The Logistics Labor Market in the Context of Digitalization: Trends, Issues and Perspectives

Andrea Bottalico

Abstract This chapter aims to provide a general picture of the current transformations in the logistics labor market in the light of digitalization and automation processes, affecting working conditions, job profiles, training systems, and skills required. The chapter reflects on the implications of labor dynamics along the maritime-logistics chain, and on a reconfiguration of the human resource management in the future, due to the ongoing structural changes and dynamics that suggest the brink of a new technological leap in the capitalist system. The digital transition related to the ongoing crisis with the social and employment consequences deriving from the technological change in the production system, could speed up the changing processes related to digitalization and automation on the logistics labor market. In light of these new scenarios, this chapter seeks to outline an explanatory framework for analyzing the logistics labor market in the context of digitalization, with its peculiarities, challenges and trends.

Keywords Logistics labor market · Digitalization · Automation · Port labor

1 Introduction

Logistics, intended as a management strategy of optimized flows, has now established itself as one of the strategic aspects of corporate businesses, introducing a new paradigm in the business economy. The organizational and transport complexity of a supply chain is directly proportional to the increasing structuring of the firms in “networks” and the fragmentation of global value chains. As Veltz [15] reiterated, the modern economy generates more and more synchronization needs, which adapt to the general trend of reduction of production time cycles. In a historical era marked by humanitarian crises, relative intensifications of migration flows and pandemics, the transport of goods presents itself as one of the fundamental sectors for the global economy. On the other hand, the health emergency resulting from the spread of
Covid-19 has increased the awareness that, in a context of global value chains and strong interdependencies between economies, a shock that hits one of the links in the chain is enough for a systemic impact. Once the emergency is over, according to some observers, the de-globalization process will accelerate [1]. Firms will consider most likely the lessons learned about the potential breakdown and disruptions of global supply chains due to these shocks, and will reflect, on a reconfiguration of the business models adopted so far. However, if some observers affirm, on the one hand, the fragility of global value chains and the trend of de-globalization, on the other hand, they will foresee a growth in the logistics sector (despite the slowdown in international trade), freight forwarders and couriers (for the growing home delivery request). All these dynamics suggest that we are on the brink of a new technological leap in the capitalist system, and that the digital transition related to the ongoing crisis, with the social and employment consequences deriving from the technological change in the production system, could even speed up these structural processes. The impact of these ongoing dynamics on the logistics labor market in the context of digitalization remains a field to be explored [5, 7].

Furthermore, in recent years, many changes occurred along the logistics transport chain. The expansion of the shipping companies towards the port services market and the inland logistics market (transport, shipping and logistics platforms), for instance, is boosting the competition along the whole of the logistics network. To understand the new challenges of the digitalization related to the logistics labor market, it is necessary to consider its totality. In light of these new and unprecedented scenarios, this chapter seeks to outline an explanatory framework for analyzing the logistics labor market on the basis of the research conducted so far and some recent studies. In the next section, key concepts necessary to understand the perimeter of the analysis will be defined, followed by a set of studies that focus the attention on labor regimes along the maritime-logistics chain, and a final section which, in the wake of this analytical approach, will focus on the variety of labor regimes in the logistics system of freight transport in Italy, with its peculiarities, challenges and trends.

2 The Logistics Labor Market

The professional profiles that we find in the logistics labor market depend in part on the boundaries that are established to delimit it. Dock workers, porters, seafarers, road haulers, airport workers, train drivers, but also couriers, riders or drivers involved in the last mile of urban logistics—all these profiles operate within that complex panorama that we call logistics, with different contractual and working conditions from each other. Some of these profiles pertain to the transport of goods by land, sea or river, air or rail; others concern the movement and handling of goods in warehouses or distribution centers, in port or airport terminals, or in intermodal railway terminals. To these professional profiles we might add the increase of technical staff, the middle managers (white-collars), the IT specialists of the companies and freight forwarders, the logistics operators on behalf of third parties (3PL). As can be imagined, the
profiles are heterogeneous as are the skills (high or low), the composition of the workforce, the work environments, the employment conditions and the forms of representation.

Along with that, the scientific literature acknowledges that the future innovations in logistics and supply chain management are driven by technological, regional, economic and social changes. The logistics and transportation industry has become a knowledge-intensive service industry, similar to other sectors such as banking, insurance, and engineering [10]. The digital transformation has reconfigured both businesses and personal lives in recent decades, with an unprecedented growth in the production and usage of data.

