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INSIGHTS INTO SUSTAINABILITY INTEGRATION AND TOP PRIORITIES FOR GREEN AND DIGITAL TRANSITION IN LOGISTICS

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Abstract

This paper explores the findings from a survey conducted among 615 logistics companies in Slovenia, investigating the priority areas for employee training in the logistics sector. The study focuses on two critical areas: digital skills and the green transition. The goal is to identify the specific skills logistics companies require to adapt to digital transformation and sustainability challenges. The research highlights priority areas of automation, artificial intelligence, circular economy and sustainable energy self-sufficiency to ensure competitiveness in business logistics. Furthermore, the paper emphasises the importance of lifelong learning and upskilling initiatives in bridging existing skills gaps and equipping employees with the necessary tools to meet technological advancements and environmental sustainability goals.

Key words: *green transition, digital skills, logistics priorities, supply chain management.*

1. Introduction

The logistics industry faces unprecedented challenges, with technological advancements and sustainability imperatives reshaping business operations. The evolving demands require a well-trained workforce to manage digital transformation and green practices. Logistics companies must prioritise equipping their employees with digital competencies and green transition skills to stay competitive.

Digital transformation is reshaping the logistics industry. The growing use of automation, artificial intelligence (AI), and robotisation requires employees to develop new competencies that enhance operational efficiency and streamline supply chain activities. According to a recent survey, 72 % of logistics companies have prioritised digitising business processes, and 58 % focus on automation

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(Kemper et al., 2020). This trend emphasises the need for logistics professionals to develop skills in data management, digital workflows, and the application of advanced technologies. As Benton-Short and Merrigan (2016) have shown, sustainability education creates opportunities for interdisciplinary efforts across sectors, which is particularly important in logistics, where environmental issues and digital innovation are interdependent.

However, a significant skills gap exists, particularly among decision-makers who completed their formal education over a decade ago. These individuals may not have had adequate exposure to the latest technological developments, making it difficult to adapt to the rapidly changing logistics landscape. Lifelong learning programs help employees keep up with technological advancements and effectively implement digital tools in their daily operations (Wamsler, 2020). Training in digital competencies must focus on the following (Hofmann & Strietska-Ilina, 2013):

- Data management and analytics: ensuring employees can interpret and act on real-time supply chain data.
- AI and machine learning: developing skills in automation tools to enhance decision-making processes.
- Digital process optimisation: streamlining workflows to improve efficiency and reduce costs.
- These skills and priority focus are critical for competitiveness in an increasingly reliant digital technology industry.

The environmental impact of logistics is significant, with the sector accounting for 24 % of global CO2 emissions, a figure expected to rise to 40 % by 2050 if no substantial changes are made (Glavič, 2006). As a result, green logistics practices are becoming a priority, with 59 % of companies indicating the need to adopt circular economy models and 55 % emphasising sustainable energy solutions (Priyadarshini & Abhilash, 2020). Training in green skills should also focus on eco-friendly practices such as renewable energy adoption, route optimization, collaboration in supply chains, and reverse logistics, which are essential for minimizing waste and reducing emissions (Copperdigital, 2022). Additionally, collaborative efforts between stakeholders within the supply chain can promote shared resources and innovative sustainable solutions (Adecco Group, 2022).

Training programs focused on green logistics should equip employees with the knowledge and skills to implement sustainable practices across the supply chain. This includes (Valderrama-Hernández et al., 2019):

- Circular economy practices: minimising waste and promoting the reuse and recycling of materials.
- Energy efficiency: reducing the carbon footprint of logistics operations by optimising energy use and integrating renewable energy sources.
- Resilience to environmental disruptions: preparing for climate-related challenges and mitigating the risks of natural disasters.

These skills are essential for companies aligning with global sustainability goals, including the European Union's Green Deal, which aims to achieve climate neutrality by 2050 (Valderrama-Hernández et al., 2019). In addition, training in

green skills helps logistics companies reduce their environmental impact and enhance their reputation in an increasingly eco-conscious market (Global Opportunity Forum, 2023).

As the logistics industry continues to evolve, lifelong learning plays a crucial role in ensuring employees can adapt to the demands of both digitalisation and sustainability. According to SDG 4 of the United Nations Sustainable Development Goals (SDGs), education must promote sustainability across industries, and logistics is no exception (United Nations, 2015). Lifelong learning programs ensure that logistics professionals are equipped to manage digital transformation and green logistics efforts (Hofmann & Strietska-Ilina, 2013). These programs must focus on (United Nations, 2015):

- Continuous upskilling: providing employees with ongoing opportunities to learn new technologies and sustainability practices.
- Cross-disciplinary education: encouraging collaboration between digital and sustainability experts to develop integrated solutions for logistics challenges.
- Leadership training: ensuring decision-makers can lead their companies through the digital and green transitions.

