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e-mail: support@smart-scm.org
тел.: (063) 593-30-41
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**Grytsenko S.I.** Doctor of Economics, Professor, Professor of Logistics Department of National Aviation University (Ukraine)

**ORCID** – 0000-0002-3322-3986
**Researcher ID** – N-4298-2018
**Scopus author id:** – 57783729900

**Ninich V.Z** master student of Logistics Department of National Aviation University (Ukraine)

**ORCID** –
**Researcher ID** –
**Scopus author id:** –

# CLUSTERING OF LOGISTICS SUPPLY CHAINS IN THE PROCESS OF UKRAINE'S EUROINTEGRATION

***Sergiy Grytsenko, Veronika Ninich. "Clustering of logistics supply chains in the process of Ukraine's eurointegration".*** *This article delves into the concept of clusters within the nation's economy, the role of logistics management in effective cluster operation, and avenues for its enhancement.*

*The research focuses on the socio-economic processes that facilitate the clustering of logistics supply chains for the company "PAPIR SERVICE SK" - one of Ukraine's largest companies involved in the procurement and distribution of paper and cardboard in rolls.*

*The subject of investigation encompasses a comprehensive range of scientific, methodological, and practical aspects related to the establishment of a mechanism for forming cluster entities within the context of Ukraine's integration with Europe.*

*Particular attention is devoted to defining the concept of an economic cluster, exploring the role of logistics management for cluster participants, examining prospects for logistics companies to become integral parts of a cluster, analyzing contemporary trends in the development of logistics management for supply chains. An arsenal of simulation modeling tools is proposed for designing supply chains within the market of printing services in Ukraine.*

*The feasibility of proposing necessary alterations to the functioning of logistical systems and enterprises within an economic cluster is demonstrated.*

*Implementing the results obtained expedites the processes of creating cluster entities within Ukraine's transportation and logistics sector, facilitating the formulation of strategies for their activities based on the application of scientific tools.*

***Keywords****:* economic cluster, enterprise logistics activity, logistics management, supply chain, logistics innovations, cluster organizational structure.

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***Сергій Гриценко, Вероніка Нініч. «Кластеризація логістичних ланцюгів постачання в процесі євроінтеграції України».*** *У статті розглянуто кластери в економіці держави, місце логістичного управління в ефективному функціонуванні кластеру та шляхи його покращення.*

*Об'єктом дослідження є соціально-економічні процеси забезпечення кластеризації логістичних ланцюгів постачання компанії ТОВ «ПАПІР СЕРВІС СК» - однієї з найбільших в Україні компаній із закупівлі та збуту паперу та картону у рулонах.*

*Предметом дослідження є сукупність науково-методичних та практичних аспектів формування механізму створення кластерних утворень в процесі євроінтеграції України.*

*Особлива увага надається визначенню поняття економічного кластеру, дослідженню ролі логістичного управління для учасників кластеру, розгляду перспектив для логістичних компаній, що можуть стати частиною кластеру, аналізу сучасних тенденцій в розвитку логістичного управління ланцюгів постачання. Запропоновано інструментарій імітаційного моделювання для проєктування ланцюгів постачання на ринку поліграфічних послуг України.*

*Показана доцільність пропозиції щодо необхідних змін в функціонуванні логістичних систем та підприємств економічного кластеру.*

*Впровадження одержаних результатів дозволяє прискорити процеси створення кластерних утворень у транспортно-логістичних перевезеннях України та формування стратегії їх діяльності на основі використання наукового інструментарію*

***Ключові слова:*** економічний кластер, логістична діяльність підприємства, управління логістичною діяльністю, ланцюг постачання, інновації в логістиці, організаційна структура кластеру

**Introduction.** The development of the global economy throughout the 21st century has been characterized by the expansion and deepening of global and regional connections, leading to the formation of a global market for capital, goods, and labor. Additionally, the creation of a unified information space has emerged as a direction within the globalization of international economic and social relations. One of the pathways to stimulate industrial production and regional development involves the establishment of cluster formations in locally integrated technological sectors, particularly in the production of office materials. This approach aims to enhance competition in the domestic market and activate foreign economic activities among participating cluster enterprises.