Moreover, the technological innovation introduced in the organization of labor, as well as the automation processes, represent a sensitive issue for social partners. Automation processes, for instance, produced unavoidably a contraction of the number of dockworkers in the port industry. Since the 1960s, European ports have experienced a contraction or stagnation of workforce. Technological innovation, increased containerization, intermodal transport, and the integration of container terminals in global supply chains are just some of the elements that have characterized this process of transformation along the maritime-logistics chain [13]. With the advancement of automation, the organizational structures, the professional and social status of the dock labor have deeply changed: less respected as a very heavy job and less attractive among young people. These dynamics are changing the nature of jobs. The question of professional skills in this segment of the logistics chain is relevant. The main issue is the erosion of jobs caused by the automation processes. Some professions may gradually lose importance, but it seems that job loss is not the most relevant problem. If some professions become obsolete due to the introduction of new technologies, other professions will be created and these will at least partially compensate for the loss of jobs. Along this line, trade unions in Italy speak about the individual right to digital literacy and the adjustment of skills.

To estimate the consistency of logistics occupations in all economic sectors, some studies uses the Ateco Istat sub-sector of “logistics as a service” as a reference. An element to consider at the outset therefore concerns the definition of “logistics”. According to the Italian Logistics and Supply Chain Management Association (AILOG), the term defines the set of organizational, managerial and strategic activities that govern the flow of materials and related information in the company from the origins to the suppliers up to the delivery of finished products to customers and post-sale service. This definition suggests that talking about logistics in general is not correct, because there are as many logistics sectors as productive sectors. The automotive logistics will be different, for instance, from the pharmaceutical logistics, and so on.

Zijm et al. stress that there exist different definitions for supply chains, logistics and their operations. Considering the definitions provided by the American Council for Supply Chain Management Professionals (CSCMP), the authors emphasize that logistics to the transportation and storage of materials, parts and products in a supply chain. Logistics therefore includes inbound and outbound processes to and from
warehouses, as well as internal and external materials handling, and transport operations. It also includes the execution of services and the transfer of information between the various stages of a supply chain [9].

Another relevant difference to consider is that between logistics intended as a value production tool (as in the German case) and logistics understood as a cost, as is the case in the Italian production system, characterized by small and medium-sized enterprises operating on international markets, that typically outsource this service to third parties (the so-called “Ex Works”, [3]). This model has significant consequences not only on the logistics labor market. From such a productive model, which relegates the logistics activity and its labor to a mere cost to be cut, emerges the recourse, above all in warehouses and logistics platforms, to a contracting and subcontracting mechanism that leverages on the peculiar Italian cooperative system for the recruitment of cheap labor, in addition to the violations of the contractual conditions.

3 Labor Along the Maritime Logistics Chain of Freight Transport

A relevant approach to observing the logistics labor market is that which considers the entire port-logistics cluster to observe the variety of the working regimes that constitute it. The assumption behind this approach concerns the paradigm shift that occurred with the logistics revolution [4]. Notteboom and Rodrigue [12] underline the process of decentralized distribution within regional networks, in which the efficiency derives from the high levels of integration with the internal transport distribution systems. Studies on port spaces have also undergone an epistemological change in the conceptualization of the port, from a single fixed spatial entity to a network of terminals operating on different scales. The scientific literature has focused its attention on the development of maritime networks and hinterlands, thus, glancing at the entire supply chain in the context of globalization and the dissolution of these spaces, which remain territorially embedded on the one hand, and on the other hand, are deterrotorialized through the regionalization process [6].

Furthermore, in recent years, the huge growth of the main shipping companies, gathered in the three alliances that today control the international movement of goods, is gradually expanding towards the port services market, but also of that traditionally carried out by shipping agencies, with further forays into the inland logistics market (transport, shipping and logistics platforms). The main effect of this trend is a competition that takes place along the whole of the logistics chain, generally formed by the maritime activities, the handling of goods in the port space and the transport services in the hinterland [11]. The strategy of the main players in the concentration processes does not seem to be limited to the maritime fraction of the logistics chains, but aims to achieve control of the entire chain in order to exploit
the economies of scale generated by the optimization of operations, but also by the reduction of intermediation times and costs.

