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**INTELLECTUALIZATION OF LOGISTICS
AND SUPPLY CHAIN MANAGEMENT**

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EVENTS AND SCIENTIFIC CONFERENCES

INTRODUCTION

We are happy to invite you to get acquainted with the first issue of the new scientific and practical publication "Intellectualization of Logistics and Supply Chain Management".

We strongly believe that the launch of this magazine indicates the objective need to rethink a wide range of issues related to the development of theory and practice in logistics and supply chain management, awareness of the need to unite the scientific community and logistics practitioners, dissemination of modern knowledge and best practices for innovative development of the logistics services market.

The first issue of the magazine is published at a difficult time. The global coronavirus pandemic and the deep economic crisis have significantly worsened business activity in the world. Currently, global supply chains are collapsing, international trade is declining, and competition between global and regional logistics operators is intensifying. The most common thesis is that the world will never be the same again. Industry experts predict the emergence of new, more flexible and adaptive supply chain management strategies and approaches to logistics business process management. The trend towards collaborations, cooperation and unification of services is emerging, comprehensive proposals for clients are being developed. There is increasing talk about the need to build bimodal supply chains, which involves the development of different decision-making scenarios: the traditional approach - cost-effective efficiency, low risk, high predictability; a new approach "second mode" - rapid recognition of opportunities, adaptability, willingness to solve unexpected problems and look for new opportunities.

Radical transformations of the global and national markets for logistics services require appropriate scientific support. Logistics science has a special role to play in this process. Initiating the emergence of a new journal, we decided to focus on its coverage of problematic aspects of the formation and development of logistics systems at the micro, mezo and macro levels, supply chain management, digitization of logistics, methods and tools for optimizing processes in logistics and supply chains, sociopsychology relations and network interaction of enterprises using cloud technologies, artificial intelligence, e-learning, neural business process management systems, etc.

Therefore, we invite scientists, researchers and business representatives, as well as our colleagues from abroad, to cooperate and present the results of scientific research, to discus and debate on them, to work together to develop the scientific theory of logistics and promote mutual intellectual enrichment.

We hope that the new scientific publication will become a theoretical guide for young researchers and representatives of other fields.

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Chief Editor

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INTELLECTUALIZATION OF A METHOD FOR SOLVING A LOGISTICS PROBLEM TO OPTIMIZE COSTS WITHIN THE FRAMEWORK OF LEAN PRODUCTION TECHNOLOGY

Eugene Fedorov, Peter Nikolyuk, Olga Nechporenko, Esta Chioma. "Intellectualization of a method for solving a logistics problem to optimize costs within the framework of Lean Production technology". *In the article, within the framework of intellectualization of the Lean Production technology, it is proposed to optimize the costs arising from the insufficient efficiency of placing goods in the warehouse by creating an optimization method based on the immune metaheuristics of the T-cell model, which allows solving the knapsack constrained optimization problem. The proposed metaheuristic method does not require specifying the probability of mutation, the number of mutations, the number of selected new cells and allows using only binary potential solutions, which makes discrete optimization possible and reduces computational complexity by preventing permanent transformations of real potential solutions into intermediate binary ones*

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and vice versa. An immune metaheuristic algorithm based on the T-cell model has been created, intended for implementation on the GPU using the CUDA parallel information processing technology. The proposed optimization method based on immune metaheuristics can be used to intellectualize the Lean Production technology. The prospects for further researches are to test the proposed methods on a wider set of test databases.

Keywords: lean manufacturing, immune metaheuristics, T-cell model, conditional optimization, knapsack problem.

Євген Федоров, Петро Ніколюк, Ольга Нечипоренко, Еста Чіома. "Інтелектуальна реалізація методу логістичного рішення для оптимізації витрат за технологією Lean Rroduction". *У статті в рамках інтелектуалізації технології Lean Rroduction пропонується оптимізувати витрати, що виникають в результаті відсутності ефективності розміщення товарів на складі, шляхом створення методу оптимізації на основі імунної метаеврістики моделі Т-клітин, що дозволяє вирішити проблему умовної оптимізації про рюкзак. Запропонований метаеврістичний метод не вимагає задання ймовірності мутації, кількості мутацій, кількості відібраних нових клітин і дозволяє використовувати тільки бінарні потенційні рішення, що робить можливою дискретну оптимізацію і знижує обчислювальну складність шляхом запобігання постійній трансформації фізичних потенційних рішень в проміжні бінарні і зворотні. Створено імунний алгоритм метаеврістики на основі моделі Т-клітин, призначений для впровадження на GPU за допомогою технології паралельної обробки інформації CUDA. Запропонований метод оптимізації на основі імунної метаеврістики може бути використаний для інтелектуалізації технології Lean Rroduction. Перспективи подальших досліджень включають тестування запропонованих методів на більш широкому наборі тестових баз даних.*

Ключові слова: ощадливе виробництво, імунна метаеврістика, модель Т-клітин, умовна оптимізація, задача про рюкзак.

Евгений Федоров, Петр Николюк, Ольга Нечипоренко, Эста Чиома. "Интеллектуализация метода решения логистической задачи для оптимизации затрат в рамках технологии Lean Production". *В статье в рамках интеллектуализации технологии Lean Production предлагается оптимизация затрат, возникающих вследствие недостаточной эффективности размещения товаров на складе, посредством создания метода оптимизации на основе иммунной метаэвристики модели Т-клеток, который позволяет решать задачу условной оптимизации о рюкзаке. Предложенный метаэвристический метод не требует задания вероятности мутации, количества мутаций, количества отбираемых новых клеток и позволяет использовать только бинарные потенциальные решения, что делает возможной дискретную оптимизацию и снижает вычислительную сложность за счет предотвращения постоянных преобразований вещественных потенциальных решений в промежуточные бинарные и обратно. Создан иммунный метаэвристический алгоритм на основе модели Т-клеток, предназначенный для реализации на GPU посредством технологии параллельной обработки информации CUDA. Предложенный метод оптимизации на основе иммунной метаэвристики может использоваться для интеллектуализации технологии Lean Production. Перспективы дальнейших исследований заключаются в тестировании предложенных методов на более широком наборе тестовых баз данных.*

Ключевые слова: бережливое производство, иммунная метаэвристика, модель Т-клеток, условная оптимизация, задача о рюкзаке.

Introduction. At present many worldwide companies are optimizing their business processes based on Lean Production technology. The concept of Lean Production is that it clearly identifies seven groups of costs that do not create value for final buyers, and therefore, the primary efforts of any company should be directed to minimizing these costs. However, the problem of finding models to minimize these costs is quite

complicated and requires searching for the new solutions. As a result, the relevance of the development of methods for the intellectualization of Lean Production technology, which is based on the solution of optimization problems, significantly increases.

Literature and research review. Highly computationally complex optimization methods that find an accurate solution. Optimization methods that find an approximate solution through directional search have a high probability of hitting a local extremum. Random search methods do not guarantee convergence. Consequently, there is a problem of insufficient efficiency of optimization methods, which needs to be addressed.

Metaheuristics (or modern heuristics) [2-5] are used to find an accelerate quasi-optimal solution optimization problems and reduce the probability of hitting a local extremum. Metaheuristics empowered of heuristics by combining heuristic methods based on a high-level strategy [6-9].

The current metaheuristics have one or more of the following disadvantages:

– there is only an abstract description of the method or the description of the method is focused on solving only a certain problem [10];

– the influence of the iteration number on the process of finding a solution is not taken into account [11];

– the convergence of the method is not guaranteed [12];

– it is not possible to use non-binary potential solutions [13];

– the procedure for determining the values of parameters is not automated [14];

– it is not possible to solve the problems of conditional optimization [15];

– the lack of accuracy of the method [16].

In this regard, the problem of constructing effective metaheuristic optimization methods arises [17].

One of the popular metaheuristics are immune metaheuristics [18, 19], among which the T-cell model [20] can be distinguished, which allows solving constrained optimization problems.

Aims and Objectives. The aim of the work is to optimize the costs arising from the insufficient efficiency of placing goods in the warehouse by creating an optimization method based on immune metaheuristics that solves the knapsack problem.

To achieve the goal, the following tasks were put and decided:

1. Conduct an analysis of existing optimization methods aimed at optimizing costs within the framework of lean manufacturing technology.

2. Create an immune metaheuristic method based on the T-cell model for solving the knapsack problem.

3. Create an algorithm of the immune metaheuristic method based on the T-cell model, intended for implementation on the GPU using the CUDA technology.

4. Conduct a numerical study.

Results, analysis, and discussion. Optimization of costs associated with inefficient placement of goods in a warehouse can be reduced to the problem of a knapsack. To solve this problem, the work proposes an immune metaheuristic - a modified model of T cells that uses imitation of annealing.

As a function of the goal F, it is proposed to use the inverse function of income

$$F(x) = \left(\sum_{j=1}^{M} v_j x_j \right)^{-1} \to \min_{x}$$

where v_j is the income from the goods of the j-th type, defined,

w_j – weight of goods of the j-th type, defined,

x_j – goods presence of the j-th type (corresponds to the T-cell),

M – the number of types of goods.

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As a limit, it is proposed to use the following function
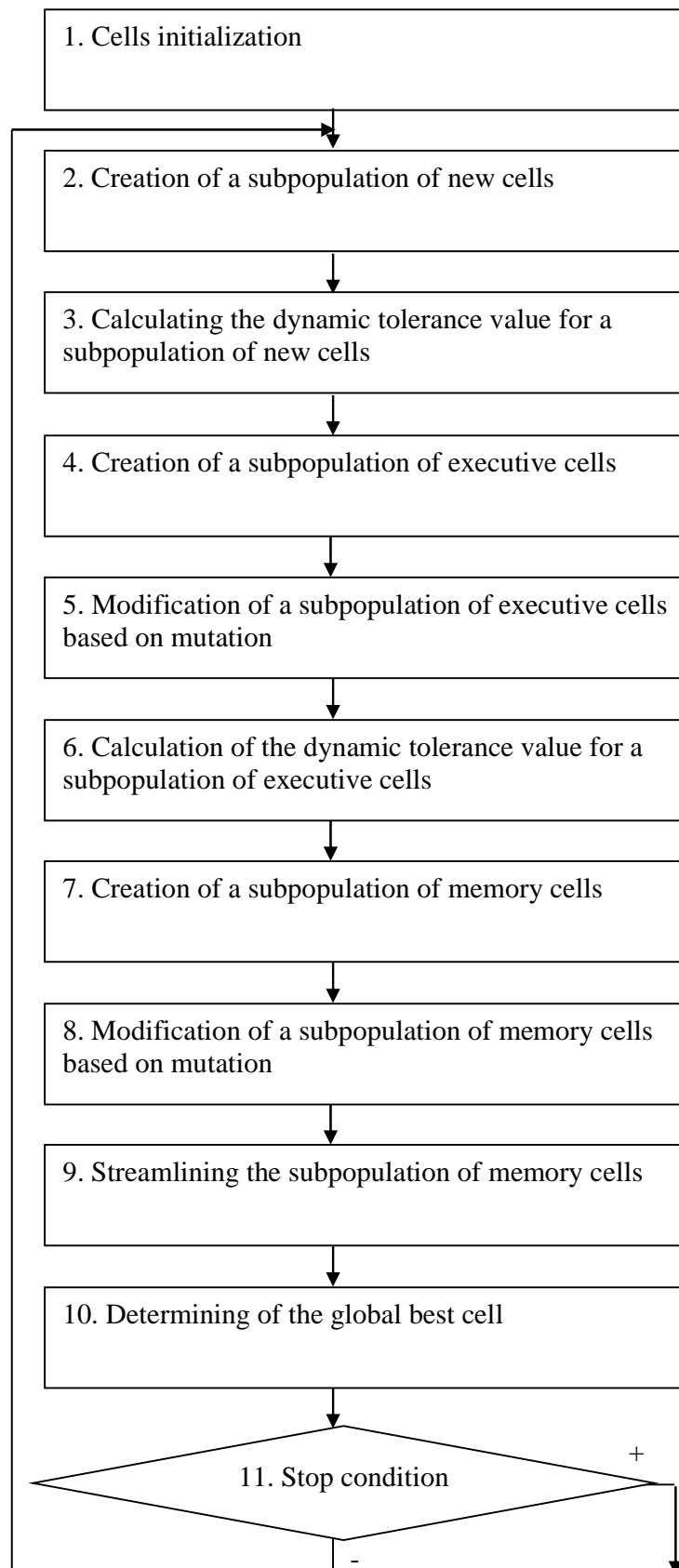
Figure 1 – The structure of the proposed immune metaheuristic method for solving the knapsack problem

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$$g(x) = \max\left\{0, \sum_{j=1}^{M} w_j x_j - W\right\}$$

where W – is the maximum total weight of all goods, defined.

The structure of the proposed immune metaheuristic method is shown in Fig. 1.

The proposed metaheuristic method makes possible to find the quasi-optimal number of placed goods and consists of the following blocks:

<u>Block 1</u> - Initialization:

– setting the number of the current iteration n to one;

– setting the number of iterations N ,;

– setting the cell length M ;

– setting the size of the subpopulation of new cells L_V ;

– setting the number of selected new cells, taking into account the restrictions $L1_V$ as $L1_V = L_V / 4$;

– setting the number of selected new cells without taking into account the restrictions $L2_V$ as $L2_V = L_V / 4$;

– setting the number of mutations of each executive cell N_E as $N_E = N$,

– setting the size of the subpopulation of memory cells L_M as $L_M = L_V / 4$;

– setting the number of mutations of each memory cell N_M as $N_M = N$,

– setting a static tolerance Δ_M for a subpopulation of memory cells;

– setting the probability of mutation of executive cells as $p^E = \dfrac{1}{M}$;

– setting the probability of mutation of memory cells as $p^M = \dfrac{1}{M}$;

– randomly create the best cell x^*

$$x^* = (x_1^*, ..., x_M^*),$$

$$x_j^* = \begin{cases} 1, & U(0,1) < 0.5 \\ 0, & U(0,1) \geq 0.5 \end{cases}$$

where $U(0,1)$ – is a function that returns a uniformly distributed random number in the range of $[0,1]$.

<u>Block 2</u> – Creation of a subpopulation of new cells P^V

$$P^V = \{(x_k, s_k)\}, \quad k \in \overline{1, L_V}$$

$$x_k = (x_{k1}, ..., x_{kM}),$$

$$x_{kj} = \begin{cases} 1, & U(0,1) < 0.5 \\ 0, & U(0,1) \geq 0.5 \end{cases}$$

$$s_k = \max\{0, g(x_k)\}$$

<u>Block 3</u> – Calculation of the dynamic tolerance value Δ_V for a subpopulation P^V

$$\Delta_V = \frac{1}{L_V} \sum_{k=1}^{L_V} s_k$$

If $\Delta_V < \Delta_M$, then $\Delta_V = 0.1$

<u>Block 4</u> – Creation of a subpopulation of executive cells P^E with capacity L_E

4.1. Dividing a subpopulation of new cells P^V into a subset $P1^V = \{(x1_k, s1_k)\}$ containing cells for which $s1_k < \Delta_V$, and a subset $P2^V = \{(x2_k, s2_k)\}$ containing cells for which $s2_k \geq \Delta_V$.

4.2. Ordering the subset $P1^V$ by target function, i.e. $F(x1_k) < F(x1_{k+1})$

4.3. Ordering the set $P2^V$ by the sum of the values of all bounding functions, i.e. $s2_k < s2_{k+1}$

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4.4. $L1_V$ of the first cells from an ordered set $P1^V$ and $L2_V$ the first cells from an ordered set $P2^V$ forms a subpopulation of executive cells $P^E = \{(x_i, s_i)\}$ with capacity $L_E = L1_V + L2_V$, while the first there are cells from the set $P1^V$

$$\widehat{x}_{ij} = \begin{cases} 1, & (r < p^E \wedge x_{ij} = 0) \vee (r \geq p^E \wedge x_{ij} = 1) \\ 0, & (r < p^E \wedge x_{ij} = 1) \vee (r \geq p^E \wedge x_{ij} = 0) \end{cases}, \; j \in \overline{1, M}$$

where $round()$ – is the function that rounds the number to the nearest integer.

– calculating the value of the constraint function

$$\widehat{s}_i = \max\{0, g(\widehat{x}_i)\}$$

– replacement by a mutant cell if the condition is met

If $\widehat{s}_i < s_i$ or $\widehat{s}_i = s_i \wedge F(\widehat{x}_i) < F(x_i)$, then $x_i = \widehat{x}_i$, $s_i = \widehat{s}_i$

Block 6 - Calculate the value of the dynamic tolerance Δ_E for a subpopulation P^E

$$\Delta_E = \frac{1}{L_E} \sum_{k=1}^{L_E} s_k$$

If $\Delta_E < \Delta_M$, then $\Delta_E = \Delta_M$

Block 7 - Creation of a subpopulation of memory cells P^M with capacity L_M

7.1. Dividing the subpopulation of executive cells P^E into a subset $P1^E = \{(x1_k, s1_k)\}$, containing cells for which $s1_k < \Delta_E$, and subset

Block 5 – Modification of a subpopulation of executive cells P^E based on mutation

For each i - th cell is performed N_E, once as the following operations are performed:

– mutation
$r = U(0,1)$

$P2^E = \{(x2_k, s2_k)\}$, containing cells for which $s2_k \geq \Delta_E$

7.2. Ordering the subset $P1^E$ by target function, i.e. $F(x1_k) < F(x1_{k+1})$

7.3. Ordering the set $P2^E$ by the sum of the values of all bounding functions, i.e. $s2_k < s2_{k+1}$

7.4. If $n = 1$, then L_M the first cells from the ordered union $P1^E \cup P2^E$ form a subpopulation of executive cells $P^M = \{(x_i, s_i)\}$

If $n > 1$, then $L_M / 2$ the first cells from the ordered union $P1^E \cup P2^E$ are replaced $L_M / 2$ by the worst (last) cells, a subpopulation of executive cells P^M

Block 8 - Modification of a subpopulation of memory cells P^M based on mutation

For each i - th cell is performed N_M, once as the following operations are performed:

– mutation
$r = U(0,1)$,

$$\widehat{x}_{ij} = \begin{cases} 1, & (r < p^M \wedge x_{ij} = 0) \vee (r \geq p^M \wedge x_{ij} = 1) \\ 0, & (r < p^M \wedge x_{ij} = 1) \vee (r \geq p^M \wedge x_{ij} = 0) \end{cases}, \; j \in \overline{1, M}$$

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– calculating the value of the constraint function

$$\widehat{s}_i = \max\{0, g_z(\widehat{x}_i)\}$$

– replacement by a mutant cell if the condition is met

If $\widehat{s}_i < s_i$ or $\widehat{s}_i = s_i \wedge F(\widehat{x}_i) < F(x_i)$,

then $x_i = \widehat{x}_i$, $s_i = \widehat{s}_i$,

Block 9 - Ordering the subpopulation of memory cells P^M

Dividing the subpopulation of memory cells P^M into a subset $P1^M = \{(x1_k, s1_k)\}$ containing cells for which $s1_k < \Delta_M$, and a subset $P2^M = \{(x2_k, s2_k)\}$ containing cells for which $s2_k \geq \Delta_M$.

9.2. Ordering the subset $P1^M$ by target function, i.e. $F(x1_k) < F(x1_{k+1})$

9.3. Ordering the set $P2^M$ by the value of the bounding function, i.e. $s2_k < s2_{k+1}$

9.4. $P^M = P1^M \bigcup P2^M = \{(x_i, s_i)\}$

Block 10 – Determining of the global best cell

If $F(x_1) < F(x^*)$, then $x^* = x_1$

Block 11 - Stop Condition

If $n < N$, then increase the iteration number n by one and go to block 2.

For the proposed method, using the example of optimization of costs arising from insufficient efficiency of placing goods in a warehouse, an algorithm is considered intended for implementation on a GPU using the technology of parallel processing of information CUDA and shown in Fig. 2. This block diagram functions as follows.

Step 1 – Operator's input of the number of iterations N, the cell length M, the size of the subpopulation of new cells L_V, the number of selected new cells taking into account the limitations $L1_V$, the number of selected new cells without taking into account the limitations $L2_V$, the number of mutations of each executive cell N_E, the size of the subpopulation of memory cells L_M, the number of mutations of each memory cell N_M, static tolerance Δ_M for a subpopulation of memory cells, the probability of mutation of executive cells p^E, setting the probability of mutation of memory cells as p^M.

Step 2 – Randomly create the best cell x^*

Step 3 – The creation of a subpopulation of new cells P^V using GPU threads L_V that are grouped into 1 block. Each thread randomly creates a cell x_k and calculates the value of the bounding function for this cell s_k

Step 4 – Computation based on reduction of the dynamic tolerance Δ_V value for the subpopulation P^V across all cells using GPU threads L_V, which are grouped into 1 block. If $\Delta_V < \Delta_M$, then $\Delta_V = 0.1$

Step 5 – Dividing the subpopulation of new cells P^V into a subset $P1^V = \{(x1_k, s1_k)\}$ containing cells for which $s1_k < \Delta_V$, and a subset $P2^V = \{(x2_k, s2_k)\}$ containing cells for which $s2_k \geq \Delta_V$.

Step 6 – Ordering the subset $P1^V$ by target function, i.e. $F(x1_k) < F(x1_{k+1})$ using GPU threads $|P1^V|$ which are grouped into 1 block

Step 7 – Ordering the subset $P2^V$ by the sum of the values of all bounding functions, i.e. $s2_k < s2_{k+1}$ using GPU threads $|P2^V|$ which are grouped into 1 block

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Step 8 – $L1_V$ first cells from the ordered set $P1^V$ and $L2_V$ first cells from the ordered set $P2^V$ form a subpopulation of executive

cells $P^E = \{(x_i, s_i)\}$ with capacity $L_E = L1_V + L2_V$, and the first cells from the set $P1^V$
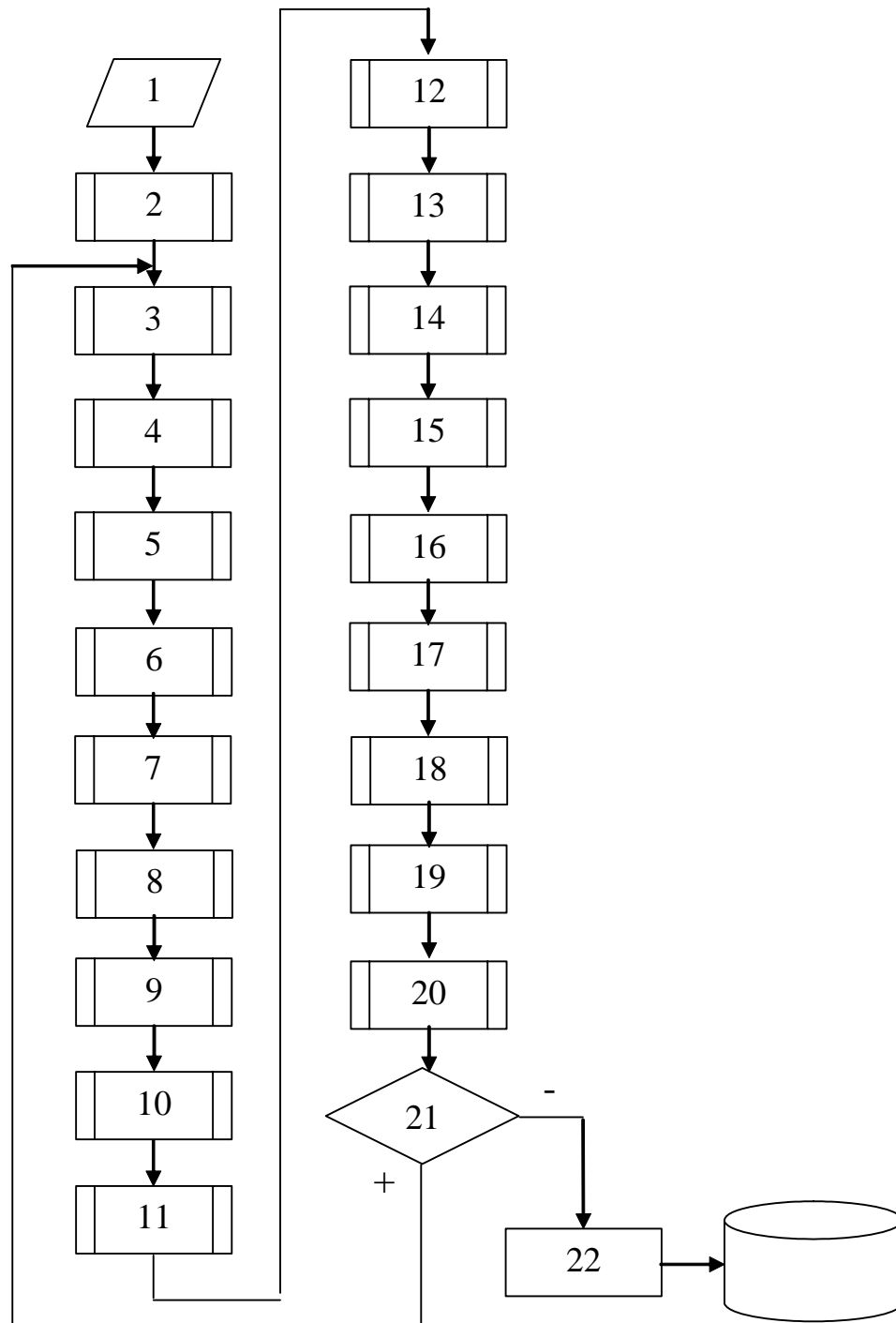
Figure 2 – Block diagram of the algorithm of the proposed immune metaheuristic method

Step 9 – Modification of a subpopulation of executive cells P^E based on mutation using GPU threads L_E that are grouped into 1

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block. Each thread N_E once mutates a cell x_i and calculates the value of the limiting function for this cell s_i

Step 10 – Reduction computation of the dynamic tolerance value Δ_E for the subpopulation P^E across all cells using GPU threads L_E that are grouped into 1 block. If $\Delta_E < \Delta_M$, then $\Delta_E = \Delta_M$

Step 11 – Dividing the subpopulation of executive cells P^E into a subset $P1^E = \{(x1_k, s1_k)\}$ containing cells for which $s1_k < \Delta_E$, and a subset $P2^E = \{(x2_k, s2_k)\}$ containing cells for which $s2_k \geq \Delta_E$.

Step 12 – Ordering the subset $P1^E$ by target function i.e. $F(x1_k) < F(x1_{k+1})$ using GPU threads $|P1^E|$ which are grouped into 1 block

Step 13 - Ordering the set $P2^E$ by the sum of the values of all bounding functions, i.e. $s2_k < s2_{k+1}$ using GPU threads $|P2^E|$ which are grouped into 1 block

Step 14 – If $n = 1$, then L_M the first cells from the ordered union $P1^E \cup P2^E$ form a subpopulation of executive cells $P^M = \{(x_i, s_i)\}$, otherwise $L_M / 2$ first cells from the ordered union $P1^E \cup P2^E$ are replaced $L_M / 2$ the worst (last) cells, a subpopulation of executive cells P^M

Step 15 – Modification of a subpopulation of memory cells P^M based on the mutation using GPU threads L_M, which are grouped into 1 block. Each thread N_M once mutates a cell x_i and calculates the value of the limiting function for this cell s_i

Step 16 – Dividing the subpopulation of memory cells P^M into a subset $P1^M = \{(x1_k, s1_k)\}$ containing cells for which $s1_k < \Delta_M$, and a subset $P2^M = \{(x2_k, s2_k)\}$ containing cells for which $s2_k \geq \Delta_M$.

