

## THE INFLUENCE OF LOGISTICS INNOVATIONS ON MANAGEMENT OF FREIGHT-TRANSPORTATION PROCESSES

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**Abstract:** Time is one of the main factors, and it affects the decision of costumers while choosing a particular transportation company. Every stage of logistics processes takes a particular period. That is why almost every firm thinks about the ways of decreasing the time wastes in order to maximize the profit of business. The objective of this research is to explore how different logistics innovations can affect freight transportation processes and save operational time. To achieve this goal and explore the topic more deeply, a list of articles published in worldwide databases related to this domain was analyzed and interpreted. The survey on freight transportation was used to get a better knowledge of today's situation of freight systems. Based on the result of this article, it is suggested that new ideas for the management of companies in this sphere are suggested. The findings of this research can help Kazakhstan's logistics companies to develop better strategies and to adopt innovative logistics technologies into freight transportation. They can make them become innovation-based logistics service providers.

**Key words:** logistics, innovations, freight transportation, management, transport policy

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### Introduction

The need to understand the dynamics of freight systems has gained considerable importance. Policies need to be adapted to time-definite policy objectives like decarbonization. In cases of disturbance of the freight system, time to respond is critical for resilience. In addition to that, innovations and policies have become cyclical and adaptive processes, requiring more advanced predictive capabilities. (Tavasszy, 2020). In conditions of globalization, freight transportation should be fast, flexible and precise process by the reason that it has a direct impact on almost all spheres of human lives like medicine, infrastructure, food industry, clothing industry, etc. The effectiveness and quick response of the organizations depend on how fast the trucks with necessary goods are being delivered. To make freight transportation more processes and effective, it is compulsory to consider new

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techniques and equipment for delivery of products. History has already shown that the improvement of transport services has led to significant changes in agriculture production and regional growth. The building of canals and railroads in the 19th century, for example, opened up large parts of the United States to agricultural production. In this process, large-scale production and specialization are subject to changes in production technologies and hence performance. New technologies used in transportation can lead to a wide range of changes. The use of telecommunications and information technology in freight transportation has improved the ability to coordinate long-distance transportation, and it reduces the costs, thus, resources and components are delivered at the international level (FHWA, 2004). This shows that freight transportation should be modified up-to-time and companies should focus on the establishment of new technologies to the supply chain.

### **Literature review**

With the general growth of freight transportation work in many academic fields, it is hardly surprising that the relationship between freight transportation and logistics innovations has attracted considerable attention in recent years. Various studies provide information about freight transportation or logistics innovations separately. However, there is only a limited studies that show the connection between these two topics and its effect on the whole economic system.

For instance, the study of Southworth focuses mainly on freight transportation and its importance. Freight transportation encompasses the movement of a wide variety of products, from raw materials to finished goods, from low value-to-weight commodities such as coal, grain, and gravel to high value-to-weight items such as computers and pharmaceuticals. On-time delivery is crucial to business success for perishable items, refrigerated items and a growing number of time-sensitive items. More importantly, these products must be moved safely and at a reasonable cost (Southworth, 2003). On the other hand, the researcher like Rossum, whose study is based on logistics innovation only. There are seven main changes within the logistics industry and freight transportation system, respectively automation, robotics, wearable technology, drones, self-driving vehicles, cloud computing and Internet of things (Rossum, 2016). Several works that were analyzed for this work implementation does not represent only freight transportation; they consider it as a part of the supply chain. Service offers related to physical products become a product-service system (Tukker, 2004). When coordinated with supply chain control points, it allows scale savings to be achieved by creating large-scale flows at slow speeds in the distribution channels in the office before the flows are distributed to customers. Such a change in the supply chain is unprecedented, and it is expected to continue in logistics systems for decades to come, supported by increased modularity of loading facilities and collaboration between shippers and transport and storage service providers (Montreuil, 2011). It is expected that these

innovations in logistics will have a profound economic impact. The World Economic Forum estimates that the social value of innovation in 2025 will be several trillion US dollars (WEF, 2016).

There are some researches that connect all of the information that was provided in previous studies into one. Federal Highway agency, for instance, has shown how transportation improvements can affect the economic performance of the country. Despite the wealth of information on transportation's contribution to the economy, the debate continues on the linkages between transportation improvements and economic performance and the relative strength of these links (FHWA, 2002).

