National Report for older senior logistic workers

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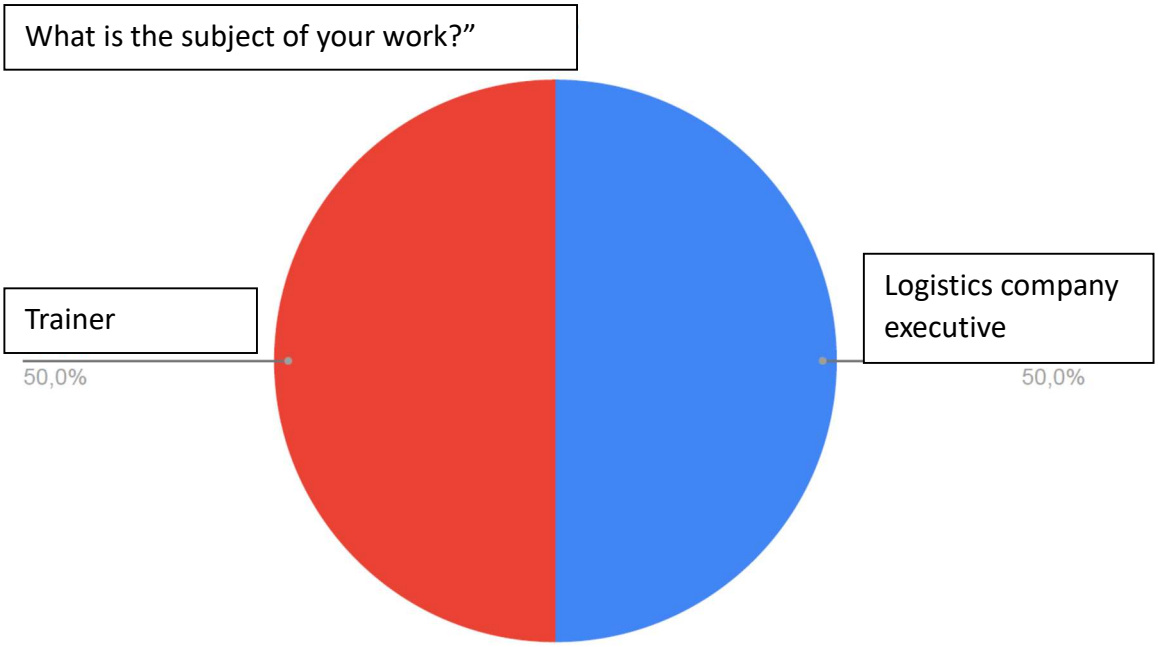
Poland

1. Field Research

First, we would like to mention that the questionnaire was distributed in Poland and there is a question: “What is the subject of your work?” and 2 options are given.

The option: logistics company executive, and the option: trainer

options, the corresponding question field is automatically opened.



As we can see in the pie chart above, 50% of the respondents are logistics company executive and 50% are trainer.

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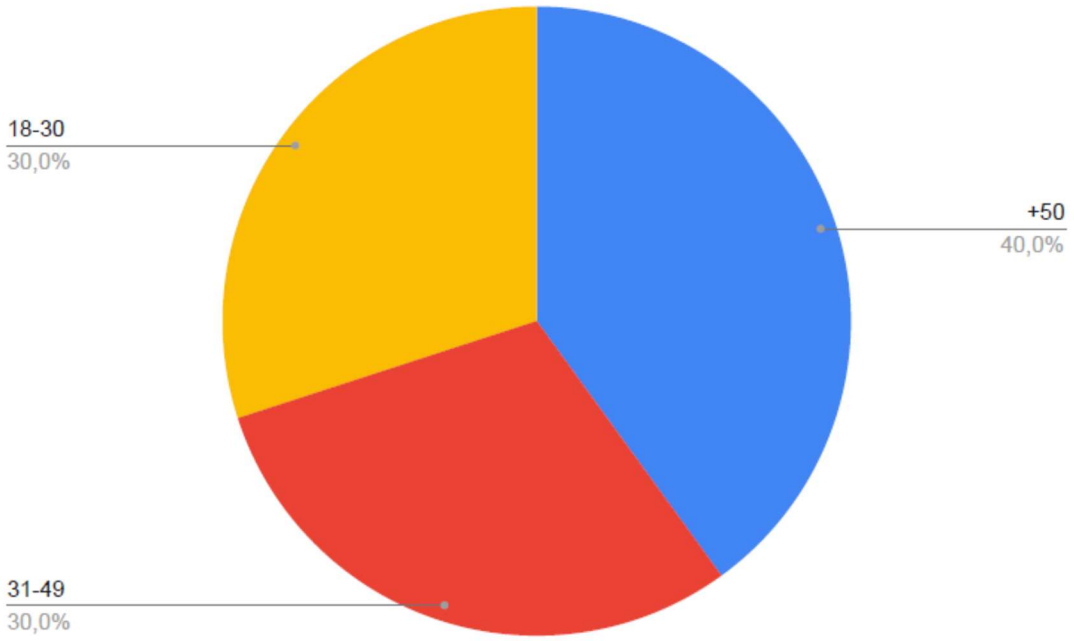
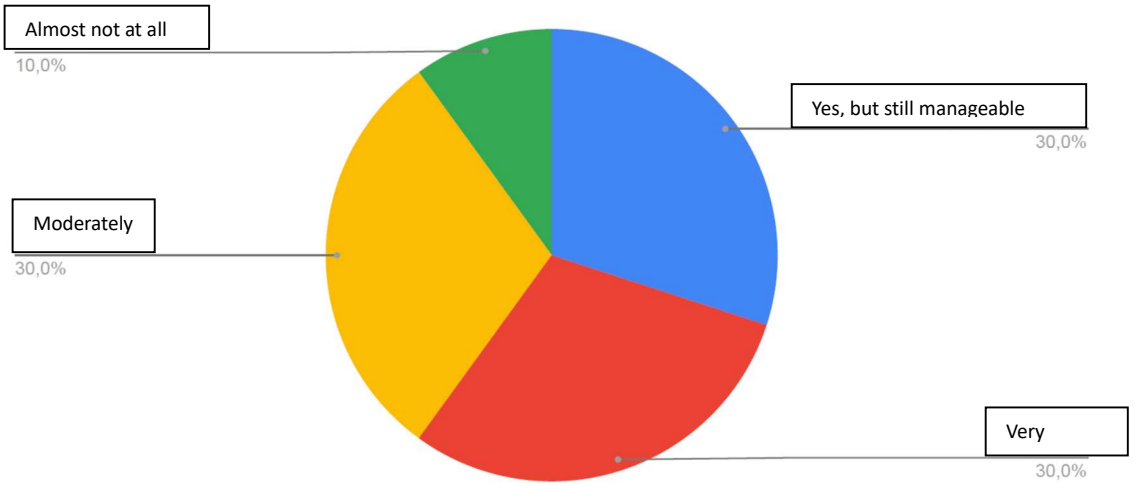
1.1 Logistics company executive

- **How old are you?**



In this particular pie chart, the highest percentage - 40%, are between the ages of +50

- **If yes, is your company facing a shortage of logistics professionals?**



We observe that 60% face a shortage of logistics professionals in their company, while in 30 % this shortage is at a moderate level.