Step 17 – Ordering the subset $P1^M$ by target function i.e. $F(x1_k) < F(x1_{k+1})$ using GPU threads $|P1^M|$ which are grouped into 1 block

Step 18 – Ordering the set $P2^M$ by the value of the bounding function, i.e. $s2_k < s2_{k+1}$ using GPU threads $|P2^M|$ which are grouped into 1 block

Step 19 – Ordered sets $P1^V$ and $P2^V$ form a new subpopulation of memory cells P^M, i.e. $P^M = P1^M \cup P2^M = \{(x_i, s_i)\}$

Step 20 – Determining the global best cell according to the following rule

If $F(x_1) < F(x^*)$, then $x^* = x_1$

Step 21 – Stop Condition

If $n < N$, then increase the iteration number by one and go to step 4.

Step 22 – Writing the obtained global best position to the database.

In the work, the number of iterations $N =$ 100, the size of the subpopulation of new cells $L_V =$ 100, the number of selected new cells taking into account the constraints $L1_V = L_V / 4 = 25$, the number of selected new cells without taking into account the constraints $L2_V == L_V / 4 = 25$, the number of mutations of each executive cell $N_E = N =$ 100, the size of the memory cell subpopulation $L_M == L_V / 4 = 25$, the number of mutations of each memory cell $N_M = N =$ 100, the static tolerance $\Delta_M = 0.0001$ for the memory cell subpopulation.

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For the knapsack problem, the search for a solution was carried out on the standard KNAPSACK_01 databases. For the proposed method, a root-mean-square error of 0.02 was obtained.

The traditional method for optimizing a T-cell model requires:

– setting the probability of mutation, the number of mutations, the number of selected new cells;

– real potential solutions, which makes discrete optimization impossible;

– constant transformations of real potential solutions into intermediate binary ones and vice versa.

The proposed method eliminates these disadvantages.

Conclusions.

1. To minimize losses that do not create consumer value and are the basis of Lean Production technology, an immune metaheuristic method based on the T-cell model was developed to solve the knapsack problem. The use of this method is aimed at minimizing costs arising from insufficient efficiency of the placement of goods in the warehouse.

2. The proposed metaheuristic method does not require setting the probability of mutation, the number of mutations, the number of selected new cells and allows using only binary potential solutions, which makes discrete optimization possible and reduces computational complexity by preventing constant transformations of real potential solutions into intermediate binary ones and back.

3. There was created an immune metaheuristic algorithm based on the T-cell model, intended for implementation on a GPU using the CUDA parallel processing technology.

4. The proposed optimization method based on immune metaheuristics can be used to intellectualize the Lean Production technology. Prospects for further research are in testing the proposed methods on a wider set of test databases.

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CORPORATE CULTURE REENGINEERING STRATEGY OF A MULTINATIONAL LOGISTICS COMPANY

Maria Hryhorak, Viktoriia Leha. "Corporate culture reengineering strategy of a multinational logistics company". *The article substantiates the role of strategic re-engineering of corporate culture in increasing the level of competitiveness of a multinational logistics company and optimizing the efficiency of its activities. The main processes, principles and features of corporate culture transformation as one of the stages of re-engineering of the company's business processes are considered. The main concepts of corporate culture, management innovations, and re-engineering, which are effective tools for improving the efficiency of enterprise management, are defined. An algorithm for creating a corporate culture is proposed, including its positioning at the strategic level, as well as ensuring appropriate financial results. Corporate culture management is considered as an intangible asset that has value and creates conditions for generating income for the enterprise. In addition, it gives the company advantages by reducing conflicts, improving business relationships, reducing non-production time costs, and increasing the economic efficiency of the business. The factors influencing the level of employee involvement in work and transformation of employee behavior in accordance with the leader's strategic vision for company development and in accordance with his decisions on business re-engineering are identified. The main tasks of business process re-engineering are revealed, key directions and necessary tools for implementing the transformation of corporate culture are highlighted. The research methodology is based on methods of theoretical analysis and generalization of scientific literature and periodicals on the research topic, statistical analysis, classification and analytical method and methods for determining economic efficiency. The approach to scenario modeling of the process of managing the development of corporate culture of an enterprise based on a combination of components of culture, methods of managing it, basic values and strategies of enterprise management as a whole has been further developed, which allows taking into account the multidirectional interests of stakeholders and harmonizing them in the process of managing a multinational logistics company.*

Keywords: strategy; corporate culture; managerial innovations; staff involvement; consistency; adaptation; leader; business processes; reengineering; efficiency; multinational logistics company.

Марія Григорак, Вікторія Лега. "Стратегія реінжинірингу корпоративної культури трансноціональної логістичної компанії ". У статті обґрунтована роль стратегічного реінжинірингу корпоративної культури у підвищенні рівня конкурентоспроможності транснаціональної логістичної компанії та оптимізації ефективності її діяльності. Розглянуто основні процеси, принципи та особливості трансформації корпоративної культури як одного із етапів реінжинірингу бізнес-процесів компанії. Визначено основні поняття корпоративної культури, управлінських інновацій, реінжинірингу, що є дієвими інструментами підвищення ефективності управління підприємством. Запропоновано алгоритм створення корпоративної культури, що включає її позиціювання на стратегічному рівні, а також забезпечення відповідних фінансових результатів. Управління корпоративною культурою розглядається як нематеріальний актив, що має вартість і створює умови для отримання доходу підприємства. Окрім того, дає підприємству переваги за рахунок зменшення конфліктності, покращення ділових взаємовідносин, скорочення невиробничих витрат часу, росту економічної ефективності бізнесу. Визначено фактори, що впливають на рівень залученості працівників у роботу та трансформацію поведінки співробітників у відповідності до стратегічного бачення лідера щодо розвитку компанії та згідно з його прийнятими рішенням щодо реінжинірингу бізнесу. Розкрито основні завдання реінжинірингу бізнес-процесів, виділено ключові напрямки та необхідні інструменти при реалізації трансформації корпоративної культури. Методологія дослідження базується на методах теоретичного аналізу та узагальнення наукової літератури та періодичних видань за темою дослідження, статистичного аналізу, класифікаційно-аналітичний метод і методи визначення економічної ефективності. Набув подальшого розвитку підхід до сценарного моделювання процесу управління розвитком корпоративної культури підприємства на основі поєднання складових культури, методів управління нею, базових цінностей та стратегій управління підприємством у цілому, що дозволяє враховувати різноспрямовані інтереси зацікавлених сторін і гармонізувати їх у процесі управління транснаціональною логістичною компанією.

Ключові слова: стратегія; корпоративна культура; управлінські інновації; залученість персоналу; узгодженість; адаптація; лідер; бізнес-процеси; реінжиніринг; ефективність; транснаціональна логістична компанія.

Мария Григорак, Виктория Лега. "Стратегия реинжиниринга корпоративной культуры трансноциональной логистической компании". В статье обоснована роль стратегического реинжиниринга корпоративной культуры в повышении уровня конкурентоспособности транснациональной логистической компании и оптимизации эффективности ее деятельности. Рассмотрены основные процессы, принципы и особенности трансформации корпоративной культуры как одного из этапов реинжиниринга бизнес-процессов компании. Определены основные понятия корпоративной культуры, управленческих инноваций, реинжиниринга, которые являются действенными инструментами повышения эффективности управления предприятием. Предложен алгоритм создания корпоративной культуры, включающий ее позиционирование на стратегическом уровне, а также обеспечение соответствующих финансовых результатов. Управление корпоративной культурой рассматривается как нематериальный актив, имеющий стоимость и создает условия для получения дохода предприятия. Кроме того, дает предприятию преимущества за счет уменьшения конфликтности, улучшения деловых взаимоотношений, сокращения непроизводственных затрат времени, роста экономической эффективности бизнеса. Определены факторы, влияющие на уровень вовлеченности работников в работу и трансформацию поведения сотрудников в соответствии со стратегическим видением лидера по развитию компании и согласно его принятым решениям по реинжинирингу бизнеса. Раскрыты основные задачи реинжиниринга бизнес-процессов, выделены ключевые направления и необходимые инструменты при реализации трансформации корпоративной культуры. Методология исследования базируется на методах теоретического анализа и обобщения научной литературы и периодических изданий по теме исследования, статистического анализа, классификационно-аналитический метод и методы определения экономической эффективности. Получил дальнейшее развитие подход к сценарному моделированию процесса управления развитием корпоративной культуры предприятия на основе сочетания составляющих культуры, методов управления ею,

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базовых ценностей и стратегий управления предприятием в целом, что позволяет учитывать разнонаправленные интересы заинтересованных сторон и гармонизировать их в процессе управления транснациональной логистической компанией.

Ключевые слова: стратегия; корпоративная культура; управленческие инновации; вовлеченность персонала; согласованность; адаптация; лидер; бизнес-процессы; реинжиниринг; эффективность; транснациональная логистическая компания.

Introduction. Permanent changes in the external environment, increasing competition, complicating the production and commercial activities of enterprises, increasing the importance of the time factor, expanding the space of enterprise activity and increasing the volume and speed of obtaining information and new knowledge increase the importance of internal sources of economic growth that can ensure an increase in production. The relevance of the topic follows from the fact that in recent years the issue of corporate culture has become particularly important, attracting the attention of both management theorists and practitioners. In the context of the formation of market Relations, increased competition, globalization and Ukraine's integration into the EU, enterprises are forced to constantly evolve and respond quickly to changes. The driving force in these processes is the corporate culture, which unites the enterprise and personnel with a single mission, a single philosophy, development strategy, principles, values, traditions, creates a reputation in the business world, forms the image of the organization, increases its competitiveness and provides a competitive advantage.

The formation of corporate culture is an important component of the development of a modern organization. Embracing the deepest values, attitudes and ideas of employees, corporate culture is a powerful means of influencing, on the one hand, the disclosure of the human potential of the organization, and on the other — the realization of its sustainable competitive advantages in the market. In the context of the knowledge economy, improving the efficiency of an enterprise is determined not only by the use of the latest techniques and technologies, the material interest of

performers, but, above all, their dedication, the level of favorable social atmosphere, common goals, interests and values. The relevance of corporate culture research attracts the attention of scientists, however, both theoretical and practical approaches can reveal such a limitation. The problems of forming a corporate culture, especially in newly created enterprises, are often reduced to the introduction of image and entertainment programs, while the potential of corporate culture can be revealed only if it is strategically directed.

Analysis of research problems. Theoretical foundations of the formation and development of corporate culture are actively studied in the world and domestic scientific literature. Among foreign scientists, various aspects of this problem were studied by: M. Armstrong, R. Akoff, T. deal, K. Davis, P. Drucker, A. Kennedy, W. Ouchi, K. Cameron, R. Queen, J. Newstrom, R. Waterman, G. Hofstede, S. Handey, E. Shane. A lot of research on this topic has appeared in recent years in Russian science, among which we can mention the works of A. Amosha, I. Buleev, A. Voronkova, A. Grishnova, M. Doronina, V. Dubyag, G. Zakharchenko, S. Ilyashenko, A. Kamenskaya, O. Martyakova, L. Melnik, G. Nazarov, O. Prokopenko, Yu. Shipulina and others. in the works of these scientists, the essence of corporate culture is revealed, various typologies and approaches to evaluating and managing its development are considered. However, in the context of post-crisis economic turbulence, fierce competition in the markets, increased processes of restructuring and reorganization of enterprises, mergers and acquisitions, the features of corporate transformation require a more thorough analysis. The phenomenon of corporate culture has always been given a lot

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of attention, especially now, when in almost all economic, psychological, socio-humanitarian sciences such a direction as the "human factor" and its role in improving production efficiency is quite deeply studied. The analysis of economic literature shows that the issues of building organizational culture are quite deeply studied by scientists from both far and near abroad – these are, first of all, K. Cameron, R. Quinn, E. Kapitonova, V. Sate, T. Solomanidina, V. Spivak, O. Tikhomirova, V. Tomilov, S. handy, G. Hofsted, and others.

The works of Ukrainian scientists, namely: A. Voronkova, V. Grineva, Yu. Ivanov, T. Lepeyko, I. Mazhura, G. Nazarova, L. Panchenko, S. Paseka, M. Semykina, G. Khayet, I. Shvets, A. Shegda, A. Yastremskaya and others, are also devoted to the study of the problems of communication between organizational culture and competitiveness.

Determining the level of organizational culture, therefore, appears as a kind of means of diagnosing the state of culture and identifying its weaknesses. In this context, the issues of assessing and determining the impact of organizational culture on the efficiency and competitiveness of an enterprise in the context of Strategic Management become relevant.

Purpose and objectives of the article. Based on the above, the aim of the study is to develop a model for the transformation of corporate culture as the main stage of re-engineering business processes of strategic management of the organization.

Presentation of the main material and research results. In search of levers to improve the efficiency of enterprise development and its competitiveness, the emphasis is often placed only on economic factors. However, we must not forget that a business entity is a person. And the result of its work largely depends on it, on its culture, and in general on the culture of the enterprise. Therefore, it is the corporate culture that is an important factor in the successful operation of the enterprise, increasing its competitiveness.

Today, there is no single approach to the interpretation of the concept of "corporate culture". In addition, various scientists often use such terms as "organizational culture", "enterprise culture", "organization culture", and "corporate culture" to characterize it. The analysis of interpretations of these concepts gives grounds to conclude that their essence is mainly identical and corresponds to the concept of "corporate culture". Functional, psychological, normative, and historical and genetic aspects are often used to determine the essence of corporate culture. Thus, functional definitions of corporate culture describe the functions of corporate culture, its role as a mechanism for regulating behavior between employees. Psychological definitions emphasize the formation of employee habits and the peculiarities of their adaptation to the organizational environment. Descriptive definitions include a list of elements of corporate culture. Normative-pay attention to norms and patterns of behavior, historical and genetic include in corporate culture the processes of social and cultural imitation, the development of traditions, customs, rituals.

Summarizing the studied definitions, we can conclude that corporate culture is a system of values, beliefs, beliefs, ideas, expectations, symbols, as well as effective principles, norms of behavior, traditions, rituals, etc. that have developed in the organization or its divisions during its activities and are accepted by the majority of employees.

Corporate culture is a permanent system of checks and balances that needs to be strengthened at all levels of the life cycle of the organization and employees. A strong corporate culture may attract new employees to the organization, but the motivation and relevance of the work must correspond to the desire to integrate into the culture. Unmotivated employees generate a negative culture with those around them, and all this work can quickly fall apart, so understanding what drives all employees in terms of motivation, and matching this to work,

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thinking, and behavioral preferences is a better, more holistic approach to hiring, training, and retaining the employees who make up the organization – and who make up the organization's culture.

The corporate culture of an enterprise is closely linked to human resources management. Each management function (selection, motivation and evaluation of personnel, formation of groups) is associated with the task of corporate culture – to provide the employee with important, up-to-date, complete and transparent information related to current and planned initiatives (activities) of the enterprise, its mission and strategies.
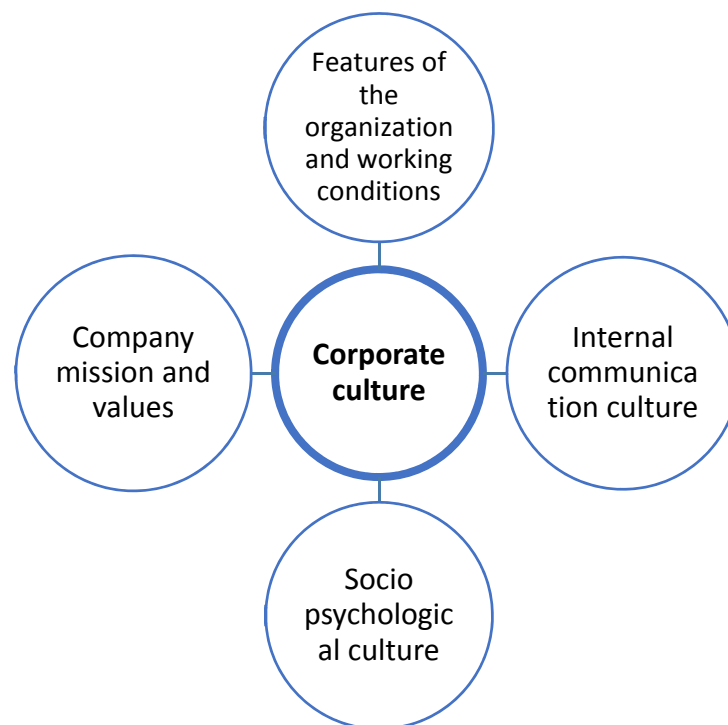
Figure 1 – Structure of the corporate culture of the enterprise. Compiled on the basis of [2]

Corporate culture provides a list of the main provisions in the work of the enterprise, depending on the development strategy and mission, and consists of an approved leadership system, a perfect communication system, the position of each employee, conflict resolution styles, existing symbols – taboos, restrictions, rituals, etc.

The decisive factor in the formation of corporate culture is the philosophy of the enterprise, that is, the principles that the company's management imitates and which are formed in advertising materials, management speeches, and information documents. Their formation aims to create a certain image of the enterprise in the eyes of

its employees and the external environment. The main concern of the company's management is appearance, because the success of the company's activities in a competitive environment depends on it. This type is formed in the minds of enterprises and individuals under the influence of contacts with the enterprise, both directly with employees of the enterprise, and when getting acquainted with advertising, visiting exhibitions, presentations.

Thus, although working on the company's image is difficult and troublesome, covering many processes and many people, it is extremely necessary if the company is trying to gain a foothold in the market and

have good prospects for further development.

The formation of corporate culture is a management tool that increases the productivity of employees of the enterprise, helps to create a positive image, good reputation and respect for it. Nowadays, corporate culture is the main mechanism that provides a practical increase in the efficiency of the enterprise. It affects the motivation of employees, the attractiveness of the enterprise as an employer, which is reflected in the turnover of personnel, the morality of each employee, his business reputation, productivity and efficiency of work, the quality of work of employees, the nature of personal and industrial relations at the enterprise, the attitude of employees to work, their creative potential. In modern conditions, the company's management is directly interested in ensuring that flexibility and innovation are the most important and integral components of the corporate culture.

Re-engineering is the most radical approach to improving business processes. It is also often referred to as process innovation, as its success is largely based on the team's innovation and creativity to improve the process. This approach provides a new perspective on the goals of the process and completely ignores the existing process and structure of the organization.

The main conditions for re-engineering, in addition to process orientation, include ambitious goals (not only to get out of the crisis, but also to become an industry leader in the future), abandoning the established rules of doing business (which is quite difficult for domestic companies), and finally improving business processes through the use of modern information technologies.

In order for re-engineering to achieve these goals, it is also necessary to ensure a decent motivation of the system of incentives for senior management, since without management's confidence in the need to rebuild the enterprise, it is impossible to achieve the final result of re-engineering – a breakthrough in its work. All employees

responsible for re-engineering must be given appropriate powers, otherwise they will be alienated by the middle management level that will perform their current functions. Re-engineering work should be widely covered within the enterprise, which will ensure that all employees understand the changes that are taking place, otherwise it will lead to distrust and disobedience of performers and resistance of employees.

Re-engineering and its most efficient implementation require the creation of a separate budget (the minimum required), without which it is impossible to start and carry out the entire complex of works. As practice shows, in order to implement the planned program, it is important to clearly define and distribute the roles, responsibilities and responsibilities of each participant in order to ensure the implementation of the program's goals. During the implementation of re-engineering works, the results achieved in the course of work should be clearly highlighted.

Daniel Denison created one of the most representative models of corporate culture transformation in terms of organizational effectiveness. Since any company whose efforts are aimed at re-engineering business processes are based on the human factor, Denison's model is based on a behavioral approach with an emphasis on the personal statements, values and expectations of the company's employees. The range of tasks that the Denison model is used to solve is quite wide: from issues of economic efficiency of the organization, functioning of the management system and corporate communication to support mergers and acquisitions, restructuring and reorganization, development of innovative products, entering new markets, improving the quality of Service and personal development of managers and staff. A special feature of the Denison model is that it is based on evaluating four main characteristics of corporate culture and Leadership: Mission, adaptability, engagement, and consistency. Accordingly, each of these characteristics is

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divided into 3 qualities (indicators), so 12 parameters are evaluated within the Denison model (fig. 2) [16].
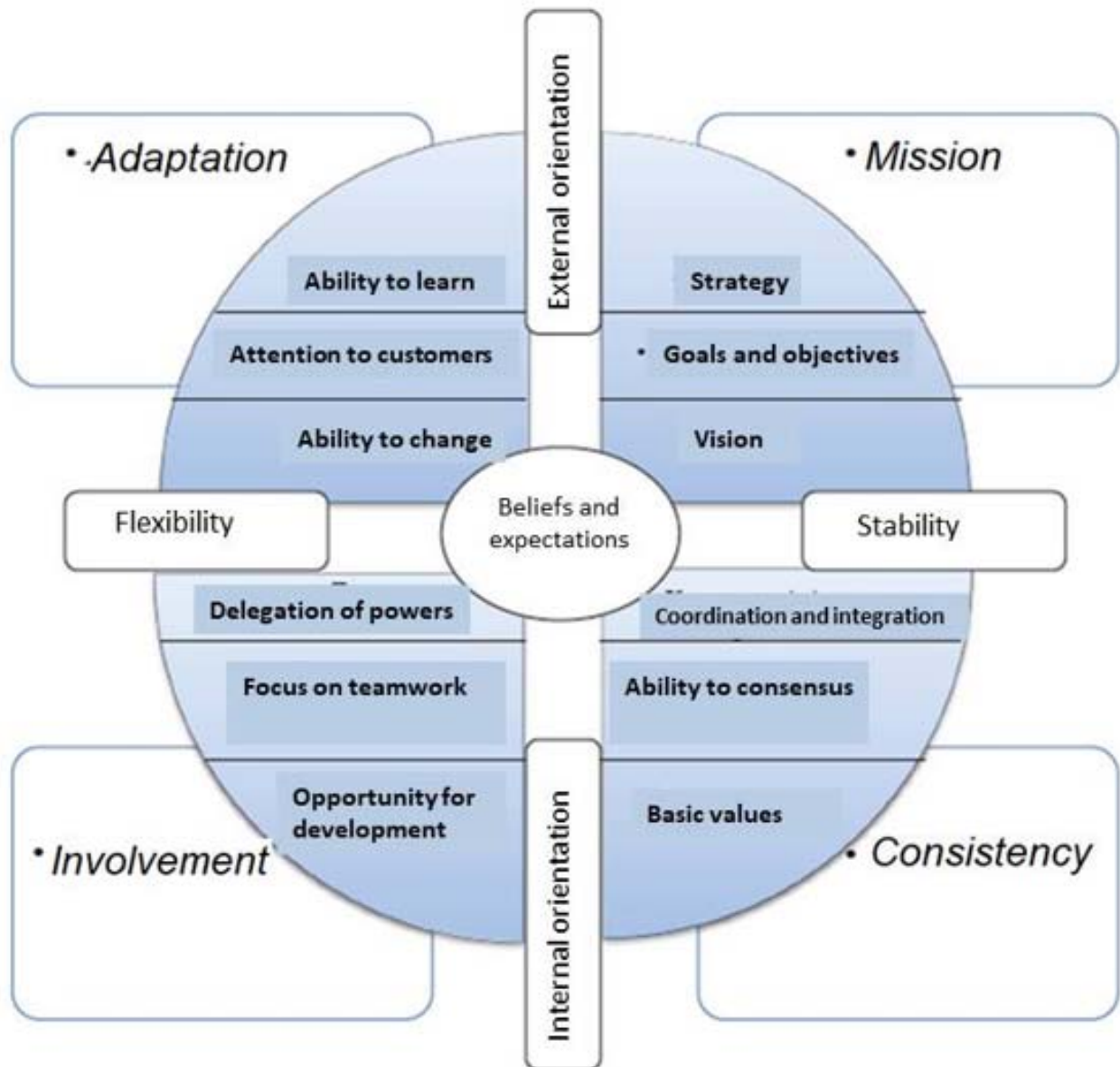
Figure 2 – Denison's corporate culture model

Re-engineering of the corporate culture of an organization cannot take place without changing the paradigm, principles and behavior of its manager, since it is a reflection of his personal values and qualities. In 1997, Richard Barrett developed cultural Transformation Tools (CTT), which are based on a seven – level model of consciousness, which allow you to determine the balance of personal values of employees and the existing corporate culture. Adding to The Maslow pyramid, Richard Barrett characterized personal levels of consciousness in accordance with the levels of awareness of needs and identified groups of values that correspond to them (table. 1) [17].

It is proved that compliance with the corporate culture and strategy of the enterprise is fundamentally important. With strategically important changes in the external environment, two possible scenarios are possible: evolutionary and revolutionary.

In the event of a revolutionary development, fundamental changes in strategy and corporate culture (reengineering technologies) are necessary. With evolutionary development, there is a gradual adjustment of the existing strategy and corporate culture (Kaizen technology). To identify opportunities for implementing reengineering and strategic planning, a SWOT analysis of the corporate culture and a mandatory survey of employees should be conducted.

Table 1

Levels of personal and corporate consciousness

Human needs	Self-awareness		Corporate consciousness
Spiritual	Ministry	7	Long-term life expectancy
	The desire to change something	6	Cooperation
	Internal integrity	5	Corporate values
Mental	Self-transformation	4	Improving performance
Emotional	Self-esteem	3	Efficient processes and systems
	Attitude	2	Customer satisfaction
Physical	Survival	1	Financial stability

According to the authors, according to the results of the analysis, re-engineering of the corporate culture of a multinational logistics company should be aimed at staff involvement. After all, a corporate culture based on staff involvement allows the company to achieve its strategic goals, creating a synergy environment where the labor, creative and intellectual potential of each employee is realized and conditions for their professional development are provided. In companies with a strong corporate culture, each employee makes every effort to achieve their own goals and the goals of the organization and is personally interested in its development. In turn, engagement is manifested in the fact that the staff shows enthusiasm and proactivity in their activities and takes full responsibility for the proper performance and quality of work. To achieve the proper level of engagement, the organization's management needs to create an open and extensive system of Corporate Communication and delegation of authority and provide a working atmosphere in which each employee will be inspired to realize their potential. To do this, you need to create an appropriate corporate culture – a culture of engagement and self-discipline.

Corporate engagement culture is the successful implementation of a business strategy aimed at increasing profits and business value by revealing the sources of internal motivation of employees aimed at the highest and highest quality results.

At the initial stage of corporate culture transformation, it is necessary to take into account that the search and selection of employees who are characterized by self-motivation and self-discipline is the most important element of the engagement strategy.

The distinctive qualities of an employee with a high engagement rate are: absorbed in work – "time flies fast at work"; maintains concentration for a long time; feels a strong emotional connection with the company; treats work with enthusiasm and passion; expands the scope of his responsibility, flexible, not limited to describing job responsibilities; adapts quickly to changes; strives to develop work skills; does not need reminders and instructions; does everything on time; persistent; takes initiative; focused on achieving goals; conscientious; responsible; dedicated to work.

The process of formation, development and changes of the Criminal Code should take

place in accordance with the life cycle of the organization. Since there are three important periods in the development of the organization, each of them has its own cultural problems and corresponding mechanisms for solving them.

If we consider the process of developing and implementing a corporate culture strategy as a separate project, then it can distinguish three stages:

1) Diagnostics of the existing corporate culture;

2) Creating a model of a new corporate culture;

3) correction of the existing (introduction of a new) corporate culture.