**Research Objective and Tasks:** The theory of cluster formations has influenced the principles of forming production-territorial complexes within Ukraine's economy. However, the scientific and practical framework for addressing this issue is still in the development and testing stage. The aim of this work is to refine the theoretical and methodological foundations for creating territorial transport-logistics clusters and develop scientific-practical recommendations for forming a cluster of logistics supply chains.

**Presentation of the main results.** In the context of societal globalization, significant changes are taking place in the organization of production at both the national and international levels. Advanced territorial-industry and integration associations known as clusters are forming. Clusters represent a combination of competition and cooperation, where collaborations in certain areas aid competitive success in others. The article [1] is dedicated to ensuring a country's competitiveness within the framework of innovation and industrial modernization strategies based on cooperative alliances. Successful cluster and cooperation association functioning depend on their activities in research and development, among other factors.

The development of Ukraine's regions, taking into account competitive advantages

through rational resource utilization within transport-logistics clusters, is explored in sections of the monograph [2]. The monograph [3] delves into the theoretical foundations of cluster formation and development at the global and regional levels by synthesizing theoretical advances in identifying trends and the regional development of the global economy on innovative grounds. It also elucidates the essence of cluster formations, modern concepts of their development, and theoretical approaches to formulating strategies for the foreign economic activities of cluster formations. The technology of forming and operating transport-logistics clusters is detailed in a section of the monograph [4].

For Ukraine, territorial clustering stands as an ideal approach to bolstering its economy and sustaining a competitive stance within the global economic framework. Cluster schemes offer the ability to pinpoint sectors in which the country can exhibit competitiveness.

The creation of a territorial transport-logistics cluster is the outcome of the collective efforts of enterprises whose products require delivery across various segments of the global market. The geographical distribution of these enterprises defines an area of attraction towards an inter-industry and inter-regional center, such as a zonal airport within the territorial business cluster. This center would possess all the facilities necessary for executing aviation export-import services at a contemporary international level, with minimal expenditure.

Among the proposals, the establishment of a transport-logistics system for printing enterprises within a territorial cluster can be considered. This system would further localize within a transport-logistics cluster encompassed by a geographically concentrated business cluster. Given the prioritized parameter of swift international passenger and cargo delivery, each territorial business cluster should be incentivized to create and foster its own carriers – pivotal elements of a territorial transport-logistics cluster geared towards expanding export activities.

The establishment and growth of a market-based economic system in Ukraine necessitate fundamentally new approaches to organizing entrepreneurial activities. In this regard, strategic development management based on a cluster approach holds particular significance. The success, outcomes, and long-term viability of any enterprise are contingent upon the consistent logical decisions made by its leaders. Each of these decisions ultimately entails economic repercussions based on the enterprise's activities.

In today's landscape, enterprise leaders are compelled to make economic decisions within conditions of uncertainty and heightened risk. This stems from a lack of comprehensive knowledge regarding consumer behavior, competitive stances, appropriate partnership selection, and dependable sources of commercial and other information. Moreover, most domestic enterprise managers focus their efforts on addressing immediate tasks, operating at an operational level, and consequently, planning on a short-term horizon. Issues pertaining to prospective, primarily Euro-centric, development often find themselves on the periphery of managerial activities. However, the clustering of logistics supply chains within the scope of Ukraine's evolving integration process is an indispensable necessity, destined to become an integral facet. The external environment transforms so rapidly that relying solely on operational measures from higher management for enterprise adaptation to new realities is insufficient.

In many cases, the inefficiency of supply chain functioning, characterized by failures, delayed order execution, substantial time and cost losses, can be attributed to inadequate supply chain design during the preparation phase. The primary channel through which products are obtained from suppliers by "PAPIR SERVICE SC" LLC is through deliveries from Germany. "PAPIR SERVICE SC" LLC is one

of the largest companies in Ukraine engaged in the procurement and distribution of paper and cardboard in rolls. It was founded on October 24, 2016, with its headquarters located in Kyiv. The primary type of economic activity according to the Classification of Economic Activities (CED) is 17.12 - Manufacture of paper and paperboard [5].

Interest in the ecological aspects of cellulose, paper, and cardboard production varies among different users. Producers of cellulose, paper, and cardboard often receive inquiries from clients regarding product quality and its impact on the environment.

During the selection of raw materials, it is important to consider that different products possess varying ecological characteristics based on the employed production processes. Local environmental conditions at the production site also represent another crucial aspect that needs to be taken into account.