***The freight transportation process and its importance***

Freight transportation is the main part of all supply chains and logistics processes. Freight transportation is an integral part of global commodities, precisely, supply chains, different production networks including complex and integrated ones, several activities from the stage of transformation of the raw materials to distribution of finished goods to the consumers. Nowadays, the company's managers pay more attention to the efficiency of the movement of goods and strict control of inventories and supply chains. Logistics costs include transportation costs, cost of ownership and operation of warehouses, inventory orders and costs (mainly interest and insurance). In recent years, transportation costs have decreased, and reliability to this service has been improved.

Even though freight is a smaller representation of the flows in transport networks, it plays a crucial role in infrastructure costs, traffic performance and other factors of logistics. The availability of freight transport has a considerable direct and indirect economic influence and will have more in future. Because of COVID-19, the danger of a lack of supply of products is visible, and it has already shown the disadvantages of freight transportation systems. These processes need to improve in several ways. The first thing to consider is, doubtless, time of delivery. Supply of vital products such as medicals and food takes too much time: the shops are not able to supply the populations with food, the pharmacies are not prepared for a big demand on some simple personal protective equipment. These all lead to a deficit of some products and price speculation that can subsequently cause the crisis. Moreover, businesses buy more services of good transportation and use them to reduce other components of logistics costs (for example, fewer warehouses or fewer stocks). As we can see, the main source is the tendency of managers to approach this method to reduce costs and/or improving the quality of transportation economic efficiency of the advanced freight system (ICF Consulting, 2002). That is why e-commerce, individual deliveries, as well as business deliveries are so crucial in the age of developed technologies. Respectively, freight transport has become more significant for a policy of different countries. The main task in this work is to consider the innovations in logistics and the requirements for freight modeling. Digitalization, automation and other technological inventions affect the logistics industry in different ways. Supply chains have started using the new

capabilities to provide digital services in their businesses. Consequently, different logistics and transportation activities are being changed due to the establishing of new technologies. The main objective of freight modeling is to provide necessary evidence in order to create better policy in industrial logistics activities. In this work, the authors have focused on different innovations that should be used in management and implementation of transportation. If the logistics company has a weak management system, the freight transportation that is already the most significant cost component in SCM, may lead to net loss instead of income. Management of freight transportation is a process that ensures the success of the whole operations from the beginning to the end by considering different options of freight loading and unloading, packaging, transportation and other activities within the logistics. This is the reason it is compulsory to consider management of cargo transportation and change it in accordance with modern requirements.

***The logistics innovations and their application***

Digitalization, automation and other technological progress products are radically changing the logistics sphere. The supply chain opens up new possibilities for digital services with new business models, and logistics and transport processes are transforming within these changes.

Basically, there are seven main changes within the logistics industry and freight transportation system respectively: automation, robotics, wearable technology, drones, self-driving vehicles, cloud computing and Internet of things (Rossum, 2016).

***Automation***

Automation that uses data-driven software to enhance machine efficiency offers many solutions to the logistics -- starting with improving labeling and ending with optimizing warehouse sorting systems. Holland's port of Rotterdam often refers to as the "world's most developed port", is a leader in the implementation of this kind of technology. It is in the form of full automation.

Fully automated port container terminals utilize programmable cranes to unload cargo, and it can increase the service capacity, improve processing and reduce labor costs. According to the Wall Street Journal, automation allows Holland's port to increase overall productivity by 30% (Page, 2020).

### ***Robotics***

Unlike automated machines, robots are designed to handle multiple tasks at the same time, and those limit their use in the logistics industry. This is especially true for e-commerce operations that require increased levels of speed and efficiency to ensure the rapid growth of online sales. Amazon set up the road in 2012 when it acquired a monopoly on Kiva robots, and called Bloomberg a "robot gun race". Robots that execute one-click orders in less than 15 minutes, but typically it takes 60-75 minutes for humans and also they have reduced production costs by about 20% (Bhasin and Clark, 2016). Other companies are now trying to fill their warehouses with similar ones to stay competitive.