These three legs (maritime activities, handling of goods in the port space and transport services in the hinterland) are more and more integrated, whereas ports represent the central and essential link of the logistics chain. For this reason mainly, in recent decades ports have experienced a paradigm shift. They have been integrated as links into broader supply chains and global production networks, representing pivotal links within maritime supply chains and global production networks, while also being embedded within specific, path-dependent, spatial and institutional frameworks. The competitiveness of global production networks is mainly determined by the performance of the highly dynamic logistics networks as they link production, distribution and consumption [8]. To understand the new challenges of the logistics labor market in light of the digital transformation, hence, to understand it is necessary to consider the totality of the logistics chain [9, 14].

4 The Structure of the Maritime-Logistics Chain

Mersmaan et al. [11] tried to represent the main features of a maritime-logistics chain in order to understand the new challenges of the overall sector. First, the maritime-logistics chain is a network and the main actors are the cargo owners, the shipping companies, and intermediaries such as agents and forwarders. The terminal operating companies into the ports will depend on the decisions made by those three parties, but the shipping companies are the lead firms in this network and in the port area. It is precisely through the cargo flow along this chain that the value is produced and the competition takes place.

The dotted lines in Fig. 1 indicate alternatives to direct paths that could be undertaken, involving one or more intermediaries. The owner of the goods or shipper chooses a shipping company with or without the mediation of a forwarder, as shown in bold lines. In the reverse case, marked with non-bold lines, the receiver of the goods makes that choice. In turn, the shipping company will opt for a specific route and then for a port of call, either in collaboration with the shipper or independently of them. On arrival at the port, with or without an agent’s mediation, the shipping company chooses a terminal operator. The final stretch of the route requires the choice of a logistics operator and of intermodal transport in the hinterland. This decision might be made by the shipper (in bold), the receiver of the goods (not in bold), or the shipping company. Distribution centers (in dotted boxes) can be used in the land stretch. The main issue is to organize this complex context so that market forces can ensure the flow of unhindered goods through the logistics chain in the most efficient way.

In the last years, the shipping companies have focused attention on terminal operators and hinterland transport services. Their strategic alliances and ownerships (partly or entirely) of terminal operating companies is a rather widespread phenomenon. In the European Le Havre—Hamburg Range (called Northern range),
Fig. 1 Structure of the maritime-logistics chain [11]
for example, where the most efficient ports in Europe are located, the main players are global terminal operators and market-leading shipping companies, which cooperate in most cases. Seven main terminal operators are located in twenty terminals of which one (the subsidiary APM Terminals) is directly owned by a shipping company (Maersk). In thirteen of the twenty terminals there is a form of cooperation with a shipping company (vertical integration or joint ventures), while the other terminals are “independent” (Table 1).

Taking into consideration, for example, the 2 M alliance (Maersk and MSC) it is possible to assess the effort of each of the two partners in the conquest of spaces within the port arena. APM Terminals (APMT), until 2017, was present in 69 countries with terminals located in 73 ports and 140 hinterland transport services. Being owned by the shipping company A.P. Moller Maersk, APMT is vertically integrated. In addition, Maersk line also offers forwarding and supply chain management services through its Damco company. In this way, Maersk Line is present in the entire supply chain. Terminal Investment Limited Sàrl (TIL) is the second terminal operating company owned by a shipping company (MSC) and active in Northern Europe. TIL is a terminal operator founded in 2000 to guarantee mooring and capacity for ships of the MSC shipping company. The group manages and operates 36 terminals in 24 countries, most of them in joint ventures with other terminal operators (situation in 2017).

Nevertheless, the compatibility between national regulations and neoliberal policies and regulations at European level has been a strong influence on port services and in particular on the variety of port labor systems and schemes. The aim of European institutions in recent years has been to liberalize port services, including port labor, according to the principles of the European Treaty on freedom of establishment and freedom to provide services (Article 49 of the TFEU, Treaty on the Functioning of the European Union). On the other hand, national port labor systems and schemes in Europe, in addition to other variables, very often tend in the opposite direction. In 2016, for instance, a port labor reform took place in Belgium after the infringement procedure sent by the European Union to the Belgian government, concerning the incompatibility of the port labor system with the principles of the Treaty. The same process took place in Spain in 2017 and in Italy before the port reform in 1994. The infringement procedure in Belgium started from the complaints sent to the European Commission by a multinational cargo handling company, which is involved mainly in logistics activities in the port of Antwerp (one of the most efficient ports worldwide in terms of productivity, throughput, etc.), and by several interim agencies. After months of talks, the social partners proposed a process of port reform to the European Commission to be implemented in the coming years. The solution proposed by the Belgian government was positively assessed by the Commission in May 2017 and the infringement procedure was withdrawn, which concerns the “freedom of establishment”. Although the port of Antwerp is mostly carried out by multinational companies locally situated, the infringement procedure sent by the European Commission to the Belgian government concerning the organization of port labor is derived from the incompatibility between the national law and the article 49 TFUE, concerning the “freedom of establishment”.

