polarized labor market, where a lot of middle-paid paperwork jobs will disappear. Jobs on the work floor will be increasingly supported by robotics and data applications, and management jobs will become more and more complex. These major changes are strictly related to training programs, which must include new skills such as ICT, soft skills such as teamwork and communication, and greater diversity in the port labor market, in terms of gender and ethnicity.

Accordingly, employee training continues to be a source of competitive advantage for terminal operators in Europe (Dynamar, 2019). The current organization of port labor on conventional terminals is expected to be impacted by changing requirements of port workers’ skills and competencies, which are focused on the need for multifunctionality, training, and career path, and need for low-cost, productivity, and flexibility.

The market environment of ports is continuously forcing terminal operators to achieve higher levels of labor performance. This pressure has direct consequences on the requests for labor arrangements and employment

systems and has intensified the search for technological, organizational, and regulatory innovative solutions (Notteboom & Vitellaro, 2019).

The key point here is that the port industry, besides having a similar pattern in terms of labor market polarization, presents a set of specificities compared to other industries. First, the port labor market is typically subject to a number of regulations and schemes that differentiate it from the labor market outside the port area (Verhoeven, 2011). Second, port labor is a traditional form of waterfront work, related with unionism, casualism, and close-knit communities (Levinson, 2006; Mah, 2014). Port labor can be narrowly defined as the loading or unloading of ships, or as all forms of cargo handling in a port area. The work environment of the dockworker remains the dock and the ship's hold, but the spatial dimension may vary. One of the common characteristics of port labor is related to the uncertain dynamics of maritime traffic. Typically, the demand for dock labor by a port employer is based on the average level of trade and, in moments of peak workloads, the use of temporary work. The temporary work, in turn, is often framed within a specific regulation. This old form of casual labor is distinct from manufacturing work, given its irregularity (Dempster, 2010). These characteristics allow us to distinguish port labor from other jobs in manufacturing, and to underline the complex and conflictual nature of the highly dynamic port industry. The specificities of port labor markets are path-dependent and embedded in the history of each port.

The past research on innovation initiatives in port industry focuses on specific characteristics related to a particular innovation goal (or process), whereas only few other papers analyze the elements affecting labor (Barton & Turnbull, 2002; El-Sahli & Upward, 2017; Miller & Talley, 2002; Turnbull, 2016; Walters & Wadsworth, 2016). Over the past years, technological developments have affected the organizational and institutional relationships within the port community (Cepolina & Ghiara, 2013; Martin & Thomas, 2001; Mondragon et al. 2017). Work organization in ports has been affected by innovation initiatives in the last decades, producing job losses (Notteboom, 2012).

Analyzing the main differences in labor intensity and automation on container terminals of Antwerp and Rotterdam, Van Den Driessche et al. (2019) discuss the port value added for container traffic, arguing that labor and capital intensity vary, based on terminal history, absorptive capacity, and strategic priorities. The authors underline, among the benefits of automated ports, the operational performance, increase safety and security, environmental sustainability, and operational expenses. Among the potential automation drawbacks, they mention the cost of implementation, the availability of skills and resources, and the labor cost. According to these

authors, the relationship between automated terminals and labor costs increase may be affected by the power of trade unions, which are mostly stronger in countries with expensive labor. The coordination among social partners, as well as the potential role of good social dialogue and employment relations concerning these key issues, is not considered in terms of success factors. At the moment, however, innovation initiatives and automation processes have not reduced the operating expenses or increased the productivity as much as it was expected. The impact of radical innovations such as automation on labor is substantial as in the conventional setting the port sector involves a workforce with a considerable share of field labor (Dynamar, 2019).

For this reason, trade unions at national and international level are particularly watchful and sensitive about the topics related to innovation initiatives impacting on labor. According to the European Transport Workers Federation (2017), for example, the purpose of innovation initiatives such as automation is to achieve higher throughput or productivity, lesser direct human labor costs and expenses, replacement of operators in tasks that involve hard physical or monotonous work. The potential impact on dockworkers depends on the terminal concept (greenfield, expansion, brownfield), increase of volumes and terminal capacity in relevant ranges, current job structure and collective labor agreements, labor market, job content, and working conditions. However, the job and qualification structures are affected. Radical innovations impact on labor, also producing a shift from direct to indirect jobs, and in terms of skills and job losses. Health risks may change (also improve), as well as the flexibility demands, who may increase. The impact on total employment in the next decades is uncertain, while the impact on unskilled or lower skilled workers is expected to be high (European Transport Workers Federation—ETF, 2017).

In the next sections, the interaction between innovation initiatives, work organization, and employment relations in the port industry is analyzed in a comparative perspective, to show how the variety of coordination between social partners can play a decisive role in governing these trends.

## VALIDATION APPROACH AND CASE SELECTION

The comparative design emphasizes the distinctive contexts of the case studies, which represent two logistics models with similar features. Two ports and two container terminals managed by the same global terminal operator were selected throughout Europe. The case studies for the comparative analysis are identified and selected through



the *most different system design* criteria (Fideli, 1998), which compares contrasting cases to show the robustness of a relationship between dependent and independent variables. The number of cases was chosen not only for objective reasons linked to time constraints but also for better identifying the sharp distinctions in two representative cases. Such a design assumes that, by demonstrating that the observed relationships hold in a range of contrasting settings, the argument of the research is better supported.

Starting from this research strategy, the cases identified for the cross-national comparison are the port of Genoa (Italian case) and the port of Antwerp (Belgian case). The same global terminal operator settled in both ports was analyzed for the comparison.

The methodological itinerary of this research starts from the information gathered during the fieldwork in Antwerp and Genoa. The case studies were built through five sources of evidence: documentation, archival records, interviews, direct observation, and participant observation. Another source consulted and analyzed regularly during the fieldwork has been the press review and the specialized newsletters. The following items have been identified to build the case studies:

- Port labor systems
- Innovation initiatives (container terminals)
- Labor organizations at workplace (container terminals)
- Training systems
- Employment relations
- Key Performance Indicators (container terminals)
- Wages

The first phase of data collection was aimed at circumscribing the empirical context of the research and acquiring information. In this phase, semi-structured exploratory interviews were conducted with privileged witnesses identified among the main actors involved in the port sector.

