ISSN: 2029-4913 / eISSN: 2029-4921

VILNIUS TECH
Vilnius Gediminas Technical University

TECHNOLOGICAL and ECONOMIC DEVELOPMENT of ECONOMY

2024
Volume 30
Issue 4
Pages 976–1008
https://doi.org/10.3846/tede.2024.21366

# NAVIGATING THE DIGITAL LANDSCAPE: SITUATION AND RISK ASSESSMENT OF DIGITAL SOLUTIONS IN FORWARDING COMPANIES

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**Article History:**
- received 28 December 2023
- accepted 25 March 2024

**Abstract.** This research emphasises the transformative power of digital solutions in Lithuanian forwarding companies, addressing the necessity for a systematic risk assessment to optimise processes and mitigate associated risks. The survey indicates an increasing adoption of digital solutions, with around two-thirds of companies already utilising them. A case study employing the AHP method identifies three key digital solutions: invoice automation, waybill digitisation and blockchain. A combined solution called a "document flow and management system", showed significant potential for time and cost savings. Three risks – synchronising participants, employee resistance, and a lack of specialists – are identified as having the highest overall assessment and were selected for further analysis while implementing the prioritised digital solution. The expert evaluation identifies employee resistance as the most probable risk, posing potential significant losses in the initial post-implementation phase. Although issues with synchronising participants could yield similar losses, experts view this risk as less probable than employee resistance. After the AHP analysis, it was decided to evaluate the current information and document flow process, in other words, to optimise the process. The optimisation results show that freight forwarding companies could reduce document management time by up to 59%.

**Keywords:** risk of digital solutions, FinTech solutions, forwarding companies, supply-chain, AHP method.

**JEL Classification:** N7, G32, D81.

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## 1. Introduction

In today's business landscape, digital transformation has become a pervasive trend revolutionising various sectors of the global economy. The emergence of digital solutions designed to streamline business processes, reduce operational costs, minimise environmental impact and improve overall efficiency has significantly reshaped the business perspective. Financial technology (FinTech) plays a key role in this digital shift, with a notable surge in organisations planning digital transformation strategies, doubling from 17% in 2019 to 35% in 2021, according to Kenyon's (2021) analysis. This wave of transformation extends to industries such as logistics and supply chain, prompting academics to explore its potential for societal, economic and organisational transformation (Herold et al., 2021). In this context, logistics and supply

chain companies strive to improve their value proposition by addressing challenges such as fragmentation, low transparency, underutilised assets, manual processes, and outdated customer interfaces. FinTech is emerging as a focal point due to its potential to revolutionise supply chain networks across multiple sectors. As a critical participant of the supply chain, freight forwarders face challenges such as information asymmetry, long processing times and coordination issues between supply chain members. Despite the widespread adoption of digital solutions, freight forwarders often struggle with freight documentation, relying on paper-based submissions and facing inaccuracies in invoices and receipts throughout the supply chain (Casanova et al., 2022).

With so many digital solutions available, choosing the most appropriate one is a complex challenge for freight forwarders. Despite enterprises' recent high eagerness to adopt digital technologies, they have been reported to be successful in this process in less than 30% of cases (Silberg & Manyika, 2019). Solutions such as blockchain offer enhanced security and service levels in the supply chain, utilising a widely offered pay-as-you-go model for accurate tracking and payment based on the distance travelled by vehicles (Tipping & Kauschke, 2016). Meanwhile, invoice automation, another digital solution, can potentially reduce the risk of errors (Upadhyay et al., 2021). As an integral part of the supply chain network, freight forwarders must identify their core challenges and understand the benefits of digital solutions. Implementing such solutions will be critical to ensure seamless data flow, eliminating the information fragmentation issues prevalent throughout the supply chain.

To summarise the *relevance*, the ongoing wave of digital transformation is profoundly reshaping the global business landscape, with a notable increase in the number of organisations planning digital strategies. In the logistics, or rather in the freight forwarding and supply chain sector, the adoption of digital solutions, including FinTech, addresses challenges such as fragmentation and manual processes. Despite progress, forwarding companies are still struggling with issues such as paper-based documentation.

The recent surge in research on implementing digital solutions in logistics underscores the transformative potential of technology in the field. Casado et al. (2021) examined the implications of digitalisation on the logistics sector through a case study on the CMR, concluding that the benefits of e-CMR outweigh the drawbacks, despite some employer reluctance. Kottler (2018) explored the potential of blockchains in addressing supply chain challenges, emphasising transparency and authenticity in transaction records. Arsan et al. (2009) highlighted the increasing adoption of automated expense control software, presenting advantages such as a nearly paperless system for approval routing and expense management. However, challenges emerge as organisations become more multinational, necessitating web-based solutions.

Despite the benefits, the implementation of new technologies brings challenges. Barmuta et al. (2020) identified obstacles hindering companies from digitising their processes, including employee resistance and the need for skill development. Bekmurzaev et al. (2020) emphasised the poorly understood issues of risk analysis in logistics concerning digitalisation, addressing risks such as uncertainty about the future and a shortage of skilled specialists. Jabbar et al. (2021) discussed challenges in blockchain adoption, including a need for more understanding and scepticism due to the absence of industry-wide standards. Herczeg et al.

(2018) highlighted the importance of managing synchronisation issues in the supply chain when implementing new solutions.

Cichosz et al. (2020) have identified barriers, success factors and associated leading practices for digital transformation based on multiple case studies across international and global logistics service providers.

Hohenstein (2022) explores what impact the COVID-19 pandemic has had and may yet have on supply chains, which supply chain risk management approaches have proved successful and how logistics service providers have applied the knowledge they have gained to improve their supply chain risk management practices and resilience to prepare better for the next major disruption. The study identifies eight factors that are critical to the adaptive capabilities of logistics service providers and, therefore, to their resilience in extreme conditions.

A whole series of studies were carried out in manufacturing companies. Shang et al. (2023) aimed to investigate the major areas of relevance to transforming companies into the digital economy, considering the impacts of new risks encountered during such transitions. The novel decision support model was developed to find the weight of different risks for digital economy transformation in the manufacturing industry. Ballestar et al. (2021) provide new evidence regarding the effects of robotisation, digitisation, and innovation on productivity and employment in Spanish manufacturing firms. Regarding Menzefricke et al. (2021), the interactions between technical, organisational and human dimensions pose a risk that could endanger the successful digital transformation and thus should be managed preemptively. The authors determined suitable approaches dealing with socio-technical characteristics.

In summary, in this field, one group of studies dedicated to the risk management of digital solutions aimed to find out what impact the implementation of digital solutions has on business, other studies found hindering obstacles, challenges and reasons, third ones focused on factors influencing the success of digital solutions, fourth ones on digitisation processes of manufacturing companies. However, there needs to be a systematic approach to the risk assessment of digital solutions, and there are no scientific studies focused on the situation and risk assessment of digital solutions in forwarding companies – a smaller group of companies in the transport sector. No scientific research was conducted in Lithuania. Therefore, *the aim of this research* is to assess the situation and risks of digital solutions in Lithuania's forwarding companies to optimise processes.

To provide a complete picture of digital solutions for a forwarding company, this paper will use the term *digital solutions* as the main term for both *digital* and *FinTech solutions*.

There are several *limitations* that may affect the results and should be mentioned. The method of brainstorming sessions is limited to the insights of experts, as the content of the solution depends on the creativity of the participants; the competence of the participants determines the content of the solution.

Quantitative survey: To draw conclusions about all Lithuanian forwarding companies, the sample size must be 97 respondents so that the result obtained for the 95% confidence level would be within +/– 10% error. To select the respondents for this survey, non-probability sampling was used. It should be remembered that non-probability samples do not guarantee representativeness, the conclusions should not be generalised to the whole population, and the sample's accuracy cannot be objectively estimated.

The AHP method is limited to 12 digital solutions that were distinguished after theoretical analysis, brainstorming session and survey of forwarding companies and are mainly based on experts' opinions, as the experts are employees of the analysed forwarding company, and the results may be more related to the company's individual situation, the results may be slightly different when analysing other forwarding companies.

The results of the qualitative survey and unstructured interviews regarding the identification of digital solutions and the assessment of risks, which are limited to 6 distinguished risks, are based on the answers and opinions of the experts of the forwarding companies, and the results may be different if another forwarding company is analysed. The process of selecting risks may involve a degree of subjectivity, influenced by the perspectives of the researchers and experts involved. Different research teams may prioritise risks differently, affecting the generalisability of the results.

While significant, the selected risks may not capture all potential risks associated with adopting digital solutions in logistics. The research does not account for risks that could emerge in the future, which were not explicitly identified in the theoretical framework or identified by the experts. The dynamic nature of technology and the industry may introduce novel risks that were not considered during the selection process. It is essential to mention that the selected risks predominantly focus on negative aspects and challenges in this research. While this provides valuable insights into potential pitfalls, it does not represent the positive or transformative aspects that could arise from adopting digital solutions in logistics.

The first section of the paper addresses the theory where the main processes in the forwarding company, theoretical aspects of digital solutions for optimising forwarding processes, and risks associated with digitalisation in forwarding companies are analysed. The next section is dedicated to the description of the methods applied in the research. The research results are presented in the third section, following the discussion and conclusions part.

