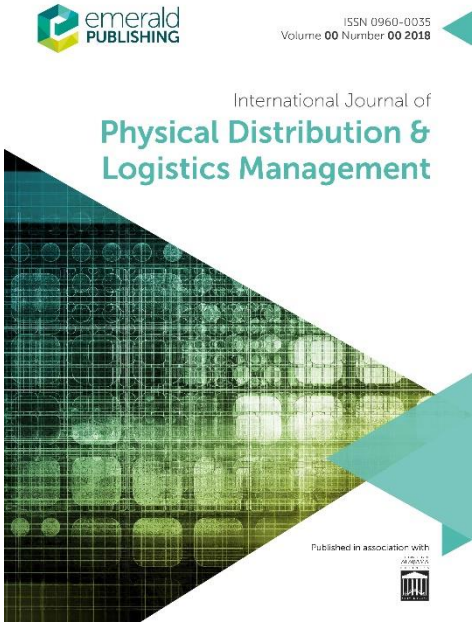
Towards decent work in the era of Logistics 4.0

Introduction



Social sustainability holds an important position in logistics management, emphasizing the fulfillment of responsibilities pertaining to human rights, employment, equality, poverty, education, health, and safety (Alghababsheh and Gallear, 2022). In the logistics industry, which encompasses the management of goods, services, and information flow, the pursuit of social sustainability goals involves the effective management of logistics activities to generate positive impacts on employees, customers, and society at large (Fernandes et al., 2023). Among the various social sustainability concerns, decent work is a critical aspect that requires meticulous attention. Decent work, as articulated by the International Labor Organization, encompasses "*opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men."* It aligns with the United Nations' Sustainable Development Goal 8, titled "Decent Work and Economic Growth," which underscores the significance of ensuring fair employment practices and fostering economic development. This strategic alignment emphasizes the integral role of decent work in achieving broader sustainable development objectives.

In the logistics sector, ensuring decent work for logistics workers remains an ongoing challenge. For example, a particularly vulnerable segment of the workforce is seafarers in the maritime logistics sector. They operate in a predominantly male industry where approximately 98% of seafarers are male, highlighting significant gender equality concerns, including issues related to sexual harassment (Mellbye and Carter, 2017). The nature of their work, often away from shore, exposes seafarers to confined and isolated working conditions, making them susceptible to well-being issues (Andrei et al., 2020). Further exacerbating their well-being are disparities in payment equality, insufficient insurance coverage, and limited access to medical services, especially mental health assistance (Kyaw and Geater, 2021). While the Maritime Labor Convention 2006 defines basic standards for seafarers' physiological and safety protection, the existing legislation has not considered the impact of technological change and is inadequate to address issues regarding seafarers' human rights (Exarchopoulos et al., 2018).

Shifting the focus to freight logistics, the trucking industry also exhibits a male-dominated landscape. Scott and Davis-Sramek (2023) discovered that women drivers are underrepresented in private carrier, local, and less-than-truckload jobs. Truck drivers may experience burnout and stress, underscoring the importance of offering health-related support, garnering respect from

various stakeholders, and addressing the implications of government regulations (Williams Jr et al., 2017). A thorough examination of the legal aspects surrounding trucking operations is essential for addressing issues such as working hours, rest breaks, and driver safety protocols. The diverse forms of individuals participating in the logistics work summarized by Wang and Yuen (2023) shed light on the complexities surrounding the decent work in the logistics sector. Various stakeholders, including industry associations, advocacy groups, and policymakers, should continuously advocate for changes to existing regulations to better align with the evolving needs of logistics workers.

Despite persistent social issues yet to be fully addressed, the logistics industry is currently undergoing transformative shifts driven by the fourth industrial revolution, transitioning into the era of Logistics 4.0. Logistics 4.0 can be defined as "*the logistical system that enables the sustainable satisfaction of individualized customer demands without an increase in costs and supports this development in industry and trade using digital technologies";* it underscores the pivotal role of humans, particularly employees whose work will be both influenced and supported by advanced technologies (Winkelhaus and Grosse, 2020).