The second phase of the research focused on the comparison between the case studies, assessing the link between innovation initiatives and labor relations. The selection criteria related, on the one hand, to the peculiarity of certain organizational models involving the introduction of innovations and, on the other hand, to the role of social partners in negotiating these changes. For each terminal operating company, workers, union delegates, and human resource managers were interviewed. The questions, during the interviews, were formulated around the following topics: main characteristics of the companies in the port area, composition of workers, evolution of professional profiles, personnel management, evolution of labor relations over time, impact of innovation initiatives on labor, and training programs.

Interviewees were identified and selected through snowball sampling: a few identified members are asked to identify other members, those so identified are asked to identify others, and so on (Thompson, 2002). The interviews, which lasted between approximately 60 and 90 min, were recorded and later converted into textual documents. All data were processed in pseudonymized form: the names of workers were replaced by fictitious names to ensure their anonymity. At the explicit request of the interviewees, who were particularly wary of the use of research materials, the informed consent form was modified to assure them that information regarding age, educational qualifications, geographic origin, family status, and monthly income would not be disclosed (See Appendix 1). The empirical material collected, consisting of notes, transcribed interviews, and documents reviewed, was subject to thematic analysis (Boyatzis, 1998), using an inductive approach. The interviews conducted were analyzed, divided into thematic cores, and coded in two distinct phases. In the first phase, the main models of work management in organizations were examined to identify the peculiarities of the organizational models. In a second phase, the analysis focused on comparing the relationships between innovations and employment conditions. Table 1 summarizes the main information concerning the research fieldwork.

In Genoa, empirical documentation was collected during six months (from January to June 2016). About thirty-nine in-depth interviews were conducted. Respondents, anonymized, were identified and selected through a snowball sampling. The following actors were heard and interviewed: permanent dockworkers employed by terminal operating companies, managers, and casual dockworkers of the labor pool (the workers' cooperative Paride Batini), managers of the temporary agency for port labor (Intempo), terminal operators, trade union members, members of the employer associations Assagenti (Associazione Agenti e Mediatori Marittimi) and Assiterminal (Associazione Italiana Terminalisti Portuali), and officials of Genoa Port Authority. Attention was paid to the container handling process, through several sessions of observations into the terminals and the port area.

The fieldwork at the port of Antwerp was conducted from October 2016 to May 2017. In this period, twenty in-depth and semi-structured interviews were conducted with the key actors of the Belgian ports and the Northern Range, through a similar working plan and approach of the fieldwork conducted previously in Genoa. After the observation stage, a set of in-depth and semi-structured interviews were conducted for the management of several cargo handling companies, dockworkers, management of labor pool and employer association CEPA (historically named in full *Centrale des Employeurs au Port d'Anvers*), board of VOKA (Flemish chamber of commerce), and trade unions.

**TABLE 1** Key information on the research fieldwork

	Port of Genoa (I)	Port of Antwerp (B)	European institutions
Number of structured and semi-structured interviews	39	20	3
Actors interviewed	Permanent Workers Casual workers (Labor Pool) Port Authority Assagenti (Associazione Agenti e Mediatori Marittimi) Assiterminal (Associazione Italiana Terminalisti Portuali) Terminal operating companies Cargo handling companies Shipping companies Trade Unions ANCIP (Associazione Nazionale Compagnie Imprese Portuali) Interim agency (Intempo)	Workers (Labor Pool) CEPA (Centrale des Employeurs au port d'Anvers) Training Centre Chamber of Commerce Public employment service Flemish port commission Terminal operating companies Cargo handling companies Shipping companies Trade Unions	Sectoral Social Dialogue Committee for Ports European Commission (Directorate General Mobility and Transports) Feport (Federation of European Private Port Operators and Terminals) Espo (European Seaports Organization) IDC (International Dockworkers Council) ETF (European Transport Workers' Federation)
Fieldwork period	Jan–June 2016	Oct. 2016–May 2017	Oct. 2016–May 2017

Different moments of observations in the hiring hall for the recruitment of casual dockworkers belonging to the labor pool were organized. Moreover, thanks to the participation in the advanced specialization courses in Port Economics and Business and Maritime Supply Chain at the Centre for Maritime and Air-Transport Management of the University of Antwerp (C-MAT), it was possible to visit in depth the Antwerp port area, the training center (OCHA), and the main container terminals of the Northern Range (i.e., Rotterdam, Hamburg, Le Havre). A set of interviews was conducted in Brussels, with the actors involved at the European level in the Sectoral Social Dialogue for ports. Two sessions of observations during the works of the Sectoral Social Dialogue were conducted.

## THE ANTWERP CASE

### Introduction

The port of Antwerp is among the top European logistics hubs, located in the Rhine-Scheldt Delta, the largest port region in Europe in terms of volume. In Belgium, port labor is currently regulated by the so-called Major Act (June 1972), which stipulates that only recognized dockworkers are entitled to work in the port area.<sup>1</sup> This means that all cargo handling activities, goods entering or leaving the port, and

services related to these goods must be treated by registered port workers from the labor pool, with a few exceptions. According to the Major Act, port employers cannot hire dockworkers from the external labor market.

The port labor pool includes highly unionized workers who can be assigned according to various professional occupations. Considering the nature of labor contracts with the port employers involved in handling different types of goods, Antwerp port workers can be further subdivided into permanent workers hired by one port employer and casual workers. The latter work on call and are hired by the different port employers daily through the hiring hall. There are also quasi-permanent workers, who are hired daily, for a definite but long period, and always by the same cargo handling company. The table below shows the distinction between casual, permanent, and quasi-permanent dockworkers of the labor pool with respect to the job categories (Table 2).

The following table shows the evolution of the number of dockworkers. In 2019, the total number of recognized workers belonging to the labor pool in Antwerp was about 7053. Due to containerization, requiring more technological inputs and innovative solutions, the labor pool in Antwerp has decreased substantially since 1980. However, in the period 2006–2019, the number of dockworkers increased (Table 3).