## 2. Theoretical background of the main processes in the forwarding company

One of the reasons FinTech is emerging and attracting so much attention is its potential to transform supply chain networks in all business sectors (Wamba et al., 2020). The proliferation of digitalisation is becoming increasingly evident in various sectors, such as the logistics and supply chain industry. Before analysing the processes of the forwarding company, it is beneficial to understand the whole supply chain process and the place of the forwarding company in it. The Civil Code of the Republic of Lithuania (2000) defines freight forwarding as the organisation of freight transportation and related processes and actions described in the freight forwarding contract. One party (forwarding company) undertakes to provide or organise the services described in the contract related to cargo transportation for the other party – the customer (CC Art. 6.824 part 3). The whole supply chain process is complicated and involves the movement of material, financial and information flows. The main task of supply chain management is to optimise and improve production processes. The supply chain is viewed as an integrated entity rather than a collection of separate operations. The system planning process involves both the supplier and the consumer, as well as the various stages of supply, production and distribution.

Guerpinar et al. (2020) emphasised that new approaches and technologies are needed to link the participants in today's supply chains and to enable transparent but secure exchanges within these material, financial and information flows. Saberi et al. (2018) highlighted that one of the hurdles to overcome is that participants in multi-party supply chains are often inhibited from providing relevant information. Therefore, the entire process may face issues such as poor supplier coordination, lack of accountability and inability to monitor partner activities in real-time. It must be acknowledged that current supply chains rely heavily on centralised and sometimes disparate and independent information management systems within supply chain organisations. To summarise the supply chain participants and processes, a supply chain scheme based on Guerpinar et al. (2020), Saberi et al. (2018), and Farooque et al. (2019) was constructed and illustrated (Figure 1).

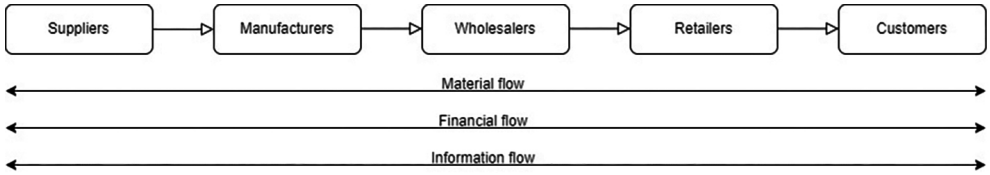


**Figure 1.** Supply chain scheme (source: compiled by the authors based on Guerpinar et al., 2020; Saberi et al., 2018; Farooque et al., 2019)

Typically, the supply chain consists of 5 main participants: suppliers, manufacturers, wholesalers, retailers and customers. Between each participant, there are processes such as material, financial and information flows, and the forwarding company is responsible for the accurate movement of the information flow.

Freight forwarding companies started to operate when the transport company transferred part of its functions – transport companies take care of the fleet of vehicles, reduce transport costs and look for solutions how to deliver the cargo safely and quickly to the right place, while freight forwarding companies take care of the organisation of the transport itself (Kontautaitė & Zinkevičiūtė, 2013). Forwarding company can also provide transport management, shipping, customs, and even door-to-door delivery services. Usually, the scope of work is listed in the contract for work and agreed upon between the two parties, namely between the forwarding company and the work order provider (Sari, 2022).

A forwarding company becomes necessary when the company needs the most optimal, non-traditional option for cargo transportation, which can be managed in response to changes, or the company seeks to save time. A logistics company must proficiently handle substantial volumes of information concerning cargo storage, packaging, product specifications, and timely deliveries to effectively participate in the supply chain process. It can, therefore, be argued that a forwarding company occupies an important place in the entire supply chain. It is responsible for the flow of information. From a procedural point of view, its activities could be described by a scheme (Figure 2).

A company receives an order from a customer to arrange a shipment, providing resources such as cargo information and customer and consignee information. These resources go through the transformation process related to the organisation of cargo transportation, and

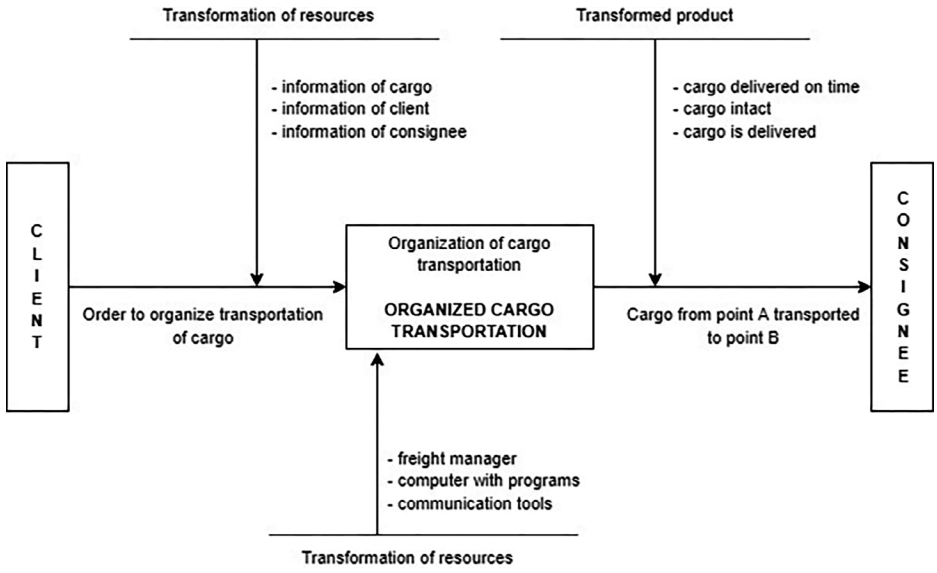


**Figure 2.** Process scheme of a forwarding company (source: Kontautaitė & Zinkevičiūtė, 2013)

the customer receives fully prepared cargo transportation from such a company. If the consignee receives the cargo on time and in good condition, and the customer remains satisfied with the quality of the service, added value is created. Resources such as freight managers, computers with software and communication tools are needed to make this process work.

If the cargo crosses national borders, the forwarding company must prepare the documents required for customs clearance according to the information provided by the customer. Given the large volume of cargo and the accompanying flow of documents, most of which are written on paper, it becomes crucial for the forwarding company to monitor and control the entire route of its movement, the crossing of customs posts.

## 2.1. Theoretical aspects of digital solutions for optimising forwarding processes

The development of information technology has led to the Fourth Industrial Revolution (Industry 4.0), which has enabled technological possibilities such as automation, the Internet of Things, robotics, cloud computing, artificial intelligence, digitalisation and more (Berger, 2016). Industry 4.0 is characterised by the fact that innovation and large-scale digitisation have expanded very rapidly, affecting different sectors (Schwab, 2017). New innovations, characterised by huge amounts of data available in real-time, are emerging, transforming service and manufacturing processes and activities in supply chains, and changing the relationships between their users and actors. As the pace of digitisation increases across the manufacturing sector, established methods and business models that were previously considered the most appropriate are being heavily impacted (Barrett et al., 2015). Most companies in the manufacturing and transport sectors are investing in digitalisation opportunities that have the potential to transform societies, economies, and organisations.

Operations such as the transportation of goods, warehousing and distribution have had to change in response to changes in local and global markets driven by new technologies and innovations. The digitalisation of forwarding companies has an exciting potential to contribute to competitiveness. At the heart of any digitalisation initiatives in forwarding companies is the need to have appropriate information and communication technologies (ICT) for data collection, storage, and processing, as well as strong digital communication within and between organisations (Wang & Sarkis, 2021).

According to Table 1, digital solutions are having a significant impact on the operations of forwarding companies. The main technologies are dedicated to accurate data collection, storage, and processing: identification (RFID system) and location tracking systems. A great deal of attention is also being paid to information-sharing platforms based on the one-stop-shop principle. They can reduce administrative costs, help avoid errors in entering the same data into the system multiple times, and increase trade flows.

Moșteanu (2019) emphasises that digital solutions and innovative technologies offer enormous potential to overcome massive development challenges and can contribute to achieving the goal of universal access to all business services. Despite the fact that as a new term – FinTech has become a popular term describing novel technologies adopted by financial service institutions (Gai et al., 2018), covering various processes, techniques and technologies, from cybersecurity to rapid delivery of financial services, FinTech is nowadays

**Table 1.** Summary of the main categories of digital solutions for a forwarding company (source: compiled by the authors based on Shi et al., 2016; Su et al., 2020; Seyedan & Mafakheri, 2020; Somapa et al., 2018; Marston et al., 2011; Muchahari & Sinha, 2013)

| Authors | Digital solution | Definition | Effect on forwarding company |
|---|---|---|---|
| Shi et al. (2016), Su et al. (2020) | Identification (RFID system) | Radio Frequency Identification technology designed for wireless communication, has been used for more than two decades to track and manage products and inventory. | This system improves the performance of logistics operations; provides data about the product even while it is moving; by marking the movement of cargo and goods in warehouses in real-time, the number of possible errors is reduced. |
| Seyedan and Mafakheri (2020) | Systems based on Big Data | It is a concept that emphasises that the volume of data is so large that it requires new processing and storage methods and systems. | The proper management of such data makes it possible for the forwarding company to make more accurate decisions, predict possible events and model situations that may have specific consequences for all participants in the supply chain. |
| Somapa et al. (2018), Marston et al. (2011), Muchahari and Sinha (2013) | Cloud computing | Cloud technology offers technology based on an elastic usage model, where the user (organisation) pays only for the information resources they need. | For forwarding company, it allows them to store, manage, and process data using a network of remote servers on the Internet and allows third parties to manage IT systems on behalf of their clients. |

recognised as one of the most important innovations not only in the financial industry. It is rapidly emerging due to favourable regulations, the sharing economy and, most importantly, constantly improving information technologies (Lee & Shin, 2018). In summary, companies could use FinTech solutions to improve their processes in three main areas: payments, advisory services and financing. Such innovations should increase sales, improve the efficiency of automation, increase customer loyalty, increase profits or market share, improve the process of information exchange, reduce transaction prices and enable new financial solutions or support better financial decision making.