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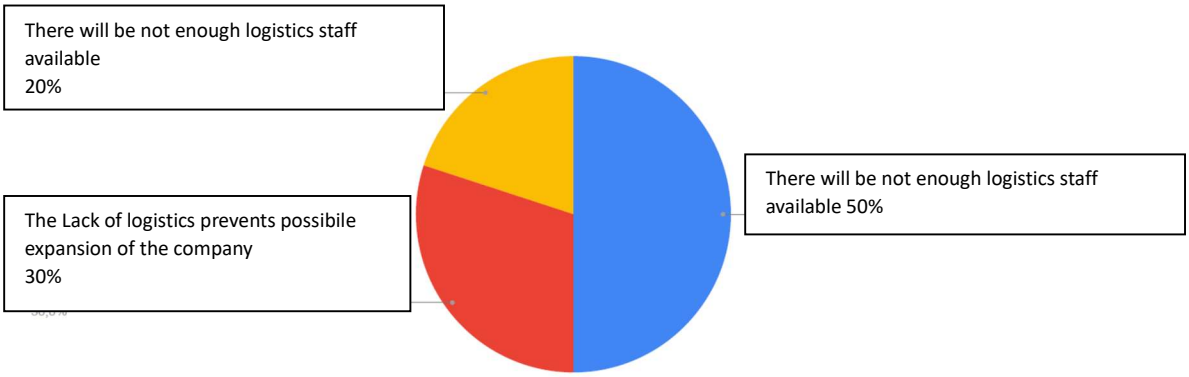
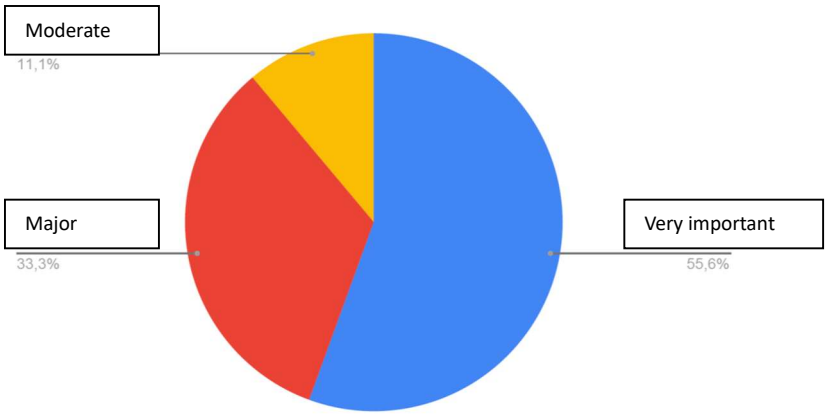
- **How do you think the situation will evolve in terms of logistics recruitment over the next 10 years?**



50% of respondents believe that the situation regarding logistics recruitment in the next 10 years will become more difficult to find enough logistics staff, and 30% believe that shortages in logistics staff will not allow the company to expand.

- **How important will digital skills be in the future?**



88,9% believe that digital skills will be important or very important in the future.

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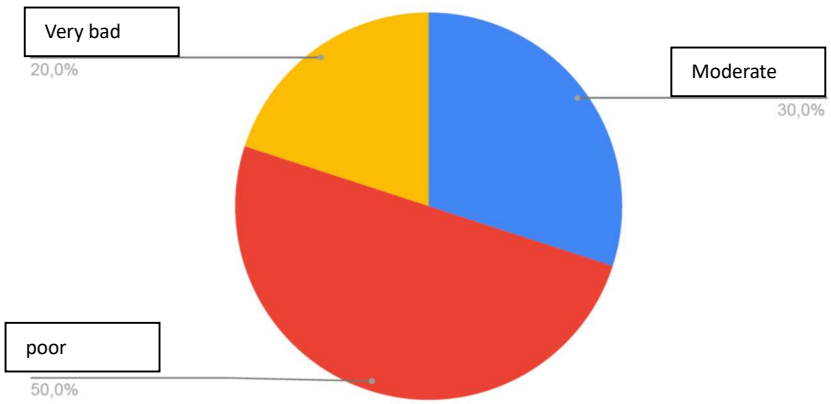
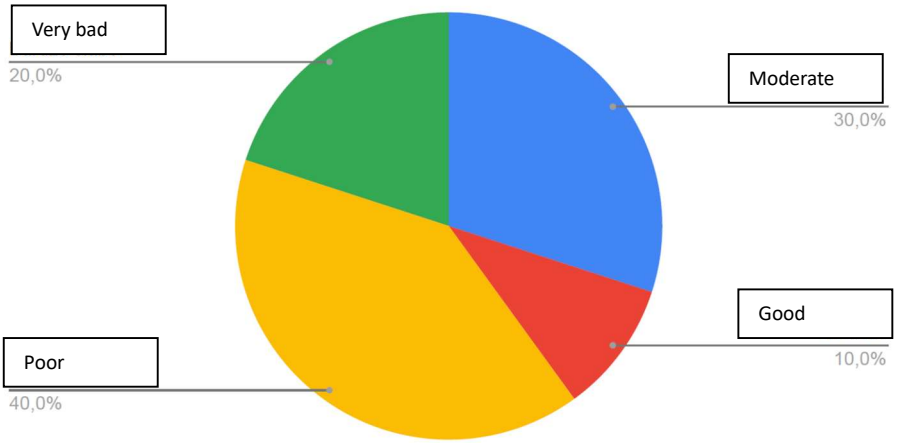
- **How do you assess the digital skills of your logistics staff (50+ years)?**



The digital skills of logistics staff (50+ years old) are rated by the company's executives as " moderate" with 30% demonstrating this, while 50% consider the digital skills of logistics staff (50+ years old) to be at a " bad" level.

- **How do you assess the expertise in your company in relation to new technologies in the logistics field?**



60% rate their company's expertise in relation to new technologies in the field of logistics as bad or very bad. Only 10% rate their company's expertise in relation to new technologies in the field of logistics as "good".