In recent years, the number of tasks also increased (from 1.16 million units in 2014 to 1.33 million units in 2019). The average number of tasks per dockworker ranged from 188 in 2014 to 201 tasks in 2017, and then again to 189 tasks in 2019.

<sup>1</sup>Port workers must be recognized by the Joint Subcommittee of the port, after fulfilling a number of conditions such as being medically fit for port labor, knowledge of the Dutch language, etc.

**TABLE 2** Port of Antwerp. Casual, permanent and quasi-permanent workers

Port workers general work	Casual	Permanent
Specialized workers	Casual	Permanent
Drivers of special engines		Permanent
Supervisory staff		Permanent
Container tallyman	Casual	Permanent
Logistics workers		Permanent

Source: CEPA

### Port labor system, innovation initiatives, and role of trade unions

All port employers operating within the geographical borders of the port of Antwerp are obliged to employ the recognized workforce from the labor pool for all port activities. In addition, they are obliged to join CEPA. CEPA had been set up in 1929, is in charge of managing personnel and salary payments for all the dockworkers recognized in the port of Antwerp, and is also engaged in collective bargaining with the trade unions. This institution also has responsibility for training the labor force using the training center for dockworkers (OCHA), which offers obligatory professional training courses with the joint supervision of the port employers and the trade unions: the main representative is the socialist union, Algemeen Belgisch Vakverbond—Belgische Transportarbeidersbond (ABVV-BTB), followed by the christian union, Algemeen Christelijk Vakverbond—Transport & Communicatie (ACV-Transcom), and the

liberal union Algemene Centrale der Liberale Vakbonden van België (ACLVB).

In Belgium, the bargaining system uses both a general collective bargaining agreement at the national industrial level and a collective bargaining agreement at subindustry level. Moreover, employers and trade unions at the port level can bargain a specific agreement called “Codex”. The definition of dock work is on the first page of the “Codex”—considered as the “Bible” of the dockworkers. The Codex of the port of Antwerp is only applicable in that port. In each port, the Codex sets in detail the prevailing labor regulations applicable within the port. The port-specific Codex contains stipulations on wages and working conditions, mandatory compositions of the gangs and tasks, and includes a clear description of the geographical area for which the regulation applies. Changes and additions to the Codex are under the responsibility of the competent joint subcommittee in which representatives of both employers and trade unions negotiate. The joint subcommittee of the port of Antwerp is formed by CEPA, the trade unions, and a representative of the federal ministry of labor. In the words of the director of CEPA (Interview no. 1, December 6, 2016), the joint committee is “an institution that controls if things are going in the right and same way within a sector, with the supervision of the government”.

In homage to a rooted tradition and path dependent institutions such as CEPA and the joint subcommittee, economic and social actors are therefore involved in negotiations that ensure a shared agreement that would

**TABLE 3** Port of Antwerp. Evolution of workers and amount of tasks worked, 2006–2019

Year	General Register	Logistics workforce	Total recognized workforce	Total amount of tasks performed per year (General register)	Average amount of jobs per worker per year (General register)
2006	6900	1696	8596	1.303.664	189
2007	6819	1679	8498	1.356.651	199
2008	6898	1777	8675	1.377.539	200
2009	6650	1785	8435	1.228.708	185
2010	6240	1827	8067	1.322.822	212
2011	6053	1862	7915	1.170.631	193
2012	6029	1776	7805	1.166.335	193
2013	6160	1741	7901	1.183.817	192
2014	6181	1727	7908	1.162.372	188
2015	6131	1743	7874	1.193.747	195
2016	6136	1542	7678	1.211.218	197
2017	6277	1630	7907	1.262.963	201
2018	6723	1687	8410	1.315.804	196
2019	7053	1637	8690	1.335.804	189

Source: Own composition from Flanders Port Commission, CEPA.

safeguard, at least in principle, market efficiency and social peace. The innovation initiatives in the port of Antwerp need to be framed within this structured context.

Among the major events that recently affected market conditions, power relationships, and work organization in the port of Antwerp, it is worth mentioning the port labor reform that took place in 2016. The reform was designed after the letter of formal notice sent by the European Commission to Belgium in 2014, in which it informed it that its dock work legislation infringed the freedom of establishment (Article 49 of the Treaty on the Functioning of the European Union, TFEU). Following that letter, in 2016, the Belgian government had adopted a royal decree relating the recognition of dockworkers in the port area, establishing the arrangements for the implementation of the Law organizing dock work, which had let the Commission to close the infringement procedure against it.

Nevertheless, the strategic terminals in the port of Antwerp have begun to be managed by global players and multinational companies. The global terminal operating company PSA International, for example, obtained a dominant position in the container business with the acquisition of Hesse Noord-Natie (HNN) in 2002. Furthermore, DP World from Dubai took over P&O Ports (2005–2006). A new container terminal is managed through a vertical integration between the shipping company MSC (Mediterranean Shipping Company) and the global terminal operating company PSA. Along this line, the most notable development in 2016 was the transfer of all MSC services to the Deurganckdock on the left bank of the river Scheldt (quay 1742). Operated by forty-one gantry cranes and 200 straddle carriers along a quay of about 3.7 kilometers, 2,420,000 square meters, and a total capacity of 9 million TEUs, MPET (MSC PSA Europe Terminal) is the largest container terminal in Europe.

The new container terminal MPET in the port of Antwerp, built from scratch, has not been characterized by radical innovative solutions in contrast to the other container terminals managed by PSA. The economic operators chose to adopt an incremental approach of innovative solutions. The main reason for this is that the workers and their trade unions promptly negotiated these decisions with port employers. Alex, a dockworker of the labor pool with permanent contract at MPET and union delegate of the Belgian Union of Transport Workers (ABVV-BTB), explains why radical innovation initiatives are not implemented:

Automation does not get through because it is not flexible enough. In our operations, if you want to change a complete shift-loading plan, you can do that, and it happens. In an

automated terminal, you can't change anything because [it] is too rigid. That is currently our strength here: you can change plans in one hour, and at the moment the amount of containers we handle here with one gang is still higher than the amount of an automated terminal like in Rotterdam, which is in our backyard.