Attempts to change the corporate culture cause active or passive resistance of employees. Resistance to change can have different strength and intensity. It manifests itself both in the form of passive, more or less hidden rejection of changes, expressed in the form of a decrease in productivity or a desire to move to another job, and in the form of an active, open speech against perestroika (for example, in the form of a strike, a clear deviation from the introduction of innovations). The reason for resistance may lie in personal and structural barriers.

Conclusions. Therefore, both scientists and business consultants are of the opinion that corporate culture directly affects the production performance of personnel. In particular, the weak corporate culture of the organization causes staff to feel helpless, depressed and meaningless in their work, which affects the decline in human performance and productivity. Attempts to re-engineer business processes and improve employee efficiency mostly end in complete failure, as it is extremely difficult to change the existing corporate culture. Therefore, in the process of business process re-engineering, a crucial role is given to leaders who must focus their efforts, time and resources on simultaneously transforming many aspects of the business and creating a corporate culture that reflects and supports transformational decisions. With this in mind, corporate culture

should be understood as a general reflection of all aspects of the company's activities, in particular the behavior of management and staff in the process of implementing a business strategy, all technological business processes and business practices. Corporate culture is the result of the behavior of employees of the company, so under the transformation of corporate culture, it is worth considering changing the model of behavior of employees in accordance with the strategic vision of its leader for the development of the company and in accordance with his decisions on business re-engineering.

The question of how corporate culture affects strategic management can be divided into two parts:

− is there a correspondence between strategy and corporate culture;

− is it possible to make recommendations on the applicability or non-applicability of certain management practices in a certain corporate culture?

Since the corporate culture is formed in the process of finding working solutions and approaches to doing business by the enterprise, the correspondence between the enterprise strategy and the corporate culture should be observed. The task of the strategy author is to choose a strategy that is compatible with the "untouched" elements of the existing corporate culture in the enterprise. The task of the cultural leader is to change the aspects of culture that hinder the implementation of the strategy.

In general, the theoretical analysis carried out suggests that the time has come for more complex and "subtle" methods of managing social and labor relations based on the principles of corporate culture. Management tools should cover the sphere of thoughts, moods, value orientations, and motivations of educated, qualified, and informed personnel. The need to create a unified system of values, norms, rules, and everything that forms the basis of corporate culture for the team is being updated in order to achieve the effect

of its members ' participation in socially useful activities.

Further development of this direction involves both deepening research in the field of the relationship between strategy and rapid response in the development of corporate culture, and their features in the context of enterprise employee types.

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LOGISTICS AS A SUPPLY TOOL ECOLOGICAL AND ECONOMIC SECURITY OF THE STATE

Volodymyr Hobela. "Logistics as a supply tool ecological and economic security of the state". *The growing role of logistics as a means of improving business efficiency and global trends in the greening of economic activity have highlighted the need for the introduction of eco-friendly logistics tools and the formation of eco-friendly logistics. To perform the tasks of this scientific work, the following general scientific methods of cognition were used, in particular, analysis to determine the main advantages of the development of logistics activities in Ukraine and the world in general; synthesis to identify obstacles to the implementation of logistics activities in Ukraine; deduction to determine the goals and environmental and economic effects of greening logistics activities; hypothetical used to justify logistics as a tool for environmental and economic security of the state; formalization and generalization for the formation of the main directions of greening of modern logistics.*

The study examines the importance of logistics in the process of competition in national and international markets. Emphasis is placed on the security aspects of logistics. It has been established that security plays an important role in the world's leading companies. It is noted that logistics is an area of activity that allows you to optimize material, information and financial flows, which helps to increase the economic and environmental efficiency of business. Economic security is considered a component of National Security, but it is argued that economic activity causes significant damage to the environment and causes the formation of potential environmental problems.

The analysis of approaches to the definition of the theoretical content of the concepts of environmental, economic and ecological-economic security is carried out. It is claimed that eco-friendly logistics is a tool to ensure such development that will help ensure the achievement of economic objectives while minimizing the damage caused to the environment.

It has been established that in recent years' Ukrainian enterprises have appreciated the important role of logistics in improving business efficiency. The main advantages of logistics for business efficiency and the main obstacles for the development of logistics are highlighted. The main goals and directions of greening of modern logistics are singled out, the corresponding ecological and economic effects are formed. Given the global trends of greening and EU integration requirements, it is recommended to strengthen measures of state support and promotion of logistics activities, development of logistics infrastructure and greening of logistics.

Summarizing the results of the study, it is established that logistics should be identified as a tool to ensure environmental and economic security of the state. Given the global trends of economic greening, EU integration requirements and trends in the inner economy, there is an urgent need for state support to promote the development of logistics and infrastructure, greening of logistics. The goals of greening logistics are to reduce resource consumption and reduce pollution. In the course of the conducted research the perspective directions

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of further researches were formed: research of expenses of greening of logistics and their correlation with logistic expenses; formation of measures for the greening of logistics activities of enterprises and industries; development of modern logistics technologies.

__Keywords__: logistics; global problems; ecological security; economic security; greening; ecological and economic effect.

Володимир Гобела. "Логістика як інструмент забезпечення еколого-економічної безпеки держави". *Зростаюча роль логістики як засобу підвищення ефективності бізнесу та світові тенденції екологізації економічної діяльності актуалізували необхідність впровадження екологічно безпечних логістичних інструментів та формування екологоорієнтованої логістики. Для виконання завдань цієї наукової праці було використано такі загальнонаукові методи пізнання, зокрема аналіз для визначення основних переваг розвитку логістичної діяльності в Україні та світі загалом; синтез для визначення перешкод для впровадження логістичної діяльності в Україні; дедукція для визначення цілей та еколого-економічних ефектів екологізації логістичної діяльності; гіпотетичний застосовано для обґрунтування логістики як інструменту забезпечення еколого-економічної безпеки держави; формалізація та узагальнення для формування основних напрямів екологізації сучасної логістики).*

В дослідженні акцентовано увагу на безпекових аспектах логістичної діяльності. Зазначено, що логістика є сферою діяльності, що дозволяє оптимізувати матеріальні, інформаційні та фінансові потоки, що сприяє підвищенню економічної та екологічної ефективності бізнесу.

Здійснено аналіз підходів до визначення теоретичного змісту понять екологічна, економічна та еколого-економічна безпека. Стверджується, що екологоорієнтована логістика є інструментом забезпечення еколого-економічної безпеки.

Виокремлено основні переваги логістики для ефективності бізнесу та основні перешкоди для розвитку логістики. Сформовано основні цілі та напрями екологізації сучасної логістики, виокремлено відповідні еколого-економічні ефекти. Враховуючи світові тенденції екологізації економіки та інтеграційні вимоги ЄС, рекомендовано посилити заходи державної підтримки та сприяння розвитку логістичної діяльності, розбудови логістичної інфраструктури та екологізації логістики.

У ході проведеного дослідження було сформовано перспективні напрями подальших досліджень: дослідження витрат екологізації логістики та їх співвідношення із логістичними витратами; формування заходів екологізації логістичної діяльності підприємств та галузей економіки; розвиток сучасних технологій логістики.

__Ключові слова:__ логістика; глобальні проблеми; екологічна безпека; економічна безпека; екологізація; еколого-економічний ефект.

Владимир Гобела. "Логистика как инструмент обеспечения эколого-экономической безопасности государства". *Растущая роль логистики как средства повышения эффективности бизнеса и мировые тенденции экологизации экономической деятельности актуализировали необходимость внедрения экологически безопасных логистических инструментов и формирования экологоориентированной логистики. Для выполнения задач этой научной работы были использованы следующие общенаучные методы познания, в частности анализ для определения основных преимуществ развития логистической деятельности в Украине и мире в целом; синтез для определения препятствий для внедрения логистической деятельности в Украине; дедукция для определения целей и эколого-экономических эффектов экологизации логистической деятельности; гипотетический применен для обоснования логистики как инструмента обеспечения эколого-экономической безопасности государства; формализация и обобщение для формирования основных направлений экологизации современной логистики.*

В исследовании акцентируется внимание на аспектах безопасности логистической деятельности. Отмечено, что логистика является сферой деятельности, позволяет оптимизировать материальные, информационные и финансовые потоки, способствует повышению экономической и экологической эффективности бизнеса.

Осуществлен анализ подходов к определению теоретического содержания понятий экологическая, экономическая и эколого-экономическая безопасность. Утверждается, что экологоориентированная логистика является инструментом обеспечения эколого-экономической безопасности.

Выделены основные преимущества логистики для эффективности бизнеса и основные препятствия для развития логистики. Сформированы основные цели и направления экологизации современной логистики, выделены соответствующие эколого-экономические эффекты. Учитывая мировые тенденции экологизации экономики и интеграционные требования ЕС, рекомендовано усилить меры государственной поддержки и содействия развитию логистической деятельности, развития логистической инфраструктуры и экологизации логистики.

В ходе проведенного исследования было сформировано перспективные направления дальнейших исследований: исследования расходов экологизации логистики и их соотношение с логистическими затратами; формирование мероприятий экологизации логистической деятельности предприятий и отраслей экономики; развитие современных технологий логистики.

Ключевые слова: *логистика; глобальные проблемы; экологическая безопасность; экономическая безопасность; экологизация; эколого-экономический эффект.*

Introduction. The intensification of competition in the domestic and world markets contributes to the formation of effective means of increasing the competitiveness of enterprises. Accordingly, the growing role of logistics as a means of improving business efficiency and global trends of greening the economic have highlighted the need for the introduction of eco-friendly logistics tools and the formation of eco-friendly logistics. Under such conditions, it is possible to increase the economic efficiency of business and reduce the amount of environmental damage, which will help counteract environmental threats and increase the competitiveness of enterprises in today's market economy. There is a need to form tools of economic and environmental security. Therefore, it is proposed to consider logistics as an activity aimed at ensuring the environmental and economic security of the state and to explore the main directions of greening the modern logistics.

Analysis of recent research and publications. The study of topical issues of logistics, current trends in logistics, eco-friendly, "green" logistics were engaged in such domestic and foreign reseachers: Brdulak H. [1], Ivanishcheva A. [2], Poliakova O., Shramenko O. [3], Koblianskaia N. [4], Mashchak N. [5], Mnykh O. [6], Fesina Yu. [7], Kharichkov S. [8]. The study current issues and

environmental aspects of economic activity and ensuring economic and ecological safety work dedicated scientists, such as: Dudiuk V. [9], Franchuk V. [10], Polovian O. [11], Lytsur I. [12] and other.

Purpose and objectives of the article. To carry out the theoretical substantiation of identification of logistics as the tool of maintenance of ecological and economic safety of the state and to offer directions of greening the modern logistics.

Presentation of the main material and research results. At the present stage of development there is a significant role of logistics in obtaining sustainable competitive advantages, especially for international business. Thanks to logistics, organizations provide the required level of service to the end user, while providing him with certain additional benefits or values. These additional benefits may include optimizing deliveries, payment terms, timing, place of execution, and other benefits that create a competitive advantage for the business. However, the experience of the world's leading companies shows the important role of security issues and their impact on the business activities of international and national enterprises. This is especially true of economic and environmental security at all levels of manifestation - enterprise, industry, state, global. The impact of logistics operations on the economic efficiency of business,

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especially in recent decades, is extremely significant, but it is worth noting the growing role of environmental aspects of logistics and economic activity in general. Because logistics is the area of activity that allows you to optimize material, information and financial flows, which helps to increase the economic and environmental efficiency of business. That is why there is a need to study logistics as a tool to ensure not only economic security but also environmental.

In general, economic security is an important component of national security, but in turn, economic activity causes significant damage to the environment, which leads to the formation of potential environmental problems. It is worth noting that the dynamic development of the world and globalization have led to the transformation of local environmental problems into global environmental problems that have threatened the existence of earthly civilization. Of particular importance are studies in the field of overcoming global environmental threats and finding a safe way for humans to live.

Currently, there is a lot of research on topical issues of security, including economic and environmental security. It should be noted that environmental safety is interpreted as a state characterized by the provision of all vital human needs while maintaining the impact on the environment at a level that ensures safe living conditions and human health, does not worsen future living conditions and creates a system of safety measures to prevent and eliminate the consequences of natural phenomena and natural disasters [9]. Instead, economic security is interpreted as a state of protection of national economic interests, which provides effective counteraction to external threats and guarantees the satisfaction of social needs [10]. However, a significant number of researchers suggest combining these concepts into one – ecological-economic security. The introduction of this concept has led to the definition of environmental safety as "a state of protection

of recipients and the environment from the negative effects, threats and consequences of anthropogenic activities" [11], and ecological-economic security is interpreted as a state in which biotic, abiotic and anthropogenic load is acceptable limits of the system, and the system, in turn, is in a state of stability and dynamic equilibrium [12].

The most complete description of the state of the ecological and economic system can be obtained by comparing economic indicators with the corresponding state of the environment. Therefore, the further development of the ecological and economic system will be based on two guidelines. This will make it possible to determine what "price" we pay for economic development, whether economic growth ensures the growth of social standards and how much socio-economic benefits society loses, ensuring environmental and economic security. Awareness of the real state of the ecological and economic system will provide an opportunity to form a strategy for further economic development, which will be based on the optimal combination of requirements of the two subsystems. The tool to ensure such development will be eco-friendly logistics, which will help ensure the achievement of economic objectives while minimizing damage to the environment. Accordingly, we believe that we are talking about the green logistics in order to form tools to combat environmental and economic threats and ensure the environmental and economic security of the state.

Although the term "greening" has appeared relatively recently, it is commonly understood and most in demand in modern science. This concept is widely used in scientific papers, periodicals, political discussions and everyday conversations [13]. We consider it expedient to single out greening as an activity aimed at overcoming environmental problems as the main threat to the economic security of the state.

That is, greening is essentially an activity that contributes to economic security without compromising environmental security. Thus,

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the main goal of greening is to transform socio-economic development into an environmentally safe and acceptable form [13]. Based on the above provisions, we emphasize that the main task of greening is to make environmental products and services an attractive and efficient commodity for the national economy. Note that in the context of the outlined provisions, we tend to the following interpretation of greening – all types of human activities aimed at preventing, identifying and eliminating environmental threats to the economic system [14].

Given the chosen strategic course of the state towards the transition to low-carbon economic development, which is based on the main provisions of the Paris Agreement to the UN Framework Convention on Climate Change, we consider green logistics one of the priorities. It should be noted that the market of logistics services is developing very dynamically, we are talking about both international and national markets. Nowadays, logistics is not only a tool for counteracting environmental threats, but also a tool for improving the economic efficiency of business. The share of companies providing logistics services is growing rapidly. Note that according to current legislation, the main sources of pollution in Ukraine are industry, energy and transport [15]. Accordingly, the greening of logistics operations will increase the environmental and economic efficiency of industry and transport operations and will make a significant contribution to environmental and economic security at the enterprise level and at the national level. Because the level of economic security largely depends on the level of management efficiency and the ability to take into account possible threats and avoid harmful consequences and negative factors of both its external and internal environment [16]. That is why logistics should be considered an effective tool for ensuring the environmental and economic security of the state.

In recent years, Ukrainian companies have appreciated the important role of logistics in improving business efficiency and are actively integrating the world experience of logistics management into domestic practice. As a result, the quality of logistics services increases [2]. In such circumstances, not only the introduction of modern logistics technologies is especially important, but also the need of green logistics, and transformation of logistics tools into eco-friendly. However, obstacles to the active development of logistics in Ukraine should also be identified. Domestic researchers distinguish the following among them: technological lag of the domestic transport system in comparison with foreign ones; low level of transport infrastructure development; gaps in the legislation in the field of logistics and land relations, which complicates the process of creating large logistics centers and other logistics infrastructure; high level of bureaucracy and corruption; lack of investment [3]. Analysis of obstacles to the development of logistics in Ukraine shows a low level of state support for this area of activity, especially the financing of logistics projects and the development of innovative technologies in the field of logistics. Note that the development of logistics infrastructure, including the construction of roads, terminals and logistics centers are quite expensive and require significant investment and resources, therefore there is a need for significant support from the state, and reducing bureaucracy and fighting corruption is the exclusive competence of the state. Given the growing role of logistics as a tool for environmental and economic security of the state should actively develop this type of activity.

Global trends in logistics, and especially the development of the European Union's logistics, indicate the world community's significant concern about global environmental issues, especially global warming due to excessive greenhouse gas emissions, and the role of logistics in solving them. Currently, the greening of logistics is a priority for the development of national and global economy. It should be noted that

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modern technologies contribute to greening the logistics and, accordingly, help reduce the harmful effects of the economy on the environment. The European Union has adopted a number of directives concerning the increase of environmental requirements for logistics operations, in particular for the production process, transport operations, requirements for packaging, packaging, labeling, etc. Ukraine's integration into the European economic space implies harmonization of European and domestic legislation. This is especially true of environmental requirements for production and transportation of products. The greening of logistics activities will help increase the competitiveness of domestic products on the world market and remove barriers to integration processes. It is also worth noting that in our country there are a number of environmental problems that become a threat to present and future generations. Accordingly, the greening of logistics will help eliminate environmental problems and strengthen the environmental and economic security of the state.

Given the above arguments, it is necessary to identify the main objectives of modern green logistics: reducing resource costs and reducing pollution. Accordingly, the main directions of greening the modern logistics and the corresponding environmental and economic effects are shown in table 1.

Table 1

The main directions, goals and ecological and economic effects of greening the logistics activities

Directions	Goals of greening	Ecological and economic effects of greening
Introduction of lean production systems	Reduction of resource costs	Reducing the use of resources, reducing labor costs, reducing warehouse space, reducing production costs
Recycling logistics, reverse logistics	Reduction of resource costs; Reduction of environmental pollution	Reduction of resource use, reduction of waste and pollution, reduction of transport costs, after sales service and repair, reduction of production costs
Implementation of software packages (MRP II, ERP, WMS)	Reduction of resource costs	Reducing the use of resources, reducing labor costs, reducing production costs, optimizing the use of warehouse space
Using the electric cars including forklifts and trucks	Reduction of resource costs; Reduction of environmental pollution	Reducing fuel consumption, reducing emissions of CO_2 and other harmful substances, reducing the cost of logistics operations and production costs
Using the unmanned vehicles, drones, etc.	Reduction of resource costs; Reduction of environmental pollution	Reducing the cost of logistics operations, more economical use of fuel, transportation of goods in difficult weather conditions, in dangerous conditions, optimization of transport and warehousing operations

Conclusions. Logistics is an important type of economic activity that aims to increase the economic efficiency of business.

During the last decades the research of ecological and ecological and economic efficiency of logistics is actualized. Logistics is

formed as an activity that helps to eliminate environmental threats and increase the economic efficiency of economic activity. Accordingly, logistics can be identified as a tool to ensure environmental and economic security of the state. Given the global trends of economic greening, EU integration requirements and trends in the national economy, there is an urgent need for state support to promote the development of logistics and infrastructure, green of logistics.

In general, the goals of green logistics are to reduce resource consumption and reduce pollution.

In the course of the conducted research the perspective directions of further researches were formed: research of expenses for greening the logistics and their correlation with logistic expenses; formation of measures for greening the logistics activities of enterprises and industries; development of modern logistics technologies.

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IDENTIFICATION OF AIR TRANSPORT ECOLOGICAL COMPONENT LEVEL IN THE CONTEXT OF ENSURING SUSTAINABLE DEVELOPMENT OF THE NATIONAL ECONOMY

Dmytro Bugayko. Yuri Kharazishvili, Anna Antonova, Zenon Zamiar. "Identification of air transport ecological component level in the context of ensuring sustainable development of the national economy". Aviation safety is an important component of the concept of general national security, the system of personal security, ecological and public safety and transport safety from external and internal threats. Maintaining an acceptable level of national aviation safety is a priority for the industry. In the context of globalization, ecological safety is becoming especially important. World leaders gathered at the United Nations (UN) and adopted the 2030 Agenda for Sustainable Development. It is a plan of action aimed at achieving global sustainable development in economic, social and environmental areas, which ensures that no UN member state

is left behind. The 17 sustainable development goals on the 2030 Agenda can be used as benchmarks for the coordinated development of UN member states. One of the most important goals for the global survival of humankind is Goal 13 "Climate Change". In order to find an adequate answer to this challenge, the International Civil Aviation Organization (ICAO) has identified the following areas that can contribute to the attainment of the global aspirational goal: aircraft related technology and standards; improved air traffic management and operational improvements, development and deployment of sustainable aviation fuel and the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The implementation of CORSIA is carried out not only at the global level, the initiative requires the search for effective management solutions at the national level. Statistics on the activities of the aviation industry of Ukraine indicate its stable development. However, unfortunately, the dynamic growth of air traffic entails an increase in emissions of chemical elements into the atmosphere, which are a real threat to the environment and can contribute to climate change processes. The main tool for ensuring ecological safety tasks is proactive risk management. The development of proactive tools for environmental risk management is relevant and has practical implications for sustainable development, both in the industry in particular and for the state as a whole. The articles offer the author's approaches to the identification of air transport ecological component level.

Keywords: ecological safety; proactive civil aviation risk management; sustainable development of the national economy; carbon offsetting and reduction scheme for international aviation (CORSIA); identification of air transport ecological component level.

Дмитро Бугайко, Юрій Харазішвілі, Анна Антонова, Зенон Заміар. "Ідентифікація рівня екологічної складової авіаційного транспорту з метою забезпечення сталого розвитку національної економіки." *Безпека авіаційної галузі є важливою складовою концепції загальної національної безпеки, системи забезпечення особистої безпеки, екологічної безпеки суспільства та безпеки на транспорті від зовнішніх та внутрішніх загроз. Підтримка прийнятного рівня безпеки національної авіації є пріоритетним завданням галузі. Особливого значення в умовах глобалізації набуває екологічна безпека. Міжнародна організація цивільної авіації (ICAO) з огляду на динамічні глобальні зміни клімату, пропонує програму компенсацій та скорочення викидів діоксиду вуглецю для міжнародної авіації (CORSIA). Основним інструментарієм забезпечення цих завдань є випереджаюче управління ризиками. Розробка проактивного інструментарію управління екологічними ризиками має актуальність та має практичні значення для сталого розвитку, як галузі, зокрема, так і для держави в цілому. У статтях пропонується авторські підходи до ідентифікації рівня екологічної складової авіаційного транспорту.*

Ключові слова: екологічна безпека; випереджаюче управління ризиками; сталий розвиток національної економіки; програма компенсацій та скорочення викидів діоксиду вуглецю для міжнародної авіації (CORSIA); ідентифікація рівня екологічної складової авіаційного транспорту.

Дмитрий. Бугайко, Юрий Харазишвили, Анна Антонова, Зэнон Замиар. "Идентификация уровня экологической составляющей авиационного транспорта с целью обеспечения устойчивого развития национальной экономики". *Безопасность авиационной отрасли является важной составляющей концепции общей национальной безопасности, системы обеспечения личной безопасности, экологической безопасности общества и безопасности на транспорте от внешних и внутренних угроз. Поддержание приемлемого уровня безопасности национальной авиации является приоритетной задачей отрасли. Особое значение в условиях глобализации приобретает экологическая безопасность. Международная организация гражданской авиации (ИКАО), учитывая динамические глобальные изменения климата, предлагает программу компенсаций и сокращения выбросов диоксида углерода для международной авиации (CORSIA). Основным инструментарием обеспечения этих задач является упреждающее управление рисками. Разработка проактивного инструментария управления экологическими рисками имеет актуальность и представляет практические значение для устойчивого развития, как отрасли, в частности, так и для*

государства в целом. В статье предлагаются авторские подходы к идентификации уровня экологической составляющей авиационного транспорта.

Ключевые слова: экологическая безопасность; упреждающее управление рисками; устойчивое развитие национальной экономики; программа компенсаций и сокращения выбросов диоксида углерода для международной авиации (CORSIA); идентификация уровня экологической составляющей авиационного транспорта.

Introduction. Relevance and formulation of the problem. In September 2015, world leaders gathered at the United Nations (UN) and adopted the 2030 Agenda for Sustainable Development. It is a plan of action aimed at achieving global sustainable development in economic, social and environmental areas, which ensures that no UN member state is left behind.

Figure 1 – Strategic management of aviation transport in the conditions of sustainable development of the national economy

Source: Bugayko D.O., Kharazishvili Yu.M. Theoretical bases of aviation branch strategic safety management in the context of maintenance of sustainable development of national economy. Bulletin of Economic Science of Ukraine. 2020. № 1 (38). Pp. 166-175. Institute of Industrial Economics of the National Academy of Sciences of Ukraine, Academy of Economic Sciences of Ukraine. doi: https://doi.org/10.37405/1729-7206.2020.1(38).166-175 10 [1].

The 17 sustainable development goals on the 2030 Agenda can be used as benchmarks for the coordinated development of UN member states.

The aviation industry is an open system that is affected by a wide range of ecological, technical, natural, human and economic hazards. For its part, it itself is a generator of

significant threats to the environment. Therefore, we cannot imagine the aviation industry outside the search for answers to the latest global challenges. The main challenges for aviation are to develop air transportations at the national, regional and global levels, in order to ensure economic, social and environmental priorities.

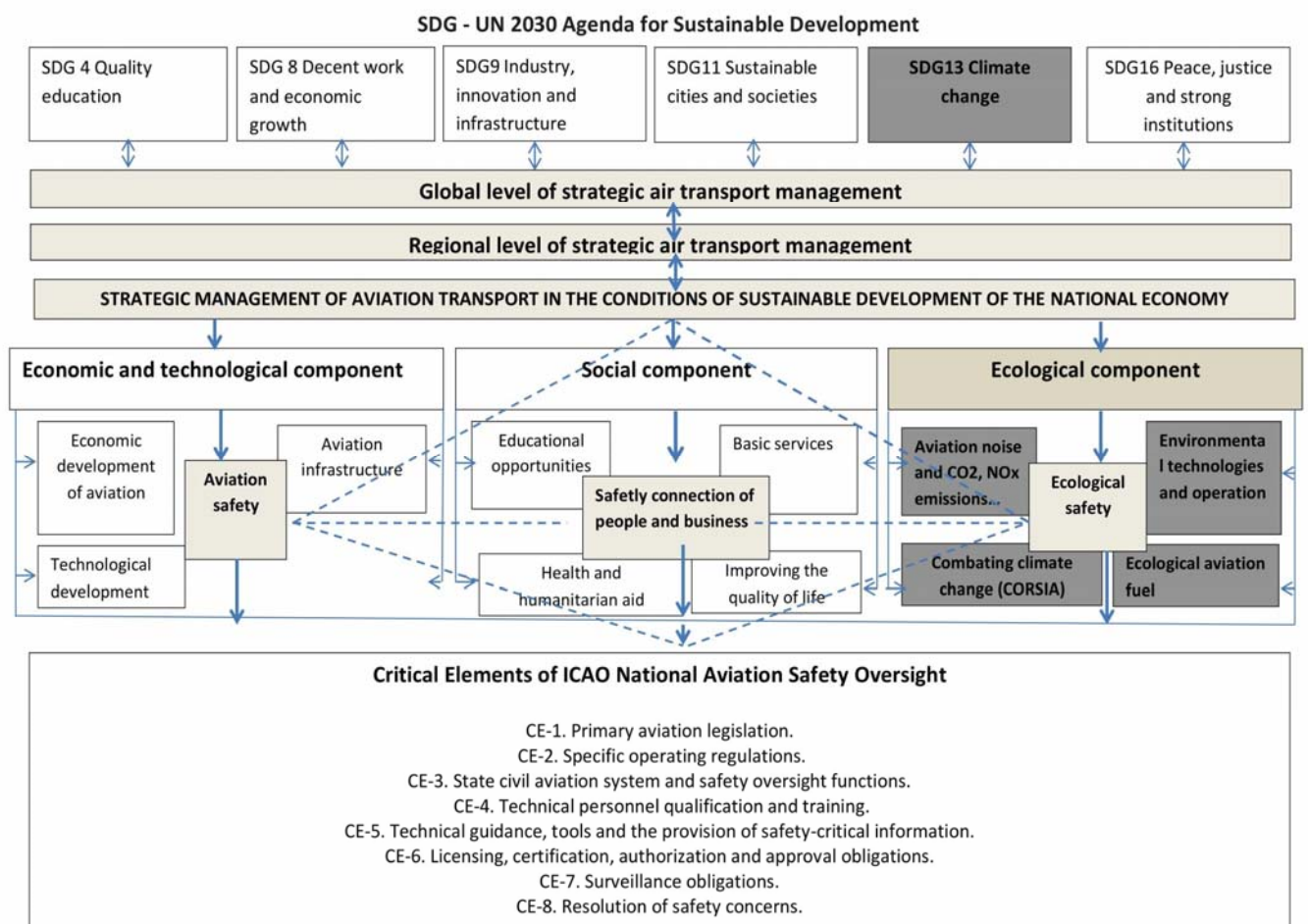Figure 1 shows a diagram "Strategic management of aviation transport in the conditions of sustainable development of the national economy".