Currently, the company serves over 20 regular clients throughout Ukraine, engaged in the production of corrugated packaging from corrugated cardboard and paper, as well as Ukrainian printing houses. Among them are companies like "ECOPRES VV" LLC, "TORGHTEKHNIKA KPK" LLC, "EL'GRAF" LLC, "ZARORISHPOLIMERTARA" LLC, "GRINKAR COMPANY" LLC, "ELIA PROMO" LLC, "ZHYTOMYR CARDBOARD PLANT" LLC, "DBK-AGRO" LLC, "MEGA-POLIGRAF" LLC, "POLIPRINT" LLC, and others.

Paper and cardboard for these clients are supplied directly from European plants or are transshipped at the company's own warehouse. Among the suppliers of raw materials are LEIPA Georg Leinfelder GmbH (Schwedt, Germany), Julius Schulte Söhne GmbH & Co KG (Trebzen, Germany) [6], UPM Communication Papers (Augsburg, Germany) [7], COLOMBIER INTERNATIONAL BV (Meindrecht, Netherlands) [8], Baltijos Brasta (Kaunas, Lithuania), Profil Papiervertriebs GmbH & Co KG (Hamburg, Germany) [9].

Supply is conducted by road transportation, which incurs substantial costs. Additionally, there are significant risks associated with delays due to customs clearance and transportation within Ukraine.

As per the contract terms, transportation of a 20-foot container from the port of Hamburg (Germany) to the central warehouse in Kyiv (Ukraine) is conducted. The cargo must be delivered and unloaded in Kyiv within 13 days, as each day of delay results in a penalty of 300 USD.

The analysis of calculation results indicates that for transporting a 20-foot container, the most attractive delivery route would be:

- For the "time" parameter: by road transportation, customs clearance in Kyiv by a customs broker.

- For the "cost" and "total cost" parameters: by railway, customs clearance in Kyiv using the company's resources.

For further analysis to determine the optimal route considering cost and time characteristics, it's necessary to normalize the time, transportation cost, and total cost into relative values.

Subsequently, using decision criteria (Laplace, Wald, Savage, Hurwicz) under conditions of uncertainty, the optimal delivery route should be selected.

Starting from the 20th century, paper production became a highly mechanized industry. Engineers continuously work on developing new specialized types of paper and improving production technology to reduce harmful emissions and increase the amount of finished products [10].

In the printing industry, offset printing is in high demand for producing over 70% of the printed products. A noticeable trend in the market is the implementation of combined printing machines that integrate various technologies, such as offset and flexography. There's also a growing demand for multi-color printed products. Despite the overall increase in the turnover of printing companies, their profitability is decreasing due to several reasons. Firstly, the development of the printing industry in Ukraine is restrained by the high cost of typographic equipment.

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Another significant barrier to entering the market is the shortage of skilled specialists.

Designing supply chains in the Ukrainian printing services market can benefit from simulation modeling.

Simulation modeling is a method that allows constructing models that describe processes as they would occur in reality [11]. Such a model can be simulated over time for a single trial or numerous trials. The results are determined by the random nature of the processes, providing statistically robust data.

Simulation modeling is a research method in which the studied system is replaced by a model that accurately describes the real system. Experiments are conducted with this model to gather information about the actual system [12]. Experimenting with the model is called simulation, and it enables understanding the essence of a phenomenon without conducting experiments on the real object.

The goal of simulation modeling is to replicate the behavior of the studied system based on the analysis of the most significant relationships between its elements, creating a simulator for various experiments [13].

Simulation modeling allows for the imitation of a system's behavior over time. Moreover, the time aspect can be controlled in the model, slowing down processes with rapid changes and speeding up processes with slow variability.

For conducting simulation modeling, let's consider a production scenario. For instance, a shipper contacts a transport and forwarding company on Tuesdays and Sundays, requesting express delivery of cargo from Kremenchuk (Ukraine) to Frankfurt Oder (Germany).

The shipper's primary condition is precise delivery by 9:00 am the next day. In this direction, the transportation is handled by airlines "WizzAir" and "Lufthansa." However, according to the data in Table 1, "Lufthansa" flights do not allow timely delivery.

Let's also analyze the availability of possible transit flights for cargo delivery by 9:00 am on Monday (Table 2).