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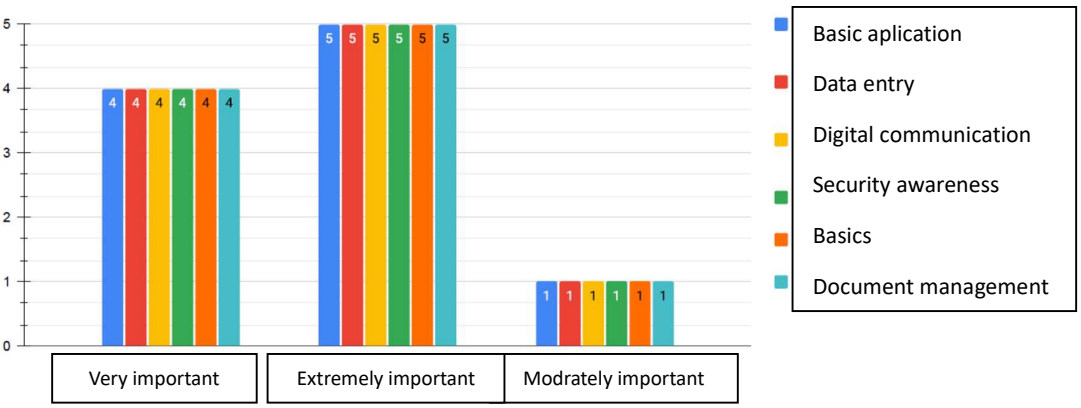
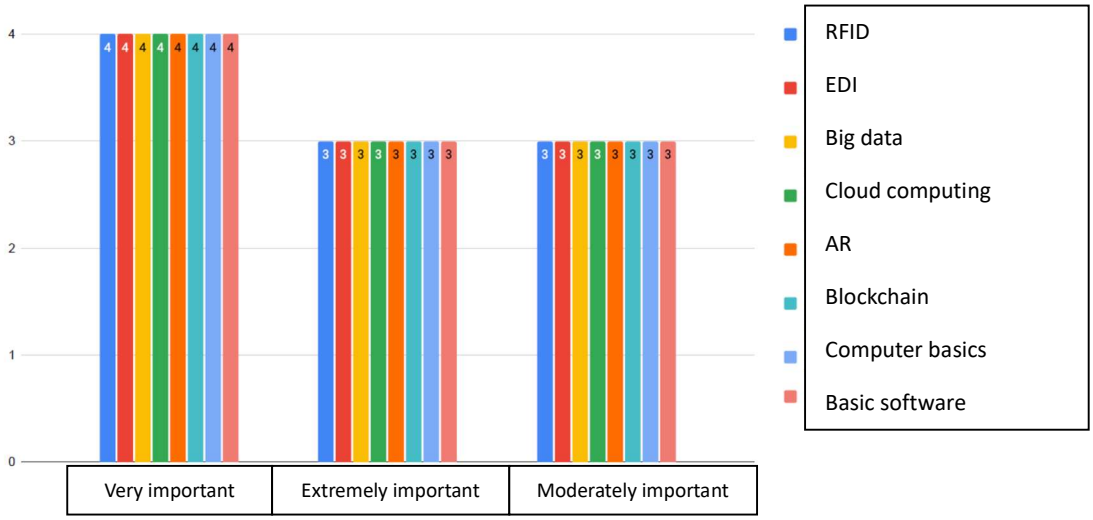
- **How important are the following basic skills for Employees in logistics**



We observe that a large majority of the respondents consider the basic skills as important or extremely important.

- **How important are the following technological skills for Employees in logistics**



We observe that most respondents consider the technological skills to be important or extremely important.

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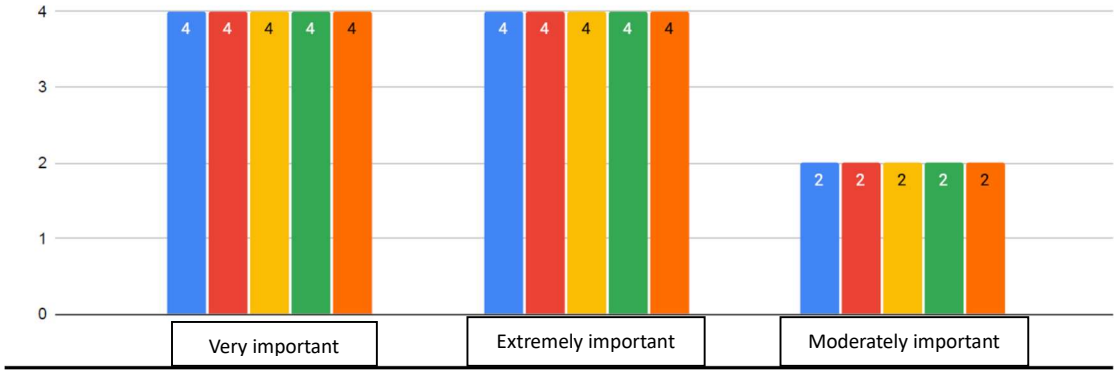
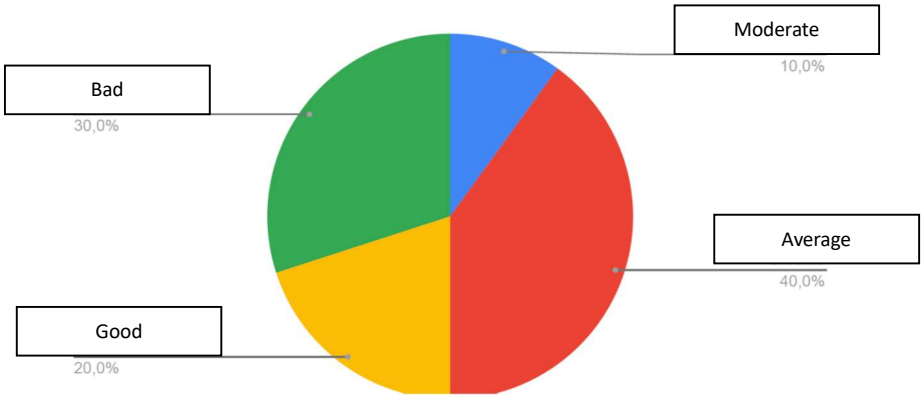
- **How important are the following systems skills for Employees in logistics**



We observe that most respondents consider the systems skills to be important or extremely important.

- **How would you assess education and training on "new technologies in logistics" in your country?**



According to the above pie chart, the respondents assess the education and training on "new technologies in logistics" in our country, as good only with a rate of 20%, and "moderate" with a rate of 40% , while the rate of 30 % which shows that by some the education and training on "new technologies in logistics" in our country, is considered " bad".

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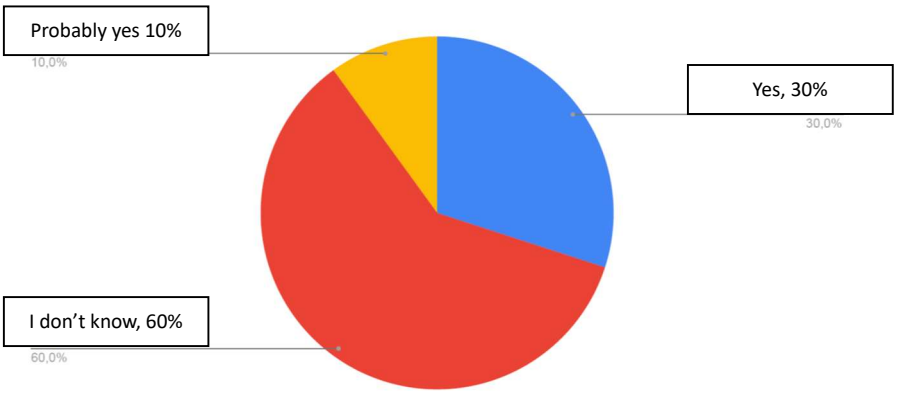
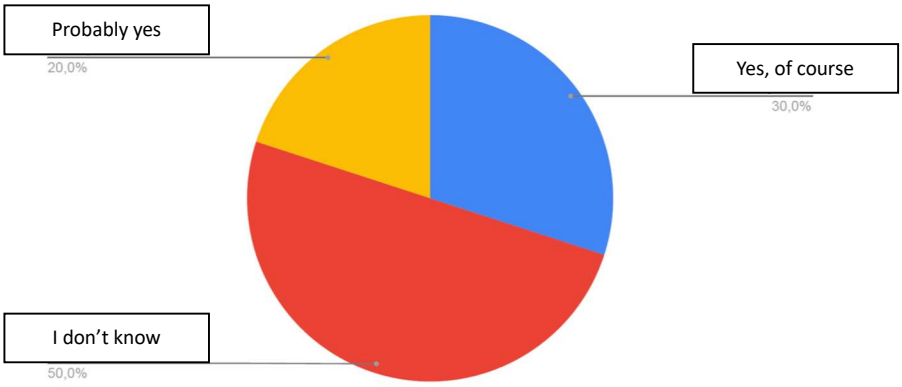
- **Do your customers require the use of sustainable and new technology services and if you had them would it be a competitive advantage for your company in the future?**



Only 30 % of respondents indicated that their customers require the use of sustainable and new technological services and believe that if the company had them, it would probably be a competitive advantage for the company in the future.