Ecological safety is an important component of the concepts of general national security, the system of personal security, public safety and transport safety from external and internal threats. Maintaining an acceptable level of ecological safety at both the global and national levels is a priority.

The purpose of the article is to identify the level of the environmental component of air transport in order to develop effective tools for sustainable development of the national economy.

ICAO's Basket of Environmental Protection Measures. ICAO has identified the following areas that can contribute to the attainment of the global aspirational goals (Fig. 2):

− Aircraft related technology and standards;

− Improved air traffic management and operational improvements;

− Development and deployment of sustainable aviation fuel;

− The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)[2].
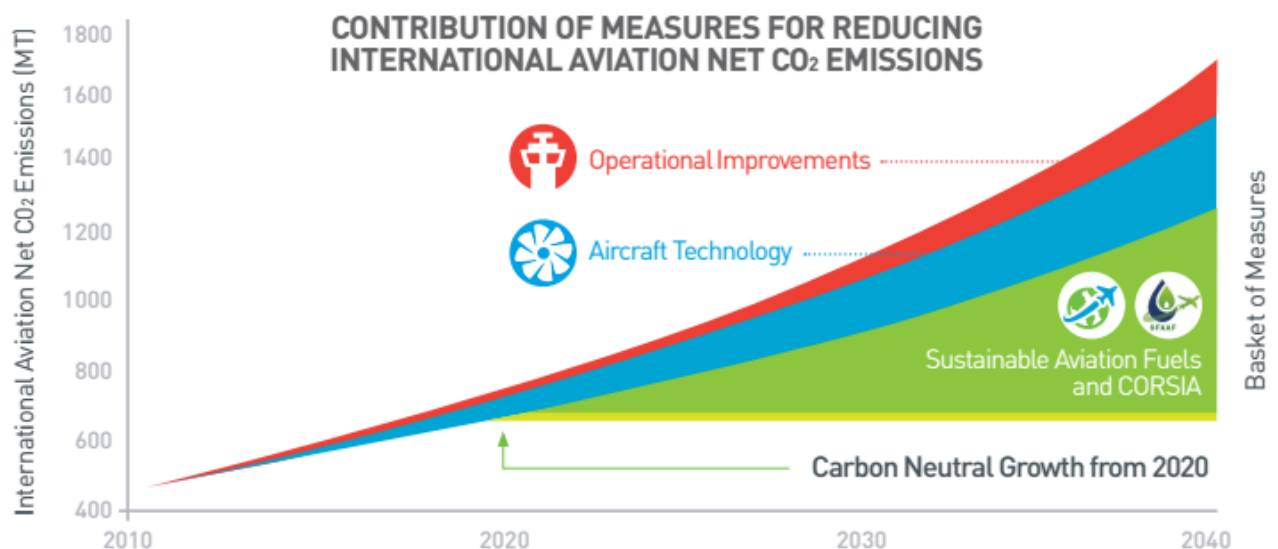
Figure 2 – Contribution of measures for reducing international aviation net CO2 emissions
Source: Carbon Offsetting And Reduction Scheme for International Aviation (CORSIA) implementation plan. ICAO, 2019 [2].

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) the first global market-based measure for any sector and represents a cooperative approach that moves away from a "patchwork" of national or regional regulatory initiatives through the implementation of a global scheme that has been developed through global consensus among governments,

industry, and international organizations. It offers a harmonized way to reduce emissions from international aviation ensuring that there is no market distortion, while respecting the special circumstances and respective capabilities of ICAO Member States [3].

ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA): History of Development. The

37th Session of the ICAO Assembly (2010) adopted two aspirational goals:

− to improve energy efficiency by 2 per cent per year until 2050, and

− to achieve carbon neutral growth from 2020 onwards.

Measures includes technological innovations, operational improvements, sustainable aviation fuels, and market based measures [3, 4].

The 38th Session of the ICAO Assembly (2013) decided to develop a global market-based measure for international aviation, further discussions on its design features and implementation mechanisms were undertaken, including possible means to address special circumstances and respective capabilities of States [3,5].

The 39th Session of the ICAO Assembly (2016). States finally adopted a global market-based measure scheme for international aviation, in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), to address the increase in total CO_2 emissions from international aviation above the 2020 levels (Assembly Resolution A39-3) [3, 6].

The 40th Session of the ICAO Assembly (2019): acknowledges the progress achieved on all elements of the basket of measures available to address CO_2 emissions from international aviation, including aircraft technologies, operational improvements, sustainable aviation fuels and CORSIA, and affirms the preference for the use of aircraft technologies, operational improvements and sustainable aviation fuels that provide the environmental benefits within the aviation sector. Marked that the environmental benefits from aircraft technologies, operational improvements and sustainable aviation fuels may not deliver sufficient CO_2 emissions reductions to address the growth of international air traffic. Recalls its decision at the 39th Session to implement a GMBM scheme in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Determines that the CORSIA is the only global market-based measure applying to CO_2 emissions from international aviation so as to avoid a possible patchwork of duplicative State or regional MBMs [7].

Phased Implementation for the CORSIA. ICAO member states participating in CORSIA need to ensure that their airplane operators comply with the CORSIA offsetting requirements every three years, in addition to annual CO_2 MRV [2].

Figure 3 – Phases of CORSIA implementation
Source: Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) implementation plan. ICAO, 2019 [2].

The 39th and 40th Session of the ICAO Assembly introduced approach, which based on the use of a phased implementation for the CORSIA to accommodate the special circumstances and respective capabilities of States, in particular developing States, while minimizing market distortion, as follows:

Pilot phase applies from 2021 through 2023 to States that have volunteered to participate in the scheme.

First phase applies from 2024 through 2026 to States that voluntarily participate in the pilot phase, as well as any other States that volunteer to participate in this phase.

Second phase applies from 2027 through 2035 to all States that have an individual share of international aviation activities in RTKs in year 2018 above 0.5 per cent of total RTKs or whose cumulative share in the list of States from the highest to the lowest amount of RTKs reaches 90 per cent of total RTKs, except Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Landlocked Developing Countries (LLDCs) unless they volunteer to participate in this phase.

Starting in 2022, the Council will conduct a review of the implementation of the CORSIA every three years, including its impact on the growth of international aviation, which serves as an important basis for the Council to consider whether it is necessary to make adjustments to the next phase or compliance cycle and, as appropriate, to recommend such adjustments to the Assembly for its decision [6, 7].

How to Calculate CO2 Offsetting Requirements?

Operator's annual emissions X Growth Factor = CO2 offsetting requirements [2]

The Growth Factor changes every year taking into account both the sectoral and the individual operator's emissions growth. The Growth Factor is the percent increase in the amount of emissions from the baseline to a given future year, and is calculated by ICAO (Fig. 4).
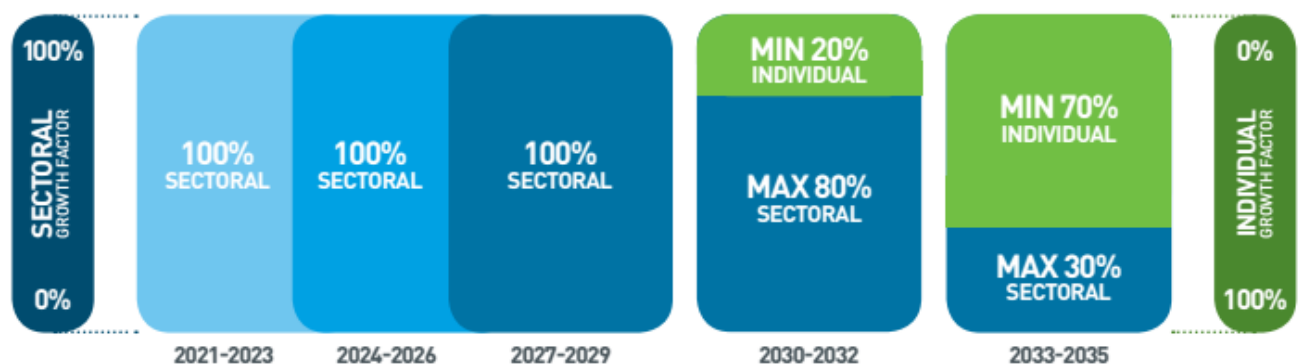
Figure 3 – Calculation CO2 offering requirements
Source: Carbon Offsetting And Reduction Scheme for International Aviation (CORSIA) implementation plan. ICAO, 2019 [2].

After the calculation of the offsetting requirements to be attributed to an aeroplane operator:

− The operator reports the use of CORSIA Eligible Fuels for the compliance period.

− The State deducts the benefits from the use of CORSIA Eligible Fuels and informs the operator's final offsetting requirements for the 3-year compliance period.

− The operator purchases and cancels eligible emissions units equivalent to its final

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offsetting requirements for the compliance period.

– The operator provides a validated Emissions Units Cancellation Report to the State, who checks the Report and informs ICAO [2].

How Does an Aeroplane Operator Monitor CO2 Emissions?

An aeroplane operator shall monitor and record its fuel use from international flights in accordance with an eligible monitoring method approved by the State to which it is attributed, and shall use the same eligible monitoring method for the entire 3-year compliance period.

An aeroplane operator can choose from five different eligible methods for fuel use monitoring. The methods are equivalent, there is no hierarchy for selecting a method.

An aeroplane operator may choose to use the ICAO CORSIA CO_2 Estimation and Reporting Tool (CERT), accessible through the ICAO CORSIA website [2].
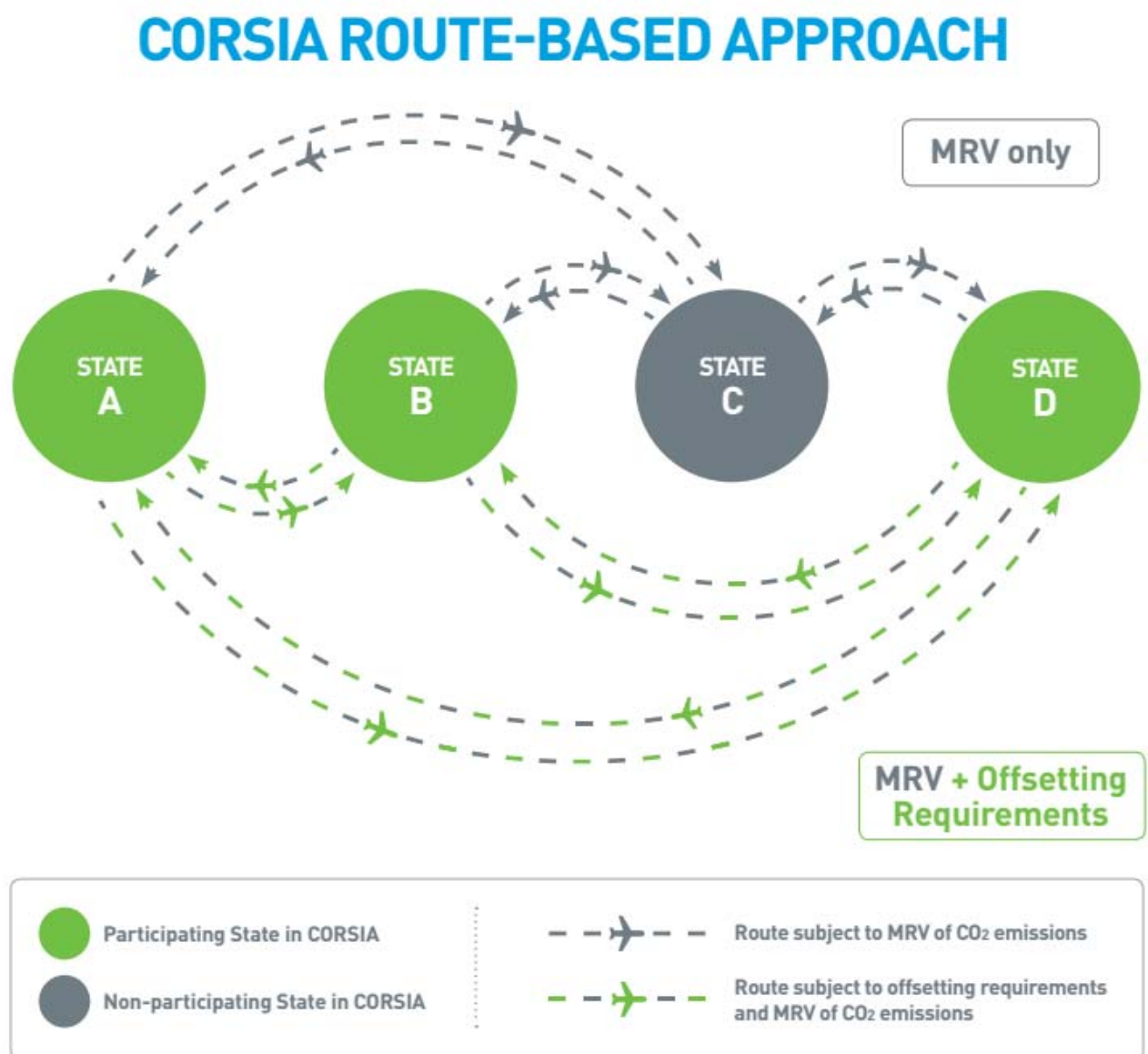

Figure 5 – CORSIA route-based approach
Source: Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) implementation plan. ICAO, 2019 [2].

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CORSIA Implementation. The success of the implementation of CORSIA relies on the establishment of a robust and transparent monitoring, reporting and verification (MRV) system, which includes procedures on how to monitor the fuel use, collect data and calculate CO2 emissions; report CO2 emissions data; and verify CO2 emissions data to ensure accuracy and avoid mistakes [4].

The implementation of CORSIA required a "package" of CORSIA-related SARPs and guidance which comprise of three distinct but interrelated components:

a) Annex 16, Volume IV, which provides the required actions by States and airplane operators (the "what" and "when") to implement CORSIA [3, 8];

b) Environmental Technical Manual (Doc 9501), Volume IV, which provides the guidance on the process (the "how") to implement CORSIA [3, 9]; and

c) Five CORSIA Implementation Elements, which are reflected in 14 ICAO documents and are approved by the Council prior to their publication [3].

These ICAO documents are directly referenced in Annex 16, Volume IV and are essential for the implementation of CORSIA. The Council adopted the First Edition of Annex 16. Volume IV in June 2018. Following its adoption, the First Edition of Annex 16, Volume IV became applicable on 1 January 2019. The First Edition of the Environmental Technical Manual (Doc 9501), Volume IV was issued under the authority of the ICAO Secretary General in August 2018. This manual will be periodically revised to make the most recent information available to administrating authorities, airplane operators, verification bodies and other interested parties in a timely manner, aiming at achieving the highest degree of harmonization possible.

The ICAO Council has been undertaking work, with the contribution of the CAEP, on the development of the five CORSIA Implementation Elements, namely:

– CORSIA States for Chapter 3 State Pairs is the list of States participating in CORSIA and will be used to define route-based emissions coverage every year from 2021 onwards;

– ICAO CORSIA CO2 Estimation and Reporting Tool (CERT) aims to simplify the estimation and reporting of CO2 emissions from international flights for those operators with low levels of activity to fulfil their monitoring and reporting requirements under CORSIA (for more details, see the dedicated article in this chapter);

– CORSIA Eligible Fuels cover aviation fuels used for the purposes of CORSIA to reduce the offsetting requirements of aeroplane operators (for more details, see the dedicated article in this chapter);

– CORSIA Eligible Emissions Units are emissions units from the carbon market that can be purchased by aeroplane operators to fulfill the offsetting requirements under CORSIA (for more details, see the dedicated article in this chapter); and

– CORSIA Central Registry (CCR) is an information management system that will allow the input and storage of CORSIA-relevant information reported by States, as well as calculations and reporting by ICAO, in accordance with the CORSIA MRV requirements as contained in the Annex 16, Volume IV (for more details, see the dedicated article in this chapter). In June 2018, to ensure that No Country is Left Behind, the Council endorsed the ICAO ACT-CORSIA (Assistance, Capacity-building and Training for the CORSIA) Programme, emphasizing the importance of a coordinated approach under ICAO to harmonize and bring together all relevant actions and promote coherence to capacity building efforts related to CORSIA implementation. By the end of June 2019, CORSIA buddy partnerships under ACT-CORSIA had been established, involving 15 donor States and 98 recipient States [3].

CORSIA Emissions Unit Eligibility Criteria. Program Design Elements. At the program level, ICAO should ensure that eligible offset credit programs meet the following design elements:

1. Clear Methodologies and Protocols, and their Development Process.

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2. Scope Considerations.

3. Offset Credit Issuance and Retirement Procedures.

4. Identification and Tracking.

5. Legal Nature and Transfer of Units.

6. Validation and Verification procedures.

7. Program Governance.

8. Transparency and Public Participation Provisions.

9. Safeguards System.

10. Sustainable Development Criteria.

11. Avoidance of Double Counting, Issuance and Claiming.

Carbon Offset Credit Integrity Assessment Criteria: There are a number of generally agreed principles that have been broadly applied across both regulatory and voluntary offset credit programs to address environmental and social integrity. Eligibility criteria should apply at the program level, as the expertise and resources needed to develop and implement ICAO emissions criteria at a methodology and project level is likely to be considerable.

Eligibility Criterion: Carbon offset programs must generate units that represent emissions reductions, avoidance, or removals that are additional.

1. Eligibility Criterion: Carbon offset programs must generate units that represent emissions reductions, avoidance, or removals that are additional.

2. Eligibility Criterion: Carbon offset credits must be based on a realistic and credible baseline.

3. Eligibility Criterion: Carbon offset credits must be quantified, monitored, reported and verified.

4. Eligibility Criterion: Carbon offset credits must have a clear and transparent chain of custody within the offset program.

5. Eligibility Criterion: Permanence.

6. Eligibility Criterion: A system must have measures in place to assess and mitigate incidences of material leakage.

7. Eligibility Criterion: Are only counted once towards a mitigation obligation.

8. Eligibility Criterion: Carbon offset credits must represent emissions reductions, avoidance, or carbon sequestration from projects that do no net harm [8].

ICAO CORSIA Package. The 'CORSIA Package' contains various elements that are all critical to the successful implementation of CORSIA. They include:

a) Annex 16 Volume IV – Standard and Recommend Practices (SARPs) [8];

b) Environmental Technical Manual (ETM) Volume IV – Guidance Material [9];

c) ICAO CORSIA Supporting Information; and

d) Supporting Documents – Technical Information and ICAO Processes to maintain the Supporting Information.

The Annex 16 Volume IV and ETM Volume IV follow a similar structure to that of the other Annex 16 Volumes (Figure 6). This includes Chapters containing requirements on administration, MRV, CO_2 offsetting requirements, Sustainable Aviation Fuels and eligible Emissions Units. Additional detailed processes and information within the Appendices supplement these requirements. The Annex 16 Volume IV also has Attachments that provide supporting information on the implementation of the standard and recommended practices.

The CORSIA also raises various innovative issues, such as:

− the definition of roles and responsibilities of the ICAO Secretariat;

− information required for the implementation of CORSIA and

− information that will need to be updated more often than the typical three-year approval cycle of Annex 16 Volumes. In order to address these issues, it is proposed to develop and use 'ICAO CORSIA Supporting Information' that is expected to be captured in some form of ICAO documentation (e.g., ICAO Document, Council Decision), managed and approved by an ICAO Body and finally published by ICAO such that it is available to the public. This information is directly referenced in Annex 16 Volume IV, and is

therefore considered to be an integral part of Standard and Recommend Practices.

The content of the ICAO CORSIA Supporting Information will be built upon the relevant Supporting Documents. The Supporting Documents will include technical information and ICAO processes that will serve as the basis for managing and approving the Supporting Information. Thus the roles of ICAO in the implementation of CORSIA, which cannot be placed directly in Annex 16 Volume IV, can be clearly defined [11].
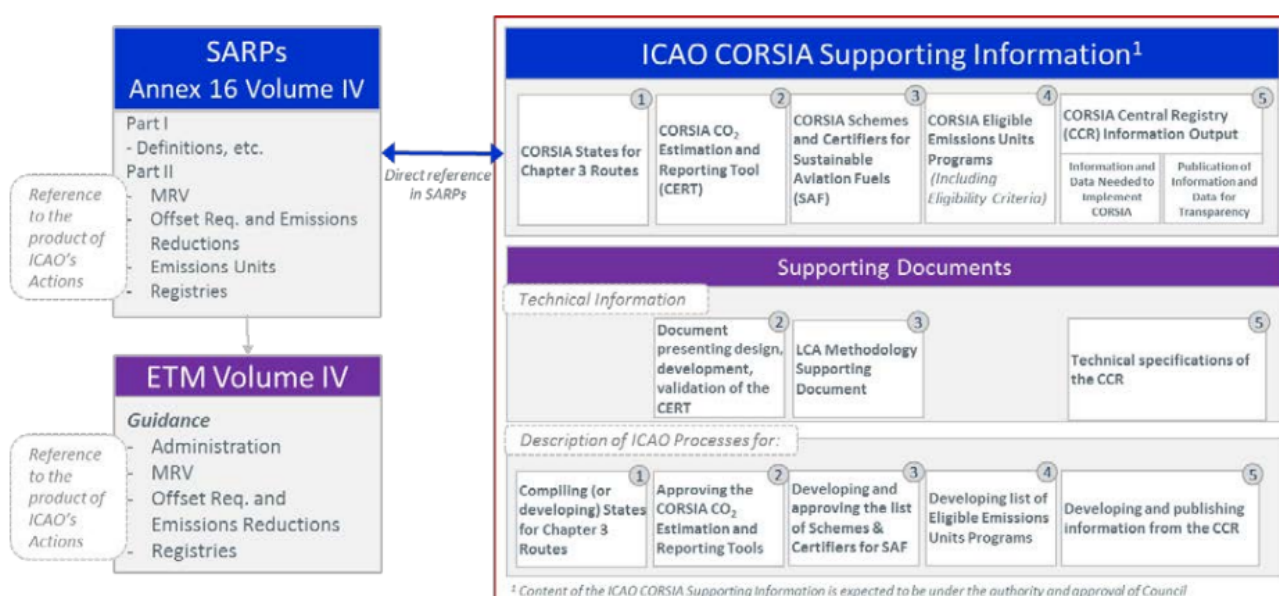
Figure 6 – Overview of the CORSIA Package containing various elements including the Annex 16 Volume IV (SARPs), ETM, ICAO CORSIA Supporting Information and Supporting Documents
Source: Committee On Aviation Environmental Protection (CAEP) Steering Group Meeting Montréal, Canada, 11 to 15 September 2017. Agenda Item 3: Global Market Based Measure Technical (GMTF) ICAO/ CORSIA PACKAGE (Presented by GMTF co-Rapporteurs), ICAO, 2019 [11].

Identification of Ukrainian Air Transport Ecological Component Level. Statistics on the activities of the aviation industry of Ukraine (2010 – 2019) indicate its stable development. During 2019, passenger and cargo transportation was performed by 29 domestic airlines, which performed a total of 103.3 thousand commercial flights (in 2018 - 100.2 thousand flights). The main production indicators of passenger air transportation are given in Table1 and 2 [12].

Table 1.

Air transportation of passengers and passenger turnover of Ukraine

	2010	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Million passengers	6	6	6	8	9	12	13,6
Passenger turnover (billion passenger-kilometers (RPK))	11	11,6	11,4	15,5	20,4	25,9	30,058

Source: State Statistics Service of Ukraine Edited by I. Petrenko. Transport and Communications of Ukraine 2018. Statistical collection. ISBN 978-617-7551-10-1 State Statistics Service of Ukraine, Kyiv - 2019 - 154 p.

In 2019 year, the market of passenger air transportation continued to show positive dynamics. According to statistics on the number of passengers who used the services of Ukrainian enterprises, increased by 9.4 percent and amounted to 13705.8 thousand

passengers. During the year, passenger traffic operated in 18 domestic air directions. During

2019 year a total of 13,306.7 thousand people were transported [12].

Table 2.

Transportation of passengers by air by type of service

(Thousands of passengers)

	2010	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Total	6 106,5	6 473,3	6 302,7	8 277,9	10 555,6	12 529,0	13 705,2
International	5 144,3	5 826,7	5 678,0	7 475,4	9 614,5	11 446,1	12 547,2
Domestic	962,2	646,6	624,7	802,5	941,1	1 082,9	1 158

Source: State Statistics Service of Ukraine Edited by I. Petrenko. Transport and Communications of Ukraine 2018. Statistical collection. ISBN 978-617-7551-10-1 State Statistics Service of Ukraine, Kyiv - 2019 - 154 p.