### ***Wearable technology***

Sooner or later, Wearable technology will become the standard "must-have" in the logistics industry. One of the success stories had been seen in the German logistics company DHL, which implemented a pilot project at its warehouse in Bergen op Zoom, which tested to improve wear technology. Remarkably, it reduced human error during the warehouse order process (Manners-Bell, 2016).

The task of the pilot was to get an idea of the advantages and disadvantages of the technology. For three weeks, Bergen op Zoom warehouse workers have been equipped with displays such as Google Glass and VuzixM100. Every display provided particular task information during the selection, product location and quantity. In total, ten customers used the equipment and collected more than 20,000 items, completing 9,000 orders over a while. As a result, employees were able to work faster and without mistakes. DHL and Ricoh are currently evaluating the implementation of the solution. Experiments have shown that smart glasses like Google Glass not only increase efficiency by 25% but also increase the satisfaction of employees.

### ***Drones***

Drones have many promising applications for the logistics industry, primarily the ability to combine new forms of express delivery with customers. Drones can have a direct impact on our ability to deliver products, which will benefit both dense and targeted urban areas with fewer vehicles on the road and more in rural areas.

Global companies and startups are already ready to master this growing technology. For example, UPS and Zipline have recently launched non-medical delivery to start deliveries in Africa, and TechCrunch can affect future business ventures. Rwanda's national drone delivery program allows blood transfusion clinics in the western part of the country to order mobile phones using instant messaging. Orders will then be taken to Zipline's distribution center in Mukhan, which has a fleet of 15 drones called Zips. Each Zip can fly up to 150 km away and carry 1.5 kg of blood, flying either by wind or by rain, which is enough to save a person's life. For comparison, DHL drones' maximum speed is about 90 less than 40 mph, and the range is only about 7.5 miles (Table 1).

**Table 1: Comparison of healthcare delivery drone payload, range and speed (Source: UPS, 2016)**

Drone company	Payload	Range	Speed
Matternet	2 kg (4.4 lb)	10 km (6.25 miles)	40 kmph 25 mph
DHL Parcel	4.4 lb	12 km (7.5 miles)	>40 mph
Zipline	3 lb	45 miles	90 mph
Flirtey	2 kg (4.4 lb)	20 miles	unknown
Delft University	4 kg (8.8 lb)	12 km (7.5 miles)	60 mph

Zipline can make 50-150 emergency flights to transfusion clinics 21 times per day across the western half of Rwanda and can process orders within 30 minutes (UPS, 2016). Rwanda plans to expand the delivery of Zipline unmanned aerial vehicles to the eastern part of the country in early 2017, which will provide immediate delivery of vital medicines to every 11 million people in the country.

"Failure to deliver life-saving drugs to the most needy causes millions of deaths each year in the world. Zipline will help solve this problem radically", said Zipline CEO Keller Rinaudo. "We have built a worldwide express delivery system that will allow you to ship medicines on-demand and at a lower price, anywhere" (UPS, 2016).

#### ***Self-driving vehicles***

Logistics companies have made significant strides in adopting self-propelled technology ahead of time, due in part to low regulatory requirements and observable test conditions that provide space, such as warehouses and storage areas. As a result, many logistics operations nowadays use autonomous vehicles from autonomous forklifts to small-scale trucks.

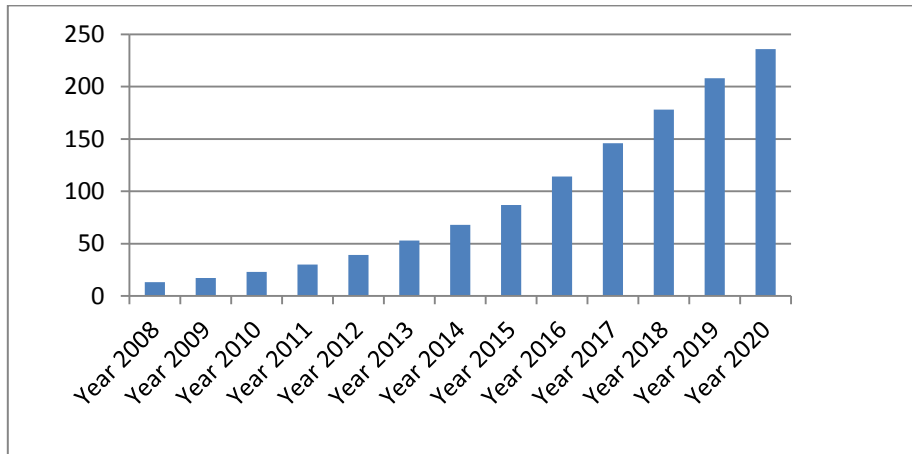
According to New York Times, despite the years that autonomous vehicles have become standard, global autonomous semi-trailers may not be far off. One of the leaders in this movement, former Google Engineer Otto, believes that self-propelled trucks create less regulatory and financial barriers than cars (DHL, 2015).