Taking all possible tasks into account within this supply chain, the following transport-technological scheme can be formed:

1. Receiving the shipment.
2. Weighing the cargo.

Table 1 - Flight Schedule for the Borispol-Frankfurt Route (direct flights)

| No. | Airline | Days | Schedule | Time of transportation of the PS |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | LUFTHANZA | 1.3.... | 11.00-13.00 | 2.55 |
| 2 | WizzAir | 1234..7 | 05.30-07.30 | 2.50 |
| 3 | LUFTHANZA | 1.3… | 14.10-16.05 | 2.55 |

3. Processing the request.
4. Labeling the shipment and preparing accompanying documents.
5. Sorting the cargo by direction to Kremenchuk - Borispol airport.
6. Loading onto the transport and forwarding company's vehicle.
7. Transportation to Borispol Airport (average time - 4 hours and 5 minutes).
8. Unloading the vehicle of the transport and forwarding company.
9. Processing at the warehouse of the transport and forwarding company or another company.
10. Customs clearance of the shipment.
11. Processing at the Borispol Airport warehouse.
12. Loading into the aircraft (AC).

Table 2 - Schedule of Transit Flights for Cargo Delivery at 09:00 on Monday

| № | Airline | The day of loading into the PS | Schedule | Time of transportation of the PS |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | LOT | 7 | KBP 14:30<br>WAW 15:05 | 1 h. 35 min. |
| | | | WAW 18:20 FRA 20:10 | 1 h. 50 min. |
| | | | **total** | **6.40** |
| 2 | WizzAir | 7 | LHR 17:25<br>KBP 15:55 | 3 h. 30 min. |
| | | | LHR 19:10<br>FRA 21:55 | 1 h. 45 min. |
| | | | **total** | **8.30** |
| 3 | LUFTHANZA | 7 | KBP 15:55<br>DUS 17:40 | 2 h. 45 min. |
| | | | DUS 18:15<br>FRA 19:10 | 0 h. 55 min. |
| | | | **total** | **4.35** |
| 4 | LUFTHANZA | 7 | KBP 17:15<br>MUC 18:40 | 2 h. 25 min. |
| | | | MUC 19:50<br>FRA 20:55 | 1 h. 05 min. |
| | | | **total** | **4.40** |

13. Transportation of the aircraft (AC).

14. Unloading cargo from the aircraft, processing at the airport warehouse.

15. Customs clearance of the shipment.

16. Loading onto the transport and forwarding company's vehicle.

17. Transportation to the recipient of the shipment.

The summarized transport-technological delivery scheme will look as follows:

- Steps 1-5: Receipt and processing of the shipment.
- Steps 6-8: Delivery within Ukraine by road transport.
- Steps 9-15: International transportation of the aircraft (Ukraine-Germany).
- Steps 16-17: Delivery to the recipient in Germany.

Based on the market analysis and the work of transportation companies, statistical data regarding the time parameters of international express delivery were obtained (Table 3).

Let's perform an imitational modeling of on-time delivery with a probability of 85% for the cycle of international express delivery to evaluate the reliability of delivering by 9:00 am every Monday and Wednesday.

Let's determine the probability distribution laws of the random variables representing the time of performing operations within the express delivery cycle. We will select the distribution law based on the coefficient of variation (defined as the ratio of the standard deviation to the mean value) – table 4-5.

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Table 3 - Statistical Parameters for International Express Delivery

| № п/п | International express delivery cycle operation | h, min. | | | |
|---|---|---|---|---|---|
| | | min | max | average value | among. square. deviation, minute |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Reception and registration of the parcel | 5 | 15 | 10 | 5,07 |
| 2 | Delivery by road within Ukraine | 300 | 360 | 330 | 34,56 |
| 3 | International transportation | 210 | 240 | 225 | 15,98 |
| 4 | Delivery to consignee | 30 | 60 | 45 | 15,21 |

Table 4 – Laws of distribution of random non-negative values depending on the coefficient of variation

| Limits of changes in coefficients of variation | The law of distribution of a random variable |
|---|---|
| 1 | 2 |
| $\nu = 0{,}3$ | Normal |
| $0{,}3 < \nu < 0{,}4$ | Gamma distribution |
| $0{,}4 \le \nu < 1$ | Weibull |
| $\nu = 1$ | Exponential |

Table 5 – Selection of distribution law

| No. | International delivery cycle operation | Coefficient of variation | Law of distribution |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1 | Reception and registration of the parcel | 0,507 | Weibull |
| 2 | Delivery by road within Ukraine | 0,1047273 | Normal |
| 3 | International transportation | 0,0710222 | Normal |
| 4 | Delivery to consignee | 0,338 | Gamma distribution |

Formulas for simulating random variables following distribution laws are provided in Table 6.