- **Would you be interested in training your employees over 50 in new technologies in the sector?**



50% of respondents were interested in training their employees over 50 years old in new technologies in the sector, free of charge.

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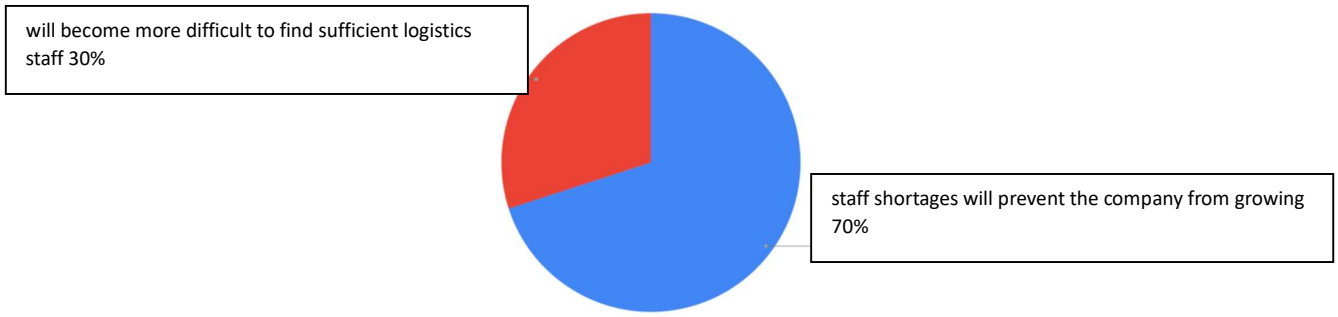
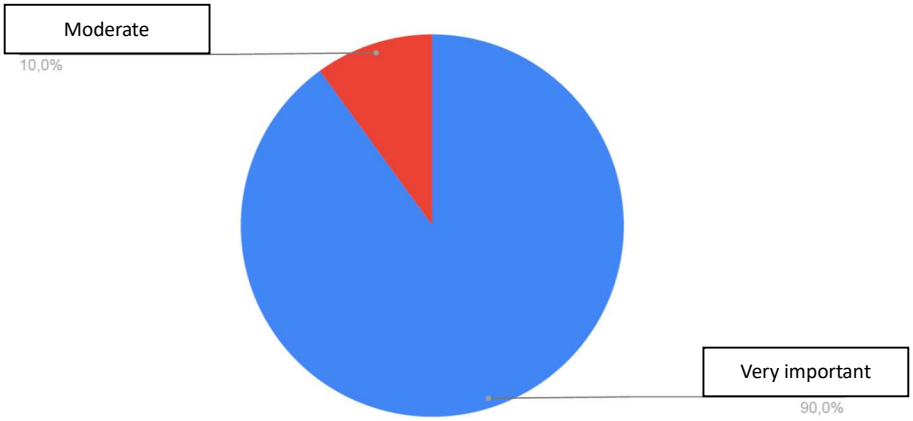
1.2 Trainer

- **How do you think the situation will evolve in terms of logistics recruitment over the next 10 years?**



VET trainers in logistics believe that the situation in terms of logistics recruitment over the next 10 years will become more difficult to find sufficient logistics staff. In particular, this perception is supported by 70% of respondents.

- **How important will digital skills be in the future?**



90% of respondents consider that digital skills will be very important in the future, while the rest, only 10% consider the development of digital skills to be quite important.

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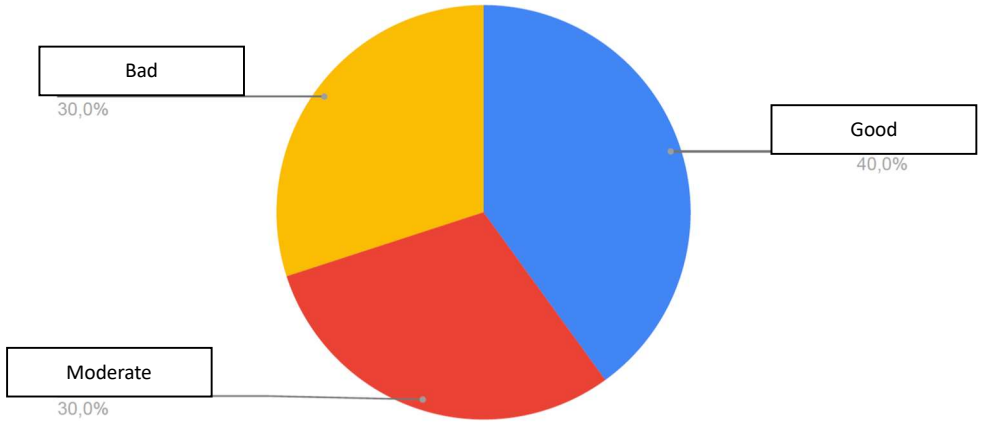
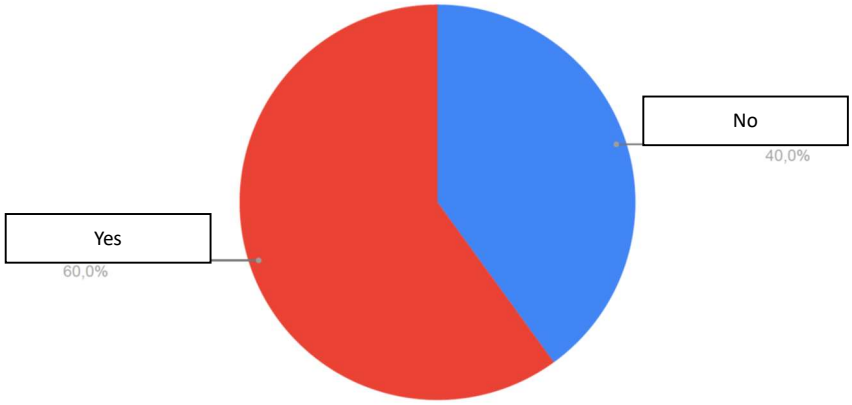
- **How would you assess education and training on "new technologies in logistics" in your country?**



30% of respondents rate education and training on "new technologies in logistics" in Poland as " bad". There is also 40% who consider it "good".

- **Do you have trainees over the age of 50?**



60% of respondents answered that they have trainees over 50 years old, which indicates the need still to develop digital skills for this age group.