The Ministry of Infrastructure of Ukraine conducted a forecast of the volume of air passenger traffic in the Ukrainian national segment. The results of the forecast are shown in Figure7.
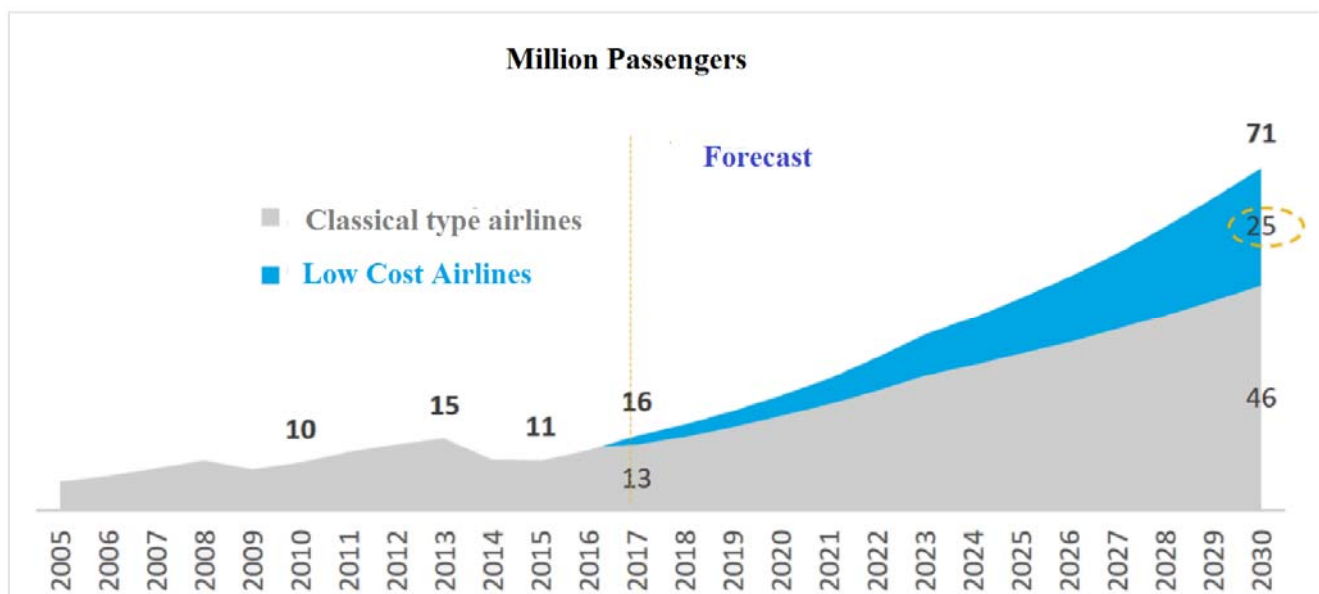
Figure 7 – Air Passenger Traffic Forecast (2018 - 2030) of Ministry of Infrastructure of Ukraine
Source: Official site of Ministry of Infrastructure of Ukraine: https://mtu.gov.ua/files/lowcost.pdf

Passenger traffic through the airports of Ukraine by 2030 will increase 4.3 times compared to 2017 - to 71.2 million out of 16.5 million people. Such forecasts have been provided by the Cabinet of Ministers. In addition, by 2030, the share of passenger traffic carried by low-cost airlines is expected to increase to 35% of the total, as well as the reduction of the minimum ticket price to 25-30 euros. In particular, the Ministry of Infrastructure hopes to triple the network of

domestic routes, international – to double, and attract air transit cargo through the capital and regional airports of Ukraine. Therefore, the results of the forecast are quite optimistic. However, both globally and nationally in 2020, we are experiencing the negative impact of the COVID 19 pandemic factor, which leads to unpredictable consequences. To corrections of optimistic forecasts of global and national aviation will be devoted to our next scientific works [12].

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However, unfortunately, the dynamic growth of air traffic entails an increase in emissions of chemical elements into the atmosphere, which are a real threat to the environment and can contribute to climate change processes. To model the level of ecological safety of air transport, a set of indicators was selected, based on the availability of sources of reliable information to form a sufficient set of data for calculations:

1. The level of CO_2 emissions from air transport to the created the Gross Value Added (GVA), kg / USD. USA (D / de-stimulator)).

2. The level of emissions of air transport pollutants into the atmosphere to the created the Gross Value Added (GVA), kg / dollar. USA (D).

3. The level of environmental costs of air transport before release, % (S / stimulator)).

The first two indicators are de-stimulators, are calculated in relation to the Gross Value Added (GVA) of air transport and characterize the level of negative environmental impact in the conversion of energy resources into services. From the point of view of the system approach these indicators reflect the procedurally of the system. Their dynamics is determined according to the State Statistics Service of Ukraine, and for comparison with other countries the data of the International Energy Agency are used.

The following indicator is a stimulator. It characterizes the costs incurred for the maintenance (maintenance and operation) of the object (fixed assets for environmental purposes) in working condition, and is part of the costs of the current period. Indicator calculated by the ratio of costs to the production of air transport in percent. As the State Statistics Service of Ukraine does not publish such data for air transport, the current environmental protection costs for air transport are calculated in proportion to similar costs and transport and communications in general.

To solve the problem of integrated assessment of the level of environmental safety of air transport in Ukraine, a universal methodology of identification and strategy in the field of national security is used, which allows to compare indicators of different security areas and substantiate strategic scenarios of security development [13, p. 41].

The safe measurement of the ecological component of air transport involves the definition of the boundaries of safe existence and the identification of the level of ecological development in comparison with the threshold values. Determining the limits of safe existence of a dynamic system is based on applied systems theory [14], the concept of "homeostatic plateau" and the method of "t-test", which allows to obtain a vector of threshold values of each indicator: lower and upper critical (red zone), lower and upper threshold (orange zone), lower and upper optimal (green zone).

Table 3.

Formalized Threshold Vector Values*

Type of functions of density of probabilities of indicators	Lower threshold value	Lower optimal value	Upper optimal value	Upper threshold value
Normal	$\mu - t \times \sigma$	$\mu - \sigma$	$\mu + \sigma$	$\mu + t \times \sigma$
Lognormal	$\mu - t \times \dfrac{\sigma}{k_{as}}$	$\mu - \dfrac{\sigma}{k_{as}}$	$\mu + \sigma$	$\mu + t \times \sigma$
Exponential	$\mu - \dfrac{\sigma}{k_{as}}$	μ	$\mu + \sigma$	$\mu + t \times \sigma$

Source: Turner, J.C. (1972) Modern Applied Mathematics: Probability, Statistics, Operational Research. New York: Van Nostrand Reinhold

* For critical values, instead of t, $\pm 3\sigma$ or more is used for abbreviated samples

According to the results of the analysis of indicator values by the "t-criterion" method, three characteristic types of distribution of probability density functions were revealed [13, p. 70-72]: normal, lognormal and exponential, for which a formalized definition of the vector of threshold values is proposed, where is the mean value, is the standard deviation, t is taken from the Student's t-distribution tables [15] (Table 3).

Identification of the level of the ecological component of air transport in the safety dimension uses the multiplicative form of the integrated index.

$$I_t = \prod_{i=1}^{n} z_{i,t}^{a_i}; \quad \sum a_i = 1; \quad a_i \geq 0, \tag{1}$$

where I – integral index; z – normalized indicator; a – weighting factor;

modified rationing method

$$S: z_i = \frac{x_i}{k_{норм}}, \qquad D: z_i = \frac{k_{норм} - x_i}{k_{норм}}, \qquad k_{норм} > x_{max}, \tag{2}$$

where x – value of the indicator; $k_{норм}$ - normalization coefficient (for stimulators it is equal to the maximum value from a number of indicators and threshold values; for destimulators it is chosen higher than the maximum value from the same series by 5–10%);

and dynamic weights due to a combination of methods of "main components" and "sliding matrix" [13, p. 66-

81], which requires in the next shift of the matrices of the minimum required size over a period of time and the determination of weights for the current time period of the main components. The minimum required size of the matrices is determined under the condition of equality of the number of indicators (the number of main components) and the number of positive eigenvalues of this matrix:

$$C_i \times D_i = \begin{pmatrix} d_1 c_{11} + d_2 c_{12} + \dots + d_j c_{1j} \\ d_1 c_{21} + d_2 c_{22} + \dots + d_j c_{2j} \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots \\ d_1 c_{j1} + d_2 c_{j2} + \dots + d_j c_{jj} \end{pmatrix} = \begin{pmatrix} w_1 \\ w_2 \\ \dots \\ w_j \end{pmatrix}, \quad a_i = \frac{w_i}{\sum w_i}, \tag{3}$$

where C – the matrix of absolute values of factor loads; D – the vector-matrix of variances.

The result of the application of this methodology is the dynamics of the integrated index of environmental safety of air transport (Figure 8).

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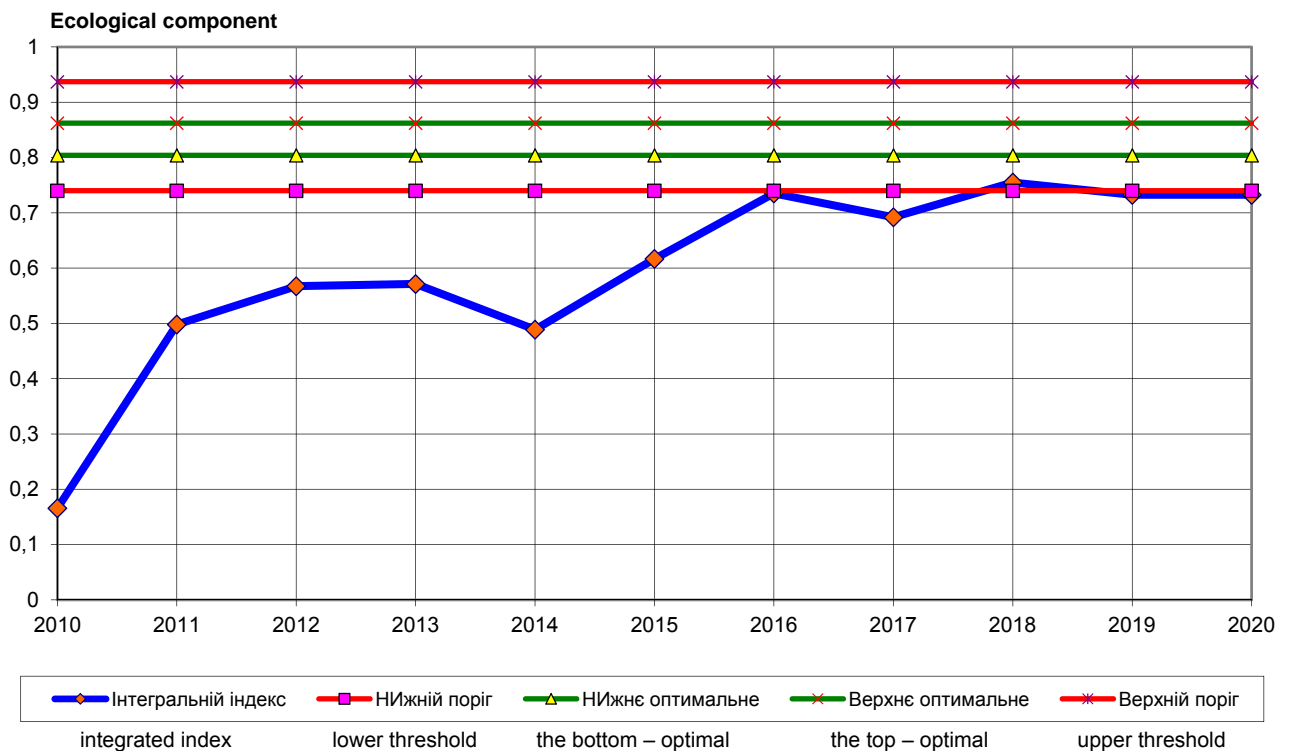
Figure 8 – Dynamics of the integrated index of air transport ecological component in the safety dimension.

The dynamics of the integrated index of air transport ecological component shows positive dynamics, but does not reach the optimal zone, where there is negative feedback and the best conditions for the functioning of the system. Given that the criterion of sustainable development is the average optimal value of the vector of threshold values [13], it is possible to calculate the deviation of integrated indices from the criteria of sustainable development, which indicates the disproportion of their development (Figure 9) and determines the list of important threats.

Equalizing disproportion and zeroing deviations in the future will ensure balanced sustainable development. The task of regulation is to ensure that the integral indices are in the optimal zone.

Conclusions. The ecological safety of the state is an integral characteristic of a set of interconnected structural components. In turn, national ecological safety is a subsystem of the highest level systems – regional ecological safety and global ecological safety. This confirms the complexity and versatility of the concept of " ecological safety ". In the context of globalization, ecological safety is becoming especially important. In view of the dynamic global climate change, the International Civil Aviation Organization (ICAO) is proposing an initiative Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).
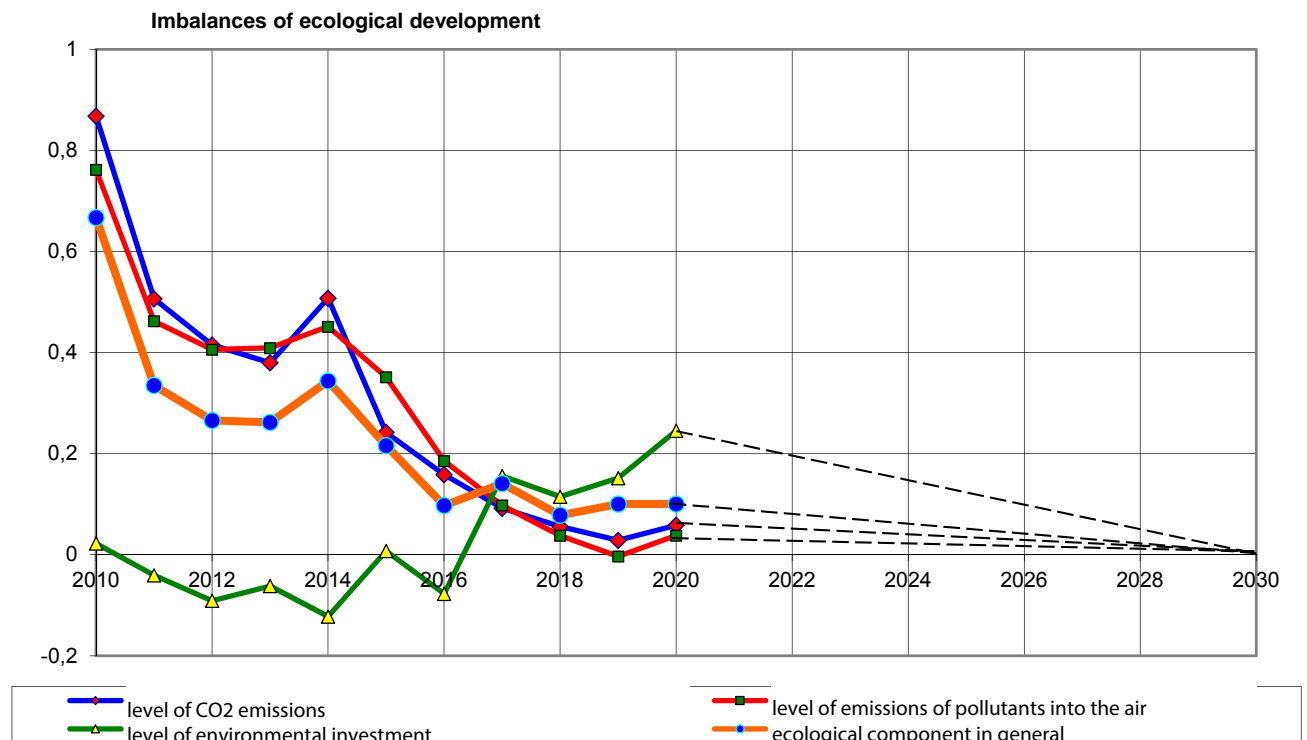
Figure 9 – Imbalances of ecological development of air transport

The main tool of ecological safety is proactive risk management. The development of proactive tools for ecological risk management is relevant and has practical implications for sustainable development, both in the industry in particular and for the state as a whole. The articles offer the author's approaches to the identification of air transport ecological component level. The dynamics of the integrated index of air transport ecological component in period from 2010 till 2020 years shows positive dynamics, but does not reach the optimal zone, where there is negative feedback and the best conditions for the functioning of the system. Given that the criterion of sustainable development is the average optimal value of the vector of threshold values, it is possible to calculate the deviation of integrated indices from the criteria of sustainable development, which indicates the disproportion of their development and determines the list of important threats.

Thus, proactive ecological risk management is the key to maintaining the reliability and sustainable development of the national economy in the context of the preservation of the global ecological system.

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MODERN CHALLENGES OF DANGEROUS AND EXTRAORDINARY GOODS TRANSPORTATIONS

Tadeusz Popkowski, Dmytro Bugayko. "Modern challenges of dangerous and extraordinary goods transportations". Dangerous goods - goods which, by the nature of their physical characteristics, chemical composition, dimensions, or other specific features and nature (live animals or fish), for some reason endanger human life or health, the environment natural or general order or material goods, including those with features of the principles of humanitarianism. The transport of dangerous and oversize goods is one of the most difficult specialties in the field of goods transport in public transport, in particular in road and rail transport. Such transport is regulated by a number of legal acts that do not apply to companies carrying out tasks related to the transport of loads, the so-called neutral. The United Nations has created a closed TN directory, giving everyone a four-digit "UN number", at the same time dividing them into classes depending on the threat or the predominant threat. The provisions of the ADR agreement relate, inter alia, to the rules (requirements) for TN transport in terms of limiting the possible effects of a potential release of hazardous substances (e.g. as a result of road or rail collisions), as well as, above all, the forms and principles of preventing the possibility of such events. The transport of dangerous goods is a special type of transport and it is subject to specific legal provisions, meeting and observing a number of specific requirements. The safety of this type of transport depends on the proper organization of its transport and the maximum involvement of participants in the entire process. The organization of the transport of hazardous materials requires a comprehensive, comprehensive view of the vehicle, packaging and cargo (means of transport and packaging should be adapted to the transported goods) as well as people involved in the preparation of transport, drivers with appropriate authorizations and training, setting the route, securing this routes in terms of maintaining safety in the event of an emergency. The article offers the author's approaches to the investigation of modern challenges of dangerous and extraordinary goods transportations.

Keywords: transport logistics; dangerous goods; extraordinary goods, International ADR Agreement; cargo label.

Тадеуш Попковскій, Дмитро Бугайко. "Сучасні проблеми перевезення небезпечних і нестандартних вантажів". *Небезпечні вантажі це товари, які за своїми фізичними характеристиками, хімічним складом, розмірами або іншим специфічним характеристикам і характером (живі тварини або риба) з яких-небудь причин становлять небезпеку для життя або здоров'я людини, навколишнього середовища, громадського порядку або матеріальних цінностей. Перевезення небезпечних і негабаритних вантажів - один з найскладніших напрямків у сфері вантажних перевезень транспорту, зокрема автомобільного та залізничного. Такі перевезення регулюються низкою правових актів, які не поширюються на нейтральні компанії, що виконують завдання, пов'язання з перевезенням даних категорій вантажів. У статті пропонуються авторські підходи до дослідження сучасних проблем перевезення небезпечних і нестандартних вантажів.*

Ключові слова: транспортна логістика; небезпечні вантажі; надзвичайні вантажі; Європейська угода про міжнародне дорожнє перевезення небезпечних вантажів; маркування.

Тадеуш Попковский, Дмитрий Бугайко. "Современные проблемы перевозки опасных и нестандартных грузов". *Опасные грузы - товары, которые по своим физическим характеристикам, химическому составу, размерам или другим специфическим характеристикам и характеру (живые животные или рыба) по каким-либо причинам представляют опасность для жизни или здоровья человека, окружающей среды, общественного порядка или материальных ценностей. Перевозка опасных и негабаритных грузов - одна из самых сложных направлений в сфере грузовых перевозок транспорта, в частности автомобильного и железнодорожного. Такая перевозка регулируется рядом правовых актов, которые не распространяются на нейтральные компании, выполняющие задачи, связанные с перевозкой данных категорий грузов. В статье предлагаются авторские подходы к исследованию современных проблем перевозки опасных и нестандартных грузов.*

Ключевые слова: транспортная логистика; опасные грузы; чрезвычайные грузы; Европейское соглашение о международной дорожной перевозке опасных грузов; маркировка.

Introduction. The transport of dangerous and oversize goods is one of the most difficult specialties in the field of goods transport in public transport, in particular in road and rail transport. Such transport is regulated by a number of legal acts that do not apply to companies carrying out tasks related to the transport of loads, the so-called neutral. The main legal act here is the International ADR Agreement [1], which is binding on all continents, supplemented by acts of local law, which in Poland include, inter alia, the act on the transport of dangerous goods, including the act on weapons and ammunition [2]. Each of these documents introduces appropriate regulations, and additionally with regard to international transport, it is important whether the potentially transit countries, and even more so the destination countries, do not introduce local periodic restrictions applicable to the planned transport route.

Presentation of the main material and research results. Dangerous goods - as it already implies, these are goods which, by the nature of their physical characteristics, chemical composition, dimensions, or other specific features and nature (live animals or fish), for some reason endanger human life or health, the environment natural or general order or material goods, including those with features of the principles of humanitarianism. The United Nations has created a closed TN directory, giving everyone a four-digit "UN number", at the same time dividing them into classes depending on the threat or the predominant threat. The provisions of the ADR agreement relate, inter alia, to the rules (requirements) for TN transport in terms of limiting the possible effects of a potential release of hazardous substances (e.g. as a result of road or rail collisions), as well as, above all, the forms and principles of preventing the possibility of such events. The set of regulations also applies to the rules of

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equipping and labeling vehicles, training their crews and others people involved in the implementation of transport, such as forwarders, warehouse workers or equipment service.

The training of drivers, tram drivers, train drivers and operators of equipment used, for example, when loading or moving dangerous goods, including oversized cargo, is one of the basic factors that reduce the likelihood of undesirable events. Lack of awareness and basic knowledge in this area is usually the main cause of the occurrence of events, the effects of which may have the nature of material losses, environmental contamination, and - most importantly - threats to human health or life. The purpose of the regulations governing the transport of dangerous goods is to minimize or significantly reduce the probability of accidents and the extent of possible damage.

The fulfillment of the above requirements is a necessary condition for the transport of cargo from the TN group. However, one should remember about the specificity of the provisions in force for individual modes of transport, as well as the regulations specified in the above-mentioned provisions of national law, not always consistent with the provisions of the ADR agreement.

Generally, the above-mentioned restrictions and conditions apply to road transport. Of course, other modes of transport with a significant share in the global transport of goods, including dangerous and oversized goods, are not to be missed. We are talking about air, sea and inland shipping. The specificity of these transports with regard to the nature, specific conditions and rules with regard to safety, requires a separate discussion, also due to the current set of provisions resulting from the law on both maritime and inland navigation and the use of airspace in relation to cargo transport. This is particularly important in international (intercontinental) transport due to the restrictions on air space and territorial waters.

The transport of dangerous goods is a special type of transport and it is subject to specific legal provisions, meeting and observing a number of specific requirements. The safety of this type of transport depends on the proper organization of its transport and the maximum involvement of participants in the entire process. The organization of the transport of hazardous materials requires a comprehensive, comprehensive view of the vehicle, packaging and cargo (means of transport and packaging should be adapted to the transported goods) as well as people involved in the preparation of transport, drivers with appropriate authorizations and training, setting the route, securing this routes in terms of maintaining safety in the event of an emergency [3]. Incorrect handling of dangerous goods during storage or transport can result in enormous risks imbalance in the functioning of living organisms (including death of humans and animals) or constitute a serious threat to the environment. The development of the existing, as well as the emergence of new, branches of production related to economic development is naturally associated with an increase in transport demand, including the transport of goods belonging to the group of dangerous goods, such as substances that may pose a threat to people, property and the natural environment [4]. Due to the risk that the transport of such loads generates, it was necessary to introduce regulations clearly regulating the principles of organization, protection of resources and protection of people and the environment.

Each type of transport has its own specifics, hence specific, specific rules and methods of planning, organizing and implementing this type of transport also apply to the transport of dangerous goods.

The transport of dangerous goods in accordance with safety regulations and standards guarantees not only the minimization of the risks associated with the transport of hazardous materials, but also its full effectiveness. The selection of the type of packaging and means of transport depending on the threats posed by specific dangerous

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goods affects the safety of transport and the external environment.

In road transport, there are three basic ways of transporting dangerous goods: in tankers, in packages and in bulk [5]. Each method has different requirements. In order to present the characteristics of the transport of dangerous goods, these concepts have been presented from the theoretical and practical side.

Basically we distinguish between three ways of transporting hazardous materials in road transport:

− transport of the shipment in pieces - each piece of goods should be marked with a warning label and UN number, and in the case of explosive goods with a label with the name of the material contained in the package. If the goods present several different hazards, separate labels indicate toxicity, corrosivity and flammability. Shipment in pieces can be carried out using crates, containers, on platforms or vehicles with a specially adapted body.

− transport in bulk without packaging - it is carried out using box vehicles or containers (dedicated to solid goods posing a low risk).

− transport in tanks - each tank has a so-called tank code, i.e. requirements that must be met for the transport of a specific load, e.g. type of vehicle, degree of tank filling, appropriate marking.

Pursuant to the regulations in force, the journey with hazardous material should take place, if possible, on roads with good surface and low traffic, with bypassing the roads running in the vicinity of active recreation and sports centers and bypassing built-up areas of cities, in particular streets located in the city center. When organizing the transport of hazardous materials, it should be planned in such a way as to avoid the necessity of parking, especially in cities.

Some hazardous materials cannot be transported on all roads. Some of the materials must be reported to the competent commander of the Provincial Police and the State Fire Service. Certain types of materials also require permission from the local Police Station or the Police Station and the Commander of the State Border Guard for loading and unloading. In the case of domestic transport, this declaration must be made at least 5 days before the start of transport. The obligation to report rests with the carrier (if it is a domestic company) or the sender (if he orders the service to a foreign entity). If, on the other hand, the transport begins abroad, the notification is made by the competent control office of the Border Guard before issuing the permit to enter the territory of Poland. The effect of this notification is not only the approval of transport, but also the determination of the transport route. Packaging and vehicles transporting hazardous materials should contain appropriate stickers indicating individual materials, as well as the corresponding UN numbers (four-digit number identifying the substances). If a given product poses several different hazards, the three most important ones should be indicated by stickers, e.g. toxicity, corrosively, flammability. Labels on collective packaging and packaging with a large capacity greater than 450 l the stickers are placed on both sides of the packaging. The collective packaging should contain all labels and UN numbers of the goods contained inside. Vehicles transporting dangerous goods by road (with the exception of a small amount of cargo in a vehicle carrying packages) must be marked with rectangular orange-colored plates placed at the front and rear of the vehicle or combination, vertically / perpendicular to the vehicle axis. At the top of the plate is the hazard identification number, consisting of two or three digits. e.g. (223, 48, X323). The numbers preceded by the letter X mean that the transported substance reacts dangerously with water and should not be used to extinguish a fire. The most common number 33 on warning boards indicates a very strong and dangerous concentration of the easily or pyrophoric liquid (gases) being transported. The lower figure represents the number under which the substance is classified in the

UN Catalog of Hazardous Materials. A vehicle transporting dangerous goods in bulk, in a container or in a tanker is marked at the front and rear with plates without numbers. At the same time, on the sides it must have plates with numbers appropriate to the transported dangerous goods. As for multi-compartment tanks, such plates should be placed on both sides of each compartment with the number assigned to a given hazardous substance. The essence of such labeling is in a very simple and transparent way to standardize the risk identification process, thus facilitating and streamlining control in each country that has adopted legal regulations the ADR convention.

Contrary to road transport, rail transport does not have the most limitations for oversized transport vehicles. For this reason, many shipping companies choose railroads as a form of carrying out this type of logistics operations. An oversized cargo is one that exceeds the standard weight or dimension. In the case of rolling stock, the key parameters are the loading edge of the wagon and the allowable axle load of the wagon or a running meter of rail. Appropriate load limits have been developed for individual speeds and classes of lines. At the same time, it is necessary to take into account the maximum heights of transported loads due to the height of the railway traction. Nevertheless, a properly planned rail transport does not encounter most of the obstacles typical of large-size transport in road traffic, which is why it is eagerly chosen by business customers.

Despite a number of structural changes in the national and European economy, rail transport is still one of the key branches in the entire freight transport system. It mainly concerns the transport of fuels, raw materials and industrial materials. Due to the speed of delivery, the ease of organizing the forwarding process or the possibility of transporting many thousands of tons of cargo, rail is one of the most-chosen means in modern logistics. Planning of deliveries and their realization are favored by an extensive network of railway connections and the speed of transport performed in this way . Moreover, rail is one of the safest and least accidental forms of modern forwarding, hence the great interest of entities from many sectors in this form of cargo transportation. However, it is subject to certain limitations both in terms of dimensions and weight of the load in relation to the so-called gauge and axle load of the wagon.