Table 6 - Formulas for Simulating Random Variables

| No. | Law of distribution, parameters | Distribution density $f(x)$ | Calculation formula |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1 | Normal, $\bar{x}$, $\sigma$ | $\frac{1}{\sigma\sqrt{2\pi}}\exp\left[-\frac{\left(x-\bar{x}\right)^2}{2\sigma^2}\right]$ | $x_i = \bar{x} + \sigma\xi_i$ |
| 2 | Weibull, $m$, $x_0$ | $\frac{mx^{m-1}}{x_0^m}\exp\left[\left(\frac{x}{x_0}\right)^m\right]$ | $x_i = x_0\sqrt[m]{-\ln\xi_i}$ |
| 3 | Exponential, $\lambda$ | $\lambda e^{-\lambda x}$ | $x_i = -\frac{\ln\xi_i}{\lambda}$ |
| 4 | Gamma distribution ($\eta$ - integer values), $\eta$, $\lambda$ | $\frac{\lambda^\eta}{r(\eta)}e^{-\lambda x}\times x^{\eta-1}$ | $x_i = -\frac{1}{\lambda}\sum_{j-1}^{\eta}\ln(1-\xi_i)$ |
| 5 | Even, $b$, $a$ | $\frac{1}{b-a}$ | $x_i = a + (b-a)\xi_i$ |

We determine the parameters of the distribution of random variables.

For the normal distribution, the parameters are the mean value and the standard deviation.

For the Weibull distribution, parameter x0 - the ratio of the mean value to the coefficient bm and parameter m can be determined using Table 7.

For the gamma distribution, the parameters can be found using the formulas 1 та 2:

$$\lambda = \frac{\bar{x}}{\sigma^2} \quad (1)$$

$$\eta = \frac{\left(\bar{x}\right)^2}{\sigma^2} \quad (2)$$

Table 7 - Coefficients for calculating the parameters of the Weibull distribution

| Coefficient of variation | Coefficient $b_m$ | Parameter $m$ |
|---|---|---|
| 1 | 2 | 3 |
| 1,000 | 1,000 | 1,0 |
| 0,910 | 0,965 | 1,1 |
| 0,837 | 0,941 | 1,2 |
| 0,775 | 0,924 | 1,3 |
| 0,723 | 0,911 | 1,4 |
| 0,681 | 0,903 | 1,5 |
| 0,640 | 0,897 | 1,6 |

End of table 7

| 1 | 2 | 3 |
|---|---|---|
| 0,605 | 0,892 | 1,7 |
| 0,575 | 0,889 | 1,8 |
| 0,547 | 0,887 | 1,9 |
| 0,523 | 0,887 | 2,0 |
| 0,499 | 0,886 | 2,1 |
| 0,480 | 0,886 | 2,2 |
| 0,461 | 0,886 | 2,3 |
| 0,444 | 0,886 | 2,4 |
| 0,428 | 0,887 | 2,5 |

Next, we will calculate the coefficients according to the points of the transport and technological cycle:

1. Reception and registration of the parcel.

From the table 5, we take the coefficient of variation (0.507) and from table. 7 we find the closest to it - 0.499, then

$b_m = 0.886$,

m = 2.1.