#### ***Cloud computing***

Nowadays, cloud computing is a fast-developing technology that allows companies to increase their profit. According to Forrester, Profit that comes from public clouds grows at a compounded annual rate of 22 percent between 2015 and 2020, reaching \$236 billion (Figure 1). Cloud computing applications can provide the logistics industry with greater efficiency and flexibility, and the trillion dollars in the Flexport Silicon Valley is a leader in this movement.

Designed as an "Internet Age Forwarder", Flexport makes the usual unclear and digitized global delivery operations available on a convenient internet dashboard (Castern, 2016). Recently expanded to New York, Hong Kong and Amsterdam, the company uses smart processes to reduce growing transaction costs, increase

transparency and meet the growing customer preferences for crowd-sourcing deliveries.



**Figure 1: Total Public Revenues** (Source: Forrester Research Inc., 2016)

### ***Internet of Things***

Internet of Things (IoT) allows us to add physical elements to devices and systems that have Internet access. Today, the logistics industry uses IoT in a variety of ways: from IoT technology experiments to temperature detection of package failure; from temperature and humidity sensors in the supply chain to quality control.

According to Cisco, by 2020, over 50 billion objects will be connected to the Internet, which will amount to \$ 1.9 trillion in the logistics industry.

### **Methodology**

In this paper, freight transportation will be examined in various perspectives. As the factors that influence the development of freight transportation, logistics innovations are taken.

This research is focused on 25 papers published from 2001 to 2020 in international peer-reviewed journals and official websites. Primarily, the data were chosen by keywords such as “freight transportation”, “logistics innovations”, “freight management” after those were filtered by the presence of reliable and topical information on freight transportation. The academic papers are analysed and classified according to the research topic adopted and the themes addressed.

It was considered to begin researching peer-reviewed journals and conference proceedings to obtain literature on freight transportation. For analysis, the authors turned to the bibliographic database Springer, Elsevier, Emerald, because they contain articles from all major magazines about transport.

In order to gain a better insight into the possibilities for improvement of the product range, semi-structured interviews were conducted with four PhD holding Professors who have a direct connection to logistics and two IT specialists who focus on Robotics. The age of the interviewers is between 20-45 years old. They were asked for ten questions about the innovations in logistics they heard about, why are they important and how they can be used in future. Interviews were conducted at Kazakh National University named after al Farabi and lasted approximately 15 minutes each. Answers were recorded by note-taking.

The article also includes a quantitative method of research a survey that was conducted online, which consisted of 10 questions. The major part of respondents are people who work in a different logistics company, professors who teach logistics, and another part is students of Logistics and Economics specialities. Questionnaire survey on freight transportation in Kazakhstan is conducted to study the presence of innovations in the logistics industry. Logistics technologies are classified into seven types: automation, robotics, drones, wearable technologies, self-driving vehicles, Internet of Things and cloud computing. The factors that can be affected by these innovations are time, cover and cost.

## Results

Different logistics innovations established a lot of new elements into the supply chain, and some of them have already shown their effectiveness in practice. This work has aimed to consider some innovations and choose options that will affect freight transportation system and find solutions to the main problems of the system. In this purpose, several methods of research were used and analyzed; as a result, the study got the conceptual model of the work (Figure 2). Management of freight transportation usually focuses on three main factors: cost, time and cover. Managers can increase the performance of the system by regulating these three factors: decreasing the cost, reducing the time and expansion of cover. There are particular stages of freight transportation (loading and packaging, warehousing, delivery and service) and each of these stages affects at least one factor. Innovations that were studied in this article, in its turn, affects various stages and processes of the freight transportation system.