(Interview n. 9, December 14, 2017)

Radical innovation initiatives that may affect drastically work organization and employment conditions have been negotiated in the workplace proactively. A cohesive and highly unionized labor pool avoided job losses, defended its conditions within a frame characterized by a mediated system of interests that makes it more difficult for a party to prevail over another. However, it seems from Alex's words that the price to pay was a demand for greater flexibility.

Operational flexibility is a key element for work organization in the port of Antwerp. Port employers involved in container handling ended up sharing the idea that radical innovation initiatives contrast with the path-dependent and historical "organization of the improvisation" in the workplace, which has been negotiated by the employers and trade unions as social partners in the bargaining processes. This perspective may be further demonstrated by the above-mentioned increase of the number of tasks.

Before being involved in port operations, and beyond the specializations, dockworkers are supposed to acquire a proper knowledge, training, and experience concerning both the tools that they are going to manage and of the environmental conditions in which they operate. This also feeds career expectations and have a direct impact on dockworkers' productivity. Professional training is managed and organized by CEPA, involving trade unions and port employers, which include newly arrived shipping companies and terminal operators.

The training system is strongly defended by trade unions, which are aware of the ongoing polarization of the job skills due to innovative solutions. Professional training provides necessary updating and additional training needed to make sure that dockworkers maintain high levels of productivity. The perspective of the port employers is not different. In this way, the reasons why currently radical innovations in Antwerp are not widespread are explained by an HR manager:

If you can automate or innovate certain processes, with an effect on your results and your efficiency, of course, every company will try to do so. But you also must invest in your employees. They are making those things work. You still will need to invest in training in other



kind of areas, IT, engineers, other profiles. Of course, we look at the costs, always we try to reduce the costs. If you ask why productivity in Antwerp is high, maybe I will tell you something you will find very strange but... because they are proud to be dockers. That is the key: their motivation.

(Interview n. 17, March 9, 2017)

From this stream, it seems that in the port of Antwerp, port labor is to be considered as something that needs investments and resources to derive higher performances, beyond the levels of specialization. A key aspect is the coordination in the training system. Port employers benefit from this professional upgrading, investing in training according to the principle that “you spend money to gain money” (by always looking at the costs).

The mutual benefits of this model are reflected also in the choice of recruiting pool workers on a permanent basis for supervisory operations and highly skilled tasks, and casual (or semi-permanent) workers for all tasks requiring low skills and less specialization. The result is a model that tends to polarize the labor market within the port in relation to the skills required, as the HR manager explains:

We want to give the workers some kind of security, and of course, we ourselves need a certain number of workers so that we can carry out our operations efficiently. The permanent workers, who occupy more specialized positions, provide us with this security. Casual workers are employed for less specialized operations. It is important to have the same people in the terminal every day, for the more complex operations. We use a lot of permanent workers because that way we make sure they can familiarize themselves with all the procedures and innovations that are introduced day after day.

(Interview no. 17, March 9, 2017)

In Antwerp, the labor union power in the bargaining process is not just a factor affecting the level of automation as some studies claim (Van Den Driessche et al. 2019), but a beneficial factor affecting the overall port labor system, which translates into political power to ameliorate working conditions and to ensure high standards, professional upgrade, and high performance, regardless of the professional profiles required. In an institutional architecture, based upon joint decision-making bodies and a single specific port regulation, trade unions have found a constructive way to negotiate both productivity, flexibility, and wage issues as

well as labor conditions, training, and organizational aspects such as the introduction of (and the interaction with) incremental innovations. The arrival of foreign capital has not managed to scrap such a dense and articulated model. Despite their greater strength when compared to local employers, global shipping companies and terminal operators have not only been expected to negotiate with trade unions about innovative solutions but have ended up recognizing the workers' disruptive power as a beneficial value. The important level of training and overall professionalism, which requires continuous investments, is supposed to promote professional updating, to increase productivity and ultimately employers' economic returns.

Dockworkers of Antwerp are often cited for having high rates of productivity (Notteboom, 2012). Besides the gang system and a peculiar “labor culture”, a key incentive is linked also to the competition with the nearby port of Rotterdam, where a radical innovation such as a fully automated container terminal is running, and seems to be used as a deterrent, as Frank emphasizes:

We are all paid the same, there are no incentives. The incentive for me in doing things good and not the other way around is chauvinism. We are proud to be dockers. That's simple. You don't want to deliver bad work, nobody does, no docker in Antwerp wants to produce something bad. Most dockers know that there is a port from here only 100 km, Rotterdam is on our backyard, and they have automated terminals. We must be better than their robots.

(Interview no. 10, February 14, 2017)

Port labor in the case of Antwerp is experiencing an ongoing shift, driven by innovation initiatives, and synthesized by the HR manager through the slogan “Less muscles, more brain”. These trends boost a polarized port labor market. However, they are mediated in the bargaining process, promoting reciprocal advantages in the ongoing interaction between innovation and employment. These major changes are strictly related to training programs.

## THE GENOA CASE

### Introduction

The port of Genoa is a universal multipurpose port, with twenty-five specialized terminals managed by private terminal operating companies (including multinational companies, as in the case of the container handling), situated on the shore of the bay of the Ligurian sea, near

the industrial production areas in Northern Italy and Southern Europe.

Cargo handling in the port of Genoa is done by the permanent workers of the terminal operating companies—who do not belong to the labor pool—and by the dockworkers of the labor pool managed by the workers cooperative Compagnia Unica Lavoratori Merci Varie “P. Batini” (CULMV), who are recruited by the terminal operating companies as casual workers. Such a pool is made up of around 1.000 workers.<sup>2</sup> Among the casual workers, there are also dockworkers employed in a quasi-permanent way, as in the Antwerp case. The law forbids terminal operators to hire casual and temporary workforce from the external labor market, but CULMV can ask the support of external workers through the interim agency linked to the cooperative.

In the Italian case, the main legal framework concerning port labor is the national law n. 84 approved in 1994 which introduced the privatization of port operations. It regulates ports’ activity, besides a collective bargaining agreement defined for the industry and second level agreements at company level. According to the port regulation, the port authority elaborates every three years the “plan of the port workforce” (Piano dell’Organico del Porto), which has the value of a strategic document of recognition and analysis of work requirements in the port area. Based on the plan, the port authority adopts operational arrangements of intervention for port labor. The last plan of the port workforce in the case of Genoa (2018) shows the picture of the employees and the forecasts for the use of temporary work in container handling (Tables 4 and 5).