### Table 1  Cooperation among terminal operators and shipping lines (Northern range, 2017)

| Terminal operator | Name of terminal | Location       | Cooperation with shipping line |
|-------------------|------------------|----------------|--------------------------------|
| Eurogate          | Container terminal Hamburg | Hamburg |                                  |
| Eurogate          | CTB (container terminal Bremerhaven) | Bremerhaven |                              |
| Eurogate          | NTB (North sea terminal Bremerhaven) | Bremerhaven | Maersk                          |
| Eurogate          | MSC gate         | Bremerhaven   | MSC                            |
| Eurogate          | CTW              | Wilhelmshaven | Maersk                          |
| PSA               | Noordzeeterminal | Antwerpen     |                                |
| PSA               | Europaterminal   | Antwerpen     |                                |
| PSA               | MPET             | Antwerpen     | MSC                            |
| DP World          | Antwerp gateway  | Antwerpen     | Cosco pacific, CMA CGM, ZIM   |
| DP World          | RWG (Rotterdam world gateway) | Rotterdam | APL, MOL, HMM, CMA CGM         |
| DP World (GMP)    | Terminal de France | Le Havre   | CMA CGM                        |
| Terminaux de Normandie (TN) | TNMSC      | Le Havre     | MSC                            |
| Terminaux de Normandie (TN) | TPO          | Le Havre     |                                |
| HHLA              | CTA (Container terminal Altenwerder) | Hamburg | Hapag-Lloyd                   |
| HHLA              | CTB (Container terminal Burchardkai) | Hamburg |                                |
| HHLA              | CTT (Container terminal Tollorort) | Hamburg |                                |
| Hutchinson Ports  | ECT Delta terminal Rotterdam | Rotterdam | MSC                            |
| Hutchinson Ports  | ECT Euromax terminal Rotterdam | Rotterdam | Cosco Pacific                  |
| APM               | APM Terminals Rotterdam | Rotterdam | Maersk                          |
| APM               | APM Terminals Maasvlakte II | Rotterdam | Maersk                          |

One of the common peculiarities of port labor deals with the uncertain dynamism of the maritime traffic. Dock work depends on the relentless and unpredictable rhythm of the goods. The management and the governance of port labor are particularly important with regard to the application of the basic rules of the European Treaty. The organization of dock labor schemes is in fact regulated and mostly subject to Treaty rules on competition at European level. The application of these principles to
port labor systems is one of the key debates in the port sector. The debate between social partners at European level refers to the forms of “protection” of the external pressures to which port labor is subject and the “restrictions” to the free market.

5 Value Creation and Employment in the Logistics Transport Chain

Although various types of goods are handled in a universal port, the container—the management, storage and transport unit—represents the most important “commodity” in statistics due to the added value it creates, the economies of scale it produces, the supply chain and the multiplicity of professional figures that it involves from origin to destination. In this regard, a study conducted by Blomme [2] tries to answer the question of what the economic contribution of the different sub-sectors in the port area of Antwerp is. To answer the research question, according to Blomme it is necessary to calculate the added value created by the ports taking into consideration the intermodal structure of the maritime-logistics chain. From this perspective, it is possible to identify the main activities and the added value that they create along the entire transport chain, consisting of docking operations, goods handling activities in the port and transport operations in the hinterland. All these activities along the maritime-logistics chain generate, to a greater or lesser extent, added value and are closely interconnected with each other.