In accordance

$$x_0 = \frac{\bar{x}}{b_m} = \frac{10}{0,886} = 11,29$$

2. Delivery by motor vehicle within Ukraine.

Parameters for normal distribution:

$$\bar{x} = 330;\ \sigma = 34,56.$$

3. International transportation.

Parameters for normal distribution:

$$\bar{x} = 225;\ \sigma = 15,98.$$

4. Delivery to consignee

Parameters for gamma distribution:

$$\lambda = \frac{\bar{x}}{\sigma^2} = \frac{45}{15,21^2} = 0,2,$$

$$\eta = \frac{\left(\bar{x}\right)^2}{\sigma^2} = \frac{45^2}{15,21^2} = 9.$$

Modeling a normal distribution can be performed using the built-in random number generator in MS Excel. For example, to model "Delivery by road transport within Ukraine," you need to set: the number of variables - 1 (each operation of the logistics cycle is modeled separately); the number of random numbers - 50; distribution - normal; parameters: mean - 330 and standard deviation - 34.56. Similarly, for modeling "International transportation," you need to set: the number of variables - 1, the number of random numbers - 50; distribution - normal; parameters: mean - 225 and standard deviation - 15.98.

For modeling a random variable distributed according to the Weibull distribution, you first need to generate a column of random numbers that are uniformly distributed in the interval (0;1). To do this, in the "Random Number Generation" dialog box, specify a uniform distribution of numbers between 0 and 1. Then, the random values are substituted into the formula (Table 6).

$$x_1 = 11{,}29 \times \sqrt[2{,}1]{-\ln 0{,}543} = 8{,}908;$$
$$x_2 = 11{,}29 \times \sqrt[2{,}1]{-\ln 0{,}552} = 8{,}811 \text{ моцо.}$$ etc.

For random values distributed according to the gamma distribution law, the parameter h = 9, accordingly, you should first derive a column of 9 random values evenly distributed in the interval (0;1), and then substitute the random values into the corresponding formula of the table. 6. For example, let's define the first realization of the time for delivery to the consignee:

$$x_1 = -\frac{1}{0{,}2} \times \left(\ln(1-0{,}594) + \ln(1-0{,}448\right) + \ln(1-0{,}87) + \ln(1-0{,}329) + \ln(1-0{,}239) +$$
$$\ln(1-0{,}762) + + \ln(1-0{,}597) + \ln(1-0{,}898) + \ln(1-0{,}03) = 44{,}36$$

The modeled values of the operation cycle execution time will be divided into several intervals using the built-in Excel tool called "Histogram." First, determine the frequency (the ratio of the number of values falling into an interval to the total number of realizations) and the cumulative frequency (sum of frequencies up to a certain interval). The results are provided in Table 8 and Figur 1.

To calculate the time, you need to first separately calculate the time for points 1 and 2 (reception and processing of the parcel, and delivery by road within Ukraine), then find the lower and upper limits based on the sum of these times. Subtract the departure time of the aircraft (05:30) to determine the start time of receiving and processing the parcel.

Table 8 – Determining the frequency of values falling into time interval intervals for the logistics cycle

| The time interval for the delivery of the parcel to the destination, hours. min. | The number of cycle time values in the interval | Frequency | Frequency with increasing total |
|---|---|---|---|
| (6.30-7.20) | 3 | 0,06 | 0,06 |
| (7.20-8.10) | 13 | 0,26 | 0,32 |
| (8.10-9.00) | 25 | 0,50 | 0,82 |
| (9.00-9.50) | 7 | 0,14 | 0,96 |
| (9.50-10.40) | 2 | 0,04 | 1,00 |

Thus, the probability of delivering the parcel to the recipient by 9 a.m. is 0.82.

Choosing the optimal delivery scheme among the possible options is proposed to be based on criteria of time and cost, as well as using selection criteria under conditions of uncertainty, where all parameters are equally important. This choice is just a tool for achieving the goal of supply chain clustering within the context of European integration, where the strategy of improving service and maximizing customer satisfaction organically allows for both strategic and economic gains.