To bring the whole picture of digital solutions for forwarding company, the term *digital solutions* will be used in this paper as the main term for both *digital* and *FinTech solutions* that could be used to enhance the forwarding company`s sales, improve automation efficiency etc.

However, it is important to identify which solutions would be worth implementing for the forwarding company in terms of its current situation, technologies, innovations and main problems. Further in this paper, the leading digital solutions that could positively affect the processes of the forwarding company and will be analysed in this paper are:

- *Invoice automation* – one of the leading solutions for forwarding company and could cut costs in the supply chain (mainly by cutting administrative costs) and decrease the risk of error (Upadhyay et al., 2021).
- *Cash flow stabilisation* for logistics service providers – solution allows the transfer of invoices to the client within 24 hours, and the client can track invoices and determine how often and how many of them are sold (Holland Fintech & Dinalog, 2017).
- *Digitisation of the waybill*, which is the main document for all transport and logistics sectors, could introduce a paperless process which minimises waste while improving returns in processes (Casado et al., 2021).
- *Digital expense management software* (provides online invoice approvals and workflows, processes company purchases, tracks approvals, and manages travel and entertainment expense reports) would allow the storage of receipts digitally and keep the forwarding company compliant with fiscal rulings (Arsan et al., 2009).
- *Monitoring drivers' behaviour* and adjusting insurance solution would reduce accidents' costs and save on fuel (Soleymanian et al., 2019).
- *Inventory financing solutions* (a line of credit or short-term loan useful for businesses that must pay their suppliers in a shorter period than it takes them to sell their inventory to their customers) reduce financing risks (Chakuu et al., 2020).
- *Blockchain solution* for industry-wide supply chain visibility – would enhance efficiencies and improve the visibility of the supply chain (Kottler, 2018).
- *Quick payments solution* using an external financer solution would guarantee stable cash flow within the company (Ayub & Mehar, 2021).

These 8 digital solutions were distinguished, which can have a positive impact on the activities of forwarding companies and will be further analysed.

## 2.2. Theoretical overview of the risks associated with digitalisation in forwarding company

Using digital solutions in transport and logistics enables companies to ensure strategic competitive advantages. Digital solutions such as the Internet of Things, blockchain and artificial intelligence have the potential to revolutionise the logistics industry. As outlined above, forwarding companies could cut administrative costs, reduce the risk of errors etc. However, the implementation of digital technologies is associated not only with positive effects but also with risks (Bekmurzaev et al., 2020). Logistics companies face different types of risks and are vulnerable to their impact. According to the International Organisation for Standardisation [ISO] (2009), risk is defined as the influence of uncertainty on objectives. Consequently, the probability of occurrence and the consequences of an event are considered when assessing risk. According to Kodym et al. (2020), the main types of risk are economic, technical / IT, social, environmental and legal/political:

- *Economic risk*. The adoption of automation, digitalisation, and networking technologies in logistics comes with high infrastructure, implementation, and maintenance costs, creating financial risks for companies. Choosing the right time and method of investment is crucial to avoid poor investment in immature or unnecessary technologies. There is also the risk of some customers being reluctant to pay for new technologies and lacking expertise and resources to develop data-driven business models. Increased transparency in the supply chain raises concerns about potential dependence on technology providers and vulnerability in negotiations over key data (Heckmann et al., 2015).
- *Technology and IT risk*. The implementation of a digital solution brings technical risks, which arise from the increasing complexity of merging mechanical and IT systems in the supply chain. There is a high dependency on technology and software, which creates risks of system failure and vulnerability to cyber attacks. Establishing common standards and clarifying data ownership is critical to ensure data quality and control. Cloud computing is a central technology in logistics and supply chain, but there are risks such as loss of control, unauthorised use, and incomplete data deletion when relying on CSP services, making building a private cloud solution a more secure approach but requiring higher investments (Whitmore et al., 2015).
- *Social risk*. These risks include job loss, particularly for employees whose jobs can be automated. There is also a risk for workers who cannot adapt to new ICT requirements and may not have the necessary IT skills. Training should be provided, but attracting and retaining skilled IT professionals can also be expensive. There is a risk of overload and strain from new demands on employees and a loss of social interaction due to increased automation. Internal resistance and an inadequate corporate culture may also hinder organisational change, potentially leading to missed opportunities and relocation of manufacturing and services (Gajbhiye & Shrivastva, 2014).
- *Ecological risk*. The production of new machinery and equipment required to implement digital solutions involves the consumption of large amounts of raw materials and energy, potentially offsetting efficiency gains. Data transmission, blockchain, and decentralised systems also require high computing power and energy consumption.

Implementing new technologies can lead to increased waste and emissions, especially when replacing existing machinery that needs to be disposed of. Customisation can save time, materials, and energy, but it can also increase waste and make recycling more difficult. A thoughtful implementation plan is key to ensuring that digital solutions bring environmental benefits rather than risks (Sarkis & Zhu, 2018).

- *Legal / Political risk*. Politicians can either support or create barriers to the wider adoption of new technologies through legislation or political inactivity. Infrastructure is necessary to support and influence the implementation of digitisation and connectivity in the economy. Legal issues, such as data protection, liability, labour law, intellectual property, and jurisdiction, need to be clarified to ensure the success of the industry as a whole. The lack of standards is a risk that hampers cross-border cooperation. Issues such as jurisdiction for online transactions or the role of "smart contracts" remain unresolved (Franco & Almeida, 2011).

Wang and Sarkis (2021) outline that the implementation of digital solutions in logistics can lead to an increase in cyber-attacks and data breaches. The study highlights the need for logistics companies to invest in secure and resilient digital infrastructure to mitigate these risks. Similarly, a study by Tavana et al. (2022), notes that the implementation of digital solutions in logistics can increase the complexity of supply chain operations. The study suggests that companies should carefully consider the costs and benefits of digital solutions to avoid adding unnecessary complexity to their operations. Therefore, it is important for logistics companies to carefully assess the risks and benefits of implementing digital solutions and develop strategies to mitigate these risks.

## 3. Methodology for identification and risk assessment of digital solutions

**Quantitative survey.** The survey is carried out to identify digital solutions and assess possible risks in the implementation of digital solutions. The questionnaire for this survey was prepared based on a theoretical literature analysis. The first two questions revealing the understanding and use of digital solutions were formulated based on Korchagina et al. (2020) and Mikl et al. (2021) and Sullivan and Kern (2021), Olanrewaju and Willmott (2013) respectively. All other question, from 3 to 10, were based on Upadhyay et al. (2021), Holland Fintech and Dinalog (2017), Casado et al. (2021), Arsan et al. (2009), Soleymanian et al. (2019), Chakuu et al. (2020), Kottler (2018), Ayub and Mehar (2021), Pernestål et al. (2020), Barmuta et al. (2020), Bekmurzaev et al. (2020), Bickauske et al. (2020), Cole et al. (2019), Plotnikov et al. (2019), Raza et al. (2023), Cichosz et al. (2020). And then the brainstorming session for risks identification with experts from a selected forwarding company was carried out (see Appendix).

**Sampling** is a particularly important element of the research process conducting surveys. When planning survey research, it is important to reasonably decide how many respondents need to be interviewed and how to select them.

In this survey, the population is forwarding companies. According to Lithuania`s State Data Agency, there is no exact number on how many forwarding companies are currently registered in Lithuania, it is only known, that in the beginning of 2023, there were 9144 op-

erating economic entities in the whole transport and storage industry. Therefore, according to Cochran (1977), to select a size of sample for this forwarding companies` population, a sample size formula was used:

$$n = \frac{t^2 p(1-p)}{\Delta^2}, \quad (1)$$

where $n$ – sample size, $t$ – Student's coefficient, expressing the level of confidence, $p$ – expected distribution (i. e. what proportion chose one answer or another), Δ – is sampling error.

For this survey, the confidence level was chosen to be of 95% ($t$ = 1.96). Therefore, as there is no prior data on the possible distribution of responses, in addition, surveys often include many essential questions, in formulas maximum expected distribution of results (50/50 percent) and it means that $p$ = 0.5, the sampling error is 10% or Δ = 0.10.

$$n = \frac{1.96^2 * 0.5(1-0.5)}{(0.10)^2} = 96.04.$$

Intending to draw conclusions about all Lithuania`s forwarding companies in order that at 95% the result obtained for the confidence level would be within +/–10 percent error, the sampling size must be 97 respondents. To choose the respondents for this survey, it was decided to use non-probability sampling. One of the non-probability sampling methods is purposive/judgemental sampling – the respondent group is formed according to the researcher's objectives. This means that the researcher decides which elements of the population of interest are the most informative in relation to the characteristics being studied. This method was used in this survey to select the respondents, which were forwarding companies and their employees.

**Risk map.** After completing the survey of forwarding companies, the risks assessment of implementation of digital solutions is identified.

In this work a quantitative technique will be used as the two parameters – probability and impact – will be identified during the survey of forwarding companies (see Table 2). It is important to complete the risk register accurately, risks must be clearly described, in some cases indicating their cause, source, likelihood, size and impact. The probability and impact are predicted for each risk in the register, and the overall assessment level is found according to the scheme in the Table 2.

**Table 2.** Risk probability and impact setting matrix (source: compiled by author based on Duijm, 2015)

| | Impact | | | | |
|---|---|---|---|---|---|
| Probability | Lowest | Less | Medium | Better | The greatest |
| Very often | Low | Medium | High | Very high | Very high |
| Often | Low | Medium | High | Very high | Very high |
| Neither rarely nor often | Low | Low | Medium | High | Very high |
| Rarely | Low | Low | Medium | High | High |
| Very rarely | Low | Low | Low | Medium | High |
| Assessment of the overall risk level: low, medium, high, very high | | | | | |

Such a risk analysis will be applied after the survey of forwarding companies and later the results of identified digital solutions and the AHP questionnaire will be used for the case study of a selected forwarding company.