In this perspective, the different components of docking in port and port handling activities are considered, plus the added value created by shipping agents, forwarders and shippers, and finally the added value associated with the transport of goods in the hinterland. The added value of the entire transport chain relating to ports is far greater than the only added value of the port handling activity at the terminals. Another interesting aspect is the observation of activities with little or high added value and employment. Logistics-related services, for example, create greater employment and high added value. Also the context of industrial relations should be considered in this context. In the Belgian case, for instance, 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 joint committees. Belgium’s trade union membership rate is among the world’s highest and it is fruitful in terms of the conclusion of agreements.
6 Port Labor, Railway Work and Intermodal Transport in Italy Between Digital Transitions and Organizational Changes

In the wake of this approach, if we look at the absolute numbers of the Italian freight transport logistics system (Table 2), port labor and railway work are residual within the logistics chain, both for employees and for wealth generated. Beyond the economic value generated, port labor and railway work, however, have a strategic value within the logistics chain because they cover two obligatory passages, the first linked to the transfer of goods (port) from land to sea, the second tied to the economic and environmental sustainability of the traffic increases caused by the growth of the tonnage of ships (intermodality sea-rail).

All this requires advanced skills, professional training and specializations, both in port and in the exchange and forwarding on the rail carrier, in particular in light of the digital transition and the quick upgrading of the skills required. However, some recent phenomena are questioning these profiles. On the one hand, driven processes of robotization and digitalization of the port cycles reduce the human contribution and increase the need of qualified personnel, due to improved technology interaction. On the other hand, the progressive horizontal integration between the main shipping companies worldwide and vertical integration between the latter and the most important terminal operating companies have contributed to redesigning the port business by redefining roles and competences of each actor involved. The increase in the size of the ships has resulted, for example, in addition to a reduction in the number of ports of call, in a greater concentration of the employment. The consolidation of a small number of alliances of the main global shipping companies, moreover, leads to an increase in traffic peaks and intermittent labor demand within ports. In light of the robotization processes, the technological innovations and market integration, rather than excluding labor due to an increase in automation, the most acute risk that must be faced in the future concerns the potential trivialization of human action and its marginalization. Along this line, the digital transition in the logistics labor market shows the key role of professional training due to the new job

| Table 2  | Ranking of logistics jobs (2019) |
|----------|----------------------------------|
|          | Value added (Millions of €) | Employees |
| Port logistics, auxiliary activities and maritime transports | 2.213 | 27.611 |
| Rail freight transport | 69 | 7.500 |
| Road freight transport | 10.571 | 309.153 |
| Air freight | 40 | 696 |
| Cargo handling | 3.119 | 108.162 |
| Other transport-related activities | 4.015 | 88.043 |
| Postal services and courier activities | 7.625 | 161.240 |
profiles and competencies required. Whereas in the past many blue collar jobs in logistics required a basic school education and rudimentary qualification levels, it is clear that these jobs now require increased competences. The same is true for white collar jobs in logistics [10]. The market for freight transport, logistics and shipping services is impressive from the point of view of the activities developed, but not very effective from that of the economic results obtained. Organizational models and poorly advanced technological systems limit the performance of companies in the sector characterized by irregular and poorly transparent forms of labor that fuel pulverization and depress the sector’s ability to create value from service activities.

The port segment of the maritime-logistics sector has seen worldwide shrinking of the workforce. In Italy, between 1983 and 2001, over 20,000 workers of who were then called “Compagnie Portuali” left work through early retirement measures. The workforce within the Italian ports has changed to the point that today the average age of workers in ports has significantly decreased. The interesting fact is that from 1983 onwards the labor force in ports first contracted, to then reacquire the consistency of the past years. The main change occurred therefore in the organization of work, but not only. Other changes relied on the professional profiles, the new skills and the training required, the increasing flexibility due to the labor peaks, etc. In few words: less muscles, more brain. Most likely, the future of port labor will see more technicians specialized in new automated systems.

The reconversion of the workers employed in the Italian ports did not serve as much to reduce the staff as to articulate the distribution of the latter differently between employees directly employed by the terminal operating companies and those employed to port activities with the intermediation of the port labor pools in place with the Italian port system. This is an important change that is measured by the new rhythms of the transport service and by the reduction of the time available for loading and unloading goods. The costs of managing the ship, both in navigation and in port, have significantly increased, as has the economic value of the damage suffered by goods. The technological innovation has changed the quality and intensity of work in ports, but has not eliminated, let alone reduced to the bone, the need for specialized workers to handle goods from the ship to the shore and vice versa.