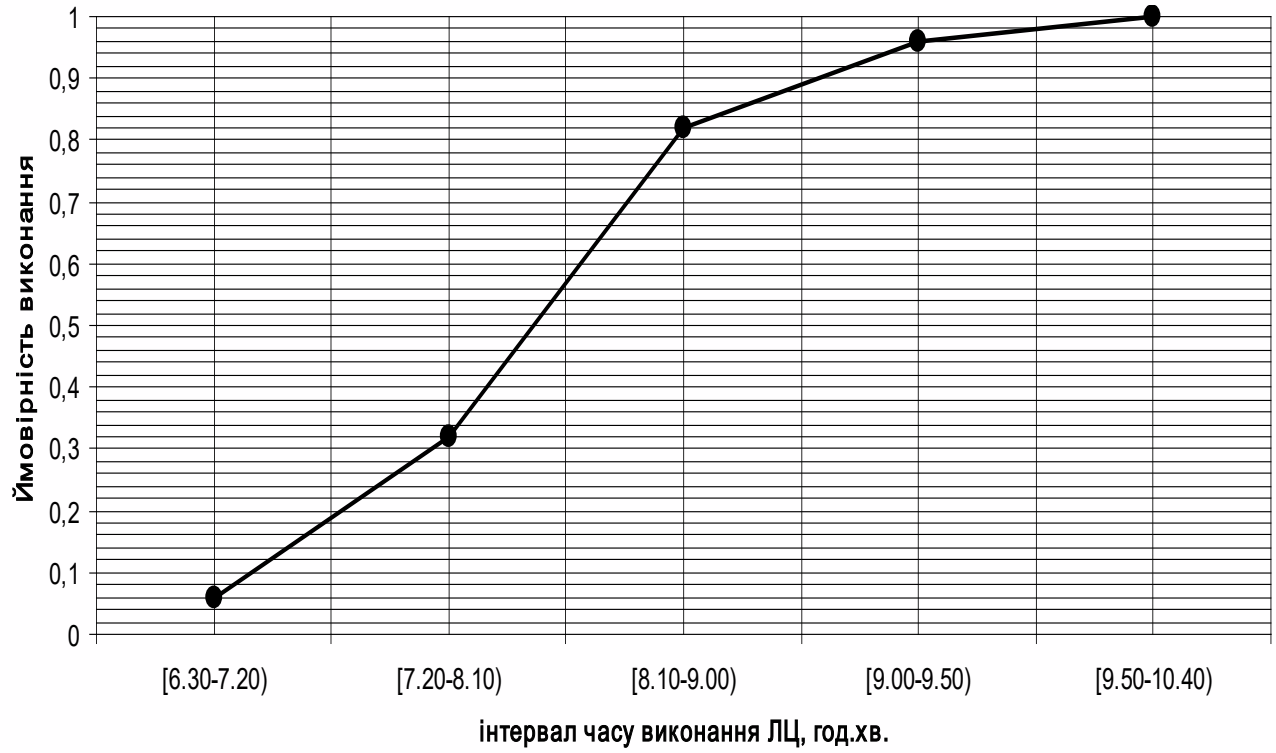


Figure 1. - Logistics cycle time distribution function

The very idea of transport and logistics clusters encourages enterprises to adopt innovative logistics strategies even in "traditional" supply chains. This applies particularly to printing companies and the paper industry, where road transportation is more common, but other forms of transportation, including aviation, are also utilized.

The purpose of evaluating the effectiveness of cluster development is to determine the factors that encourage enterprises to form such structures for the optimization of supply chains.

Clusters are a symbiosis of differentiation and cooperation, an intermediate link between interaction and merging. The stability of cluster formations is due to the fact that partners provide goods, services, and work that are significant and indispensable to each other. This ensures a synergistic effect of such interaction, as the partnership of interconnected economic entities has a potential that exceeds the simple sum of their individual potentials. The underlying principle of this development is the distribution (differentiation) of economic activities and then their integration (cooperation) into complex systems based on mutual interest and benefit. Such interactions increase the chances of all partners to survive in a dynamic economic environment, especially under conditions of intense competition [14].

Motivational mechanisms for implementing aviation clusters in supply chains of paper industry enterprises include goals that contribute to increasing the level of economic development not only for the enterprises within the transport and logistics cluster but also for the region and the country as a whole.

Optimization of transportation (proper distribution of transport and reduction of idle time) has allowed for a reduction in the number of hired transport vehicles and an increase in the accuracy of customer service for "PAPIR SERVICE SK" LLC.

**Conclusions.** The formation of a logistics development strategy based on clustering principles within the framework of European integration processes in Ukraine (especially in the context of Russian aggression) for the printing enterprise "PAPIR SERVICE SK" LLC will contribute to: minimizing overall logistical costs; improving the quality of logistics services; investing in logistical infrastructure.

In the conducted study on the clustering of logistics supply chains in the process of Ukraine's European integration, the creation of a territorial cluster's own transport and logistics system for printing enterprises is proposed, which in turn is localized within a transport and logistics cluster within a geographically concentrated business cluster..

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