**AHP method.** After the survey, digital solutions are identified (results of the 3 and 7 questions). The digital solutions are assessed by applying the case study of a selected company using the AHP method. The AHP method was developed by Saaty (1980) to provide an overarching view of the complex relationships inherent in the problem and help the decision-makers assess whether evaluation criteria are of the same order of magnitude. Due to several key advantages, the AHP method is often chosen and justified for decision-making processes in various fields. Starting with its usability, it is an effortlessly reasonable system; it disentangles a troublesome issue by separating it into smaller steps; it does not require authentic information sets (Canco et al., 2021). It allows the evaluation of quantitative and qualitative criteria and alternatives on the same preference scale (Franek & Kresta, 2014). It was also revealed that AHP is flexible and can be used as a stand-alone tool or in conjunction with other tools to resolve decision-making problems. The most prominent justifications for using AHP were found to be small sample size, high level of consistency, simplicity and availability of user-friendly software (Darko et al., 2019).

Considering the arguments the scientists presented, it was decided to use the AHP method. Statements supporting the usefulness of the method for risk management and suitability for small samples would have the greatest influence on the decision to use the AHP method.

Digital solutions were evaluated based on the judgement of the forwarding company`s experts. Experts must decide which of the two criteria is more important and then assign a score to show how much more important it is. While using this method, it usually compares criteria simultaneously and uses points between 1 and 9. The most accurate guidelines for assessing the pairs can be found in Table 3.

Saaty (1977) presented the stepwise procedure of AHP:

**Step 1.** Construct the structural hierarchy.

**Step 2.** Construct the pairwise comparison matrix.

**Table 3.** Value of criteria (source: Saaty, 1980)

| Value | Definition | Explanation |
|---|---|---|
| 1 | Equal Importance | Two activities contribute equally to the objective |
| 2 | Weak or Slight | |
| 3 | Moderate Importance | Experience and judgment slightly favour one activity over another |
| 4 | Moderate Plus | |
| 5 | Strong Importance | Experience and judgement strongly favour one activity over another |
| 6 | Strong Plus | |
| 7 | Very Strong | An activity is favoured very strongly over another |
| 8 | Very, very Strong | |
| 9 | Extreme Importance | The evidence favouring one activity over another is of the highest possible order of affirmation. |

Assuming n attributes, the pairwise comparison of attribute $i$ with attribute $j$ yields a square matrix $A_{nxn}$ where $a_{ji}$ denotes the comparative importance of attribute $i$ with respect to attribute $j$. In the matrix, $a_{ij} = 1$ when $i = j$ and

$$a_{ij} = 1/a_{ij}.$$

$$a = \begin{matrix} 1 \\ \dots \\ n \end{matrix} \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \dots & \dots & \dots \\ a_{n1} & \dots & a_{nn} \end{bmatrix}.$$

**Step 3.** Normalised pair-wise comparison matrix

$$c_{ij} = a_{ij} \Big/ \sum_{i=1}^{n} a_{ij}, \; i = 1, 2, 3, ..., n, \; j = 1, 2, 3, ..., n. \tag{2}$$

**Step 4.** Calculate geometric mean of each row of the matrix

$$g_i = \left( \prod_{j=1}^{n} c_{ij} \right)^{\frac{1}{n}}, \; i = 1,2,3,\dots,n, \tag{3}$$

$$w_i = \sum_{j=1}^{n} g_i,$$

$$W = \begin{bmatrix} w_1 \\ \dots \\ w_n \end{bmatrix}.$$

**Step 5.** Calculate Eigenvector & Row Matrix

$$\lambda_i = \sum_{j=1}^{n} a_{ij} w_{i=j}. \tag{4}$$

**Step 6.** Calculate the maximum Eigenvalue, $\lambda_{max}$.

$$\lambda_{max} = \sum_{i=1}^{n} \lambda_i. \tag{5}$$

**Step 7.** Calculate the consistency index & consistency ratio.

$$CI = \left(\lambda_{max} - n\right) \Big/ \left(n-1\right); \tag{6}$$

$$CR = CI \; / \; RI. \tag{7}$$

There $n$ & RI are the indexes of matric & Randomly Generated Consistency Index respectively.

**An expert method** of individual assessment was chosen for the AHP method – survey by pairwise comparison. To proceed with this survey, it is important to decide on three main elements:

- *Determining the number of experts.* The determination of the acceptable number of experts is guided by the methodological assumptions formulated in classical test theo-

ry, according to which the reliability of aggregated decisions and decision-makers are connected by a rapidly disappearing non-linear relationship.

- *Structure*. Experts of forwarding company received a survey for pairwise comparison of digital solutions, which were distinguished after literature analysis, brainstorming session and survey of forwarding companies. After the survey, an AHP method was applied to derive priority scales.
- *Selection of experts*. The experts were selected according to their position in the forwarding company, their experience in the logistics and transport sector, and their ability to evaluate the main problems of forwarding company`s processes. The experts who have received the survey are: Director of the company, Chief Accountant, Head of Expedition for Northern and Eastern Europe, Head of Expedition for Southern and Western Europe, Head of Sales and Marketing.

After the analysis of scientific literature sources, completing brainstorming session with 5 experts from forwarding company and the results of the 3rd and 7th questions of the quantitative survey with 97 respondents from forwarding companies, digital solutions for forwarding companies were identified and will be assessed.

## 4. Survey on current situation of Lithuania's forwarding companies' implementation of digital solutions

The questions for the survey were prepared in advance using Google form (see Appendix). The questionnaire was distributed to the managers and employees of Lithuanian forwarding companies. A total of 97 respondents from Lithuanian forwarding companies participated in this survey. The results are presented below in Table 4 and Figures 3–4.

The first question aims to find out whether employees and CEOs of forwarding companies have heard about the ongoing digitalisation processes in the transport and logistics sector. 90% of respondents have heard about digitalisation processes in the transport sector, 2% have not heard about it and 8% are not yet interested in digitalisation processes in the transport sector. The second question asked respondents to indicate whether they were using or implementing digital solutions in their current company. More than two thirds of respondents, 69% (67 respondents), are currently using or implementing digital solutions in their current company. One third of respondents, 31% (30 respondents), are not yet using or implementing digital solutions. The questions are further divided into *yes* and *no* options.

**The identification of digital solutions.** The questions 3 and 7 aim to identify which of the listed digital solutions are currently being used or implemented in the respondent's current forwarding company (Figure 3).

**Table 4.** Descriptive statistics of the survey (source: compiled by authors using SPSS program)

| The answers | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Have you heard about digitalisation processes | 97 | 0 | 2 | 0.94 | 0.317 |
| Currently using digital solutions or implementing one | 97 | 0 | 1 | 0.69 | 0.465 |
| Valid N (listwise) | 97 | | | | |

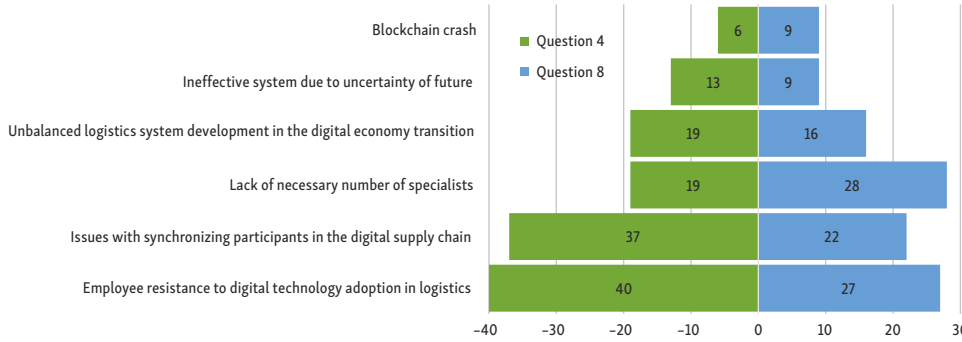


**Figure 3.** The comparison of the distribution of the answers to the questions 3 and 7 – "Which of the listed digital solutions you use or are currently implementing in your company? "and "Evaluate the listed digital solutions, which implementation in the company would bring the greatest benefit to the overall performance of the company" respectively (source: compiled by authors)

These questions were phrased differently. Those who answered *yes*, were asked to identify which of the listed digital solutions you use or are currently implementing in your company. And those who answered *no* were asked to rate which of the same list of digital solutions, if implemented in the company, would bring the greatest benefit to the company's overall performance. The respondents could choose more than one answer to these questions or give their own answer. According to the survey, the most used or currently being implemented solution in forwarding companies is invoice automation, with 59 and 30 respondents respectively. The second digital solution is the digitisation of waybills, with around a third of respondents 26 and 28 respectively. Thereafter, the positions of the answers are slightly different, but it can be said that places 3–5 are digital expense management software, monitoring the behaviour of drivers and adjusting insurance, and inventory financing solution. The respondents have also mentioned a few other digital solutions that they currently use: own information system covering all areas related to company's management, credit risk assessment of supplier/carrier, transport management system, customer self-service system, overall business management system.

**The identification of risks.** The questions 4 and 8 aim to understand if respondents have encountered or might encounter with any of the provided risks during the implementation of digital solution(-s) (Figure 4). The question 4 was for respondents who use or are currently implementing digital solutions in their company and question 8 was for the respondents who answered *no*. While answering this question, respondents could choose more than one answer or give their own ideas.