Sea transport offers many more possibilities for the transport of special loads. Sea transport is one of the forms of water navigation consisting in the delivery of goods using the waterways of the seas and oceans. It is based on a specially adapted fleet, e.g. general cargo, bulk carriers or container ships. In road transport, oversize cargo is also said when its weight exceeds the permissible axle loads of the vehicle. However, as it follows, not every oversized load in road transport will exceed maritime standards, because in sea transport, oversize loads are only those whose dimensions are several dozen or even several hundred meters, and the weight is from several hundred to several dozen thousand tons and they are specially transported. units constructed for this purpose. The development of world trade meant that many companies moved their production areas to distant regions of the world in order to reduce costs. Moving loads with parameters that exceed traditional capabilities means of transport is gaining more and more economic importance and is a consequence of the dynamic development of various industries. The largest of them are transported by sea, and the only challenge in this respect is the introduction of such cargo on board a ship or barge.

A separate section of shipping is passenger transport. Currently, this type of shipping is focused on the transport of people and goods within the broadly understood tourist traffic. Purely business passenger transport and used as part of communication systems have a much smaller share here. This does not apply to that extent to inland and coastal shipping. For example, in the region of

South-East Asian countries, coastal and inland navigation is still the basic means of passenger transport, but also freight, supported, where possible, by short-range air transport (mainly in countries with territories spread over many islands).

In sea transport, special cargo is referred to when it is to be transported in a sea container, ro-ro ship or special ship. Heavy loads are loads with a large unladen weight. This type of cargo includes: heavy working machines for construction and road construction, tanks and self-propelled guns for the armaments industry and the army, segments of wind towers, industrial machines, boats, ships in parts (ship sections, superstructures, hatch covers, etc.), railway carriages, trams. The mass of this type of cargo, transported by road or rail it ranges from 70 to even 100 tons.

In the case of water transport (by sea), heavy goods are those whose volume is less than 1 m3 by one ton. Special loads are goods with explosive, easily flammable, corrosive properties, goods transported in refrigerated or cisterns, and bulky items.

Poland has favorable natural conditions for river transport, but the statistics show that inland navigation is used minimally in relation to the existing potential. Cargo transportation by river routes accounts for only 0.3 percent of total land transport in Poland. - it follows from the GUS report "Inland navigation in Poland in 2014-2017".

Our country has a relatively high density of the waterway network compared to other European countries. In 2016, there were 11.7 km of navigable routes per 1000 km2. For comparison, the EU average (28 countries) is 9.3 km / 1000 km2. Only 6 countries have a higher density index: the Netherlands (150.7 km), Belgium (49.7 km), Finland (24.0 km), Germany (21.5 km), Hungary (20.0 km) and Luxembourg (14.3 km).

It is also important that although the network of waterways in Poland is 3,654 km long, most of their standard is not adapted to the requirements of modern navigation. The class that allows ships with a tonnage above

1000 tons, which are of international importance, to sail only 6% waterways. That's just over 214 km in total.

It is also not good when it comes to the fleet sailing on Polish rivers. And although in recent years the quantity of the towing fleet (the number of pushers and tugs) of inland navigation has gradually increased, they are practically worn out.

The calculations of the Central Statistical Office show that in 2017, compared to 2014, it increased by 5.8%. number of pushers and tugs. There were also barges without their own propulsion (for towing and pushing) - by 1 percent, and self-propelled - by 12.7 percent. Units used in the pushed system dominate (they account for 85.1% of the total barge fleet, which carried 61.3% of cargo in 2017).

In Poland, in 2017, approx. 5.8 million tonnes of cargo were transported by inland waterway, i.e. 7% less than in the previous year (6.2 million tonnes in 2016). However, last year (2019) more transport performance was performed by 5.4% (i.e. 877.3 million t-km) than in 2016, which means a significant increase in the average distance of 1 ton of cargo in inland waterway transport. In 2017, as in previous years, the freight structure was dominated by the transport of metal ore and other mining and quarrying products (41.7%).

Inland navigation is currently used primarily in servicing sea ports and ensuring their connection with the hinterland. In 2017, approx. 1.5 million tons of cargo were transported as part of servicing Polish seaports, which in total accounts for approx. 26% of all cargo transported in total by inland waterway. Until 2017, mainly the Odra Waterway was used, with a total of approx. 3 million tons of cargo.

In 2017, regular coal transport from Gliwice to the Heat and Power Plant in Wrocław was launched. Transport approx. 120 thousand. tonnes of coal is a significant share in the overall transport balance along the upper canalized section of the Oder. Unfortunately, this positive trend does not apply to the following years, but to 2020. it

will probably result in the lowest rate of transport, mainly as a result of unfavorable hydrotechnical conditions caused by widespread drought, but also significantly deteriorating technical condition of vessels and hydrotechnical devices.

Water transport is one of the safest modes of transport. The percentage of shipping accidents is negligible here. This is mainly due to the almost complete separation of freight from passengers. Unfortunately, the climate changes taking place particularly intensely in recent years have an impact on the navigability of sections of water courses, and more and more often in relation to entire routes that were once used very intensively. Periodic low water level, resulting from commonly noticeable drought, practically periodically completely prevents the navigation of vessels with even a slight draft.

Conclusions. Currently, the logistics departments of production and commercial enterprises, which include units that deal with storage, transport, planning and purchasing, as well as companies providing logistics services outside, are increasingly integrating their actions based on the use of information technology. IT becomes a natural element of supporting the implementation of logistics processes as components of an integrated market structure. It is a natural necessity, allowing the full use of all the possibilities offered by the modern logistics concept. This allows, among other things, to minimize the expenditure on the directional activity of a given economic entity thanks to the systemic, and thus possibly effective, warehouse management and creates the possibility of managing individual processes that occur as a result of cooperation in order to fulfill the order. Functioning in the conditions of global competition, also associated with the naturally forced shortening of the life of the market offer (product, service), it is necessary to launch mechanisms allowing for the parallel implementation of effective changes in the field of technical equipment, as well as economic conditions and organization and management technologies, under the common name broadly defined as logistics, including transport logistics.

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MODELS OF ZONING OF URBAN TERRITORY FOR RATIONAL DELIVERY IN THE MICROCONSOLIDATION SYSTEM

Lidia Savchenko, Volodimir Davydenko. "Models of zoning of urban territory for rational delivery in the microconsolidation system". Urban logistics (or city logistics) is developing rapidly due to the strong growth of e-commerce. Accordingly, the last-mile urban logistics faces a significant number of orders that need to be fulfilled in a dense urban development, environmental constraints and permanent congestion. One of the possible systems of rational city delivery is the use of a network of consolidation centers at the micro level. Such a network provides for a two-tier system of urban delivery - 1) from the central warehouse or warehouses to the network of microconsolidation centers; 2) from microconsolidation centers to end consumers. This scheme is especially relevant in the presence of restrictions on the movement of trucks or heavy vehicles in certain areas of the city, as well as in significant congestion and the problem of parking trucks when unloading at the location of the client.

Methods (research methodology). To create a rational delivery network through a microconsolidation system, the primary task is to determine the delivery zones (or geographical clusters) - their number, size, location. To solve this problem, optimization models are proposed based on several minimization criteria - delivery distance, time, cost and integrated distance-time criterion.

Results. The result is the optimization models creation, based on those it is possible to divide urban consumers into several delivery zones. Delivery routes are planned within each zone of the respective centroid and minimize the cost of last-mile logistics. Delivery of goods to the centroids can be carried out by light or medium trucks, and within the zones should be dominated by delivery of environmentally friendly modes of transport (motorcycle or moped, bicycle, car, on foot delivery with the possibility of public transport usage).

Conclusion. Thus, the article provides a mathematical apparatus for obtaining territorial zoning of existing customers of the city in order to minimize the cost (distance, time or their combination) for delivery within each zone.

Perspectives. A perspective study may be an analysis of the costs of operating a network of urban consolidation centers and the delivery of goods from the central warehouse or warehouses to this network.

Accordingly, the task of minimizing the total costs of the city freight delivery system should be solved, taking into account economic, environmental and social aspects.

Keywords: city logistics, zoning of territory, zoning (territorial clustering) of clients, models of optimal territorial zoning, city consolidation, two-level (two-tier) system of urban delivery.

Лідія Савченко, Володимир Давиденко. "Моделі зонування міської території для раціональної доставки у системі мікроконсолідації". *Міська логістика стрімко розвивається завдяки потужному зростанню електронної торгівлі. Відповідно, міська логістика останньої милі стикається зі значною кількістю замовлень, яку потрібно виконувати в умовах щільної міської забудови, екологічних обмежень та перманентних заторів. Однією з можливих систем раціональної міської доставки є застосування мережі консолідаційних центрів на мікрорівні. Така мережа передбачає дворівневу систему міської доставки - 1) від центрального складу чи складів до мережі мікроконсолідаціних центрів; 2) з мікроконсолідаціних центрів до кінцевих споживачів. Особливо така схема є актуальною при існуванні обмежень щодо руху вантажного транспорту або взагалі транспортних засобів у певних районах міста, а також при значних заторах та проблемою у паркуванні вантажних автомобілів при вивантаженні біля місця розташування клієнта.*

Для створення раціональної мережі доставки через систему мікроконсолідації первинною задачею є визначення зон доставки (або географічних кластерів) - їх кількості, розмірів, розташування. Для вирішення цієї задачі пропонуються оптимізаційні моделі, засновані на декількох критеріях мінімізації - відстані доставки, часу, вартості та інтегрованого критерію відстань-час.

Результатом роботи є створення оптимізаційних моделей, на основі яких можливо розбити міських споживачів на декілька зон доставки. Маршрути доставки плануються усередині кожної зони від відповідного центроїду та дозволяють мінімізувати витрати на логістику останньої милі. Доведення товарів до центроїдів може здійснюватися легкими або середніми вантажними автомобілями, а всередині зон має превалювати доставка екологічно дружніми видами транспорту (мотоцикл чи мопед, велосипед, легковий автомобіль, піша доставка з можливістю залучення громадського транспорту).

Таким чином, стаття надає математичний апарат для отримання територіального зонування наявних клієнтів міста з метою мінімізації витрат (відстані, часу або їх комбінації) на доставку усередині кожної зони. Перспективним дослідження може бути аналіз витрат на функціонування мережі консолідаційних центрів та на довезення товарів з центрального складу чи складів до цієї мережі. Відповідно, має бути вирішена задача мінімізації загальних витрат на систему міської доставки з урахуванням економічних та екологічно-соціальних аспектів.

Ключові слова: міська логістика, зонування території, зонування (територіальна кластеризація) клієнтів, моделі оптимального територіального зонування, міська консолідація, дворівнева система міської доставки.

Лидия Савченко, Владимир Давиденко. "Модели зонирования городской территории для рациональной доставки в системе микроконсолидации". *Городская логистика стремительно развивается благодаря мощному росту электронной торговли. Соответственно, городская логистика последней мили сталкивается с большим количеством заказов, которую нужно выполнять в условиях плотной городской застройки, экологических ограничений и перманентных пробок. Одной из возможных систем рациональной городской доставки будет применение сети консолидационных центров на микроуровне. Такая сеть предполагает двухуровневую систему городской доставки - 1) от центрального склада или складов в сети микроконсолидационных центров; 2) с микроконсолидаційних центров до конечных потребителей. Особенно такая схема актуальна при существовании ограничений движения грузового транспорта или вообще транспортных средств в определенных районах города, а также при значительных пробках и проблемой в парковке грузовых автомобилей при выгрузке у места расположения клиента.*

Для создания рациональной сети доставки через систему микроконсолидации первичной задачей является определение зон доставки (или географических кластеров) - их количества, размеров, расположения. Для решения этой задачи предлагаются оптимизационные модели,

основанные на нескольких критериях минимизации - расстояния доставки, времени, стоимости и интегрированного критерия расстояние-время.

Результатом работы является создание оптимизационных моделей, на основе которых возможно разбить городских потребителей на несколько зон доставки. Маршруты доставки планируются внутри каждой зоны соответствующего центроиду и позволяют минимизировать затраты на логистику последней мили. Доведения товаров до центроидов может осуществляться легкими или средними грузовыми автомобилями, а внутри зон должно превалировать доставка экологически дружественными видами транспорта (мотоцикл или мопед, велосипед, легковой автомобиль, пешая доставка с возможностью привлечения общественного транспорта).

Таким образом, статья предоставляет математический аппарат для получения территориального зонирования существующих клиентов города с целью минимизации затрат (расстояния, времени или их комбинации) на доставку внутри каждой зоны. Перспективным исследования может быть анализ расходов на функционирование сети консолидационных центров и на подвоз товаров с центрального склада или складов в сети. Соответственно, должна быть решена задача минимизации общих затрат на систему городской доставки с учетом экономических и экологически социальных аспектов.

Ключевые слова: городская логистика, зонирование территории, зонирования (территориальная кластеризация) клиентов, модели оптимального территориального зонирования, городская консолидация, двухуровневая система городской доставки.

Introduction. The urgency of clustering (or zoning) of the urban area is relevant to the need to model and build rational routes of vehicles, monitoring of freight and passenger flows between different districts or neighborhoods of the city. During clustering, a certain area of the city is considered as a whole with a certain demand for goods, supply for other areas, with a known number of consumers, shops, vehicles, and so on.

At clustering (zoning) of the territory of the city the following purposes can be set:

− modeling of logistics flows for the rational organization of traffic, construction of routes, assessment of bottlenecks in transport infrastructure, etc.;

− systematization of urban planning (obtaining zones with approximately the same indicators for the application of certain rules, technologies, restrictions, etc.);

− organization of cargo delivery, customer service of the city (division of the city into zones for customer service within each zone).

Urban logistics (or city logistics) is developing rapidly due to the strong growth of e-commerce. Accordingly, the last-mile urban logistics faces a significant number of orders that need to be fulfilled in a dense urban development, environmental constraints and permanent congestion. One of the possible systems of rational city delivery is the use of a network of consolidation centers at the micro level. Such a network provides for a two-tier system of urban delivery - 1) from the central warehouse or warehouses to the network of microconsolidation centers; 2) from microconsolidation centers to end consumers. This scheme is especially relevant in the presence of restrictions on the movement of trucks or heavy vehicles in certain areas of the city, as well as in significant congestion and the problem of parking trucks when unloading at the location of the client.

Analysis of the latest research. The issue of clustering or cluster analysis is reflected in a significant number of mathematical methods and models for dividing a certain set into several groups [1, 2, 3, 4]. Widespread use of clustering (or grouping, separation) methods proves to some extent the universality of this approach and existing methods.

In modern city logistics, grouping of customers by geographical zones is widely used, with the possible assignment of drivers of a certain car or group of cars, couriers to each zone. This method of planning allows

drivers and couriers to thoroughly study the service area and establish contacts with receivers, which generally speeds up the delivery process and increases customer satisfaction [6]. However, mathematical methods and models of geographical clustering for the needs of creating a rational distribution system are missing. Against this background, it should be noted a significant number of software products for urban delivery [7-11], which optimize the process of building rational routes, but do not allow to divide them into territorial zones to minimize delivery costs within each zone.

When dividing the territory into transport areas (zones or clusters), the number and size of such areas depend on the size of the city and population. When setting the boundaries of transport areas, it is recommended to adhere to the following principles:

− use of lines of natural and artificial obstacles (rivers, railway lines, etc.);

− observance of administrative zoning of the territory;

− accounting for functional zoning of the city;

− preservation of existing building blocks;

− prevention of formation of transport areas of elongated configuration [5].

The problem of an urban area clustering and possible tasks that can be set for zoning of city customers are considered in [16]. The authors [18] consider possible ways of interaction of participants of the process of city delivery, in particular, with the use of city consolidation centers of different levels.

Accordingly, with a significant number of studies on clustering, in particular territorial, there is a shortage of theoretical and practical information on the rational division of customers into groups for further planning of optimal routes within each group of relevant centroids (for urban logistics - from microconsolidation centers).

Formulation of the purpose of the study. Given the lack of research on territorial clustering to divide city customers into zones and further delivery through a network of microconsolidation centers, the aim of the article is to obtain basic mathematical models for grouping city customers into delivery zones by minimizing delivery costs within the respective zones.

Presentation of the main research. *1. General approaches to clustering that can be used in the city customers zoning for delivery through a network of microconsolidation centers.* Clustering (or cluster analysis) is the task of breaking a set of objects into groups called clusters. From a mathematical point of view, clustering helps to identify a set of closely related (by a certain criterion) objects in a certain set of such objects. Within each group should be "similar" elements, and the elements of different groups (clusters) should be as different as possible. The main difference between clustering and classification is that the list of groups is not clearly defined and is determined during cluster analysis.

The application of cluster analysis in general is based on the following stages:

1. Selection of objects for clustering.

2. Defining the criteria by which objects will be evaluated.

3. Calculation the degree of similarity between objects.

4. Application of a certain method of cluster analysis to create groups of similar objects (clusters).

5. Obtaining and analyzing the results of the analysis. If necessary - adjusting the model.

The first task that is recommended to be performed before starting the cluster analysis is to assess the overall clustering tendency of the available data.

Hopkins statistics are one indicator of a trend toward grouping. To calculate it, several pseudo-data sets are created, randomly generated based on a distribution with the same standard deviation as the original data set. For each observation i with n calculate the average distance to k nearest neighbors: w_i between real objects and q_i between artificial objects and their nearest real neighbors. Then Hopkins statistics

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$$H_{ind} = \frac{\sum\limits_{i=1}^{n} w_i}{\sum\limits_{i=1}^{n} q_i + \sum\limits_{i=1}^{n} w_i}$$

greater than 0.5 would correspond to the null hypothesis that q_i and w_i are similar, and the grouped objects are randomly distributed and homogeneous. A value of $H_{ind} < 0.25$ with 90% confidence indicates an existing tendency to group the data.

Clustering with a known number of clusters.

Partitioning algorithms [4] decompose a set of data consisting of n observations into k groups (clusters) with previously unknown parameters. The search for centroids - the most distant from each other the centers of condensation of points C_k with minimal scatter within each cluster. The separation algorithms include:

- method of k-means McKueen (k-means clustering; MacQueen, 1967), in which each of the k clusters is represented by a centroid;

- division around k medoids or PAM (Partitioning Around Medoids; Kaufman, Rousseeuw, 1990), where the medoid is the center of gravity, the coordinates of which are shifted to the nearest of the original data objects;

- CLARA algorithm (Clustering Large Applications) - a method very similar to PAM and used to analyze large data sets.

The most common clustering algorithm is the method of k means. It performs clustering as follows:

1. Assign the number of groups (k) into which the data should be divided. Randomly, k objects of the source set are selected as the initial centers of the clusters.

2. Each element is assigned a group number on the nearest centroid, ie on the basis of the smallest Euclidean distance between the object and the point C_k.

3. List the coordinates of the centroids μk of all k clusters and calculate the intra-cluster

$$W(C_k) = \sum_{x_i \in C_k} (x_i - \mu_k)^2$$

variation . If the data set includes p variables, then μk is a vector of averages with p elements.

4. The general intragroup scatter is minimized $Wtotal = \sum\limits_{k} W(C_k) \to \min$, for which steps 2 and 3 are repeated many times until the group assignments stop changing or the specified number of $iter.max$ iterations is reached.

It is convenient to perform clustering using the programming language R. The maximum number of iterations for minimizing W_{total}, set by the function $kmeans$ () by default, is $iter.max = 10$ [5].

Clustering by the method of k means is a very simple and efficient algorithm. However, the results of clustering are sensitive to the initial choice of group centers. A possible solution to this problem is to repeatedly execute the algorithm with the choice of different primary centroids.

Partition into (approximately) identical clusters.

For urban zoning, obtaining the same clusters makes sense if the clustering objects are customers with certain geographical coordinates. Then the cluster can be a set of such clients, the number of which allows one delivery route, while fully loading the vehicle or courier. Thus, it is possible to get areas of the city with approximately the same number of customers in each of them.

An example of clustering with the same cluster size is proposed in R [3].

Evaluation of clustering quality.

After receiving a cluster solution, the question usually arises as to how stable and statistically significant it is. There is an empirical rule here - a stable group must be preserved when changing clustering methods: for example, if the results of hierarchical cluster analysis have a coincidence of more than 70% with clustering by the method of k means, then the assumption of stability is accepted. Other methods and criteria for assessing the quality

of clustering validation results can be studied in [4].

2. Models of urban area zoning for rational delivery in the microconsolidation system.

In conditions of city delivery freight companies have to deal with an array of customers located in different parts of the city. When planning delivery routes often appeal to clustering of territory, which for the city is called zoning. In this case, we mean the division of the city into zones (clusters) in order to reduce transport costs (Fig. 1).
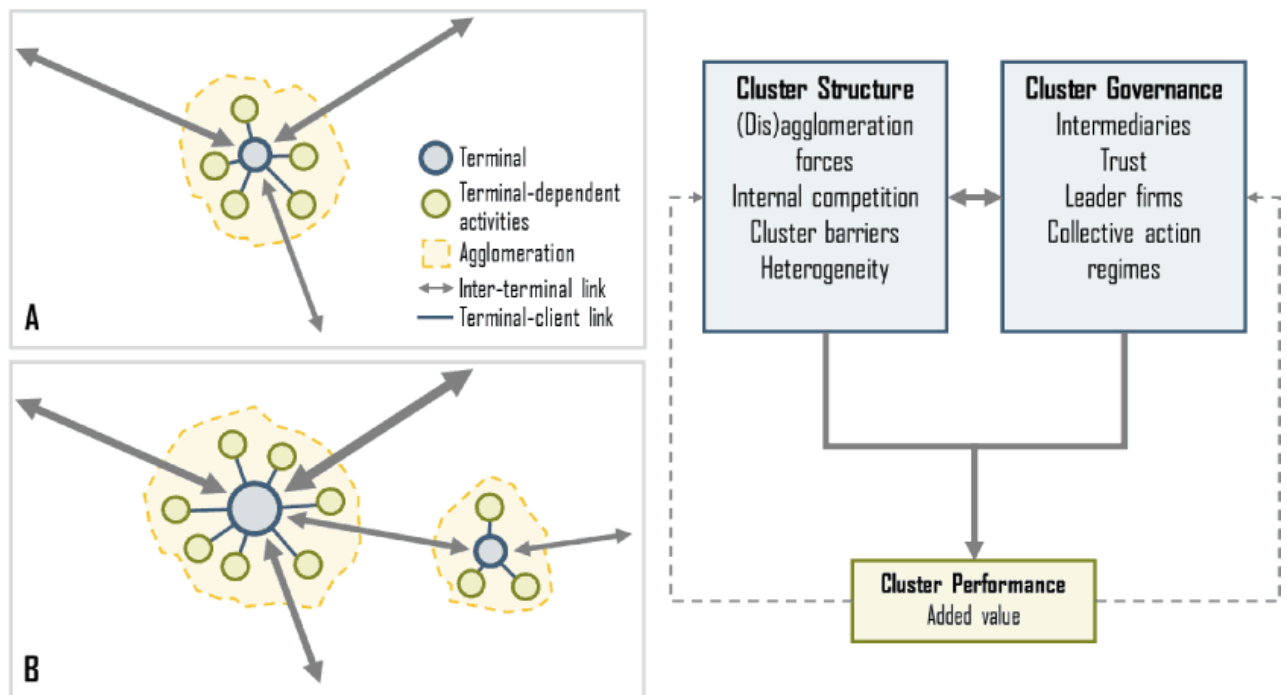
Figure 1 – Terminals (consolidation centers) as centroids [12]

Accordingly, the main criteria used for urban zoning are the distance of the route and the time of transportation. The time criterion is necessary in urban conditions, especially when delivered during morning and evening traffic jams. At this time, the minimum distance does not mean the minimum transport costs. Sometimes increasing the distance even twice allows, on the one hand, to speed up delivery, on the other hand, to reduce transport costs.

Consider the general mathematical formulation of the problem of zoning the urban area.

It is necessary to divide the urban area into zones to minimize delivery costs (Fig. 2).

For zoning of the territory, information is required on:

– the needs of the points of the territory (demand);

– location of points.

The location of the points can be seen on the map, and then set their Cartesian coordinates.

The problem of optimal zoning of the urban territory can be solved with the following criteria:

– minimum delivery distance;
– minimum delivery time;
– minimum shipping cost;
– integrated criterion.

Sometimes the optimal solution is getting a minimum of distance, time, and cost simultaneously. However, in conditions of congestion, toll roads and other limiting undesirable phenomena, one criterion should be selected and based on it, the search for an optimal solution should be made. If necessary, it can be used an additional solving of the problem to determine alternative solutions with different criteria for the problem.

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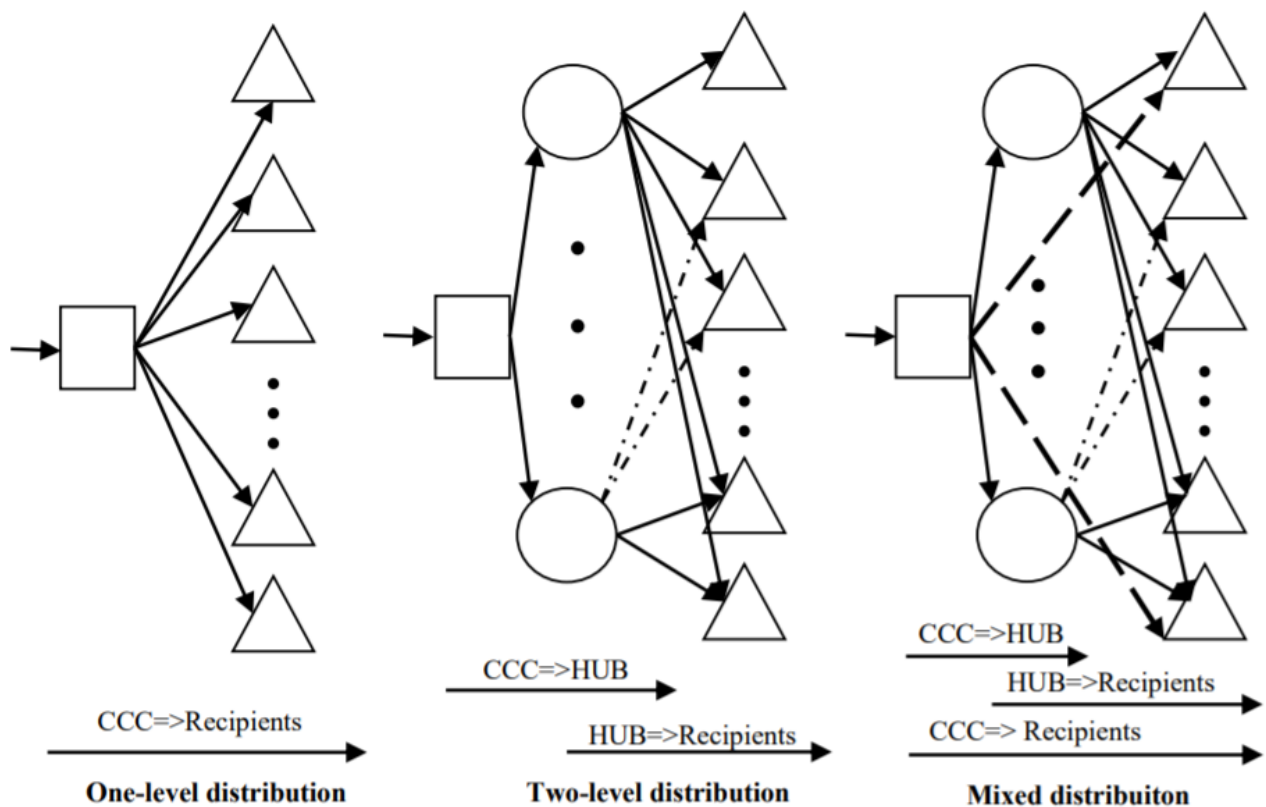
Figure 2 – Solutions based on the concept of multi-tier distribution systems Source: based on [14, 15].