In general terms, fields of automation include the maritime segment (unmanned ships), nautical services, cargo information systems, as well as operational automation at port level and supply chain level, with impacts on work and organization. Automation refers to the application of “automatic control”, the use of programmable logic controllers (PLC) in machinery, like the automated stacking cranes. It is acknowledged that automation reduces human intervention but not necessarily employment, and that it is a very slow, gradual process. Digitalization is also an important factor in this field. In general, the purpose of automation is to achieve higher throughput or productivity, fewer direct human labor costs and expenses, higher quality or increased predictability of quality, improved robustness of processes or products, a higher degree of accuracy, replacement of operators in tasks that involve hard physical or monotonous work, replacement of workers in tasks done in dangerous environments, etc. The risks of automation concern the reduction of operational flexibility, the reduction of financial flexibility (fixed costs), high initial
costs, security and vulnerability. In addition, some tasks cannot be automated, or only at high costs. The risk of operational control produces further the automation paradox: the more efficient the automated system, the more crucial the human contribution of the operators. Humans are less involved, but their involvement becomes more critical.

According to the trade unions at European level, the potential impact on dock-workers depends on the terminal concept (greenfield/expansion/brownfield), increase of volumes and terminal capacity in relevant ranges, current job structure and collective labor agreements, job content and working conditions. However, the job and qualification structures are affected. Automation has an impact on dock labors in terms of skills and job losses, producing a shift from direct to indirect jobs. Health risks may change (also improve), as well as the flexibility, which may increase (more peaks, tight schedules, etc.). The impact on total employment in the next decades is uncertain, while the impact on unskilled/lower skilled workers is expected to be high.

In the case of the port of Antwerp, ICT introduction and automation will boost a polarized labor market, where a lot of middle-paid paperwork jobs will disappear, jobs on the floor will be more and more supported by robotics and data applications, and management jobs will become more and more complex. These major changes are strictly related to training programmes that must include new skills like ICT, soft skills like teamwork and communication, and inclusion of females and non-natives in the port labor market. At terminals, in particular for containers, automation goes slower, but especially ICT introduction leads to the need for more ICT competences. In the non-maritime cluster, digitalization and data sharing will become key issues [7].

7 Conclusions

This chapter aimed at exploring the main trends, challenges, issues and perspectives of the logistics labor market in light of digitalization and the new scenarios, in particular by looking at the port segment of the logistics chain. As we have seen, the technological innovation introduced in the organization of labor, as well as the automation processes, have an impact on the logistics labor market in terms of working conditions, new job profiles and skills, qualifications, number of employees, etc. Port labor and railway work have a strategic value within the logistics chain, but they require advanced skills, in particular in light of the digital transition and the automation processes.

Moreover, digitalization in the logistics labor market shows the relevant role of training systems in the present in order to upgrade the human resource pool involved in the logistics sector [16].

The potential impact on the overall logistics labor market should be considered also with respect to the ongoing crisis produced by the health emergency resulting
from the spread of Covid-19, which will speed up a set of digital and automated solutions affecting the job and qualification structures, total employment, professional profiles and skills required, etc.

The analysis of the logistics labor market must take into account the conditions that the intermodal transport has produced over the years. From the industrial districts, which have been the subject of numerous studies and research in the past, greater attention to the logistics districts, transport infrastructures and both digital and material platforms is suitable. These are the workplaces where loading units are transported, opened, emptied (“stuffed and stripped”), refilled and forwarded; where added value and employment are produced. In these places numerous conflicts and tensions have exploded in recent years from which the strategic position of the logistics workers emerges. In this perspective, logistics represents a capillary network, like the arteries of a human body which, as stated by a union leader during an interview, “is the blood that flows in the veins of global capitalism”. If we want to have an overall picture of the impact of digitalization on the logistics labor market in light of the ongoing socio-economic changes, an analytical approach capable of observing the logistics chain of freight transport as a whole will be appropriate in order to provide a clear image of the heterogeneous, fragmented and changing occupational panorama that characterizes it.

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Andrea Bottalico is a research fellow at the University of Milan and adjunct professor in organizational sociology at the University of Bergamo. He obtained his Ph.D. in economic sociology and labor studies from the University of Milan. He was a visiting student at the University of Antwerp, Department of Transport and Regional Economics, and C-MAT (Centre of Maritime and Air Transport Management). His research focuses on port logistics, labor relations and employment conditions.