Most respondents, 40 and 27 respectively, indicated that they have encountered or might encounter the risk of employee resistance to the adoption of digital technology in logistics. More than half of the respondents indicated that they have noted that they have encountered or might encounter another major risk – issues with synchronizing participants in the digital supply chain. Blockchain or other system crash were only mentioned by 6 and 9 respondents, making it the least likely risk to be encountered, according to the respondents.

Respondents also left a comment and mentioned that their problems could be in other areas and one respondent stated that aligning the system with internal company processes

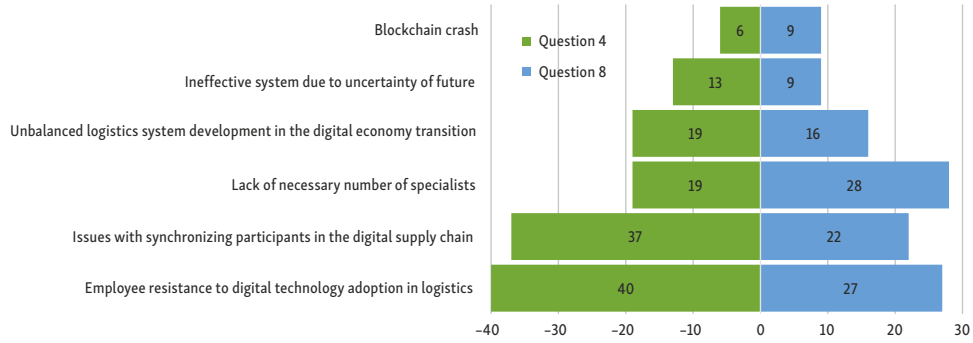


**Figure 4.** The distribution of the answers to the questions 4 and 8 – "Have your company encountered or might encounter with any of these risks during the implementation of digital solution(-s)?" (source: compiled by authors)

takes a lot of time to adapt functions/templates/settings/employee's rights precisely according to the needs of their company and it might be the biggest risk for them.

**Assessment of the digital solutions.** After the identification of digital solutions implementation, the results of the survey were applied for the case study in a selected company and to assess the selected digital solutions, the AHP method was conducted.

Five experts from a forwarding company have completed a survey and evaluated earlier distinguished digital solutions and 4 additional solutions that was identified in the survey one between another, the abbreviations of these digital solutions are:

- C1 – Invoice automation
- C2 – Cash flow stabilization
- C3 – Digitalisation of waybills
- C4 – Digital expense management software
- C5 – Monitoring the behavior of drivers and adjusting insurance
- C6 – Inventory financing solution
- C7 – Blockchain solution for industry-wide supply chain visibility
- C8 – Quick payments with the use of an external financer
- C9 – Own system related to all areas of company`s management
- C10 – Credit risk assessment of suppliers/carriers
- C11 – Transport management system
- C12 – Customer self-service system

The answers of each expert`s survey was calculated using a geometric average into one matrix (Table 5).

Matrix was normalised and compatibility analysis done:

$$CI = 0.066,$$

where CI – Consistency Index;

$$CR = 0.043,$$

where CR – consistency ratio.

As the CR is 0.043 < 0,1, this means that the experts are consistent in their evaluations. Table 6 illustrates the weights of each digital solutions.

**Table 5.** Merged matrix of 5 experts' answers (source: compiled by authors)

| Factor | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 1.00 | 4.17 | 1.93 | 2.51 | 6.15 | 3.68 | 3.10 | 5.10 | 3.29 | 5.07 | 3.87 | 4.96 |
| C2 | 0.24 | 1.00 | 0.35 | 0.58 | 3.18 | 1.52 | 0.30 | 1.52 | 0.36 | 1.52 | 0.66 | 1.25 |
| C3 | 0.52 | 2.86 | 1.00 | 1.72 | 4.42 | 2.77 | 0.38 | 2.49 | 2.00 | 3.57 | 2.70 | 3.81 |
| C4 | 0.40 | 1.97 | 0.58 | 1.00 | 2.00 | 1.00 | 0.19 | 1.89 | 0.31 | 1.00 | 0.50 | 1.32 |
| C5 | 0.16 | 0.31 | 0.23 | 0.50 | 1.00 | 0.43 | 0.15 | 0.59 | 0.30 | 0.87 | 1.00 | 0.87 |
| C6 | 0.27 | 0.66 | 0.36 | 1.00 | 2.35 | 1.00 | 0.18 | 1.32 | 0.31 | 0.87 | 0.57 | 1.32 |
| C7 | 0.24 | 5.79 | 2.64 | 5.35 | 6.79 | 5.65 | 1.00 | 6.35 | 2.05 | 3.57 | 4.13 | 4.78 |
| C8 | 0.20 | 0.66 | 0.40 | 0.53 | 1.68 | 0.76 | 0.16 | 1.00 | 0.30 | 1.00 | 0.66 | 1.52 |
| C9 | 0.30 | 2.77 | 0.50 | 3.18 | 3.37 | 3.25 | 0.49 | 3.37 | 1.00 | 3.37 | 2.70 | 3.64 |
| C10 | 0.20 | 0.66 | 0.28 | 1.00 | 1.15 | 1.15 | 0.28 | 1.00 | 0.30 | 1.00 | 0.80 | 1.25 |
| C11 | 0.26 | 1.52 | 0.37 | 2.00 | 1.00 | 1.74 | 0.24 | 1.52 | 0.37 | 1.25 | 1.00 | 2.05 |
| C12 | 0.20 | 0.80 | 0.26 | 0.76 | 1.15 | 0.76 | 0.21 | 0.66 | 0.27 | 0.80 | 0.49 | 1.00 |
| Sum | 3.99 | 23.17 | 8.91 | 20.13 | 34.23 | 23.69 | 6.67 | 26.80 | 10.86 | 23.87 | 19.08 | 27.75 |

**Table 6.** Results of experts' survey, after application of AHP method (source: compiled by authors)

| c | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | Sum | w |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 0.251 | 0.180 | 0.217 | 0.125 | 0.180 | 0.155 | 0.465 | 0.190 | 0.303 | 0.212 | 0.203 | 0.179 | 2.659 | 0.222 |
| C2 | 0.060 | 0.043 | 0.039 | 0,029 | 0,093 | 0.064 | 0.045 | 0.057 | 0.033 | 0.063 | 0.035 | 0.045 | 0.606 | 0.051 |
| C3 | 0.130 | 0.124 | 0.112 | 0.085 | 0.129 | 0.117 | 0.057 | 0.093 | 0.184 | 0.149 | 0.142 | 0.137 | 1.459 | 0.122 |
| C4 | 0.100 | 0.085 | 0.065 | 0.050 | 0.058 | 0.042 | 0.028 | 0.070 | 0.029 | 0.042 | 0.026 | 0.048 | 0.644 | 0.054 |
| C5 | 0.041 | 0.014 | 0.025 | 0.025 | 0.029 | 0.018 | 0.022 | 0.022 | 0.027 | 0.036 | 0.052 | 0.031 | 0.344 | 0.029 |
| C6 | 0.068 | 0.028 | 0.041 | 0.050 | 0.069 | 0.042 | 0.027 | 0.049 | 0.028 | 0.036 | 0.030 | 0.048 | 0.516 | 0.043 |
| C7 | 0.061 | 0.250 | 0.296 | 0.266 | 0.198 | 0.239 | 0.150 | 0.237 | 0.189 | 0.149 | 0.216 | 0.172 | 2.423 | 0.202 |
| C8 | 0.049 | 0.028 | 0.045 | 0.026 | 0.049 | 0.032 | 0.024 | 0.037 | 0.027 | 0.042 | 0.035 | 0.055 | 0.449 | 0.037 |
| C9 | 0.076 | 0.119 | 0.056 | 0.158 | 0.098 | 0.137 | 0.073 | 0.126 | 0.092 | 0.141 | 0.142 | 0.131 | 1.350 | 0.113 |
| C10 | 0.049 | 0.028 | 0.031 | 0.050 | 0.034 | 0.048 | 0.042 | 0.037 | 0.027 | 0.042 | 0.042 | 0.045 | 0.477 | 0.040 |
| C11 | 0.065 | 0.065 | 0.042 | 0.099 | 0.029 | 0.074 | 0.036 | 0.057 | 0.034 | 0.052 | 0.052 | 0.074 | 0.679 | 0.057 |
| C12 | 0.051 | 0.035 | 0.029 | 0.038 | 0.034 | 0.032 | 0.031 | 0.025 | 0.025 | 0.034 | 0.026 | 0.036 | 0.394 | 0.033 |
| | | | | | | | | | | | | | 12.00 | |

According to Table 7, 3 digital solutions received the highest weights for the implementation in the forwarding company: C1 – Invoice automation solution, C3 – Digitisation of waybills and C7 – Blockchain solutions for industry-wide supply chain visibility.

To sum up, for the further analysis, it was decided to merge C1 – Invoice automation and C3 – Digitalisation of waybills solutions and call it as document flow and management system. Due to data limitations, the C7 – blockchain solution, will be ignored.

**Results of the risk assessment.** According to the survey results, the understanding of risks differs between respondents who use or are currently implementing digital solutions (option yes) and those who have not yet implemented digital solutions (option no), so two risk registers were created (see Table 7 and Table 8).