Kopnina (2020) advocates for a broader approach to education that incorporates ecocentric frameworks and degrowth models. These models encourage companies to align their operations with global sustainability goals and adopt practices that respect planetary limits. Training employees in these alternative frameworks can help logistics companies take meaningful action toward sustainability.

1.1 Methodology

This study is based on a mixed-method approach, incorporating quantitative data from a survey conducted among 615 logistics companies in Slovenia. The study aimed to identify the priority areas for employee training, focusing on digital skills and the green transition. Additionally, a comparative analysis of relevant literature and case studies was conducted to assess current best practices in logistics training.

The survey was designed to collect data on digitalisation needs (including automation, AI, and process digitisation) and green transition requirements (focusing on sustainability, circular economy practices, and energy efficiency). Respondents included a diverse mix of size and industry companies, with key representatives such as logistics managers, supply chain leaders, and HR professionals participating in Slovenia. The survey sample covered small to large enterprises, ensuring that findings would apply across various business contexts.

The questionnaire consisted of two sections; the first section focused on digital skills, with questions related to the importance of AI, robotics, data management, and automation in logistics. The second section focused on the green transition, asking respondents about their focus on circular economy practices, sustainable energy solutions, and the impact of environmental sustainability on their operations. Participants were asked to rate the importance of each skill or

training on a Likert scale from 1 (not important) to 5 (very important), with an additional section for qualitative comments.

2. Results

Based on the responses collected from the survey, two key graphs were created to highlight the priority areas for training in digital skills and green logistics. The data from the survey has been essential in identifying the areas where companies need to focus their training efforts, and the graphs provide a clear visualisation of these findings. By examining these trends, we can better understand the evolving demands in logistics and the growing need for digital and sustainable practices within the sector.

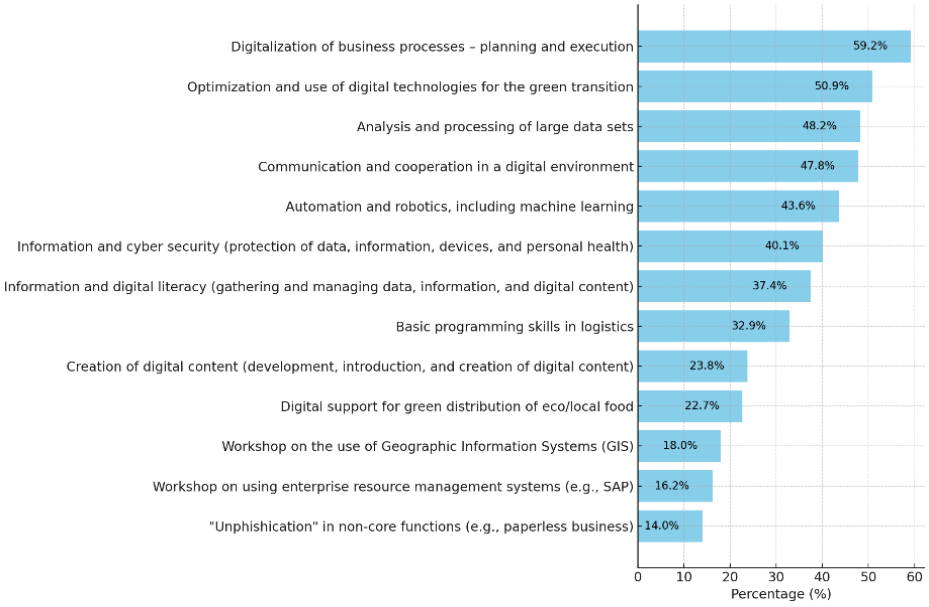

Figure 1: Necessary skills in the field of digitalisation according to the Slovenian logistics and production sector (economy)

The first graph highlights the emphasis companies place on digital transformation in logistics. Notably, 72 % of surveyed companies indicated that digitising business processes is a critical priority, demonstrating a significant shift toward automated, technology-driven systems. This transition reflects the increasing use of digital tools to enhance supply chain operations, reduce manual processes, and improve decision-making through real-time data analytics and the application of AI.