1. Criterion of minimum distance.

The simplest way to determine the distance is the formula

$$R(i, j) = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2} \quad (1)$$

where x_i, x_j, y_i, y_j - Cartesian coordinates of the points in the zone.

That is, the so-called Cartesian distance. Concequently, the objective function (minimization of the sum of all distances between all point of all zones) is

$$OF_d = \sum_{i=1}^{n} \sum_{j=1}^{n} R(i, j) \rightarrow \min \quad (2)$$

or

$$OF_d = \sum_{i=1}^{n} \sum_{j=1}^{n} \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2} \rightarrow \min \quad (3)$$

However, the transport network does not always have a direct path between points.

For obtaining more accurate data on the distance, it can be used any tools for laying routes in real time, in particular, Google Map.

If distribution routes are supposed to be used for the delivery to the customers of the zone, the length of the tour/route (L) can be calculated with:

$$L = 2l_0 + l_{cc}(n-1), \quad (4)$$

where l_0 – average length of the first and last trip of the delivery tour (route), km;

l_{cc} – average distance between customers on a typical delivery tour (route), km;

n - number of clients/customers included in a zone.

Value l_{cc} could be obtained as an atithmetic average of the distances between the points of the zone:

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$$l_{cc} = \frac{\sum\limits_{i=1}^{n} \sum\limits_{j=1}^{n} R(i,j)}{n} \qquad (5)$$

The objective function becomes

$$OF_d = 2ml_0 + l_{cc}(n-1) \rightarrow \min \qquad (6)$$

where the INT function gives the number to the nearest smaller integer;

Q – weight capacity of a means of delivery, kg;

q – average weight of a parcel, kg;

where m - number of routs during the shift (or working day).

One of the constraints to take into consideration is the number of parcels that one delivery vehicle/means can transport in a route from the point of view of vehicle capacity both in terms of weight and volume capacity:

$$n_1 = \min\{INT\{Q/q\}, INT\{V/v\}\}, \qquad (7)$$

V – volume capacity of a means of the delivery, m^3;

v – average volume of a parcel, m^3.

The maximum number of routes per shift is calculated as the ratio of the duration of the shift and the time of a route on this shift:

$$m_{max} = rounddown\{t/T\} = rounddown\left\{ t \middle/ t_{prep} + \frac{l_{cc}(2+n-1)}{V(t)} + nt_{1c} \right\}, \qquad (8)$$

where the *rounddown* function rounds numbers down;

t – duration of a shift (working day), h.

The minimal number of routes per one working shift is a ratio of the number of delivery points and capacity of delivery means:

$$m_{min} = roundup\{n/n_1\}, \qquad (9)$$

where *roundup* function rounds numbers up.

While solving the optimal solution equations (8) and (9) are the limitations of the model. Real number of the routes must be not less than m_{min} and not grater than m_{max}.

If we assume that each zone will be served from the so-called centroid, then the distance of zero run can be taken as the distance between route points ($l_0 = l_{cc}$). Then the objective function will look like:

$$OF_d = 2ml_{cc} + l_{cc}(n-1) = l_{cc}(2m+n-1) = \frac{(2m+n-1)\sum\limits_{i=1}^{n} \sum\limits_{j=1}^{n} R(i,j)}{n} \rightarrow \min \qquad (10)$$

For the resulting objective function, the variable will be the distance between the route points $R(i, j)$, which can be calculated using Cartesian coordinates.

2. Criterion of minimum time.

Minimizing delivery times is usually more important than minimizing distance. This is due to the ever increasing "cost" of time in

business. For delivery services, delivery times have a direct impact on significant cost items such as wages and depreciation. The side of customers waiting for an order should also be taken into account. In case of failures in delivery time, there is a risk of the need for re-delivery if the client did not wait for the courier. In this case, losses are incurred twice,

supplemented by reputational losses for the delivery service company.

The delivery time should be calculated taking into account the time of day (availability and intensity of congestion), as well as the number of customers on the route and the time for servicing these customers.

In distribution route, the travel time could be calculated as:

$$T(t) = t_{prep} + 2t_0 + T_{cc}(t) + T_c = t_{prep} + \left[2l_0 + (n-1)l_{cc} \right] / V(t) + nt_{1c}, \quad (11)$$

where t_{prep} – preparatory-final time for delivery tour/route, h;

t_0 – time to travel from the sender's base to the first customer and to return from the last customer to the sender's base by mode l during the working shift j, h;

$T_{cc}(t)$ – travel time between successive customers, h;

T_c – time spent at customers' delivery points, h;

$V(t)$ – average speed, km/h;

t_{1c} – average time spent at customer's delivery point, h.

The speed depends on the time of day, due to the different level of traffic/congestion, as well as on the type of delivery vehicle/means used [17].

$$OF_t = \sum_{i=1}^{n} \sum_{j=1}^{n} T(i,j) \rightarrow \min \quad (12)$$

And finally, if consider $l_0 = l_{cc}$:

$$OF_t = mt_{prep} + \frac{(2m + n - 1)\sum_{i=1}^{n} \sum_{j=1}^{n} R(i,j)}{nV(t)} + nt_{1c} \rightarrow \min \quad (13)$$

3. Criterion for minimum delivery cost.

With the possibility of calculating direct financial costs on the route, automation and simplicity of this process, it is possible to solve the zoning problem according to the criterion of total costs in monetary terms. Naturally, this criterion is the most acceptable and allows to immediately see the delivery costs. However, the calculation of transportation costs is a rather difficult task, given the constantly changing conditions on the route (different speeds, number of stops, time spent at customers' delivery points, etc.). Therefore, in practice, this criterion is rarely used.

In any case, the objective function for the shipping cost criterion looks like

$$OF_s = \sum_{i=1}^{n} \sum_{j=1}^{n} S(i,j) \rightarrow \min \quad (14)$$

where $S(i,j)$ - transport costs for movement between points i and j.

4. Integrated criterion.

It is often convenient to use an integrated criterion. For this, it is usually taking several local criteria and assign them weights (significance coefficients), showing their mutual significance in the integrated criterion. It is most convenient to use the values of the weights from 0 to 1 with the condition that the sum of the weights of the local criteria is 1. For example, for the distance criterion, the significance coefficient can be taken as 0.3, and for the time criterion - 0.7.

The most rational approach to determining the significance factors is based on the calculation of the cost of a typical transportation. Further, the components of this cost are divided into two groups: 1) depent on the distance of the route; 2) depent on delivery time. If some component of the

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cost price depends on both distance and time (for example, often the driver's salary consists of two parts - depent on the distance traveled and hours of work), it should be divided into the groups depending on the actual proportion.

After receiving the abovementionned groups of cost components, the total cost of each group is calculated and the share of each group in the total cost is determined. This specific weight should be used as the coefficients of significance in the integrated criterion:

$$OF_I = \sum_{i=1}^{n} \sum_{j=1}^{n} \left(w_d \cdot D(i,j) + w_t \cdot T(i,j) \right) \to \min \tag{15}$$

with condition $w_d + w_t = 1$.

It should be noted that modern alternatives to a warehouse can be used as a consolidation center, with a small size and weight of packages requiring delivery (Fig. 3), namely:

1. Unattended delivery systems at the customer's home include the use of:

– Reception boxes;
– Delivery boxes;
– Controlled access systems.

2. Unattended delivery systems away from the customer's home include:

– Pick-up points;
– Collection points;
– Locker banks.

Figure 3 – Principle of working of Automated parcel machine [13]

Conclusions. Assessing the current state of scientific and practical developments in the field of urban zoning to build an effective system of goods delivery to residents, construction sites, business environment, food facilities, etc. it is necessary to state some detachment of theoretical materials from

practice. It is obvious that the need of business for high-quality, fast and inexpensive software solutions for planning a rational city delivery is growing. This is confirmed by a wide range of companies offering such solutions on the market of both Ukraine and other countries. Also noticeable

is the dynamic development of existing programs in parallel with the development of cloud technologies, blockchain, and other solutions that simplify and clarify the process of transactions of participants in logistics processes, transmission and analysis of information, data processing in real time.

Thus, clustering (or zoning) of the urban territory on a territorial basis helps in the implementation of rational logistics solutions in customer service of the city. Considering the city as a set of neighborhoods with a certain number of delivery customers in each allows to make rational delivery routes and provide a reliable level of logistics service by minimizing delays and errors in the implementation of last-mile logistics. Such a delivery scheme is possible in the presence of a network of microconsolidation centers located in each defined area of the city. The environmental and social aspects of the solution are reinforced by the use of environmentally friendly vehicles or on foot delivery within each zone. Thus, the rational division of the city into delivery zones in combination with the principle of microconsolidation will reduce 1) the load on the city road network, 2) harmful emissions into the city atmosphere and 3) accidents and noise pollution in densely populated areas.

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PROBLEMS OF MANAGEMENT IN THE SYSTEM OF SPIRAL DYNAMICS OF SUPPLY CHAINS

Volodymyr Koulik, Alla Zaharchuk. "Problems of management in the system of spiral dynamics of supply chains". The article is devoted to the identification of logistics management problems that arise during the implementation of the process management concept of the spiral dynamics of supply chains. SCM, as a real system of logistics integration and coordination of business processes of the chain provides for the development of interaction and cooperation of its economic entities in the joint use of their resources. The spiral in its development changes the targets: increasing time intervals of forecasting and planning for the long term, the logistical lag of the spiral of the supply chain increases due to the focus on managing global innovation changes in society and changes in technological patterns. This requires appropriate coherence and restructuring of the cognitive and intellectual state of the climate in all sectors of the economy and their human systems.

Analysis and generalization of modern research in the field of radical change management has allowed to determine the priority of detection and opportunities for preventive management of worldview changes, values and interests of individuals and their associations in human systems, organizations and society as a whole.

The article substantiates the need and expediency of constant updating of the spiral of social thinking, synthesis of knowledge, ideas and intuition of all participants in the supply chain as a unified socio-economic system with a single ultimate goal - to meet the growing needs of consumers. The generalized requirements to spiral management of supply chains are formed and its basic functions and directions of administrative activity are defined. The specific conditions for ensuring the dynamics of the spiral worldview with the help of a set of MEMs specifically focused on supply chain management are considered. The classification of supply chain integration models was proposed, focused on the possibilities and the need to change its targets, forms and methods of management, time scales of operation.

Keywords: logistic integration, socio-economic turbulence, spiral management, MEM, change management, worldview, supply chain.

Володимир Кулик, Алла Захарчук. "Проблеми менеджменту в системі спіральної динаміки ланцюгів постачань". Стаття присвячена виявленню проблем логістичного менеджменту, що виникають при впровадженні концепції управління процесами спіральної динаміки ланцюгів постачань. SCM, як реальна система логістичної інтеграції та координації бізнес-процесів ланцюга передбачає розвиток взаємодії і співробітництва його господарюючих суб'єктів при спільному використанні їх ресурсів. Спіраль в своєму розвитку змінює цільові орієнтири: збільшуються часові інтервали прогнозування та планування на віддалену перспективу, зростає логістичний лаг спіралі ланцюга постачань за рахунок концентрації уваги на управлінні глобальними інноваційними змінами в суспільстві, змінами технологічних укладів. Це вимагає і відповідної узгодженості і перебудови когнітивного і інтелектуального стану клімату у всіх галузях економіки та їх людських систем.

Аналіз та узагальнення сучасних наукових досліджень у сфері менеджменту радикальних змін дозволив визначити першочерговість виявлення та можливості превентивного управління змінами світогляду, цінностей та інтересів як окремих індивідуумів так і їх об'єднань в людських системах підрозділів, організацій і суспільства в цілому.

В статті обґрунтовано необхідність та доцільність постійного оновлення на всіх відрізках спіралі соціального мислення, синтезу знань, ідей та інтуїції всіх учасників ланцюга постачань як об'єднаної соціально-економічної системи з єдиною кінцевою ціллю – задоволення зростаючих потреб споживачів. Сформовано узагальнені вимоги до спірального менеджменту ланцюгів постачань та визначено його основні функції і напрямки управлінської діяльності. Розглянуто специфічні умови забезпечення динаміки спірального світогляду за допомогою комплексу МЕМів, конкретно орієнтованих на управління ланцюгами постачань. Запропоновано класифікацію моделей інтеграції ланцюга постачань, орієнтовану на можливості та необхідність зміни його цільових орієнтирів, форм і методів управління, часових масштабів функціонування.

Ключові слова: логістична інтеграція, соціально-економічні турбуленції, спіральний менеджмент, МЕМ, управління змінами, світогляд, ланцюг постачань.

Владимир Кулик, Алла Захарчук. "Проблемы менеджмента в системе спиральной динамики цепочек поставок". Статья посвящена выявлению проблем логистического менеджмента, возникающим при внедрении концепции управления процессами спиральной динамики цепей поставок. SCM, как реальная система логистической интеграции и координации бизнес-процессов цепи предусматривает развитие взаимодействия и сотрудничества его субъектов при совместном использовании их ресурсов. Спираль в своем развитии меняет целевые ориентиры: увеличиваются временные интервалы прогнозирования и планирования на отдаленную перспективу, растет логистический лаг спирали цепи поставок за счет концентрации внимания на управлении глобальными инновационными изменениями в обществе, изменениями технологических укладов. Это требует соответствующей согласованности и перестройки когнитивного и интеллектуального состояния климата во всех отраслях экономики и их человеческих системах.

Анализ и обобщение современных научных исследований в области менеджмента радикальных изменений позволил определить первоочередность выявления и возможности превентивного управления изменениями мировоззрения, ценностей и интересов как отдельных индивидуумов так и их объединений в человеческих системах подразделений, организаций и общества в целом.

В статье обоснована необходимость и целесообразность постоянного обновления на всех отрезках спирали социального мышления, синтеза знаний, идей и интуиции всех участников цепи поставок как объединенной социально-экономической системы с единой конечной целью - удовлетворение растущих потребностей потребителей. Сформировано обобщенные требования к спиральному менеджменту цепей поставок и определены его основные функции и направления управленческой деятельности. Рассмотрены специфические условия обеспечения динамики спирального мировоззрения с помощью комплекса МЭМов, именно ориентированных на управление цепями поставок. Предложена классификация моделей интеграции цепи поставок, ориентированную на возможности и необходимости изменения его целевых ориентиров, форм и методов управления, временных масштабов функционирования.

The spiral dynamics of supply chains, as a complex and global phenomenon, is characterized not only by constant changes in the technical, technological, organizational and economic state of the logistics business, but also, most difficult - worldview changes in the views of individuals and society as a whole. At the forefront are the need to change the stereotypes of social psychology regarding human values, the dynamic forces of interaction of human systems, strategies and tactics of management and self-management of human relations at each time spiral.

The current and future paradigm of the evolution of the worldview systems of the spiral mind of mankind is based on awareness of the illusory nature of constant stability and recognition of the reality and inevitability of change - predictable and unpredictable (such as the pandemic COVID-19 and Chernobyl), local and global large-scale turbulences caused by the accelerated pace of development of scientific and technological progress and fundamental innovations in the activities of economically, cognitively and psychologically unprepared enterprises, organizations and public associations. New times give rise to new socially oriented thinking of individuals and their associations as a result of the synthesis and change of ideas, new knowledge, principles and human intuition. Issues of social psychology in business organizations and integrated supply chains at the present level are quite thoroughly covered in the works of Arie Gotsdanker, A. Martynov [3; 7] and the collective work "Business Psychology. Theory and practice" [8].

The current state of spiral supply chain management is characterized by specific factors and conditions of logistics as a business concept of the world economy. The basis of profound changes in the logistics spiral is, first of all, the evolution of value systems, which depends not on people's behavior but on their systemic thinking, which shapes the change of personal and social values and creates tools for managing relationships in human systems on each branch of the spiral. Given the need to manage deep differences in people to combine their efforts to achieve a single ultimate systemic goal of any activity, spiral management should be:

– organizationally flexible;
– knowledge-based;
– sensitive to situational changes;
– integral and consolidated in the composition of subjects and objects of management;
– global and multidimensional in performance.

In such a changing system of spiral management in the course of the spiral necessarily changes the content of management functions, the complexity of management processes, forms and methods of monitoring and regulation, the level and types of integration, leadership and partnership of interacting entities.

Therefore, in the system of spiral supply chain management must be carried out:

– constant deep and systematic examination of the chain as a whole to identify changes in the needs, requirements, expectations and capabilities of consumers, manufacturers and suppliers;
– sensitive monitoring of weak signals about the possibility and probability of future innovative changes and large-scale social turbulence in society and their impact on logistics activities;
– modern development and experimental verification of recommendations for preventive changes and adjustment of production relations of the supply chain entities as a single socio-economic association;
– formation of the basis for the creation of a new value system of human and inter-organizational relations in the next round of

the spiral, taking into account ethnic, religious, transnational, demographic and cognitive features of interacting supply chain actors and its cross-border and later geoeconomic nature.

Well-known researcher of management and marketing of services Christopher Lovelock argued that management systems must constantly take into account the pace and nature of changes in the service sector, which are aimed at deepening the integration, globalization and internationalization of logistics services [6].

Many modern scientists, developing the scientific ideas of Gilbrets, Mayo, Kondratiev, Leontiev, Juran, Tagucci, Covan and others came to the conclusion about the primacy of the human factor in ensuring the effective development of mankind through the constant improvement of its worldview.

Well-known social psychology expert Daniel Goleman focused the attention of managers on the importance of forming the social sensitivity of human systems to the vision of the future, using the effect of resonant leadership [4]. Such a scheme may be inherent in the socio-economic strategy of the supply chain focus company.

Thus, research conducted in recent years in the fields of innovation, business administration, marketing, management and social psychology, showed that from the standpoint of spiral dynamics, the primary factor in building a management system in any industry and the world economy as a whole is the formation of such worldview and values of human systems and their individuals, corresponding to the level of intellectual development of mankind, the phase and basic characteristics of the technological structures of society, the scale and level of globalization of a particular business. This makes the spiral management system flexible and specific to each segment of the spiral.

But there are general principles of formation of spiral management, focused, among other things, on the management of supply chains, the limits and capabilities of

which are rapidly expanding. In his work "Logistics Management" Van Hawk Remko, commenting on the features of the SCOR supply chain model emphasizes the impact of global consolidation in the system of formation of logistics values and partnership principles of logistics management [9]. The potential for the formation of new values of worldview consists of those psychological properties and needs that are inherent in each person such as survival, leadership, cognition, purposefulness, communication, kinship, compassion, self-centeredness and a huge list of other qualities. Their set and proportions form the worldview of man, and all together - the worldview of the human system and its values, adjusted at each turn of the spiral, from individual selfish interests of the individual to understanding and upholding the values of all mankind and later, perhaps, space. At the same time, of course, maintaining the consensus of the adjusted interests of all levels of management.

The most radical scientists and specialists in social psychology have compared the process of forming a person's worldview with the process of forming its physiological form on the genetic basis of DNA. Thus was born the idea of developing, researching and using a set of MEMs (gene analogs) both to prepare each person and the entire organization (human system) to function in separate segments of the spiral. The end result is achieved by "implementation-interaction-regression-exit" from the worldview system of a specifically oriented MEM (power, cooperation, mutual assistance, sacrifice, aggression, competitiveness, etc.).

Principles, the concept of specific value (properties), and also value symbols, social artifacts, behavioral instructions and etc. can be considered as MEMs.

In their works, D. Beck and Covan identified the following basic principles of the formation of the spiral mind, which to some extent can be adapted to the problems of organization of the spiral management of supply chains [2]:

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1. Creating the basic potential of ideas, methods and tools for the formation of new values in local human systems and the chain as a whole for the future demands of possible radical changes in society, economy, ecology, worldview (without complete abandonment of existing ones).

2. Monitoring, scanning and diagnostic analysis of geoeconomic changes, conflicts and collisions, threats to sustainable, balanced development of all regions of the world and ensuring the security of global supply chains.

3. Definition of a set of MEMs for elimination of the revealed turbulences and reconstruction of system of logistic management which will provide functioning of a chain in new conditions of the operating segment of a spiral.

4. Development of strategy and tactics of the life cycle of the new MEM - its introduction, development, regression, disappearance, providing flexible adaptation and the required level of use at different stages of changing technological systems in accordance with the Kondratiev-Schumpeter wave theory.

5. Anticipation and organization of pendulum alternation of MEMs along the spiral with their corresponding adjustment in the new conditions of supply chain operation and the need to change stable agreed management decisions to situational scenarios of logistical support of geoeconomic processes.

6. Ensuring targeted management and mutual acceptance of industry MEMs of suppliers, manufacturers, customers, research and marketing organizations as subjects of the supply chain at all stages of the spiral.

7. Taking into account the level of aggressiveness of social cataclysms in the development of programs for the introduction of new and change of existing worldview MEMs and value systems without harming the individual.

In the application plan for supply chain management it is a question of formation of uniform worldview principles and working off

of identical values for subjects of a chain as uniform social system focused on final result of each segment of a development spiral - satisfaction of constantly growing interests of own human system of a chain on condition of maintenance of growing needs and expectations of all society.

This is a very difficult task for logistics and for any management, the solution of which depends on the focus of employees on integration, interaction, mutual support and common interests and values of worldview.

The formation of such a direction of management Michael Armstrong recommends to start with the development of a system of collective information and the development of modern communication processes, which is especially important for supply chains [1].

Despite the variety of forms and methods of integration processes, there are several basic models of integration. Their following classification is offered:

A. The model of integration of a stream of consecutive works and operations in a supply chain which defines:

– expediency and system efficiency of separate technological operations and final efficiency of integrated efforts of their flow;

– optimization of cyclograms of performed works and their constant coordination;

– development of the chain of target expenses, costs and values of the final product with their subsequent differentiation by integrated business processes, agreed with the cooperating actors of the chain;

– use of horizontal management of interaction of subjects of a chain on the coordinated and mutually controlled programs in combination with standard internal self-management of each enterprise.

B. Integration model of incorporation, the main features of which are:

– a single system of participation of all actors in the chain to improve, maintain, strengthen operations and transitions of technological processes in the supply chain;

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– corporate management of the functions of strategic planning, controlling, technical and economic analysis and innovation;

– centralized management of organizational restructuring of the chain as external and internal changes, deviations and imbalances;

– use of flexible vertical control of supply chain operation.

C. Integration model of team intelligence, the main features of which are:

– combines the features of the first two models by creating variable flexible control systems according to real or predicted events and situations;

– is based on the capabilities and principles of the digital economy, computerization and informatization of management operations, the use of modern databases of IT, cloud technologies, roadmaps, network management and etc.;

– concentrates in the processor control center competencies, experience, consulting design solutions to coordinate joint actions of supply chain actors;

– creates an analytical and management center in combination with groups (centers) of focused intelligence.

D. Spiral management model, designed for long-term control of the supply chain, which is constantly changing - evolving or degrading (the so-called spiral funnel).

The purposes of this integration model are following:

– formation of long-term forecasts of the future state of society, its needs and opportunities, directions of development of intellectual, industrial, social and other spheres of activity;

– expanding the scope and scale of integration processes, as the subjects of the global and dynamically changing supply chain must be added and social organizations, the product of which will be new needs, research institutions that will develop products to meet these needs; a network of supply and service supply chains

of enterprises, the composition and structure of which changes along the spiral;

– development of a program of the necessary next change of worldview, which would minimize the loss of individuality, create new forms of communication, mutual understanding and interaction on the basis of common basic values, among which the priority would be system-wide interests;

– socio-psychological support of a unified policy and strategy of mandatory changes in the supply chain at different stages of its spiral dynamics by creating an appropriate innovation climate, accumulation of intellectual capital, management of resistance to change and as a result - the creation of new thinking.

As we can see, the problem of changing the worldview of people, organizations and society as a whole is the most important for spiral management. This is especially familiar to our society, which is experiencing a stressful transition from a socialist to a market economy, from the right to work to its search and struggle for a job, from collective communication to freelance, etc. Such inevitable changes require on the one hand a concentration on the development and interests of the individual and at the same time an understanding of each person's dependence on the values and interests of the entire human system. This situation completely coincides with the socio-psychological problems of integration and interaction of supply chain actors.

In spiral management, the object of management - the supply chain - is seen as a spiral of business processes:

a) from the primary source - customers of the required product to meet their specific needs and to the end point - consumers of this product;

6) from the primary process of formation of technical requirements to the future product of satisfaction of need and to the final process of utilization (liquidation) of the used product.

The realization of the essence of spiral management is associated primarily with

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changes, the scale of which is growing at an accelerated pace. The need for business response in such volatile changing conditions has led to the emergence of various forms and

methods of management that can be used to manage the spiral dynamics of supply chains (Fig. 1).
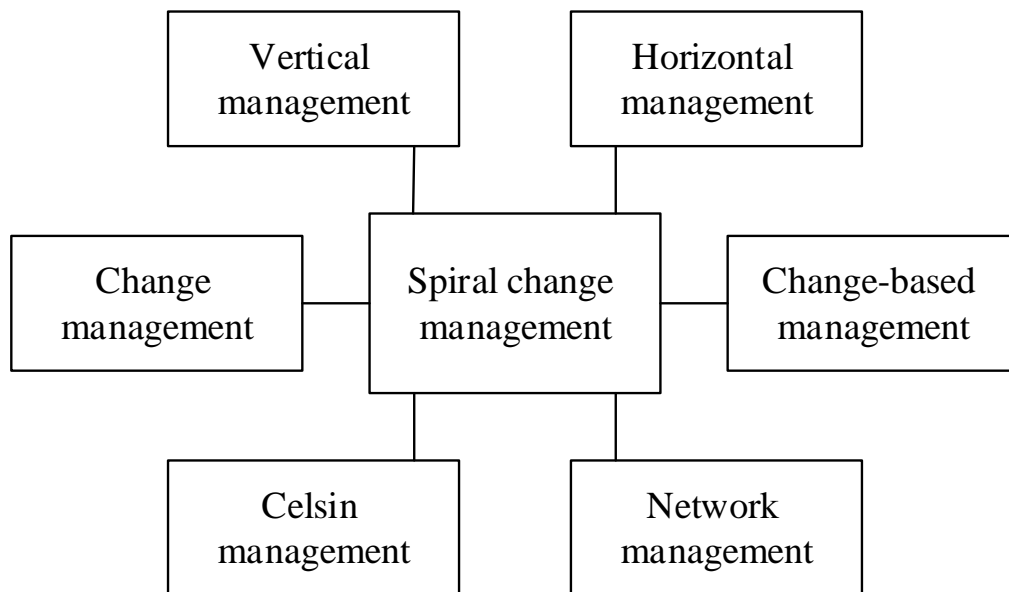
Figure 1 – Components of spiral management

The very idea of spiral management in logistics is a continuation of scientific research and proposals of Harrison, Mason-Jones, Remco van Hawke and others. on the transition from the concept of rational logistics to the model of "dynamic logistics chain", focused primarily on sensitivity to the

end user - the customer and virtual needs assessment and real demand, as well as the integration of business processes and network structure of chain partners with cross-links and a single information platform (Fig. 2).
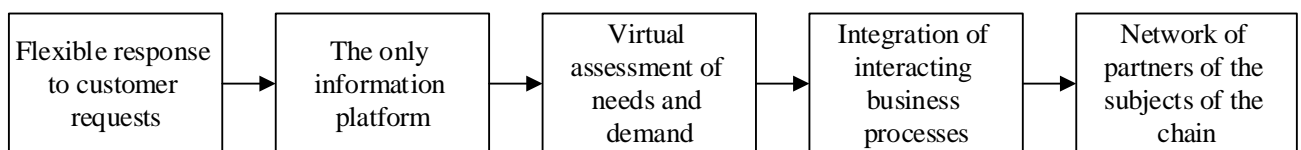
Figure 2 – Integrated dynamic logistics chain

These scientists consider that a special condition for ensuring the dynamism of the chain, the strength and stability of partnerships based on the following principles:
– common moral and ethical values and corporate principles;
– unity and priority of system-wide chain goals;

– recognition of the interdependence of actors and the need for their integration and contacts at all levels;
– mandatory use of a single common and open to partners information system;
– trust and mutual cross-checking;
– joint strategic planning;
– coordination of the subjects activities of the chain by the focus company;

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– interaction and exchange of share capital between the subjects of the chain;

– mutual benefit and shared risks.