**Table 7.** Risk register for responses from the respondents who are using or currently implementing digital solution in forwarding company

| No. | Description of risk | Current level of risk | | |
|---|---|---|---|---|
| | | Probability | Impact | Overall assessment |
| 1 | Ineffective system due to uncertainty of future | Neither rarely nor often (average 3.03) | Medium (average 3.07) | Medium |
| 2 | Issues with synchronizing participants in the digital supply chain | Often (average 3.5) | Better (average 3.66) | Very High |
| 3 | Employee resistance to digital technology adoption in logistics | Often (average 3.8) | Better (average 3.85) | Very High |
| 4 | Lack of necessary number of specialists | Neither rarely nor often (average 3.42) | Medium (average 3) | Medium |
| 5 | Unbalanced logistics system development in the digital economy transition | Neither rarely nor often (3.36) | Medium (average 3.28) | Medium |
| 6 | Blockchain or other system crash | Neither rarely nor often (average 2.97) | Medium (average 2.82) | Medium |

**Table 8.** Risk register for responses from the respondents who have not yet implemented digital solution in forwarding company (source: compiled by authors)

| No. | Description of risk | Current level of risk | | |
|---|---|---|---|---|
| | | Probability | Impact | Overall assessment |
| 1 | Ineffective system due to uncertainty of future | Neither rarely nor often (average 3.17) | Medium (average 3.07) | Medium |
| 2 | Issues with synchronizing participants in the digital supply chain | Often (average 3.67) | Better (average 3.6) | Very High |
| 3 | Employee resistance to digital technology adoption in logistics | Neither rarely nor often (average 3.1) | Better (average 3.53) | High |
| 4 | Lack of necessary number of specialists | Often (average 3.6) | Better (average 3.67) | Very High |
| 5 | Unbalanced logistics system development in the digital economy transition | Often (average 3.6) | Better (average 3.77) | Very High |
| 6 | Blockchain or other system crash | Often (average 3.67) | Medium (average 3.4) | Very High |

According to the risk register of the answers of the respondents who are using or are in the process of implementing digital solution(s) in forwarding companies (see Table 7), two risks have the overall assessment of very high level – problems with synchronisation of participants in the digital supply chain and resistance of employees to the introduction of digital technologies in logistics. The rest of the risks have an overall rating of medium.

According to the risk register of responses from respondents who have not yet implemented digital solution(s) in the forwarding company (see Table 8), four risks have an overall assessment of very high – problems with synchronisation of participants in the digital supply chain, lack of necessary number of specialists, unbalanced development of the logistics system in the transition to the digital economy and blockchain or other system crash. The risk of employee resistance to the introduction of digital technologies in logistics is assessed as high, and only one risk, ineffective system due to uncertainty about the future, is assessed as medium.

Two risk maps based on risk registers were created to illustrate the differences in risk perception (Figure 5).

In summary, according to the risk maps, the respondents who are using or are in the process of implementing digital solutions in the forwarding company have a clearer view of the risks – the resistance of employees to the introduction of digital technology in logistics and problems with synchronising participants in the digital supply chain stand out the most from the remaining risks as the risks with the highest probability and the highest impact when implementing digital solutions. The respondents who have not yet implemented digital solutions do not have a specific risk – all the risks mentioned are in the area of the highest probability and the highest impact and need to be considered when implementing digital solutions.

However, in order to assess the highest priority risks and to further evaluate them in a forwarding company, it is necessary to evaluate the answers of all respondents of the survey and to complete the common risk register (see Table 9).

According to the results of the survey, two risks with the highest overall rating are distinguished: problems with synchronising participants in the digital supply chain and employee resistance to the introduction of digital technology in logistics have an overall rating of very

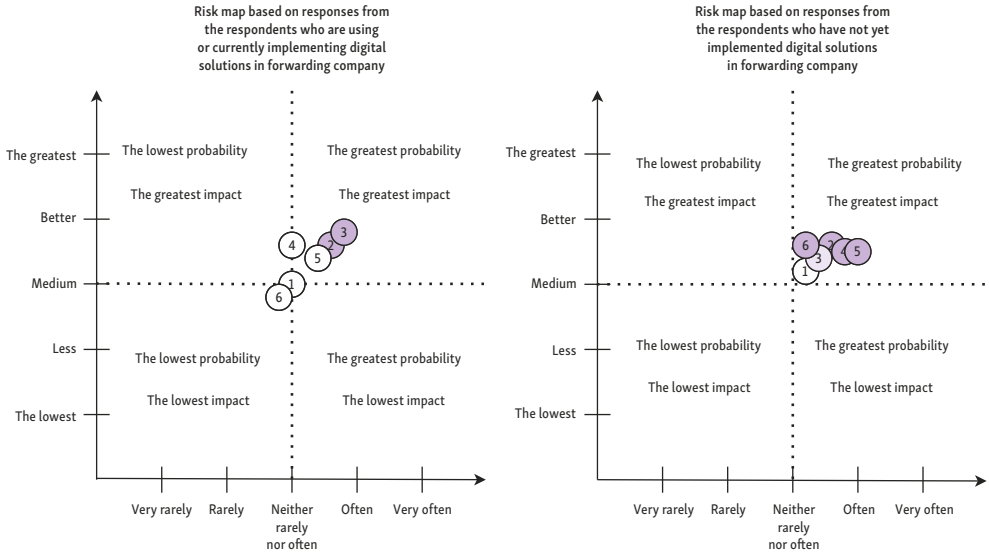


**Figure 5.** Risk maps on the basis of information from risk registers (source: compiled by authors)

high risk, and the lack of the necessary number of specialists has an overall rating of high. A risk map has been created to illustrate the results of the risk register.

Based on the collective feedback from respondents of the forwarding companies (Figure 6), three risks received the highest overall assessment – synchronisation of the participants in the digital supply chain, resistance of the employees to the introduction of digital technologies in logistics and lack of the necessary number of specialists.

The impact and likelihood of these three risks will be further analysed in the selected company during the implementation of the highest priority digital solution – the document flow and management system.

**Table 9.** Risk register for all respondents of the survey (source: compiled by authors)

| No. | Description of risk | Current level of risk | | |
|---|---|---|---|---|
| | | Probability | Impact | Overall assessment |
| 1 | Ineffective system due to uncertainty of future | Neither rarely nor often (average 3.07) | Medium (average 3.07) | Medium |
| 2 | Issues with synchronizing participants in the digital supply chain | Often (average 3.52) | Better (average 3.64) | Very high |
| 3 | Employee resistance to digital technology adoption in logistics | Often (average 3.58) | Better (average 3.75) | Very high |
| 4 | Lack of necessary number of specialists | Often (average 3.47) | Medium (average 3.21) | High |
| 5 | Unbalanced logistics system development in the digital economy transition | Neither rarely nor often (average 3.43) | Medium (average 3.43) | Medium |
| 6 | Blockchain or other system crash | Neither rarely nor often (average 3.19) | Medium (average 3.00) | Medium |

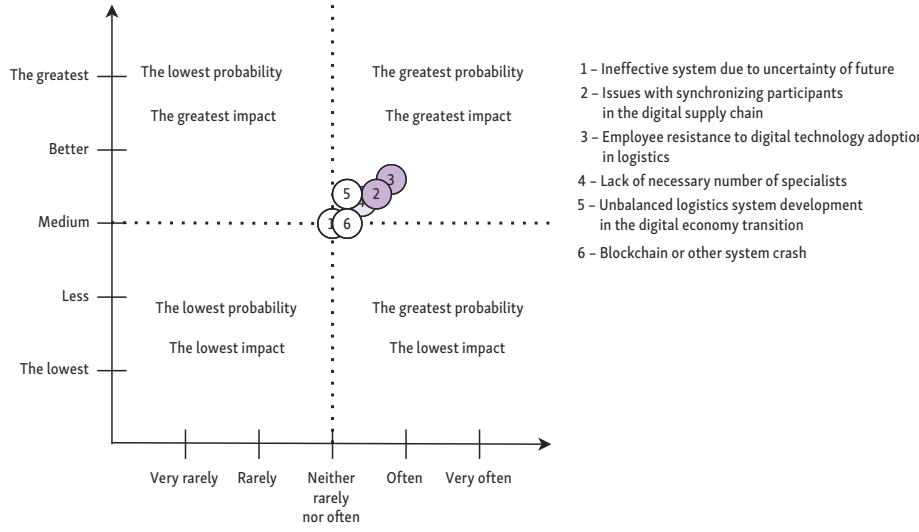


**Figure 6.** Risk map of the overall answers of respondents (source: compiled by authors)

**Process optimisation modelling.** After identifying and assessing the digital solutions and risks in the selected company, the results were used to model possible process optimisation.

After the AHP analysis it was decided to evaluate the current process of information and document flow in the forwarding company and to predict how this process could be shortened, how much time and costs could be saved by implementing a document flow and management system. In other words, to optimise the process. In order to create a scheme of information and documents, an interview was conducted with the CEO and experts of the forwarding company. The result of interview is pictured in the Figure 7.

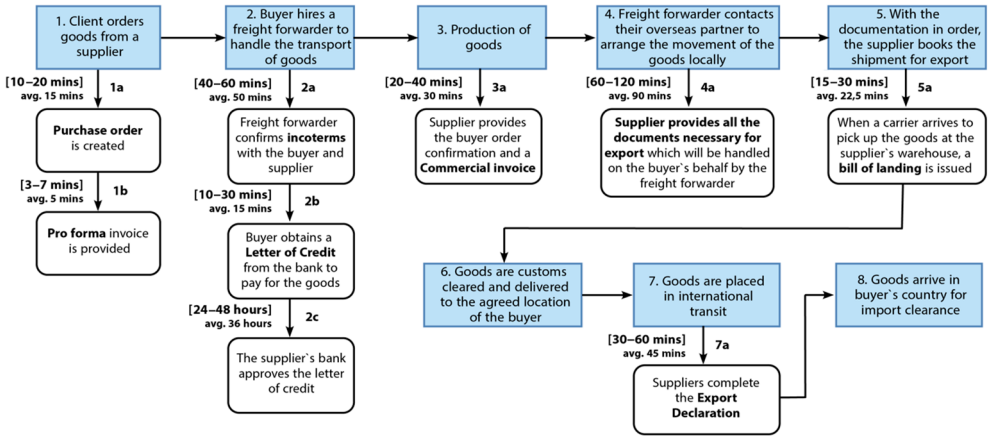


**Figure 7.** Process scheme of forwarding company (source: compiled by authors and forwarding company's experts)

The process of information flow in the forwarding company consists of 8 main steps (Figure 7), starting from the customer ordering the goods from the supplier to the arrival of the goods in the buyer's country. In 6 out of 8 steps new information and documents are received and their processing takes different amount of time. Indicators 1a, 1b to 7a mark the documentation flow of each step.