It was decided to conduct a survey, which can help to identify which difficulties clients usually meet during the transportation of goods and to know whether it is possible to avoid them, by using some of the suggested inventions. The survey, which was created at online cloud-based software SurveyMonkey, consisted of ten questions and was completed more than 200 times. A major part of the respondents had experience in the organization of freight transportation (Figure 3). It allowed us to know real-time problems that people usually meet while goods movement processes. The most common option was High cost (43,07%), Transportation takes a lot of time (29,70%) and the absence of precise time (29,70%) (Figure 4). This means that time and cost are the factors that can be crucial for clients while



choosing Transportation provider. If the company aims to increase the number of clients or make them loyal it must think of the ways of decreasing the cost and time wastes. More than 83% of the respondent supports the idea that the freight transportation system has to be changed (Figure 4). The major part would like to establish new technologies into freight systems (Figure 5). When people were asked to assess the importance of innovations, we get an opportunity to compare them between each other and can also categorize in ranking. While categorising them, Automation, Wearable Technology, Robotics, Drones, Internet of Things and Cloud computing are ranked from 1 to 6, respectively.

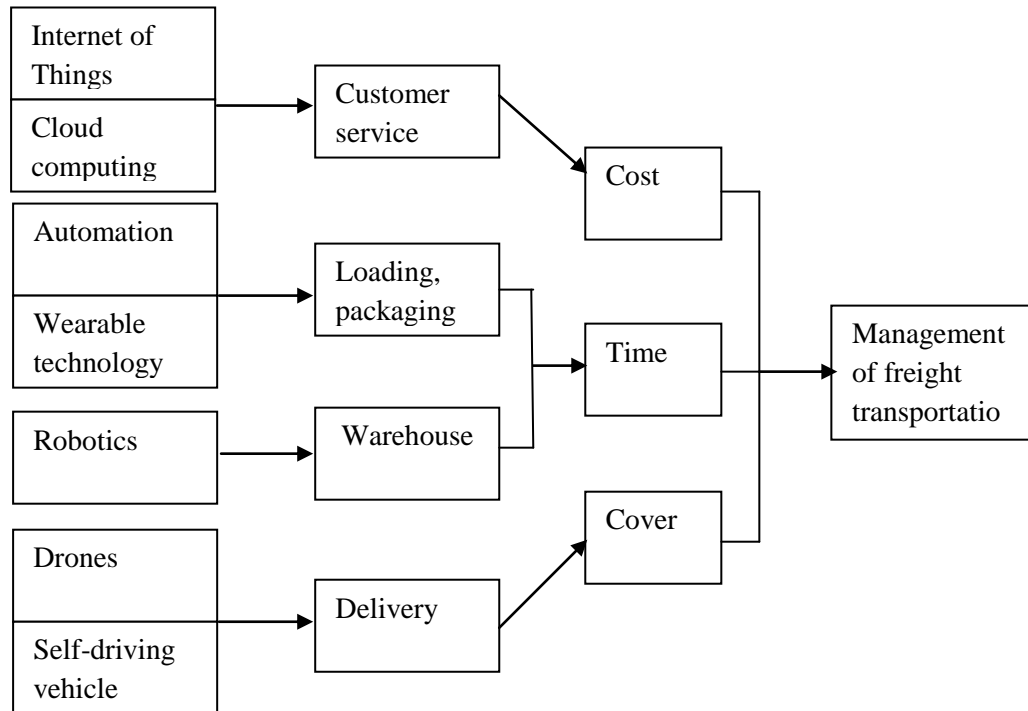


Figure 2: Conceptual model of freight transportation

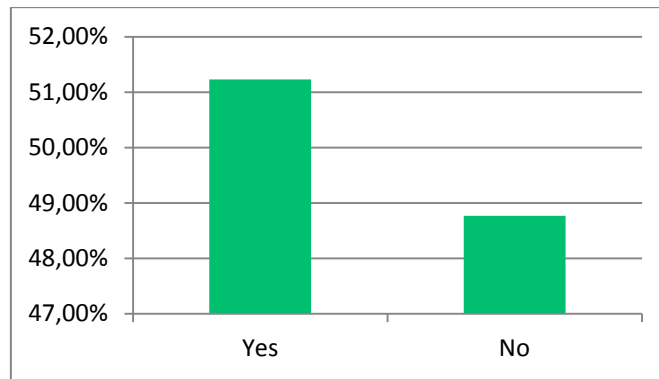


Figure 3: The results of the survey. Question 1. “Have you ever encountered the need to organize freight transportation?”