Terminal operators predicted a substantial stability of the permanent workforce, and the use of the labor pool for an average total over the three-year period of approximately 130,000 work calls.

The workforce of the labor pool in the port of Genoa offers an extremely flexible and diversified service, both qualitatively and quantitatively, whose programming is the result of the daily organization of the calls activated by the various port employers. However, it should be noticed that in this field, much praxis is based on informal rules that have come to be routinized through time and that vary according to the days, ships, and shifts. A less structured context therefore characterizes the case of Genoa.

**TABLE 4** Port of Genoa. Permanent employees: Container handling

Permanent employees		
Administrative	Operational	Total
223	670	893

Regarding the days worked, the years 2015–2018 show a trend characterized by continuous growth (Table 6).

For the year 2018, in the period January–October, the days worked amounted to 192,040, with a reduction of 4640 days compared to the same period of the previous year (−2.4%).

In general, the demand for labor in container handling is characterized by a request for high levels of specialization, multitasking, and multiskilling. There is a direct correlation between the number of specializations held by each worker of the labor pool and the average number of shifts per month in which he is employed. In terms of qualifications, the workforce of the labor pool reflects the situation represented in Table 7, which summarizes the number of specializations by professional families and job categories. At an average level, each worker can be ascribed two to three specialization families.

### Port labor system, innovation initiatives, and role of trade unions

In the port of Genoa, there is a polarized and fragmented workforce with different labor and wage conditions: the permanent, high skilled workforce employed by the terminal operating companies (white and blue collars) and the non-permanent, polyvalent dockworkers of the labor pool who represent the flexible, temporary, and casual workforce requested by the terminal operators to integrate their activities.

According to the president of Assiterminal, the relationship between permanent workers and casual dockworkers of the labor pool in the port of Genoa “is like oil in water” (Interview n. 35, April 20, 2016). The formal and substantial difference between permanent and casual workers are explained by Giovanni, a permanent dockworker of the main container terminal:

There's no real hierarchy, but there is an interdependence of tasks, because if the casual worker on the yard trailer doesn't run, the job doesn't go forward. And then the casual workers earn piecework on the number of containers they move. If a casual worker

<sup>2</sup>CULMV is the historical workers’ cooperative founded in 1340. Due to legal constraints, it was obliged to acquire the status of enterprise. CULMV groups together the registered dockworkers of the labor pool in the port of Genoa who are, at the same time, members of this cooperative.

**TABLE 5** Port of Genoa. Forecasts for temporary work: Container handling

Shifts forecasts (Labor Pool)	
2018	2019
136.000	136.000

Source: Plan of the port workforce.

**TABLE 6** Port of Genoa. Labor pool: Trend of the days worked (2015–Aug. 2018)

	2015	2016	2017	Jan-Oct 2018
Working days	200.713	206.923	235.037	192.040

**TABLE 7** Port of Genoa. Professional specializations: Labor pool

Professional family	Description	Number of Profiles
1	Technical and supervisory staff	104
2	Crane drivers	37
3	Drivers of special engines	154
4	Yard trailers (container)	476
5	RTG drivers	243
6	Stevedores, Technicians	53
7	General workers, Lashers	685
8	General workers (forest products, fruits)	197
9	Other profiles	206
	Total	2.155

<sup>a</sup>Workers are shown n° times as many as there are professional families for which at least one qualification is available. Source: CULMV, Plan of the port workforce (2018).

goes very fast, I certainly can't follow him too closely, I do my best, but I don't have the same incentive as him to do so.

(Interview no. 16, February 19, 2016)

This excerpt highlights the definite hierarchical order between permanent and casual workers, and at the same time, the close operational relationship related to the professional profiles. The distinct system of remuneration provides incentives to productivity for casual workers. The workers belonging to the labor pool have a different status than the permanent workers employed by the terminal companies.

Neither the main container terminal in the port of Genoa has been characterized by radical innovative

solutions in the last years. Mostly incremental innovations have been introduced. The first container terminal in the port of Genoa and in the region (VTE, Voltri Terminal Europe) is managed by the leading global terminal operator PSA, which is also operating the majority of container terminals in Antwerp, with the difference that no joint ventures with shipping companies are in place in Genoa. The port area of this container terminal has been developed progressively starting from 1970s.

The polarization of the workforce according to the skills required is further explained by the head of operations:

Our supervisors cooperate themselves to the labor pool supervisors. Our employees cover the most skilled jobs. We train them. Then, when we need additional labor force, the first job in order of call is the general dockworker, then the lasher, the yard trailer and the driver of special engines. The crane driver is typically the high skilled job; this task is performed by the employees. The casual workers of CULMV cover the tasks starting from the less qualified to the higher, and I gradually move my permanent workers to the higher accordingly. Any innovative solution must take this basic approach into account.

(Interview n. 25, April 29, 2016)

As this excerpt makes clear, there is a hierarchy of professional skills that is reflected in the polarized composition of the port workforce. Permanent dockworkers have a sort of pre-emption with respect to the coverage of more qualified jobs (from the crane operator downwards), according to an internal company agreement that foresees the hierarchy of tasks and professional categories to be employed between permanent and casual workers, as well as the coverage of highly specialized tasks by permanent workers. According to this approach, casual workers of the labor pool are both polyvalent and generally recruited for unskilled or less-skilled tasks. For example, it is not possible to employ a labor pool dockworker on a mechanical vehicle if the permanent dockworkers include people who can perform that task on that shift. An organizational model conceived in this way makes casual workers a structural back-up component, and at the same time aims to have an elastic system, first connected to the volumes to be handled and secondly to the tasks to be performed. When volumes decrease, the terminal operating company generally recruits a smaller number of casual workers from the labor pool and has its permanent workers to cover all tasks. When volumes increase, on the other hand, the terminal operating company gradually recruits a greater number of casual workers from the labor pool (unless it decides at some point to hire additional

permanent workers). Such a model, based on transferring risk to the labor pool, takes advantage of the flexible share of labor provided by the pool of polyvalent casual workers, while avoiding any form of interaction between innovative solutions and professional growth for this labor force.