Time has been chosen as the measure that allows to count how many hours and how many employees are needed to complete a shipment in the forwarding company. The most time is spent in the 4th step – preparation of export documentation, which is done by freight forwarders, from 40 to 60 minutes for confirmation of Incoterms between buyer and supplier, which is also done by freight forwarders.

After analysing document flow and management systems together with experts, literature and the current market of such systems, Table 10 was made, according to which implementation of document flow and management system could reduce the time of document management provided by forwarding company up to 59%. Such a system would reduce the time of 1b process (automatically adding it to 1a), reduce the time of 3a process by half, the preparation of export documents (4a) would be reduced by 3 times, 5a could be shortened up to 15 minutes and the completion of export documents (7a) would take only 20 minutes.

According to the forwarding experts, the average forwarding company carries out 17 linear transfers per week, 68 per month. Assuming that the average hourly wage of a Lithuanian freight forwarder is 9 EUR, it is possible to calculate how much freight forwarder's working time spent on processing documents will be saved per month and how much the freight forwarder will save in wages paid for this process (see Table 11).

After the implementation of the document flow and management system in the forwarding company, a freight forwarder will spend 128 working hours less per month on document management. Assuming that the average wage of a freight forwarder is 9 EUR (after tax) per hour, the freight forwarder would save 1 152 EUR (128 h × 9 EUR) in paid wages every month, which would be spent on document management.

In summary, after implementing a document flow and management system, a freight forwarder could reduce document management time by up to 59%. Meanwhile, freight forwarders would spend 128 fewer working hours processing documents and transferring their data to different systems. The forwarding company could save up to 1 152 EUR per month in salaries paid for document processing. The implementation of such a system would enable the company to provide better quality services to its customers, to attract new customers and to organise more shipments. The growing number of orders would increase the turnover and thus make the entire forwarding company more efficient.

**Table 10.** Process of information flow before and after implementation of document flow and management system (source: compiled by authors and forwarding company's experts)

| Process of information flow | Avg. minutes (in the current process of forwarding company) | Avg. minutes (if implementing document flow and management system) |
|---|---|---|
| **Total of step 1** | **20 mins** | 15 mins |
| 1a | 15 mins | 15 mins |
| 1b | 5 mins | 0 mins |
| **Total of step 2 (2c exluded)** | **65 mins** | **65 mins** |
| 2a | 50 mins | 50 mins |
| 2b | 15 mins | 15 mins |
| 2c (depends not on forwarding company) | 36 hours | 65 hours |
| **Total of step 3 (consists of 3a only)** | **30 mins** | 15 mins |
| **Total of step 4 (consists of 4a only)** | **90 mins** | 30 mins |
| **Total of step 5 (consists of 5a only)** | **22.5 mins** | 15 mins |
| **Total of step 7 (consists of 7a only)** | **45 mins** | 20 mins |
| **Total:** | **272.5 mins** | 160 mins |

**Table 11.** Transfer processing before and after implementation of document flow and management system (source: compiled by authors)

| Before implementation of document flow and management system | After implementation of document flow and management system | Difference |
|---|---|---|
| Processing 68 transfers takes 18 530 min ~309 h (68 transfers × 272.5 min) | Processing 68 transfers takes 10 880 min ~181 h (68 transfers × 160 min) | 7 650 min ~128 h (18 530 min – 10 880 min) |
| 309 h × 9 EUR = 2 781 EUR | 181 h × 9 EUR = 1 629 EUR | 1 152 EUR |

Despite the optimistic results of optimising such processes, there is a critical aspect of the risks involved. For this reason, five experts from forwarding companies assessed the three main risks involved in implementing a document flow and management system. The results, an average score of their evaluations were calculated and are presented in Table 12.

A risk map was created to illustrate the results of the experts' assessment (Figure 8).

To sum up, based on the experts' assessment, the risk of employee resistance to the introduction of digital technology in logistics has the highest probability and could happen in the first month after the implementation of the document flow and management system, which could cause a loss of 2,500 to 5,000 EUR. The same loss of money could cause problems with the synchronisation of participants in the supply chain, but according to the experts, this risk is less likely than employee resistance. The risk of not having the required number of specialists is the one with the lowest probability and impact square (Figure 8).

**Table 12.** Average scores of risks probability and impact (source: compiled by authors)

| No. | Description of risk | Current level of risk | | |
|---|---|---|---|---|
| | | Probability | Impact | Overall assessment |
| 1 | Synchronizing participants in the digital supply chain | Can happen in a range – during the first month – during the first 3 months after implementation of digital solution (average 2.4) | Could lose from 2 500 to 5 000 EUR (average 2) | Medium |
| 2 | Employee resistance to digital technology adoption in logistics | Can happen during the first month after implementation of digital solution (average 3) | Could lose from 2 500 to 5 000 EUR (average 2) | High |
| 3 | The lack of necessary number of specialists | Can happen in a range – during the first 6 months – during the first month after the implementation of digital solution / (average 1.8) | Could lose in a range from 2 500 to 5 000 EUR – up to 2 500 EUR (average 1.4) | Low |

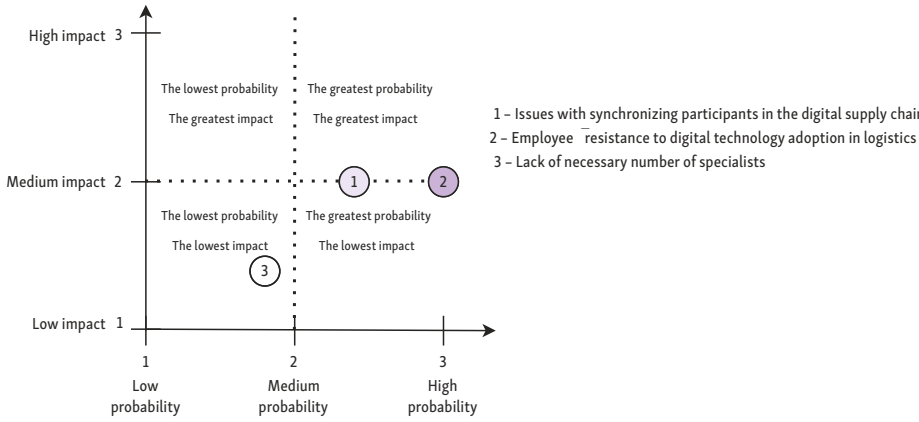


**Figure 8.** Risk map of the overall answers of respondents (source: compiled by authors)

## 5. Discussion

In this area, several studies have been conducted to explore different aspects of risk management related to digital solutions. One set of studies focuses on understanding the impact of implementing digital solutions on businesses, while another group focuses on identifying barriers, challenges and underlying reasons. In addition, there are studies that examine the factors that contribute to the success of digital solutions, with a separate set focusing on digitalisation processes within manufacturing companies.

Despite the range of research, there is a recognised need for a systematic approach to assessing the risks associated with digital solutions. In particular, there is a gap in research on the situation and risk assessment of digital solutions within freight forwarding companies – a subset of companies in the transport sector. Surprisingly, there is a lack of scientific research in Lithuania, where the geopolitical and business context remains unexplored in the context of risk assessment of digital solutions.

The survey of forwarding companies revealed that additional digital solutions were being implemented and that around two-thirds were already using digital solutions. Invoice automation emerged as the most implemented solution. A case study of a selected forwarding company, using the AHP method, identified three key digital solutions: invoice automation, waybill digitisation and blockchain. A combined solution, called a "document flow and management system", showed significant potential for time and cost savings. Three risks – synchronizing participants, employee resistance, and a lack of specialists – are identified as having the highest overall assessment. These risks were selected for further analysis during the implementation of the prioritized digital solution. During the case study, the expert evaluation suggests that the risk of employee resistance to digital technology adoption in logistics has the highest probability, potentially causing a significant loss in the first month post-implementation. While issues with synchronizing participants in the supply chain could cause a similar loss, experts consider this risk less probable than employee resistance. After the AHP analysis, it was decided to evaluate the current process of information and document flow, in other words, to optimise the process. The results of the optimization show that freight forwarding companies could reduce document management time by up to 59%.

The research results showed the current situation of implementation of digital solutions in Lithuanian forwarding companies. This research fills not only the research gap in this field but also the gap between science and practice. The results obtained from the research can be applied in practice in forwarding companies when making decisions about the choice of digital solutions and prevention measures to avoid identified risks.

Also, the research results can be used for further research. While research has delved into the benefits and risks, there remains a vast scope for further exploration. Future research could delve deeper into risk analysis during the implementation of digital solutions in forwarding companies, shedding light on the complexities and nuances involved. Additionally, a focused investigation into implementation opportunities and the associated risks could contribute to a more nuanced understanding of the advantages and disadvantages of integrating digital solutions in logistics and forwarding companies. This dynamic research field holds promise for shaping the future of logistics through informed and strategic technological implementations.