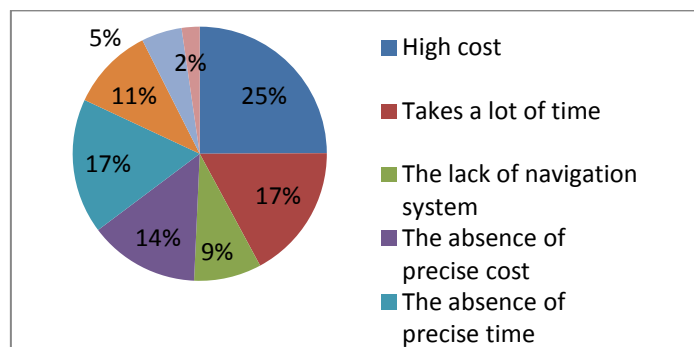


Figure 4: The results of the survey. Question 2. “List the difficulties that you met while organizing the freight transportation or using companies that provide such service?”

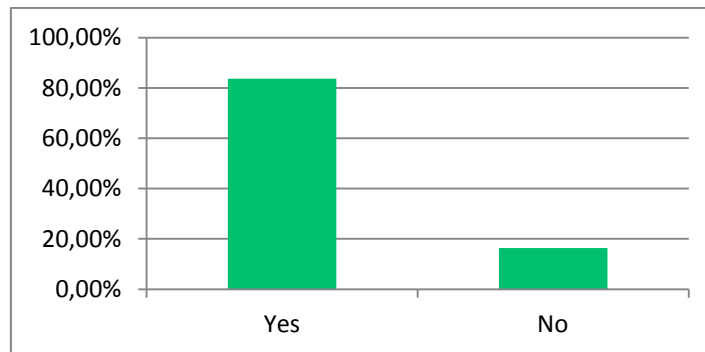
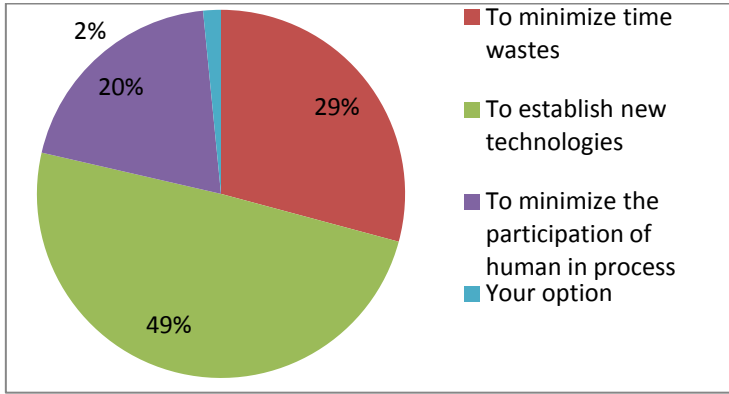
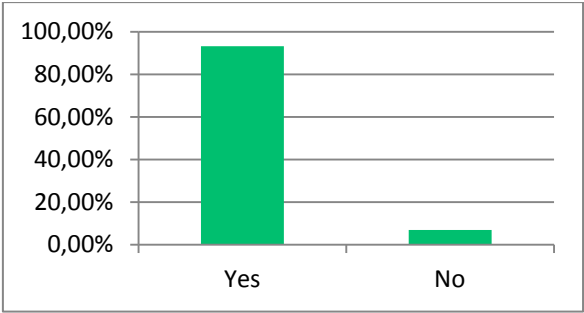


Figure 5: The results of the survey. Question 3. Do you think today's freight transportation system has to be changed?