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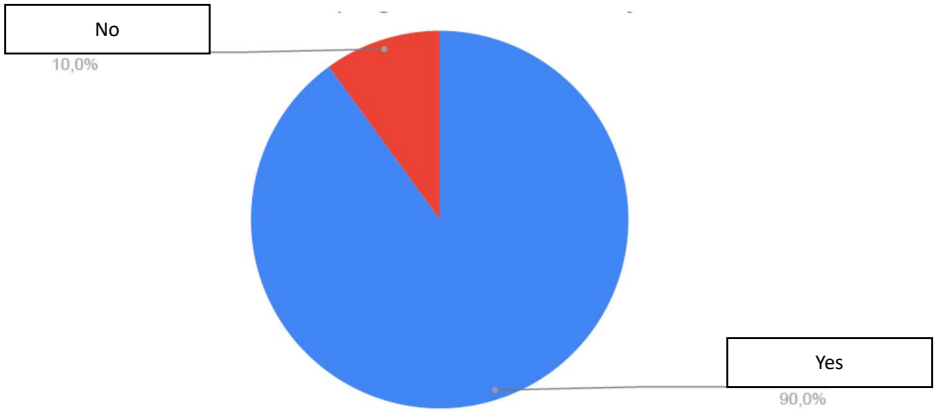
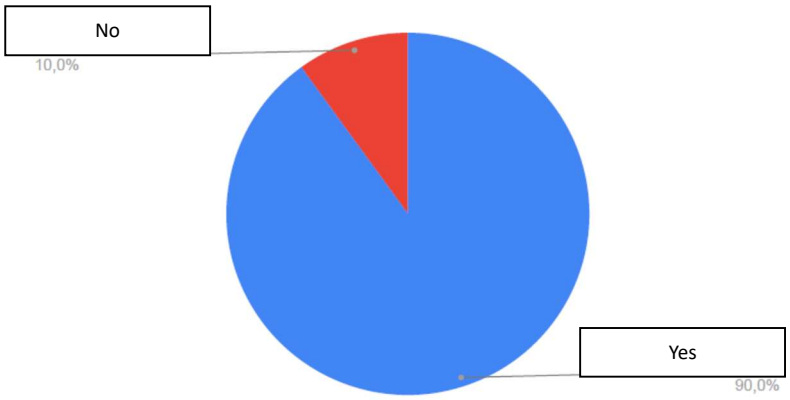
- **Do you incorporate in your training programmes the new technologies applied in the logistics sector?**



90% incorporate in their training programs the new technologies applied in the field of logistics, while the percentage that do not is smaller.

- **Have you attended specific training on recent developments in the logistics sector?**



90% of respondents have attended specific training on recent developments in the logistics sector.

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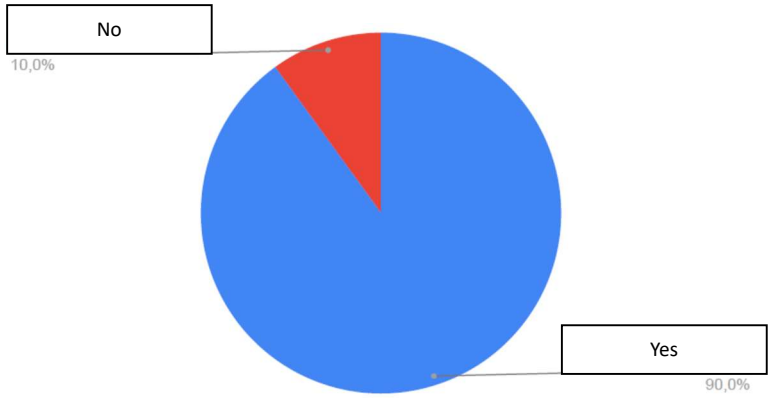
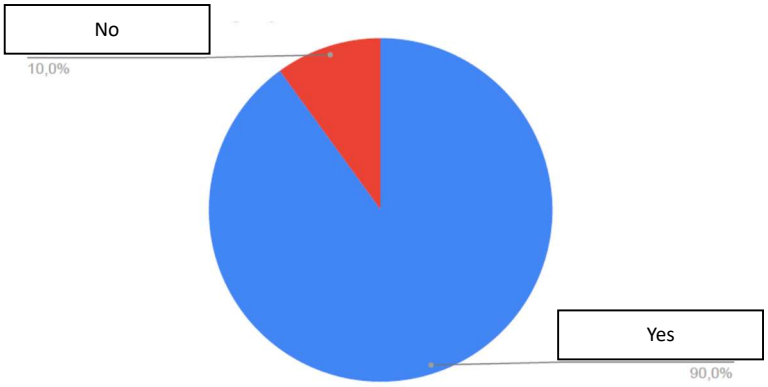
- **Do you adapt your teaching method according to the needs of logistics learners?**



90% of all VET trainers in logistic adapt their teaching method according to the needs of the logistics learners.

- **Do you consider continuous training as essential for the development of logistics workers?**



90% of the respondents consider that continuous training is essential for the development of logistics workers.

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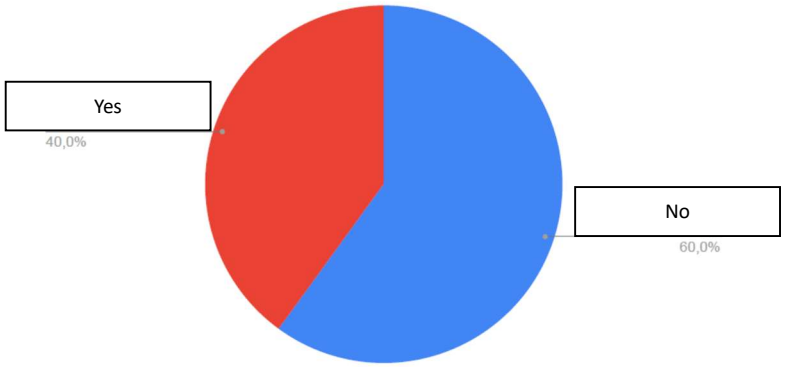
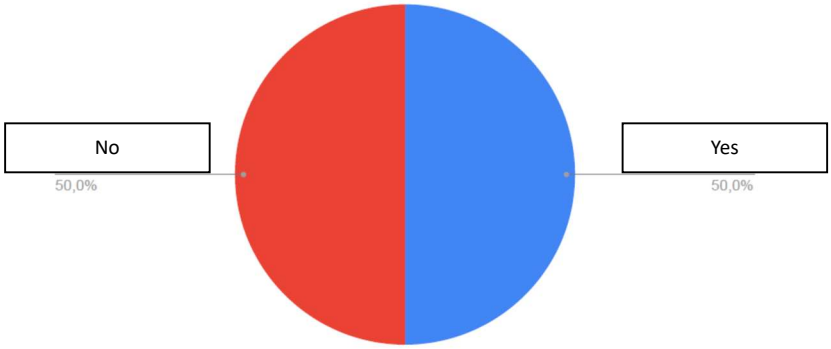
- **Do you offer practical training or laboratory experience to trainees?**



Only 40% of VET trainers in logistics offer practical training or laboratory experience to trainees.

- **Do you evaluate the performance of trainees during and after the training programs?**



50% of respondents evaluate the performance of trainees during and after the training programs, while the rest 50% do not evaluate.

1.3 Summary

In conclusion, there seems to be a significant agreement between the respondents from the two target groups (logistics company executive, trainer) regarding the need for digital skills in the logistics sector, in the age group over 50 years old. The recognition of this need is important as digital technology is becoming increasingly important in the logistics industry.