The graph also reveals that 58 % of companies prioritise automation within their supply chains. The result indicates a growing reliance on robotic process automation (RPA), AI-driven solutions, and machine learning to streamline

repetitive tasks and increase efficiency. The focus on automation highlights the industry's commitment to improving productivity and minimising human error through advanced technologies.

In addition, 54 % of companies emphasise the need to reduce transportation costs through digital solutions. That can be achieved by adopting AI-based route optimisation tools and transport management systems (TMS), which enable real-time tracking and efficient resource allocation to optimise logistics processes.

Interestingly, 48 % of companies indicated a focus on aligning digital transformation with sustainability initiatives. Recognising digital tools' role in reducing emissions and optimising energy use, such as using digital platforms to minimise fuel consumption in transport operations, is therefore important.

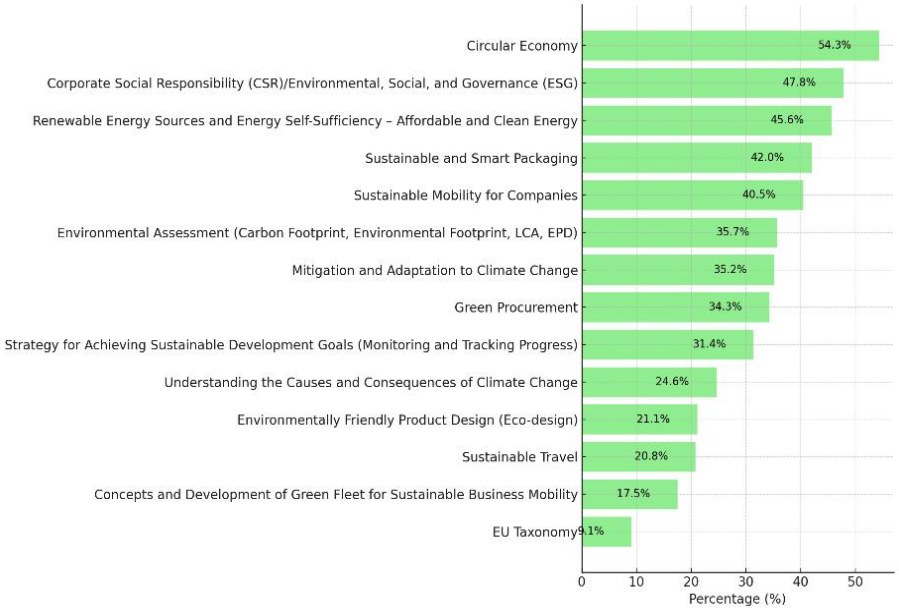

Figure 2: Necessary skills in the field of green transition according to the Slovenian logistics and production sector (economy)

The second graph illustrates the growing importance of green transition priorities within logistics, with 59 % of companies identifying circular economy practices as top priorities. Results demonstrate a strong commitment to reducing waste, enhancing resource efficiency, and promoting the reuse of materials within the supply chain.

Moreover, 55 % of respondents emphasised sustainable energy solutions as a priority area for training. So, logistics operations need energy optimisation, with companies increasingly adopting renewable energy sources and energy-saving technologies to reduce their carbon footprint.

53 % of companies also focused on building resilience to natural disasters, reflecting an understanding of the potential risks climate change poses to logistics

operations. Training in risk management and supply chain resilience is critical for companies as they seek to adapt to increasingly unpredictable environmental conditions.

In addition, 47 % of respondents prioritised sustainable mobility, focusing on reducing the carbon emissions of transportation fleets. Those actions involve training employees in using electric vehicles, alternative fuels, and green logistics infrastructure to support more environmentally friendly transportation solutions.

3. Discussion

The findings from the survey provide valuable insights into the current priorities of logistics companies, particularly in terms of green and digital skills. These results align with the broader theoretical frameworks that emphasise the increasing importance of technological advancements and sustainability in logistics operations.

As indicated by 72 % of companies, the strong focus on digitising business processes highlights the industry's shift towards integrating advanced digital tools and technologies, consistent with the theoretical discussion of AI and automation in logistics (Bell et al. 2020; Kemper et al., 2020). The theory suggests that AI-driven decision-making and robotic process automation (RPA) can enhance efficiency and reduce human error, reflected in the findings that 58 % of companies prioritise automation in their operations.

The emphasis on real-time data management and AI-based route optimisation tools also ties back to the theoretical discussions on the transformative impact of data analytics and machine learning in optimising supply chain operations (Wamsler, 2020). The theory indicates that the logistics sector's reliance on these technologies will only increase as companies seek to streamline processes and improve decision-making capabilities, supported by 54 % of companies focusing on reducing transportation costs through digital solutions.