Characterized by automation, artificial intelligence, robotics, and digitalization, Logistics 4.0 has introduced various innovations in the logistics sector, including autonomous shipping, autonomous ports, delivery drones, delivery robots, autonomous trucks, augmented reality, and the Internet of Things. In this era, logistics companies are compelled to adapt to ongoing transformations propelled by automation technologies to enhance social sustainability performance (Sun et al., 2021). In this context, this special issue aims to (1) enhance awareness and understanding among logistics management researchers regarding the significance of decent work amidst the advancements of Logistics 4.0 technologies, (2) conduct a comprehensive review to identify critical challenges and research gaps pertaining to ensuring decent work for logistics workers (3) provide strategies, interventions, and approaches that prioritize the humanization of work and tackle issues related to decent work within the logistics and its evolving technological landscape. We identify several areas that warrant further investigation by logistics researchers.

Logistics worker employment security and transition in logistics 4.0: The emergence of Logistics 4.0 technologies contributes to increased efficiency; however, they also pose potential challenges, such as job displacement, thereby affecting the income and employment security of those working in the logistics sector. Bessen (2019) found that the impact of automation on employment varies across sectors due to different elasticities in demands. Sectors within the logistics industry, such as warehousing, last-mile delivery, shipping, and ports, are particularly susceptible to concerns related to unemployment. The deployment of automation technologies such as autonomous shipping could potentially displace numerous job opportunities for logistics workers. On the other hand, the automation process is associated with emerging job opportunities associated with remote-control centers and infrastructure construction (Li and Yuen, 2024). However, this topic is under-researched in the existing literature. Research is conducted in a limited context, especially in developed economies such as Korea (Jo and D'agostini (2020)) or the US (Wang et al. (2023)). Due to socio-cultural differences, there is a need for demand and supply analysis in more contexts. In addition, there is a need for policy discussion regarding employment retention and transition, which centers on the basic rights of logistics workers. We advocate for the development of policy

and education frameworks with a theoretical foundation and empirical evidence to support employment transition and retention. Potential research questions in this area include:

- What are the mechanisms through which Logistics 4.0 technologies contribute to both job displacement and the creation of automation-complementary job opportunities within the logistics industry?
- How do logistics workers perceive and respond to the potential threats of job displacement posed by the adoption of Logistics 4.0 technologies?
- How does technology adoption theoretically impact job satisfaction and retention?
- What are the socio-cultural factors influencing the demand and supply dynamics of logistics workers?
- What are the policy interventions and regulatory frameworks needed to support logistics workers in transitioning to new roles and retaining employment security amidst technological disruptions in the logistics sector workers in different contexts?
- How can education and training programs be tailored to equip logistics workers with the skills necessary to thrive in a technologically advanced logistics environment, and how effective are these programs in facilitating employment transition

Labor Representativeness in Logistics 4.0: The representation of logistics workers is a pivotal concern within the discourse of decent work. Critiques of the maritime logistics industry highlight its hierarchical management structure, blame culture, lack of value attributed to seafarers' perspectives, emphasis on compliance over collaboration, and a tendency towards decoupling (Zhao et al., 2020, Xue et al., 2017). While there have been some discussions on empowering maritime workers (e.g.,Abila et al. (2023); Reinecke and Donaghey (2021)), an empowerment lens alone is insufficient within a supply chain driven by workers, advocating instead for democratic worker participation. Existing literature predominantly focuses on compliance with standards in traditional shipping contexts, overlooking the potential impacts of Logistics 4.0 technologies and the voice of logistics workers.

The integration of Logistics 4.0 technologies could significantly alter the landscape of worker representation. For instance, the increasing level of automation in maritime logistics could diminish the authority traditionally held by onboard officers, redistributing decision-making power and potentially influencing seafarers' sense of agency and contractual relationships (Li and Yuen, 2024). To promote logistics workers' representativeness, Das and Arya (2023) stress the necessity of regulatory frameworks such as the Maritime Labour Convention and the United Nations Convention on the Law of the Sea in the context of autonomous shipping. However, the provisions of regulations should be considered not only for their effectiveness and compliance but also from the perspective of worker participation. There is a pressing need for further research into the impact of technology adoption on representative structures and the development of frameworks promoting the democratic participation of logistics workers in codes of conduct.