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Furthermore, the recognition of the shortage of digital skills in this age group indicates the need for further training in technology.

2. Desk Research Poland

2.1 Impact of Covid in digital logistic sector transformation in Europe

According to a survey conducted by EY Poland, digital transformation accelerated during the pandemic in more than half of the companies, and 27% of the companies surveyed even admit that they were motivated to act in this area solely by the pandemic. In 8 per cent of companies, digital transformation slowed down as a result of the pandemic, and in 1 per cent of companies the process stopped because of it. In around a third of the companies surveyed (32%), the pandemic had no impact on digital transformation at all.
or 27% of respondents, however, digital transformation is primarily an investment in technology, with a slightly smaller percentage (25%) declaring that it is a process of transformation within the company that goes beyond technological solutions. Overall, more than half of those surveyed (55%) say digital transformation is part of a strategy, but 36% introduce it in response to current issues. In 5% of companies, it is imposed by factors outside the company's control, and 4% introduce it when interesting solutions appear on the market.
- Nearly 80% of the companies surveyed give digital transformation a high or medium priority, but the results of our survey show as if through a lens that the approach to digital transformation in Polish companies is polarised and can mean something completely different in each company. A large group of companies consider it merely an investment in technology, but there are also those who declare that it is for them a holistic and multifaceted stage of change in the company. Regardless of which group they are in, almost all of them realise that it generates potential for the company, although they do realise that a change in the existing way of thinking will be necessary to carry it out.
Companies still want to focus primarily on hardware purchases, with less focus on database implementation. Some companies - 17% - do not intend to implement any new digital transformation solution in the coming year or year and a half.
Thinking about the purchase of hardware and infrastructure as a core activity in the digital transformation process applies to past, present and future activities. And this is not an unreasonable attitude. Indeed, more often than not, the entire process requires the purchase of specific tools, equipment and solutions. However, one cannot stop there, as this will only mean upgrading resources and not the overall transformation of the company. Individual processes - even if they use advanced technologies and solutions - will be ineffective if the changes do not touch all aspects of the company's operations. This may turn out to be a trap, as digital transformation is a continuous process of improving a company and not just punctual and one-off actions.

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If companies already decide to carry out a digital transformation, the most dynamic transformation is taking place in the accounting, sales and customer service departments - areas characterised by the lowest level of automation, on the other hand, generating business growth. What is surprising in this juxtaposition is the perception of administrative processes as the least important areas in terms of the order in which digital transformation solutions are implemented.

Only 13% of respondents did not identify any barriers to implementing digital transformation solutions. More than a third of respondents indicated that one of the main ones is that it is too expensive. More than a quarter of companies face employee fears of change, one in four companies face a lack of competence or resources. The lack of a proper strategy, an organisational culture geared towards implementing innovation, the lack of a leader ready to lead change (14%) and even management's fear of change remain a problem for many companies in this regard.

The 'Digital Transformation of Companies 2020' survey was conducted using CATI and CAWI, at the end of October 2020 by CubeResearch, with a sample of 989 respondents. Half of the respondents surveyed hold a position as a manager or head of a department, most commonly IT, Finance, HR and Sales. 24% hold a position as a board member or director and one fifth are owners or co-owners of the surveyed company. Only 6% of respondents work in a lower position.

Representatives of various industries took part in the survey. As intended, we looked at four of them with particular attention. These are manufacturing, finance, retail and logistics.

Most of the companies surveyed have more than 10 years' experience in the market. Only slightly less than a fifth have been in business for less than a decade, while 15% have been on the market for less than five years.

Also in terms of revenue, the companies surveyed are quite diverse. Most, 36%, generate between PLN 50 and 150 million in profit annually. The revenues of about a quarter of the companies are between PLN 150 and 300 million, and more than one fifth up to PLN 50 million. The smallest group of companies, but as many as 18%, generate annual revenues in excess of PLN 300 million.

Survey participants were also asked about the percentage of the budget they allocate annually to digital transformation. More than half of the respondents declared that their company allocates up to 3% of revenue for this purpose, and about a quarter that 4-5% from profit. Fewer, less than a tenth of respondents, contribute 6 - 10% of revenue, and above 10% of revenue 8% of respondents.

Digital transformation is about adapting evolving technologies to the specific needs of the sector and modernising work organisation and company culture. Technological advances, especially those observed in the last decade, have demonstrated the superior effectiveness of digital solutions compared to traditional methods. Today, digitalisation is treated as part of the progress of civilisation, covering various industries and areas of activity. Among the most current trends, we highlight artificial intelligence, blockchain, virtual reality and the Internet of Things.

In the context of logistics, adaptation to digital innovations has allowed for more efficient, fast and sustainable process management. The logistics industry, characterised by complex structures and diverse data, has started to benefit from new technologies that have become easier to control and implement thanks to digitalisation.

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Digital transformation in logistics, following the COVID-19 pandemic, has become a key factor in shaping modern company strategies. This process, which is widespread in many industries, has contributed to increased management efficiency, especially in areas as complex as logistics. By adapting new technologies, the logistics sector can fully exploit the potential of innovation, improving its productivity.

Due to the challenges of the COVID-19 pandemic, logistics has experienced significant improvements through digital transformation, especially in the area of document management. An example is the electronic consignment note, or E-AWB, which is the digital equivalent of the traditional paper document. It allows a shipment to be tracked from the moment it is picked up to the point of delivery. But it is not just a matter of tracking - the E-AWB also brings benefits in terms of trust and process transparency. The integration of this solution with transport systems has definitely improved efficiency in logistics.

Artificial intelligence (AI) and machine learning are opening the door to a revolution in many sectors, adapting them to the digital age. Logistics is no exception. Thanks to AI, it is possible not only to optimise supply chain management, but also to gain instant access to relevant data, analysis and recommendations. This translates into better, more informed decisions for logistics companies. Artificial intelligence and machine learning applications include, for example, precision production planning, in-depth supplier assessment, customer acquisition or transport and inventory management.

The Internet of Things, or IoT, represents one of the most important technological developments of our time and its impact on the logistics sector is enormous. A key benefit of IoT for logistics is the ability to accurately monitor and transport sensitive products. Specialised sensors based on this technology make it easier to control the transport of sensitive goods such as food or medicines. With IoT sensors, it is not only possible to track parameters such as temperature or humidity, but also to verify the authenticity of products through smart labels.

In the logistics sector, as in many other industries, cloud-based technologies play a key role. With the cloud, it is not only possible to store huge amounts of data cost-effectively, but also to process it instantly. In an industry where data is integrally linked to complex networks, cloud technology is becoming essential. Any information generated by artificial intelligence and the resulting analysis and conclusions can be efficiently collected and managed using cloud solutions.

Digital transformation in the logistics sector has taken on a new dimension with the inclusion of blockchain technology. Blockchain, as a revolutionary innovation, has significantly influenced the way transactions are verified and secured. It has made it possible to precisely track every change, transaction or other operation within a given network. The technology significantly increases the security of decision-making processes, making decisions in the logistics area more informed, to the benefit of all parties. Additionally, blockchain eliminates the need for a central management point, allowing all network participants to easily access key data.