Permanent dockworkers entirely cover the specialized tasks such as crane drivers (quay cranes) and RTG, and partially the reach stackers. The yard trailers, lashing/securing, and general work are almost always covered by non-permanent dockworkers of the labor pool. From the lowest task upward, the main professional profiles for the operations of loading and unloading in a container terminal of the port of Genoa are typically the following:

- Generic dockworker
- Lasher
- Yard trailer
- Self-propelled vehicle driver
- RTG driver
- Quay crane driver
- Supervisor, foreman.

The setting of the operational cycle is changed throughout the time, together with the increasing amount of volumes handled. The number of self-propelled vehicles for instance has been increased, modifying in turn the IT system to adequately distribute the tasks. At the same time, the moves per hour increased, so an additional reach stacker had been introduced to follow the pace of the quay cranes. The increasing rhythms in the last years determined a different labor setting of the gangs at operational level to avoid bottlenecks during the operations of loading and unloading. The volumes increased with the pace of work, i.e., the moves per hour. This trend did not produce the choice of the management of introducing radical innovation initiatives or employing permanent workers.

The organizational changes resulting from innovative processes were addressed by the President of Assiterminal (Associazione Italiana Terminalisti Portuali) during a conference in Genoa:

Terminal operators are the link in a logistics chain governed by the shipping companies. This is another reason why we are not willing to introduce work organization as a negotiable issue. And automation or technological innovations are the organization of work in the purest and most precise sense of the term. We are in the presence of a process in which port labor is becoming more and more labor and less and less port labor.

(Genoa, February 2019)

Nevertheless, in the case of Genoa, the predominant model seems to be based on multitasking, on the productivity incentive system, and on the polarization between permanent high-skill workers and casual low-skill workers. The training system is connected to the contingent needs of the professional profiles required by companies.

Fractures and differences are also reflected in terms of workers' representation. The workers cooperative CULMV itself expresses a collective subject, with union cohesion and social solidarity, somehow in competition with the collective representation of Confederal Trade Unions (FILT CGIL, FIT CISL, and UILTRASPORTI). The antagonism between these collective organizations has always been relevant for the bargaining processes.

This fragmentation is framed in a broader disarticulated context. The port of Genoa lacks an institutional entity (such as CEPA in Antwerp) for the coordination and supervision of pool members and port employers. Genoa Port Authority has not been able to mediate the conflicting interests and has often been submissive towards port employers. The fragmentation of the workforce, the weakness and rivalry of trade unions, and the lack of cohesive institutions able to mediate the variety of interests among social partners have produced a conflictual system of employment relations and an elastic model from which port employers benefit. A constructive ground to debate professional upgrade, job skills, productivity, and wage issues as well as labor conditions and innovation initiatives is lacking. Port operators exercise great power in the organization of the port activity to which workers and their representatives find it hard to oppose. Innovation initiatives and their interaction with employment seem to be not a matter of negotiation.

In Genoa, therefore, a disarticulated and less structured context reflects the lack of joint institutions between employers and workers. Labor productivity and professional upgrade are anchored almost exclusively to functional and operational flexibility, to multitasking and to work intensification as implied by the piecework rate system. In general terms, the case of Genoa displays a weaker ability to influence bargaining processes connected to innovation initiatives.

## OVERALL FINDINGS AND DISCUSSION

In terms of magnitude of impact, both cases analyzed are of the "incremental" type of innovation, which means that they are not based on new initiatives or technologies, but rather on further developments of existing practices. These findings are in line with previous studies,



confirming that the port sector struggles with radical innovations (Vanelslander et al. 2019).

Moreover, the comparative analysis shows that the interaction between innovation initiatives and employment follows the same pattern as other manufacturing sectors in terms of labor market polarization (Autor & Dorn, 2013; Esser et al. 2019; Goos et al. 2014; Ircha & Balsom, 2005; Michaels et al. 2014; Notteboom & Vitellaro, 2019). Training programs represent a source of competitive advantage in both cases (Dynamar, 2019).

On the other hand, understanding the interaction between innovation and employment requires thinking about more than just substitution (Autor, 2015; Barton & Turnbull, 2002; El-Sahli & Upward, 2017; Miller & Talley, 2002; Turnbull, 2016; Walters & Wadsworth, 2016). Previous studies on innovation in the port industry often underestimated or even ignored the role played by social partners in the bargaining process on innovative solutions (Van Den Driessche et al. 2019).

In the two analyzed cases, the model of employment relations specifically appears to have had a differentiating impact on innovation initiatives, performances, and labor conditions. As we have seen, the general context of employment relations differs. In the Belgian case, there is a strong culture of social dialogue, an important role of work councils, joint committees, and subcommittees. Working conditions are determined by means of collective bargaining agreements concluded within these institutions. Belgium's trade union membership rate is among the world's highest, and it is fruitful in terms of the conclusion of agreements.

The employment relations system in Italy is characterized by ambivalent features inherited from the past, such as a low level of regulation and weak institutionalization, accompanied by little engagement in a generalized participative-collaborative model, weak cooperation and coordination between unions and employers, and absence of concertation (Pulignano et al. 2018).

Innovative initiatives are therefore negotiated in a structured system of coordination among social partners in the case of Antwerp, and in a more conflictual environment among social partners in the case of Genoa. Port workers in Belgium are protected against any distortions deriving from the changing nature of their work. The port of Antwerp has undertaken a substantially mediated process of bargaining involving employers and trade unions and based upon social dialogue. Social partners have found a constructive ground to debate both productivity and wage issues as well as labor conditions, professional upgrades, and therefore, work organization, included the introduction of innovative solutions. The beneficial value of the Antwerp labor pool is recognized by port employers involved in container handling, who invest in training and

professional upgrading to increase productivity and ultimately employers' economic returns.

In Genoa, different groups of workers emerge with different employment conditions and professional profiles. These differences are reflected at the level of workers' representatives. In this polarized and less structured context, there are no joint institutions between employers and workers, or their representatives, which regulate employment conditions and other organizational issues such as innovation initiatives. Whereas the Antwerp case shows the enhancement of social value, and not a limit to innovative solutions related to successful outcomes, the concept of shared value hardly fits in the case of Genoa.