In advancing these discussions, it is imperative to encourage submissions that explore the evolving employment relationships and worker voices brought about by Logistics 4.0 technologies. Adopting a worker-centered approach rooted in industrial democracy can foster meaningful participation among logistics workers. Potential research questions include:

- How does the integration of Logistics 4.0 technology impact communication channels, decision-making processes, and employee roles?
- How does the emergence of gig economy platforms and flexible employment arrangements impact the fair representativeness of logistics workers?
- What are the potential social and economic implications of automation-induced changes in employment relationships within the logistics industry?
- What are the barriers and facilitators to promoting the democratic participation of logistics workers in the adoption of Logistics 4.0 technologies?
- To what extent does the integration of Logistics 4.0 technologies in the logistics sector impact the distribution of decision-making power among workers and management,
- How can theoretical models of industrial democracy be applied to analyze and improve worker participation and representation?

Logistics worker health and safety in logistics 4.0: Automation within the logistics industry has the potential to replace repetitive operational tasks, such as the movement of heavy goods, thereby alleviating the physical burden and operational risks on logistics workers (Gutelius and Theodore, 2019). Despite its potential benefits, the evolving technological landscape in logistics raises concerns about health and safety risks associated with these new work conditions, particularly evident in the maritime industry's adoption of autonomous shipping. Traditionally, seafarers working at sea are exposed to adverse physical environments, including noise and chemicals, which can negatively impact their well-being. The introduction of autonomous shipping would lead to a shift to remote control centers ashore, operating as a socio-technical system involving interactions with both co-workers and automated systems. While this offers protection from sea environments, the technology-supported working environment can still pose challenges for maritime logistics workers (Li and Yuen, 2024).

Existing research on maritime logistics workers' health has primarily focused on specific aspects such as chronic diseases, stress, and fatigue (Li et al., 2022). However, the digitalized and automated working context calls for attention to under-researched issues such as automated bias, mental fatigue, and cognitive and psychological health. Additionally, much of the existing research is limited to descriptive or case studies, providing knowledge on workers' current health conditions but lacking in establishing causality, making it challenging to draw conclusions about the relationships between maritime health factors.

Regarding safety research, while researchers have identified some barriers to safety performance in the context of autonomous shipping, such as human factors in information processing, decision-making, and action phases (Ramos et al., 2020, Zhang et al., 2020), there is a need for a deeper understanding of the fundamental mechanisms influencing the dynamic decision-making processes of logistics workers. Moreover, there is a call for more high-quality intervention research in logistics workers' occupational health and safety. Potential research questions in this area include:

- What are the specific risks and benefits associated with technological adaptations?
- How do advancements in automation affect the ergonomics of logistics workstations?
- How can smooth human-computer interaction be promoted in the logistics industry?

- What factors impact logistics workers' safety performance in a technology-supported working environment?
- What is the psychosocial impact of technology adoption in Logistics 4.0 on the mental health and well-being of logistics workers?
- What are specific stressors associated with the changing work environment?
- What are the antecedents of logistics workers' mental health issues in the interaction with technologies?
- How can we enhance logistics workers' resilience in the event of technological failures or disruptions in Logistics 4.0 systems?
- What factors influence logistics workers' safety performance, and how can logistics workers be effectively protected?

We also recommend reviewing the work by Hasle and Vang (2021), which advocates for the design of sustainable interventions integrating health outcomes and productivity.

Logistics workers' equality: The pursuit of equality stands as a pivotal objective for sustainable development. Traditionally, sectors within the logistics industry, such as trucking and maritime activities, have been characterized by male dominance. Existing frameworks have primarily focused on investigating barriers to gender equality, by identifying factors through case studies (Zhao et al., 2017) or literature reviews (Kitada, 2021), including social, psychological, and regulatory factors.

While these factors are valuable, the implementation of Logistics 4.0 technologies raises questions about potential changes in working conditions and policies. Automation, as discussed by Roberts et al. (2019), could lead to structural shifts, higher wages for women, and more flexible working hours. Narayanan et al. (2023) emphasize the need for a level playing field and equal access to technology education for marginalized workers such as female seafarers. Along with an understanding of the changes, sustainable strategies to promote equality in the logistics industry are equally important. The role of regulations and laws has been acknowledged (e.g., Kitada (2019)), which aims to facilitate the implementation of international laws and policies at a national level. However, current research primarily focuses on examining the effectiveness of policy implementations. A perspective on how to formulate worker-beneficial codes of conduct is necessary (Reinecke and Donaghey, 2021).