**Figure 6: The results of the survey. Question 4. “What would you like to change?”**



**Figure 7: The results of the survey. Question 5. Do you think that logistics innovations affect freight transportation?**

**Table 2: The results of the survey. Question 6. Assess the importance of AUTOMATION for freight transportation processes (5-max, 1-min)**

1	2	3	4	5	Total	Weighted Average
5,91%	12	5,91%	12	23,15%	47	22,66%
46	42,36%	86	203	3,9		

**Table 3: The results of the survey. Question 7. Assess the importance of ROBOTICS for freight transportation processes (5-max, 1-min)**

1	2	3	4	5	Total	Weighted Average
6,90%	14	8,87%	18	20,20%	41	24,63%
50	39,41%	80	203	3,81		

1	2	3	4	5	Total	Weighted Average
5,91%	12	1,48%	3	16,75%	34	25,12%
51	50,74%	103	203	4,13		

**Table 4: The results of the survey. Question 8. Assess the importance of DRONES for freight transportation processes (5-max, 1-min)**

Answer Choices	Average Number	Total Number	Responses	
0-49 Cloud computing, 50-equal 51-100- Internet of Things	67,32	13464	100,00%	200

**Table 5: The results of the survey. Question 9. In your opinion, Which of these innovations is more important in freight transportation?**

1	2	3	4	5	Total	Weighted Average
4,98%	10	3,48%	7	19,90%	40	30,85%
62	40,80%	82	201	3,99		

## Conclusion

With globalization process, the demand for transportation of goods is increasing. The work of logistics companies focused basically on satisfying the needs of clients, increasing their number and optimizing the expenses. Due to the logistics innovations, freight transportation has already been improved and can become even more efficient. The establishment of such technologies like Internet of Things, robots and drones can affect the company's growth in various ways starting with reducing delivery time, ending with the expansion of its cover. It can also help to minimize human participation in some processes, which has become more important due to the situation caused by COVID-19.

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### WPLYW INNOWACJI LOGISTYCZNYCH NA ZARZĄDZANIE PROCESAMI TRANSPORTU TRANSPORTOWEGO

**Streszczenie:** Czas jest jednym z głównych czynników i wpływa na decyzję klientów przy wyborze konkretnej firmy transportowej. Każdy etap procesów logistycznych zajmuje określony okres. Właśnie dlatego prawie każda firma myśli o sposobach zmniejszenia marnotrawstwa czasu w celu maksymalizacji zysku firmy. Celem tych badań jest zbadanie, w jaki sposób różne innowacje logistyczne mogą wpłynąć na procesy transportu towarów i zaoszczędzić czas operacyjny. Aby osiągnąć ten cel i głębiej zgłębić ten temat, przeanalizowano i zinterpretowano listę artykułów opublikowanych w światowych bazach danych związanych z tą domeną. Ankieta dotycząca transportu towarowego została wykorzystana, aby uzyskać lepszą wiedzę na temat dzisiejszej sytuacji systemów towarowych. Na podstawie wyników tego artykułu sugeruje się nowe pomysły dotyczące zarządzania przedsiębiorstwami w tej dziedzinie. Wyniki tych badań mogą pomóc Kazachstanom w logistyce w opracowaniu lepszych strategii i zastosowaniu innowacyjnych technologii logistycznych w transporcie towarów. Mogą sprawić, że staną się dostawcami usług logistycznych opartych na innowacjach.

**Słowa kluczowe:** logistyka, innowacje, transport towarowy, zarządzanie, polityka transportowa

### 物流创新对货运过程管理的影响

**摘要：**时间是主要因素之一，它会影响客户在选择特定运输公司时的决策。物流过程的每个阶段都需要一个特定的时期。这就是为什么几乎每个公司都在思考减少时间浪费以最大化业务利润的方法。这项研究的目的是探索不同的物流创新如何影响货运过程并节省运营时间。为了实现此目标并更深入地探讨该主题，分析并解释了在与该领域相关的全球数据库中发布的文章列表。货运调查用于更好地了解当今货运系统的状况。根据本文的结果，建议针对此领域的公司管理提出新的想法。这项研究的结果可以帮助哈萨克斯坦的物流公司制定更好的战略，并在货运中采用创新的物流技术。他们可以使他们成为基于创新的物流服务提供商。

**关键词：**物流，创新，货运，管理，运输政策