Digital transformation has opened up exciting new opportunities for the logistics industry, such as sustainability and green logistics. In many sectors, technological advancements are shifting the focus towards green measures, and logistics is no exception. Modern developments such as intelligent traffic management, the use of artificial intelligence and the development of autonomous vehicles have influenced

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the industry to become more sustainable. The interest in green innovations in the logistics sector is increasing the demand for such technologies. Promoting a green approach is becoming key to achieving a competitive advantage in the industry.

Consequences of the COVID-19 pandemic:

According to the research, which was conducted in 2022 among 335 randomly selected small, medium and large Polish manufacturing, trade and service enterprises. As a result of the research, it was found that the COVID-19 pandemic had a huge influence on logistics in all surveyed enterprises in 2020–2021. Changes in logistics conditions caused by the pandemic overlapped with the logistics determinants of contemporary enterprises before the pandemic. Strategic and operational management of logistics processes increasingly determined the economic and market results of the best surveyed enterprises during the COVID-19 pandemic. Enterprises achieving the best results during the pandemic implemented the supply chain management strategy that was in a constant state of creation and development, characterized by an immediate response to changing customer requirements, environmental conditions and competitors' activities, respecting, at the same time, the principles of sustainable development. During the pandemic, the most effective logistics managers took quick actions so as to reduce the likelihood of disruption, decrease the severity of the effects of events, and create and maintain competitive advantages of their enterprises.

The COVID-19 pandemic caused multiple hazards that disrupted the logistics systems of businesses around the world (Choi et al, 2023; Rinaldi & Bottani, 2023; Vilko & Hallikas, 2023). The simultaneous occurrence of supply and demand shocks has created enormous challenges in logistics regarding the management of procurement, production, distribution, inventory, returns, after-sales service, transportation and the entire supply chain (Butt, 2021; Pauli et al, 2023, pp. 336-362; Min, 2023, pp. 1765-1781; Skowronek, 2023, pp. 2-10). The pandemic has created unprecedented logistical challenges related to the need to protect health and ensure safety. Logistics managers had to start taking a strategic approach to creating logistics activities and solutions, which were implemented at a strategic and operational level within the company (Gąsowska, 2022a, pp. 81-107).

The COVID-19 pandemic has created enormous uncertainty and a sharp increase in risk in logistics systems. In such an environment, it was crucial to

limiting the likelihood of disruption to logistics processes throughout the logistics system and taking rapid action to reduce the

severity of the consequences of an incident (van Hoek, 2020, pp. 341-355; Kohl et al, 2022, pp. 1386-1407; Song et al, 2022, pp. 1408-1436). Digital technologies have played an important role in the risk analysis of logistics systems, enabling faster decision-making processes with appropriate use of information, facilitating rapid responses to disruptions in logistics systems (Choi, 2021).

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2.2 Opinions and problems this change occurred in logistics workers over 50 years old in Europe

The COVID-19 pandemic has brought huge disruptions and challenges to supply chains, affecting many industries worldwide. For instance, in various countries, healthcare systems have been under extreme levels of stress due to the capacity issues such as shortage in personnel, equipment, and space in hospitals and the poor governance of infections. Many airlines suffered huge losses and bankruptcies because of increased travel restrictions and uncertainties posed by changing regulations . Recreational industries such as restaurants, hotels, and gyms were also hit by huge losses due to implemented lockdowns to curb the spread of infections.

The logistics sector is also experiencing risks and challenges brought by COVID-19 pandemic. Crossing border of goods became much more complex due to imposed lockdowns at national and international levels, hampering logistics operations and causing delays in delivery of goods. A decline and shortage of logistics service providers (LSPs) for transporting goods were also observed, especially at the beginning of the pandemic. Many manufacturing companies were forced to close plants due to government regulations, thereby reducing the supply of goods. Other companies shifted their focus on manufacturing in-demand products during COVID-19. In the global logistics transportation alone, the value of losses in revenue due to COVID-19 pandemic is estimated to be 1.1 trillion euros in 2020.

Changes resulting from the COVID-19 pandemic among workers 50+:

The number of logistics workers performing work at the employer's premises fell from 88.5% before the pandemic to 65.5% during the pandemic, before rising again to 83.1%. In contrast, the scale of hybrid and remote working provided increased during the pandemic period to 21.4% and 11.4% respectively (Table 5). The isolation of workers was a result of top-down restrictions on maintaining social distance to limit coronavirus transmission.

In response to the emerging shortage of logistics workers and the problems of retaining them - if only because of their conviction not to retire - employers began increasingly to offer their staff various types of benefits. In this way, they wanted to make work more attractive and increase their own competitiveness in the market. The economic downturn following COVID-19 forced a change in the approach to employee benefits, including for logistics employees. Savings, including reductions in labour costs, became necessary. The survey found that employers were giving up on paying additional benefits, mainly providing employees with sports and leisure cards and training, courses and other forms of professional qualification. Although they were not guaranteeing benefits to too many employees, they were still depleting their availability.

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The negative changes that affected logistics employees' working situation mainly included stress, instability and job insecurity. This inconvenience was indicated by more than 3/5 of the population who spoke critically about the impact of the COVID-19 pandemic on professional matters. Other negative changes were a reduction in salary for work, an increase in responsibilities (excess work), and loss of work at the previous company.

When considering the situation and the rules of coexistence in the workplace, the respondents identified the negative phenomena they could face. For 47.8% of people, time pressure was the most important, which could translate into excess stress and psychological strain, which in turn was highlighted by 38.9% of respondents. About one third of the population was dissatisfied with overcrowding with tasks to be performed, and a slightly smaller group criticised the excessive demands (pressure) of superiors. Gender discrimination was the least perceived.

In terms of the strength of the impact of negative phenomena in the company, abstracting from the scale of their occurrence, excessive work control and time pressure were felt most strongly. This was followed by stress and heavy mental workloads and lack of flexibility at work. Other phenomena had an average impact on interpersonal relations and the functioning of the workforce, and therefore did not constitute a particular annoyance for the respondents.

Vocational qualifications of employees 50+ It is a favourable phenomenon to take care of qualifications and to broaden employee qualities in this respect. When asked whether the respondents had ever been forced to retrain, 34.6% answered in the affirmative, while the remaining 65.4% denied it. Most had done so quite a long time ago, more than 10 years ago. During the last years, when the COVID-19 pandemic was ongoing, one in five respondents had retrained.

The main reasons for retraining were the desire to change jobs and the inability to find employment in their occupation - 28.3% and 28.1% respectively. Respondents also pointed to employer requirements, as well as the idea of learning and trying something different - 22.2% and 20.8%. Unattractive working conditions within their occupation came next. When analysing the reasons for retraining, it is worth noting that these were both due to external reasons beyond the employees' control and based on their individual aspirations, thoughts.

As regards participation in activities related to improving professional competences and adapting to current changes (e.g. resulting from digitisation), 65.6% of respondents answered in the affirmative. Thus, they expressed their willingness, as opposed to 15.4% of those who were not interested and negated participation in such activities

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2.3 Summary and Intermediate Conclusions

Conclusion

The pandemic has accelerated all the evolutionary changes taking place in the area of digitisation, and has allowed the rapid implementation of many solutions that had remained in the testing and trial phase for years.
In summary, Poland's logistics work force aged 50+ has faced multiple challenges in adapting to the digital transformation and manoeuvring through the volatile circumstances caused by the COVID-19 pandemic. By addressing the technological skills gap, providing tailored training and support, and leveraging local initiatives, Poland can strengthen its mature workforce to thrive in the evolving field of digital logistics. Nurturing the skills development and resilience of the older workforce is essential to ensure their continued relevance and contribution to Poland's logistics ecosystem.