Moreover, the finding that 48 % of companies are integrating sustainability into their digital transformation efforts reflects the theoretical argument that digital tools can serve a dual purpose: enhancing operational efficiency while reducing environmental impact. The connection between digital transformation and sustainability practices, as discussed in the theory (Glavič, 2006), is evident here, where companies increasingly leverage digital tools to track and optimise their carbon emissions and energy use.

The survey findings strongly support the theoretical emphasis on green logistics—particularly the integration of circular economy practices and sustainable energy solutions. The 59 % of companies prioritising circular economy practices reflect the theory's call for logistics to adopt sustainable models that reduce waste and enhance resource efficiency (Valderrama-Hernández et al., 2019). The findings align with the concept that logistics operations must transition towards more sustainable practices to meet global sustainability goals such as the European Green Deal.

The fact that 55 % of companies prioritise sustainable energy solutions further supports the theoretical argument that the logistics sector must focus on reducing its environmental footprint through energy-efficient technologies and adopting renewable energy sources (Priyadarshini & Abhilash, 2020). As the theory discusses, companies must train their employees to manage energy-saving technologies and adopt renewable solutions like solar-powered logistics facilities and battery storage systems, which are essential for reducing the sector's carbon emissions.

Furthermore, the theory highlights the importance of building resilience to environmental risks, which is directly supported by the 53 % of companies focusing on training in resilience to natural disasters. This finding reflects the industry's recognition of the risks posed by climate change and aligns with theoretical discussions on the need for supply chain resilience and disaster preparedness (Kopnina, 2020). As the frequency of extreme weather events increases, logistics companies are acknowledging the importance of preparing their workforce to handle disruptions caused by these environmental challenges.

The focus on sustainable mobility, with 47 % of companies prioritising this area, is closely linked to the theoretical framework around green logistics and carbon emissions reduction (Daub et al., 2020). The theory discusses the proposed adoption of electric vehicles, alternative fuels, and green logistics infrastructure, which is reflected in the priorities expressed by the surveyed companies, highlighting the logistics industry's broader commitment to reducing the environmental impact of its transportation fleets.

The survey findings reinforce the theoretical discussion on the role of lifelong learning and upskilling as key strategies for addressing the skills gap. Both digital transformation and the green transition require continuous employee development, as outlined in the theory (Wamsler, 2020). Companies must ensure that employees are trained in the latest digital tools and equipped with the knowledge to implement sustainable practices, as the findings indicate that companies are prioritising training in both areas.

The need for cross-disciplinary education, as discussed in the theory, is particularly relevant here. The survey results show that logistics companies increasingly recognise the importance of integrating digital and green skills into their training programs, a reflection of the broader industry shift towards sustainability-driven digital solutions (Brudermann et al., 2019). The theoretical framework around ecocentric learning and holistic educational models ties into the industry's recognition that technological and sustainability goals must be addressed simultaneously.

4. Conclusions

The findings from this study highlight the critical importance of green and digital skills for the future of the logistics sector. The survey conducted among 615 logistics companies in Slovenia underscores that companies are prioritising the digitisation of business processes, with automation and AI-driven solutions

emerging as key areas for operational efficiency. At the same time, the growing emphasis on sustainability – evidenced by the focus on circular economy practices and sustainable energy solutions – reflects the sector's need to address environmental challenges in line with global sustainability goals.

However, the results also reveal significant challenges in implementing these priorities focused skill training. The persistent skills gap requires urgent attention (especially among decision-makers and employees who may not have had exposure to modern technologies and sustainability practices.) Companies must invest in comprehensive training programs that combine digital skills and green transition knowledge to ensure that their workforce is prepared for the rapidly evolving demands of the logistics industry.

The study highlights the need for lifelong learning initiatives to bridge this gap and facilitate continuous employee development. Such programs will enable companies to remain competitive by equipping their workforce with the necessary tools to navigate technological advancements and sustainability challenges. Integrating cross-disciplinary training that address digital transformation and sustainability practices will be essential for future of logistics companies.

In conclusion, the logistics industry is at a pivotal moment, with the dual priorities of digitalisation and sustainability shaping the future of employee training. Companies that proactively invest in upskilling their workforce in these areas will enhance their operational efficiency and contribute to the broader goal of achieving a sustainable and digitally optimised supply chain.

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