In both cases, however, the empirical findings show that a certain degree of incremental innovation has been introduced in the existing container terminals, but these trends are addressed differently by social partners in the bargaining processes, providing different outcomes.

Table 8 displays the findings of the comparative analysis between the selected case studies.

As shown in Table 8, in both cases, the port employers benefit from the flexible labor provided by the pool system, in light of the specific regulations. A similar polarization between permanent and casual workforce has been noticed, but in the case of Genoa, a fragmented workforce is due to the joint presence of highly skilled employees of port employers and low skilled (and multiskilled) dockworkers of the labor pool (CULMV), whereas in Antwerp a more cohesive and structured labor pool is in place. The port labor systems are therefore both characterized by a pool system. The Belgian case displays a more structured model based on the idea that labor requires continuous investments. In the Italian case, the non-structured model refers mainly to the informal and conflictual relationships between social partners, as well as the absence of an institution that regulates the employment conditions (such as CEPA and Joint Subcommittee in the Belgian case). The work organization differs according to the legal constraints of each case and the degree of coordination among social actors. Labor productivity is mainly (but not exclusively) determined by the functional flexibility, the multitasking, and the incentive schemes in the Italian case (piecework rate system), whereas in the Belgian case this is due to the specificity of a well-trained gang system and the professional upgrading. In both cases, incremental innovation initiatives have been detected in the existing container terminals, but they have been negotiated in the case of Antwerp to obtain reciprocal advantages.

The following table summarizes the comparative analysis of the performance indicators (Table 9).

In the port of Genoa, the average number of moves per crane working hours is ten times lower than in Antwerp. Concerning the 'cash cost per box', namely, a

**TABLE 8** Comparison of the impact of innovation initiatives on labor

Variables	Port of Genoa	Port of Antwerp
Port labor system	Employees + Labor pool system Focus on costs	Labor Pool system Focus on value
Labor pool governance and management	Non structured	Structured
Work organization	Multitasking Piecework rate system Elastic system	Gang system
Innovation initiatives	Incremental	Incremental
Professional training	Not coordinated Not negotiated Professional mismatch	Coordinated Negotiated Professional upgrade (Training system) High standards
Employment relations	Conflictual Noninstitutionalized Fragmented	Collaborative Cohesive Institutionalized (Union bargaining power)

**TABLE 9** Comparison of port performance indicators (container terminals)

Variables	Port of Genoa	Port of Antwerp	Notes
Container terminal productivity (Gross Crane Rate)	20–25 boxes (Moves per hour)	30–35 boxes (Moves per hour)	KPIs–Average per crane working hour
Cash Cost Per Box	High	Low	Limited data availability
<i>Wages and salaries</i>			
<i>Contract labors</i>			
<i>Running, repair, Maintenance</i>			
<i>Power and Fuel</i>			
<i>Other direct charges</i>			
TOT.	Approx. 96,00 €	Approx. 6000 €	
Wages	Low	High	Limited data availability

key cost indicator that represents how much a container handling company spends only in terms of out-of-pocket costs for each volume unit handled, labor composes the main value in both cases. The findings in the two ports have been elaborated from different sources and refer to two different container terminals managed by the same global terminal operator. Due to confidentiality, it has been not possible to obtain more details or concrete figures. However, there is enough empirical evidence to state that in the Italian case the cash cost per box parameter is higher than in the Belgian case. Moreover, in the port of Antwerp, a low cash cost per box reflects high wages per capita, whereas in the port of Genoa a high cash cost per box reflects low wages per capita. This might be due mainly, but not exclusively, to the coordination on innovative solutions, the equipment at workplace, the different number of workers per container handled (lower in the Belgian case), the economies of

scale of the terminals. In turn, these settings have an impact on terminal efficiency and productivity.

## CONCLUSIONS

How do jobs and employment relations in ports change as a result of innovations? How do they interact? Innovation processes affected both work organization and employment relations, representing a sensitive issue for social partners in the debate and negotiations on port labor. Innovation initiatives unavoidably produced a contraction of the number of jobs in the port segment of the maritime-logistics chain since the 1960s, as well as new jobs and skills that were required. With the advancement of innovation initiatives, the organizational structures as well as the professional and social status of port labor have fundamentally changed. However, the idea that innovations

will lead to the disappearance of work is not sustained by empirical evidence, whereas few studies analyze in depth the interaction between innovation and labor relations.

This comparative analysis has tried to fill this gap. The port industry has been strongly influenced by innovation initiatives in the last decades, affecting labor organization and employment relations. For these reasons, it is crucial not only to investigate innovation initiatives in the port industry, but also to analyze the interaction between these ongoing processes and labor dynamics, as well as the role of social partners in the bargaining processes. This last aspect, in fact, is mostly neglected in the scientific literature.

Albeit with a differing pace of change among ports, port labor systems in Europe are undergoing a slow process of transformation in terms of employment relationships, number of jobs, new tasks, professional profiles, and knowledge issues. These trends are constantly monitored by trade unions, both at national and at international levels. In this paper, we shed light on the interaction between innovative solutions and employment relationships in two different European ports, and on how these processes are mediated by social and economic partners to obtain a reciprocal benefit. In the Belgian case, innovation initiatives are negotiated among the social partners involved in the bargaining process, fostering reciprocal advantages. In the Italian case, the uncoordinated relationships among social partners seem to prevent such kind of proactive collaboration, affecting the social dialogue on work organization, performances, and labor conditions.

Port labor systems are confronted with specific labor challenges not commonly found in many other industries, beyond the common trends of polarization of labor markets. The general trend towards incremental innovation initiatives suggests a need for collaborative employment relations, to mitigate the negative impacts and externalities of such dynamics, by maintaining high performances, and creating economic value through the enhancement of social value.

Despite its contributions, this comparative study also has various limitations. First, it examines only two specific cases with a qualitative approach. Although a qualitative comparative study provides a better understanding of these ongoing processes, a survey might help to visualize and measure the impacts and changes of port-related innovation initiatives on labor dynamics in a variety of cases. A comparison with cases characterized by radical innovations such as automated ports would be beneficial. However, there are still little cases of fully automated port terminals yet, except for Rotterdam in Europe. Other developments are ongoing in Singapore and Dubai, but they are still at a first stage of the process.