2.4 Bibliography Resources

- Ambrogio, G., Filice, L., Longo, F., & Padovano, A. (2022). Workforce and supply chain disruption as a digital and technological innovation opportunity for resilient manufacturing systems in the COVID-19 pandemic. Computers & Industrial Engineering, 169, 108158. https://doi-1org-1000093cp5dfe.han.buw.uw.edu.pl/10.1016/j.cie.2022.108158
- Archibugi, D., Filippetti, A., & Frenz, M. (2013). Economic crisis and innovation: Is destruction prevailing over accumulation? Research Policy, 42(2), 303–314. https://doi.org/10.1016/j.respol.2012.07.002
- Ardolino, M., Bacchetti, A., & Ivanov, D. (2022). Analysis of the COVID-19 pandemic's impacts on manufacturing: A systematic literature review and future research agenda. Operations Management Research, 15, 551–566. https://doi.org/10.1007/s12063-021-00225-9
- Bai, C., Quayson, M., & Sarkis, J. (2021). COVID-19 pandemic digitization lessons for sustainable development of micro- and smallenterprises. Sustainable Production and Consumption, 27, 1989–2001. https://doi.org/10.1016/j.spc.2021.04.035
- Banaszyk, P., Konecka, S., Maryniak, A., & Paprocki W. (2020). Diagnoza ostrzegawcza i wytyczne dalszych działań transportu drogowego rzeczy w warunkach kryzysu wywołanego pandemią COVID-19. https://oees.pl/wp-content/uploads/2020/04/EKSPERTYZA-7-1.pdf
- Belitski, M., Guenther, C., Kritikos, A. S., & Thurik, R. (2022). Economic effects of the COVID-19 pandemic on entrepreneurship and small businesses. Small Business Economics, 58, 593–609. https://doi.org/10.1007/s11187-021-00544-y

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- Bhattacharyya, S. S., & Thakre, S. (2021). Coronavirus pandemic and economic lockdown: Study of strategic initiatives and tactical responses of firms. International Journal of Organizational Analysis, 29(5), 1240–1268. https://doi-1org-1000093yw1d7c. han.buw.uw.edu.pl/10.1108/IJOA-05-2020-2198
- Browning, T., Kumar, M., Sanders, N., Sodhi, M. S., Thürer, M., & Tortorella, G. L. (2023). From supply chain risk to system-wide disruptions: Research opportunities in forecasting, risk management and product design. International Journal of Operations & Production Management. https://doi.org/10.1108/IJOPM-09-2022-0573
- Bughin, J. (2024). Resilience and performance: Capturing their synergy
- Donthu, N., & Gustafsson, A. (2020). Effects of COVID-19 on business and research. Journal of Business Research, 117, 284–289. https://doi.org/10.1016/j.jbusres.2020.06.008
- Dyduch, W., Chudziński, P., Cyfert, S., & Zastempowski, M. (2021). Dynamic capabilities, value creation and value capture: Evidence from SMEs under Covid-19 lockdown in Poland. PLoS ONE, 16(6), e0252423. https://doi.org/10.1371/journal.pone.0252423
- Eggers, F. (2020). Masters of disasters? Challenges and and opportunities for SMEs in times of crisis. Journal of Business Research, 116, 199–208. https://doi.org/10.1016/j.jbusres.2020.05.025
- Kumar, A., Luthra, S., Mangla, S. K., & Kazançoglu, Y. (2020). COVID-19 impact on sustainable production and operations management. Sustainable Operations and Computers, 1, 1–7. https://doi.org/10.1016/j.susoc.2020.06.001
- Kumar, B., & Sharma, A. (2021). Managing the supply chain during disruptions: Developing a framework for decision-making. Industrial Marketing Management, 97, 159–172. https://doi.org/10.1016/j.indmarman.2021.07.007
- Lee, S. M., & Trimi, S. (2021). Convergence innovation in the digital age and in the COVID-19 pandemic crisis. Journal of Business Research, 123, 14–22. https://doi.org/10.1016/j.jbusres.2020.09.041
- Li, L., Wang, Z., Ye, F., Chen, L., & Zhan, Y. (2022). Digital technology deployment and firm resilience: Evidence from the COVID-19 pandemic. Industrial Marketing Management, 105, 190–199. https://doi.org/10.1016/j.indmarman.2022.06.002 Magableh, G. M. (2021). Supply chains and the COVID-19 pandemic: A comprehensive framework. European Management Review, 18(3), 363–382. https://doi.org/10.1111/emre.12449
- Min, H. (2023). Assessing the impact of a COVID-19 pandemic on supply chain transformation: An exploratory analysis. Benchmarking: An International Journal, 30(6), 1765–1781. https://doi.org/10.1108/BIJ-04-2022-0260
- Mishra, R., Singh, R. K., & Subramanian, N. (2022). Impact of disruptions in agri-food supply chain due to COVID-19 pandemic: Contextualised resilience framework to achieve operational excellence. The International Journal of Logistics Management, 33(3), 926–954. https://doi.org/10.1108/IJLM-01-2021-0043
- Muzi, S., Jolevski, F., Ueda, K., & Viganola D. (2023).

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- Singh, S., Kumar, R., Panchal, R., & Tiwari, M. K. (2021). Impact of COVID-19 on logistics systems and disruptions in food supply chain. International Journal of Production Research, 59(7), 1993–2008. https://doi.org/10.1080/00207543.2020.1792000
- Skowronek, C. (2023). Aktywa obrotowe i procesy logistyczne przedsiębiorstw w latach 2019–2022 – podstawowe zjawiska i tendencje. Gospodarka Materiałowa i Logistyka, (2), 2–10. https://doi.org/10.33226/1231-2037.2023.2.1
- Song, M., Ma, X., Zhao, X., & Zhang, L. (2022). How to enhance supply chain resilience: A logistics approach. The International Journal of Logistics Management, 33(4), 1408–1436. https://doi.org/10.1108/IJLM-04-2021-0211
- Suguna, M., Shah, B., Raj, S. K., & Suresh M. (2022). A study on the influential factors of the last mile delivery projects during Covid-19 era. Operations Management Research, 15, 399–412. https://doi-1org-1000093cp5dfc.han.buw.uw.edu.pl/10.1007/s12063-021-00214-y
- Witkowski, J. (2022). Strategie wzrostu odporności łańcuchów dostaw w turystyce. Gospodarka Materiałowa i Logistyka, (10), 2–7. https://doi.org/10.33226/1231-2037.2022.10.1
- Yang, L., Huo, B., & Gu, M. (2022). The impact of information sharing on supply chain adaptability and operational performance. The International Journal of Logistics Management, 33(2), 590–619. https://doi.org/10.1108/IJLM-11-2020-0439 Ye, F., Liu, K., Li, L., Lai, K.-H.,
- Zhan, Y., & Kumar, A. (2022). Digital supply chain management in the COVID-19 crisis: An asset orchestration perspective. International Jou

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