Furthermore, it is imperative to acknowledge and understand demographic differences to enhance overall productivity. Gligor et al. (2022) suggest that women and men workers approach logistics innovations in distinct ways. However, nuanced research on demographic-specific approaches to logistics innovations is insufficient. By tailoring strategies to capitalize on the strengths and preferences of both male and female workers, organizations can enhance productivity. Potential research questions in this area include:

- How does the implementation of automation and artificial intelligence in logistics 4.0 influence the distribution of gendered job roles within the logistics workforce?
- How do demographic disparities impact the adoption of advanced technologies and skills in Logistics 4.0 among workers?

- To what extent does the organizational culture in logistics 4.0 companies contribute to or hinder gender equality in the workplace?
- What are the perceptions of gender equality among logistics workers in the era of Logistics 4.0?
- How factors such as race, ethnicity, socioeconomic status, and disability intersect with gender to shape individuals' experiences in logistics and transportation industries.

While the maritime logistics industry is taken as an example in this proposal, we welcome submissions that research different sectors of the logistics industry, such as freight logistics, which would be affected by autonomous vehicles. Inspired by the research of Soundararajan et al. (2021), we welcome submissions that meet the following three criteria:

1) ***Have a focus on logistics workers***: We encourage submissions that prioritize the decent work of logistics workers over economic aims, a common focus in logistics and supply research (Soundararajan et al., 2021). While research on collaboration between maritime stakeholders and actors is valuable, the primary objective should be to address decent work issues of logistics workers. Research can span from examining the behavioral and cognitive aspects of logistics workers (micro level) to exploring worker-centered logistics management implications (meso level) and engaging in policy framework discussions (macro level), offering diverse and practical perspectives.
2) ***Present novel theoretical framework(s)***: In line with the scope of the IJPDLM, we invite contributions that address these research issues empirically while also offering innovative theoretical perspectives and insights. Submissions should transcend mere linear discussions between Logistics 4.0 technologies and logistics workers' decent work. Instead, the research should apply novel theoretical frameworks to explore the synergistic relationships between various elements.
3) ***Use novel context and/or methods:*** Submissions should avoid simply duplicating existing research and instead focus on tailoring their approach to the specific context of Logistics 4.0. We encourage contributions that facilitate a thorough understanding of decent work issues within the framework of Logistics 4.0. We recommend reviewing Soundararajan et al. (2021) and Hasle and Vang (2021) for insights into ethnographic methods, data considerations, and sustainable intervention strategies. Please kindly note that submissions for this call should transcend mere general descriptions of work conditions relative to logistics 4.0 applications or broad speculative inquiries of technology adoption. Similarly, research focused on mathematical modeling, simulation, or multi-criteria decision-making frameworks lies beyond the intended scope of this issue and IJPDLM.

Review process

Manuscripts should comply with the scope, standards, format, and editorial policy of the International Journal of Physical Distribution & Logistics Management. All papers must be submitted through the official IJPDLM submission system with a clear selection indicating that the submission is for this Special Issue. Before submission, authors should carefully read over the Journal's "Author guidelines." Particularly, we advise authors to adhere to the journal's word limits

for initial submissions (10,000 words, which includes all text, the structured abstract, references, all text in tables, and figures and appendices). Additional research materials for the review process can be included as "Supplementary materials." Supplementary materials are not included in the paper word count and, if the paper is published, will be uploaded as a separate Word document along with the paper

Submission proposals

The authors are **highly** encouraged to submit their proposal to guest editors to receive feedback before submission of the full paper. The submitted proposals should be no more than 1,000 words (excluding references, tables, and figures). All proposals should be sent to Dr Kum Fai Yuen at kumfai.yuen@ntu.edu.sg. by **July 30, 2024.**

Key dates

Abstract submissions open: 15th April 2024

Abstract submissions close: 30th July 2024

Full paper submissions open: 1st May 2024

Full paper submissions close: 30th November 2024

Guest editors

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