Second, data on more recent insights related to these dynamics are hard to obtain, due to confidentiality and

sensitivity of the information related to the advancement of innovative solutions with respect to employment issues.

Third, this comparative study focused mainly on the relationships between innovation initiatives and employment relations. The key strategies implemented by trade unions for protecting labor conditions and professional upgrade by the market requirements in the long run need to be identified, to provide more extensive knowledge about the process of negotiating innovative solutions. Along this line, the results of this comparative study suggest implications for policy makers at national and international levels, such as encouraging the coordination among social partners in training programs and able to activate mutual benefits considering the innovation initiatives in the port industry.

This study does not apply a “benchmarking” approach but provides a comparative analysis between two distinct cases, which are, in principle, positioned at the same level. While the importance of the logistics hub of Antwerp in the European and global port landscape should be acknowledged in terms of its overall competitiveness, this is not a sufficient condition to set a comparative design as a benchmarking. It should be noted that the Belgian port system has been subject to an infringement procedure by the European Union, due to the organization of port labour, in contrast with the principles about competition of the European Treaty.

Based on the abovementioned limitations, we suggest some directions for future research. First, cross-national comparative analysis about innovation initiatives impacting on labor dynamics are needed. The institutional context and the bargaining system might be crucial in the differences among various cases, due to the peculiarity of port industry. It would be interesting to explore in a larger set of cases whether the similarities and the differences detected in this comparative analysis still hold or can even be further refined.

Second, it might be interesting to realize other comparisons among ports embedded in similar socio-institutional environments, but with different levels of innovation initiatives and systems of employment relations, and to see whether the coordination between social partners in the bargaining process of these issues has had a key role. There is however room for expanding the geographical scope of cases. The comparison can be used to conduct quantitative cost benefit analysis on the interaction between port-related innovation projects and professional training, not only in the container handling. The comparative approach among distinct types of innovation initiatives can however provide evidence on beneficial effects derived from the professional upgrade of the workforce involved in port operations, assuming that labor still matters.

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## APPENDIX 1

## Interview list

City	Interview number	Company/Institution	Role	Date
Genoa (Italy)	1	CULMV “P. Batini” (Labor Pool)	Consul (President)	20th February 2016
	2	CULMV “P. Batini” (Labor Pool)	Vice-Consul	20th February 2016
	3	CULMV “P. Batini” (Labor Pool)	Trade Union delegate	15th March 2016
	4	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	21st April 2016
	5	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	25th April 2016
	6	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	26th April 2016
	7	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	27th April 2016
	8	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	28th April 2016
	9	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	29th April 2016
	10	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	2nd May 2016
	11	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	3rd May 2016
	12	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	8th April 2016
	13	CULMV “P. Batini” (Labor Pool)	Casual Dockworker	6th April 2016
	14	CULMV “P. Batini” (Labor Pool)	Former dockworker/Union member	7th April 2016
	15	Port of Genoa	Retired worker/former Consul	16th March 2016
	16	Port of Genoa	Permanent Dockworker	19th February 2016
	17	CAP (Consorzio Autonomo del Porto)	Former employee	15th March 2016
	18	Port Authority	Planning office manager	4th April 2016
	19	Port Authority	General Secretary	4th April 2016
	20	Port Authority	Official	4th April 2016
	21	UASC Italy	General director	19th April 2016
	22	Terminal SECH	General manager	10th May 2016
	23	Terminal San Giorgio	Managing director	19th April 2016
	24	Voltri Terminal Europe	Head of HR & IR	20th April 2016
	25	Voltri Terminal Europe	Head of operations	29th April 2016
	26	Voltri Terminal Europe	Permanent dockworker	10th May 2016
	27	Voltri Terminal Europe	Responsible for safety	12th May 2016
	28	Port of Genoa	Permanent dockworker	11th June 2016
	29	FILT CGIL	General secretary	12th January 2016
	30	FILT CGIL	Union member	12th January 2016
	31	Chamber of Labor	General secretary	15th March 2016
	32	Intempo agency	General secretary	24th March 2016
	33	Assoporti	President	24th March 2016
	34	Esa Cluster (Shipping Agency)	Shoreside recruitment department director	24th March 2016
	35	Assiterminal	President	20th April 2016
	36	Assiterminal	General secretary	12th June 2016
	37	ANCIP	President	27th April 2016
	38	Intempo agency (Rome)	General director	25th January 2017
	39	Gavio group	HR manager	26th April 2016

City	Interview number	Company/Institution	Role	Date
Antwerp (Belgium)	1	CEPA	Director	6th December 2016
	2	Labor Pool	Dockworker	25th October 2016
	3	Labor Pool	Dockworker	26th October 2016
	4	CEPA	HR manager	11th April 2017
	5	OCHA (Training Centre)	General manager	6th March 2017
	6	VDAB	Official	11th November 2016
	7	ABVV-BTB (Union)	Union leader	16th December 2016
	8	ABVV-BTB (Union)	Secretary	16th December 2016
	9	ABVV-BTB (Union)	Union member – Dockworker	14th February 2017
	10	Port of Antwerp	Dockworker	14th February 2017
	11	Port of Antwerp	Dockworker	14th February 2017
	12	Port of Antwerp	Senior executive	18th May 2017
	13	ACV-Transcom (Union)	Union member - dockworker	20th February 2017
	14	Alfaport VOKA (Chamber of Commerce)	General manager	12th December 2016
	15	Flanders Port Commission	Port commissioner	21st April 2017
	16	MSC Belgium	CEO	7th March 2017
	17	PSA Antwerp	HR manager	9th March 2017
	18	PSA Antwerp	Retired manager	22nd May 2017
	19	Katoen Natie	General manager	6th April 2017
	20	Maersk Line (Copenhagen)	Head of VSA terminal procurement	9th March 2017
Brussels	1	European Commission	Senior expert	8th February 2017
	2	ETF	Union secretary	9th November 2016
	3	FEPORT	President	8th December 2016