## 6. Conclusions

The research underlines the importance of digital solutions in the logistics sector and their potential to transform forwarding companies. An in-depth literature analysis highlights the consensus among authors on the pivot role of digital solutions in improving logistics efficiency and competitiveness. The term "digital solutions" encompasses both digital and FinTech solutions that offer potential benefits to forwarding companies. The selection of relevant solutions for implementation depends on the unique context of the forwarding company, including its current situation, technologies, innovations and key challenges.

The literature also highlights the risks associated with implementing digital solutions, including uncertainty, synchronisation challenges, staff resistance, lack of specialists, development imbalance and blockchain crashes. Recognising the interconnected and overlapping nature of these risks, effective risk management, including risk assessment, is considered crucial to avoid the pitfalls of poor implementation.

The survey of forwarding companies revealed that additional digital solutions were being implemented and that around two-thirds were already using digital solutions. Invoice automation emerged as the most implemented solution. In a forwarding company survey, eight previously mentioned digital solutions are excluded, and four additional solutions are identified.

A case study of a selected forwarding company using the AHP method identified three key digital solutions: invoice automation, waybill digitisation and blockchain. A combined solution called a "document flow and management system", showed significant potential for time and cost savings. Later on, interviews with experts highlighted substantial time and cost reductions post-implementation of the document flow and management system. A subsequent in-depth literature source analysis and brainstorming session with five experts exclude six risks, and a risk assessment involving respondents reveals varying perspectives between companies implementing and those not yet implementing digital solutions. Overall, three risks – synchronizing participants, employee resistance, and a lack of specialists – are identified as having the highest overall assessment. These risks were selected for further analysis while implementing the prioritized digital solution. During the case study, the expert evaluation suggests that the risk of employee resistance to digital technology adoption in logistics has the highest probability, potentially causing a loss ranging from 2 500 to 5 000 EUR in the first month post-implementation. While issues with synchronizing participants in the supply chain could cause a similar loss, experts consider this risk less probable than employee resistance.

The introduction of a document flow and management system in the forwarding company would lead to a significant reduction of 128 working hours per month spent on document management by a freight forwarder. The average hourly salary for a freight forwarder at 9 EUR (after taxes) results in monthly savings of 1 152 EUR specifically designated for document processing.

In conclusion, implementing the document flow and management system not only achieves a remarkable 59% reduction in time dedicated to document management but also translates into tangible cost savings for the company. Beyond the financial benefits, the enhanced efficiency from this system has the potential to improve service quality, attract

new clients, facilitate organised transfers, and contribute to increased sales revenue, thereby elevating the overall operational efficiency of the forwarding company. This underscores the multifaceted advantages and positive impact that strategic technological implementations can have on the success and growth of a company.

There are concerns about the subjectivity inherent in the AHP method, which is mainly based on expert opinion and may lead to results that do not accurately reflect the actual situation. Given these specific limitations and drawbacks, it is advisable to use an alternative method to identify the most beneficial digital solutions for a forwarding company. However, despite these concerns, the main findings of the research underline that the selected digital solutions have the potential to optimise the forwarding company's operations and offer significant benefits to its processes.

Future research could delve deeper into risk analysis while implementing digital solutions in forwarding companies, shedding light on the complexities and nuances involved. Additionally, a focused investigation into implementation opportunities and the associated risks could contribute to a more nuanced understanding of the advantages and disadvantages of integrating digital solutions in logistics and forwarding companies.

The implications of this research span policy, practice, theory and future research endeavours. Policymakers can use the identified risks associated with implementing digital solutions to develop comprehensive risk management frameworks for the logistics and forwarding industry. Forwarding companies can strategically select and implement digital solutions based on their specific context, addressing unique challenges and exploiting opportunities for efficiency gains. The research contributes to theoretical frameworks by classifying and evaluating various digital solutions and identifying risks. The identified risks and their varying probabilities contribute to the theoretical understanding of the complex dynamics between risk factors and the successful implementation of digital solutions.

In summary, future directions for research include the following. Examine the landscape of emerging digital and FinTech solutions that could further revolutionise logistics and forwarding companies. Analyse the potential benefits and risks associated with these new technologies. Conduct a longitudinal study to assess the long-term impact of implementing digital solutions in forwarding companies. Track changes in efficiency, competitiveness and financial performance over time to understand the lasting benefits. And carry out a comprehensive cost-benefit analysis of the implementation of digital solutions in freight forwarding companies, depending on the data access.

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# APPENDIX

**Table A1.** The survey's questionnaire (source: compiled by the authors)

| Question | Comments and Measurements |
|---|---|
| 1. Have you heard about the ongoing digitalisation processes in the transport and logistics sector? | Yes, No |
| 2. Are you using digitalisation solutions (including FinTech solutions) in your current company or currently implementing one? | ***According to the responses of the 2 question, the following questions of the survey will differ.***<br>Yes, No |
| ***If your answer to second question was "Yes":***<br>3. Which of the listed digital solutions you use or are currently implementing in your company:<br>▪ Invoice automation<br>▪ Cash flow stabilisation for logistics service provider<br>▪ Digitalisation of waybills<br>▪ Digital expense management software<br>▪ Monitoring the behaviour of drivers and adjusting insurance<br>▪ Inventory financing solution<br>▪ Blockchain solution for industry-wide supply chain visibility<br>▪ Quick payments with the use of a external financer<br>▪ Other (provide your answer).<br>4. Have your company encountered or might encounter with any of these risks during the implementation of digital solution (-s):<br>▪ Ineffective system due to uncertainty of future<br>▪ Issues with synchronizing participants in the digital supply chain<br>▪ Employee resistance to digital technology adoption in logistics<br>▪ Lack of necessary number of specialists<br>▪ Unbalanced logistics system development in the digital economy transition<br>▪ Blockchain crash<br>▪ Other (provide your answer) | ***3 question is used for the identification of digital solutions.***<br>***4 question is used for the identification of risks.***<br>Yes, No |
| 5. On a scale from 1 to 5, evaluate which of listed risks caused or would cause the greatest impact on your current company`s activity:<br>▪ Ineffective system due to uncertainty of future<br>▪ Issues with synchronizing participants in the digital supply chain<br>▪ Employee resistance to digital technology adoption in logistics<br>▪ Lack of the necessary number of specialists<br>▪ Unbalanced logistics system development in the digital economy transition<br>▪ Blockchain crash | ***5 question is used for the risk assessment.***<br>1 – the lowest impact<br>2 – less impact<br>3 – medium impact<br>4 – better impact<br>5 – the greatest impact |

| Question | Comments and Measurements |
|---|---|
| 6. On a scale from 1 to 5, evaluate how often the listed risks have occurred or could occur in your company:<br>▪ Ineffective system due to uncertainty of future<br>▪ Issues with synchronizing participants in the digital supply chain<br>▪ Employee resistance to digital technology adoption in logistics<br>▪ Lack of the necessary number of specialists<br>▪ Unbalanced logistics system development in the digital economy transition<br>▪ Blockchain crash | ***6 question is used for the risk assessment.***<br>1 – very rarely<br>2 – rarely<br>3 – neither rarely nor often<br>4 – often<br>5 – very often |
| ***If your answer to second question was "No":***<br>7. On a scale from 1 to 5, evaluate the listed digital solutions, which implementation in the company would bring the greatest benefit to the overall performance of the company:<br>▪ Invoice automation<br>▪ Cash flow stabilisation for logistics service provider<br>▪ Digitalisation of waybills<br>▪ Digital expense management software<br>▪ Monitoring the behaviour of drivers and adjusting insurance<br>▪ Inventory financing solution<br>▪ Blockchain solution for industry-wide supply chain visibility<br>▪ Quick payments with the use of a external financer<br>▪ Other (provide your answer).<br>8. In your opinion, would your company encounter with any of these risks during the implementation of digital solution (-s):<br>▪ Ineffective system due to uncertainty of future<br>▪ Issues with synchronizing participants in the digital supply chain<br>▪ Employee resistance to digital technology adoption in logistics<br>▪ Lack of necessary number of specialists<br>▪ Unbalanced logistics system development in the digital economy transition<br>▪ Blockchain crash<br>▪ Other (provide your answer) | ***7 question is used for the identification expectation of digital solutions.***<br>1 – the least beneficial<br>2 – less beneficial<br>3 – neither not beneficial nor beneficial<br>4 – more beneficial<br>5 – the most beneficial<br>***8 question is used for the identification of risks.***<br>Yes, No |

| Question | Comments and Measurements |
|---|---|
| 9. On a scale from 1 to 5, evaluate which of listed risks would cause the greatest impact on your current company`s activity:<br>▪ Ineffective system due to uncertainty of future<br>▪ Issues with synchronizing participants in the digital supply chain<br>▪ Employee resistance to digital technology adoption in logistics<br>▪ Lack of the necessary number of specialists<br>▪ Unbalanced logistics system development in the digital economy transition<br>▪ Blockchain crash | ***9 question is used for the risk assessment.***<br>1 – the lowest impact<br>2 – less impact<br>3 – medium impact<br>4 – better impact<br>5 – the greatest impact |
| 10. On a scale from 1 to 5, evaluate how often the listed risks could occur in your company:<br>▪ Ineffective system due to uncertainty of future<br>▪ Issues with synchronizing participants in the digital supply chain<br>▪ Employee resistance to digital technology adoption in logistics<br>▪ Lack of the necessary number of specialists<br>▪ Unbalanced logistics system development in the digital economy transition<br>▪ Blockchain crash | ***10 question is used for the risk assessment.***<br>1 – very rarely<br>2 – rarely<br>3 – neither rarely nor often<br>4 – often<br>5 – very often |