These factors remain relevant for spiral management, only increasing the horizon for predicting changes and their scale along the spiral, as well as increasing the importance of ideological socio-psychological transformations in human supply chain systems. Spiral management is actually the management of progressive changes - extinction of obsolete products, technologies, ideas, relationships and stimulating the components of a new technological structure and the corresponding change in the value system. The direction of change, as a rule, is towards strengthening the tendencies of integration, globalization and changing the priority of public interests from local, regional, national to the global level of sustainable and secure development of society.

Management of changes (Fig. 1) of the spiral turns, as well as internal changes in the supply chain requires the use of a full range of types, forms and methods of management. First of all - flexible use of both vertical and horizontal control. The vertical of successive technological business processes in supply chains has its own feature: it is directed in the reverse order - from the customer to the initial state - the emergence of a need for a product or service. The vertical of organizational and economic management of the chain is not authoritative in nature, but recommendatory and coordinating in nature. Such management decisions, in our opinion, should have the tools of mandatory implementation provided by the relevant corporate agreements for the actors in the supply chain. At the same time, there are situations that threaten the security of the world, such as pandemics, natural disasters and etc., when competent decisions of government are needed. Therefore, in the future, the human community will need to have control centers for vertical control of the chains necessary to ensure security of supply on sections of the spiral that threaten humanity.

Horizontal management in the system of spiral management is based on the relationships and partnerships of the chain as a collective like-minded person with a broad outlook and systemic focus, which goes beyond the interests of their own unit and even the company. After all, the understanding of spiral changes as global transformations includes all aspects of activity - scientific, economic, industrial, social and undoubtedly leads to a change in people's worldview on a more complex cognitive, intellectual and spiritual levels. This trend is very instructive in the search for Japanese management, which results in systems of quality control circles, logistics scheme "just in time", production associations such as "keiretsu", and others.

As for the direct management of changes in the supply chain spiral, in addition to the passive adaptive strategy of change management in the external environment of the chain, it is mandatory to manage radical changes in the internal structure, methods and technologies of logistics operations and business processes.

As any processes of production, transportation, use and utilization of products of deliveries are connected with a network of accompanying providing, servicing and service enterprises of various branches of economy, the supply chain in itself represents an extensive network of the integrated system of interacting business entities which is determined by network management methods. Finally, the spiral dynamics of the supply chain is constantly affected by indirect influence of external factors, changes in which, according to the essence of Celsin management, can significantly affect the formation and operation of the spiral of the supply chain.

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DIGITAL PLATFORMS AND THEIR APPLICATION IN THE AVIATION INDUSTRY

Kateryna Molchanova, Natalia Trushkina, Olga Katerna. "Digital platforms and their application in the aviation industry". The article considers one of the directions of digital transformation, namely digital platforms. United Nations Conference on Trade and Development says that digital platforms create new opportunities for companies of all sizes to engage in trade. They can lead to efficiency gains through lower transaction costs and reduced information asymmetries supported by rating systems. Other benefits include lower consumer prices, increased market access, more competition, better use of underutilized resources and increased flexibility for the providers of services. However, gains are not automatic, and there are growing concerns over the rising market power of certain platforms and the related implications for competition, data protection and ownership, consumer protection and taxation and employment policies. Economic policies and regulations will need to maximize the benefits while at the same time minimizing the costs of digital platforms.

Accordingly to Digital Economy Report 2019 by UNCTAD digital platforms provide the mechanisms for bringing together a set of parties to interact online. A distinction can be made between transaction platforms and innovation platforms. Transaction platforms are two/multi-sided markets with an online infrastructure that supports exchanges between a number of different parties. They have become a core business model for major digital corporations (such as Amazon, Alibaba, Facebook and eBay), as well as for those that are supporting digitally enabled sectors (such as Uber, Didi Chuxing or Airbnb). Innovation platforms create environments for

code and content producers to develop applications and software in the form of, for example, operating systems (e.g. Android or Linux) or technology standards (e.g. MPEG video).

Several factors help explain the rapid rise to dominance of these digital giants. The first is related to network effects (i.e. the more users on a platform, the more valuable it becomes for everyone). The second is the platforms' ability to extract, control and analyses data. As with network effects, more users mean more data, and more data mean a stronger ability to outcompete potential rivals and capitalize on first-mover advantages. Thirdly, once a platform begins to gain traction and starts offering different integrated services, the costs to users of switching to an alternative service provider start to increase.

The transformative power of data in the sphere of economic and social interactions means that governments, businesses, and people must adapt to use emerging opportunities and avoid traps and risks. The ability of countries and various stakeholders to master digital transformation varies greatly and depends on their level of development and digital readiness. Developed countries are in many ways better equipped to deal with the growing role of digital platforms than countries with limited resources and capabilities.

The aviation, travel and tourism industry has been at the forefront of digital innovation, but industry and technology trends suggest that further change lies ahead. The sector has been an early adopter of digital technologies and platforms, but steep demand for travel, driven by a growing middle class in emerging markets and the increasing importance of digital experiences, implies that further digitalization will be vital if the expectations of tomorrow's consumers are to be met.

Keywords: digital transformation, digital platform, digitalization, platformization, digital economy, digital readiness.

Катерина Молчанова, Наталія Трушкіна, Ольга Катерна. "Цифрові платформи та їх застосування в авіаційній галузі". *В статті розглядається один з напрямків цифрової трансформації, а саме цифрові платформи. Багато комерційних підприємств на сьогоднішній день обирають платформенні бізнес-моделі і дослідження самого поняття цифрової платформи дозволяє зрозуміти причини їх виникнення та цілі існування. Виконано аналіз методології, що оцінює рівень готовності країн до цифрової трансформації і це дозволяє виявити сильні та слабкі сторони на шляху цифровізації. Також досліджені типи та види цифрових платформ в залежності від їх функціональних особливостей. Розглянуті сфери застосування цифрових платформ в авіаційній галузі та існуючі платформи для просування послуг авіакомпаній до клієнтів та платформи призначенням яких є об'єднання учасників авіаційної галузі для оптимального технічного обслуговування та ремонту літаків та обміну інформацією.*

Ключові слова: цифрова трансформація, цифрова платформа, цифровізація, платформізація, цифрова економіка, цифрова готовність.

Екатерина Молчанова, Наталия Трушкина, Ольга Катерная. "Цифровые платформы и их применение в авиационной отрасли". *В статье рассматривается одно из направлений цифровой трансформации, а именно цифровые платформы. Многие коммерческих предприятий на сегодняшний день выбирают платформенные бизнес-модели и исследование самого понятия цифровой платформы позволяет понять причины их возникновения и цели существования. Выполнен анализ методологии, которая оценивает уровень готовности стран к цифровой трансформации и это позволяет выявить сильные и слабые стороны на пути цифровизации. Также исследованы типы и виды цифровых платформ в зависимости от их функциональных особенностей. Рассмотрены сферы применения цифровых платформ в авиационной отрасли и существующие платформы для продвижения услуг авиакомпаний к клиентам и платформы назначением которых является объединение участников авиационной отрасли для оптимального технического обслуживания и ремонта самолетов и обмена информацией.*

Ключевые слова: цифровая трансформация, цифровая платформа, цифровизация, платформизация, цифровая экономика, цифровая готовность.

Introduction. Recently, many aspects of our life have become associated with numbers. Digital data, digital technologies, digital transformation, digitalization, digital economy - these concepts are firmly entrenched in daily routine. Many studies describe the essence of these concepts and provide definitions. To put it simply, the digital world is a world encoded with the numbers 0 and 1. In order to gain access to the digital world, we need certain devices, programs and energy. Now it is difficult to find such a sphere of human activity in which digital technologies are not used. Of course, the level of digitalization is not uniform. Therefore, primitive tribes in the Amazon, Africa and Oceania do not use such technologies at all. However, these are exceptions to the rule, and the Earth is increasingly becoming a digital planet.

United Nations Conference on Trade and Development says that digital platforms create new opportunities for companies of all sizes to engage in trade. They can lead to efficiency gains through lower transaction costs and reduced information asymmetries supported by rating systems. Other benefits include lower consumer prices, increased market access, more competition, better use of underutilized resources and increased flexibility for the providers of services. However, gains are not automatic, and there are growing concerns over the rising market power of certain platforms and the related implications for competition, data protection and ownership, consumer protection and taxation and employment policies. Economic policies and regulations will need to maximize the benefits while at the same time minimizing the costs of digital platforms. [1]

Literature and researches review. Accordingly, to Thomas R. Eisenmann the platform encompasses the set of components and rules employed in common in most user transactions. Components include hardware, software, and service modules, along with an architecture that specifies how they fit together. Rules are used to coordinate network participants' activities. They include

standards that ensure compatibility among different components, protocols that govern information exchange, policies that constrain user behavior, and contracts that specify terms of trade and the rights and responsibilities of network participants. [2]

Idris Mootee notes that most industries today operate on certain platforms and platform owners means market power and usually benefit from economic gain. Many are quick to call their products platforms in a casual manner, but here are some of the key characteristics:

- It must perform one or more critical function in a superior fashion within an industry;

- It must define certain "standards" and has influence over the overall architecture;

- It must be open or semi-open for others to build upon;

- The economics must allow the compliments in the ecosystem to see some upside in order to attract them to participate;

- Early momentum is key for any platform strategy so a lot of negotiation needs to take place to make business trade offs. [3]

European Commission defines that digital platforms provide the technological basis for delivering or aggregating services/content and mediate between service/content providers and end-users. They integrate the components of industrial value chains in a seamless communication between interoperable business processes (e.g. design, production, sales, logistics, and maintenance). [4]

In the literature on digital platforms, the term platform economy is also often found. The platform economy poses significant questions, challenges and opportunities for society, the labour market and organizations. An increasing number of businesses are starting to adopt the platform business model and its digital strategies in order to remain competitive. The Deloitte Company states the platform economy is a complex phenomenon that is significantly disrupting the general concept of 'normal jobs'. It is any type of digital platform that uses the internet to

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connect dispersed networks of individuals to facilitate digital interactions between people. Within the platform economy there is a triangular relationship between three parties (1) the platform (2) the worker and (3) the customer. It is the job of the platform to connect people with demand (the customer) to people that provide supply (the worker). [5]

Aim and objectives. The purpose of the article is to study the concept of digital platforms, their place in the modern digital world, their types and the reasons why commercial enterprises are striving to switch to platform business models. Study of the methodology for assessing the readiness of countries for digital transformation allows you to see the strengths and weaknesses of the country and determine the vector of movement. Since the aviation industry is inherent in the use of the latest technologies, digital platforms find their application in this area too.

Results, analysis and discussion. The basic of digital world is digital data. Digital data is machine-readable information. In the Digital Economy Report 2019 of United Nations Conference on Trade and Development (UNCTAD) digital data and digital platform are considered as major drivers of digital economy's expansion. [6]. The digital economy continues to evolve at breakneck speed, driven by the ability to collect, use and analyse massive amounts of machine-readable information (digital data) about practically everything. These digital data arise from the digital footprints of personal, social and business activities taking place on various digital platforms. Global Internet Protocol (IP) traffic, a proxy for data flows, grew from about 100 gigabytes (GB) per day in 1992 to more than 45,000 GB per second in 2017 (Fig. 1). And yet the world is only in the early days of the data-driven economy; by 2022 global IP traffic is projected to reach 150,700 GB per second, fuelled by more and more people coming online for the first time and by the expansion of the Internet of Things (IoT).

The CISCO Annual Internet Report 2018-2023 announced 5.3 billion total Internet users (66 percent of global population) by 2023, up from 3.9 billion (51 percent of global population) in 2018. [7]

Figure 1 – Evolution of Global Internet traffic, selected years
Source: [6].

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Globally, devices and connections are growing faster (10 percent CAGR) than both the population (1.0 percent CAGR) and the Internet users (6 percent CAGR). This trend is accelerating the increase in the average number of devices and connections per household and per capita. Each year, various new devices in different form factors with increased capabilities and intelligence are introduced and adopted in the market. A growing number of M2M (Machine-to-Machine) applications, such as smart meters, video surveillance, healthcare monitoring, transportation, and package or asset tracking, are contributing in a major way to the growth of devices and connections. By 2023, M2M connections will be half or 50 percent of the total devices and connections.

By 2023, the consumer share of the total devices, including both fixed and mobile devices, will be 74 percent, with business claiming the remaining 26 percent. Consumer share will grow at a slightly slower rate, at a 9.1 percent CAGR relative to the business segment, which will grow at a 12.0 percent CAGR (see Fig. 2).

The development and policy implications of data collection and use depend greatly on the type of data involved: personal or non-personal; private or public; for commercial or government purposes; volunteered, observed or inferred; sensitive or non-sensitive. An entirely new "data value chain" has evolved, comprising firms that support data collection, the production of insights from data, data storage, analysis and modelling. Value creation arises once the data are transformed into digital intelligence and monetized through commercial use.

Accordingly to Digital Economy Report 2019 by UNCTAD digital platforms provide the mechanisms for bringing together a set of parties to interact online. A distinction can be made between transaction platforms and innovation platforms. Transaction platforms are two/multi-sided markets with an online infrastructure that supports exchanges between a number of different parties. They have become a core business model for major digital corporations (such as Amazon, Alibaba, Facebook and eBay), as well as for those that are supporting digitally enabled sectors (such as Uber, Didi Chuxing or Airbnb). Innovation platforms create environments for code and content producers to develop applications and software in the form of, for example, operating systems (e.g. Android or Linux) or technology standards (e.g. MPEG video).
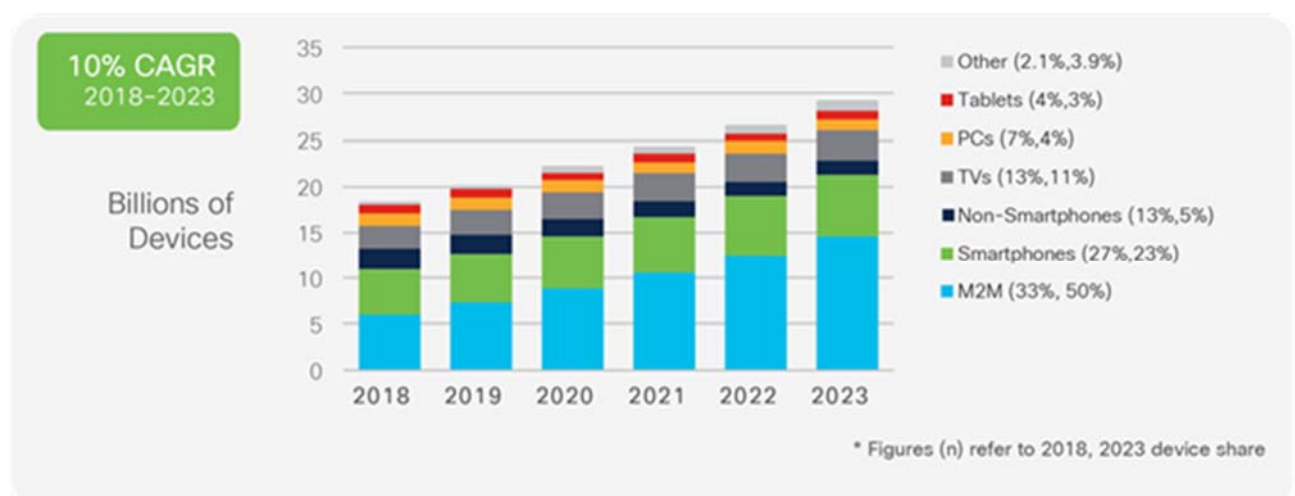

Figure 2 – Global device and connection growth
Source: [7]

Platform-centred businesses have a major advantage in the data-driven economy. As both intermediaries and infrastructures, they are positioned to record and extract all data related to online actions and interactions among users of the platform. The growth of digital platforms is directly linked to their capacity to collect and analyse digital data, but their interests and behavior depend greatly on how they monetize those data to generate revenue.

Digital platforms are increasingly important in the world economy. The combined value of the platform companies with a market capitalization of more than $100 million was estimated at more than $7 trillion in 2017 – 67 per cent higher than in 2015. Some global digital platforms have achieved very strong market positions in certain areas. For example, Google has some 90 per cent of the market for Internet searches. Facebook accounts for two thirds of the global social media market, and is the top social media platform in more than 90 per cent of the world's economies. Amazon boasts an almost 40 per cent share of the world's online retail activity, and its Amazon Web Services accounts for a similar share of the global cloud infrastructure services market. In China, WeChat (owned by Tencent) has more than one billion active users and, together with Alipay (Alibaba), its payment solution has captured virtually the entire Chinese market for mobile payments. Meanwhile, Alibaba has been estimated to have close to 60 per cent of the Chinese e-commerce market.

Several factors help explain the rapid rise to dominance of these digital giants. The first is related to network effects (i.e. the more users on a platform, the more valuable it becomes for everyone). The second is the platforms' ability to extract, control and analyse data. As with network effects, more users mean more data, and more data mean a stronger ability to outcompete potential rivals and capitalize on first-mover advantages. Thirdly, once a platform begins to gain traction and starts offering different

integrated services, the costs to users of switching to an alternative service provider start to increase.

Global digital platforms have taken steps to consolidate their competitive positions, including by acquiring potential competitors and expanding into complementary products or services. Major acquisitions by digital platform companies include Microsoft's takeover of LinkedIn and Facebook's acquisition of WhatsApp. Alphabet (Google) and Microsoft have invested in telecommunications equipment by acquiring Motorola and Nokia, respectively. Major platforms have also made other large acquisitions in the retail industry, advertising and marketing industry, and in non-residential real estate.

Other steps include investing strategically in research and development (R&D) and lobbying in domestic and international policy-making circles. At the same time, strategic partnering between multinational enterprises (MNEs) in traditional sectors and global digital platform corporations is also being explored. For example, Walmart has partnered with Google to use Google Assistant; Ford and Daimler have joined Baidu in its Apollo platform; Google has built the Android Automotive platform with Volvo and Audi; GE has partnered with Microsoft to use its Azure cloud services; and Intel and Facebook are collaborating on the development of a new artificial intelligence (AI) chip. [6].

For understanding why digital platforms are co important in modern life we must correctly define the term itself. In business literature the term "multi-sided platform" is used as well as platform and platform business model. One of the definitions comes from Professor Andrei Hagiu who defines Multi-sided platforms as: "Multi-sided platforms (MSPs) are technologies, products or services that create value primarily by enabling direct interactions between two or more customer or participant groups." [8]

There are a lot of different types of multi-sided platforms. On the Fig. 3 are presented some common categories and examples.
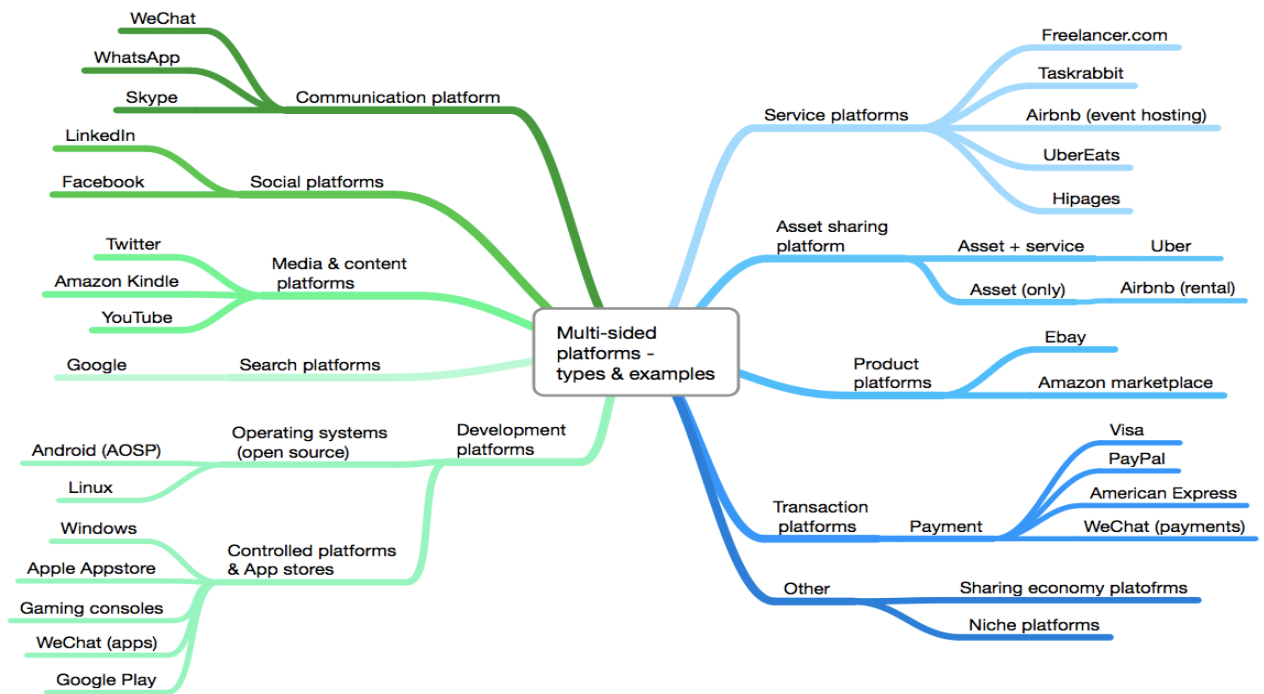
Figure 3 – Types of multi-sided platforms
Source: [9]

It's important to remember that a platform is a business model, not just a piece of technology. A lot of people make the mistake of conflating a platform with a mobile app or a website, but a platform isn't just a piece of software. It's a holistic business model that creates value by bringing together consumers and producers. [10]

Traditional, non-platform companies are common called linear businesses, because their operations are well-described by the typical linear supply chain. Linear companies create value in the form of goods or services and then sell them to someone downstream in their supply chain. [11] Linear Business: a business that takes in components, creates finished products/services and sells that good/service to consumers. The platform is solely focused on building and facilitating a network. Platforms don't own the means of production – instead, they create the means of connection.

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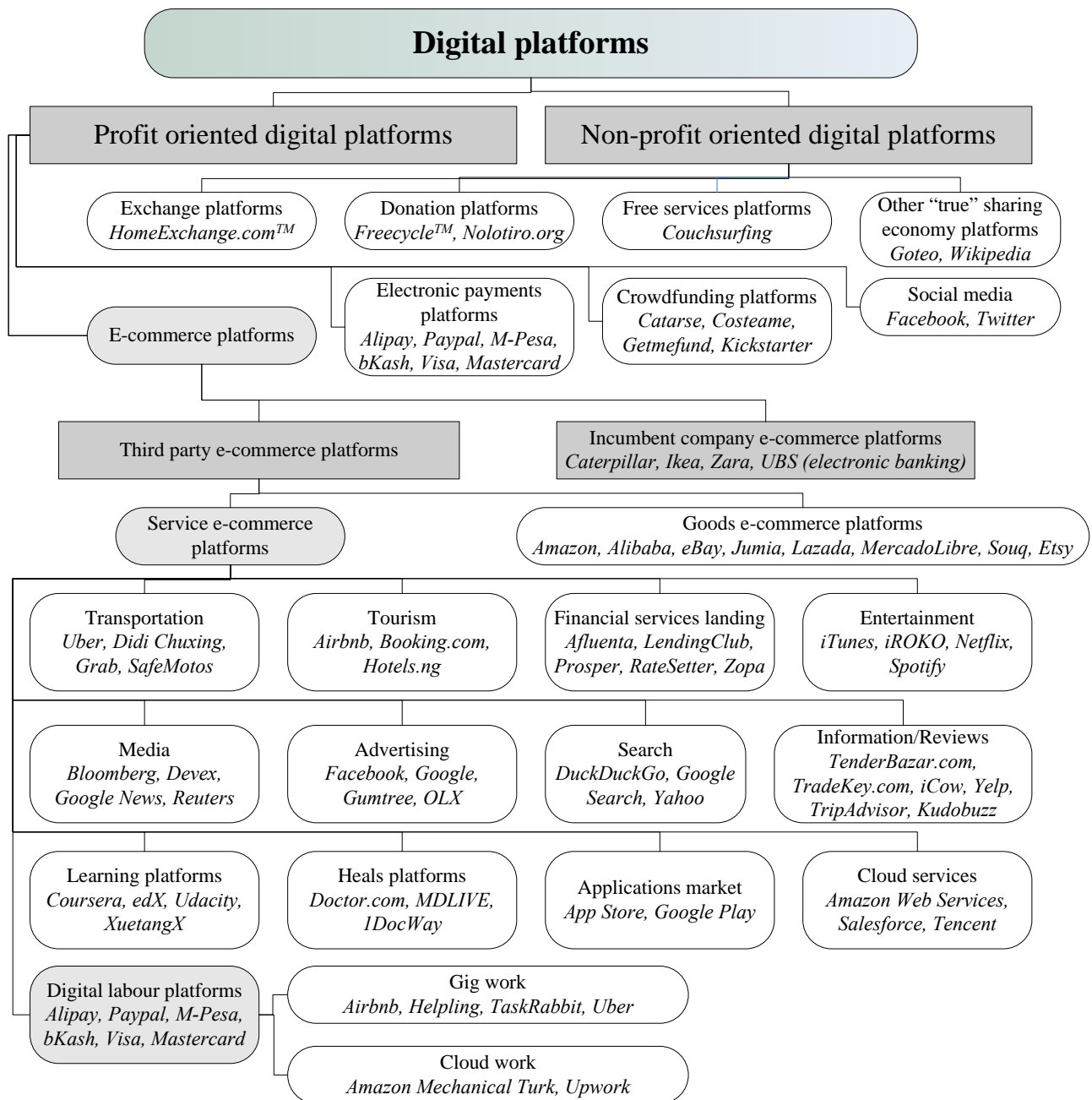
Figure 4 – Electronic commerce in the digital platforms landscape

Digital platforms are key in the evolving electronic commerce (e-commerce) and digital economy landscape. Their main characteristics include the provision of infrastructure to intermediate between different users; the reliance on network effects, as more users beget more users, leading to monopolistic trends; and the use of cross-subsidization. The most important value of such platforms stems from the data extracted from users that can be further analysed, used and monetized. Data have become a valuable extractable resource in the digital economy. [12]

By reducing transaction and search costs, digital platforms enable those offering assets or services to connect more easily with those wishing to use or consume them. This has created potential opportunities for new trade types (in digitally traded products, services and tasks) and for more traditional trade using e-commerce and other online platforms to better match buyers and sellers and to make products more visible. Many

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platforms provide access to free or paid services via the Internet to connect users, buyers and sellers, such as services related to logistics, payments, market research, trade compliance, market intelligence data, advertising, refunds and dispute resolution.

Digital platforms can allow for a more efficient utilization of physical assets and time. Often accessed through mobile applications, they aggregate and bring together supply and demand in ways that were not possible before. Digital platforms can also help to empower women entrepreneurs.

One way of illustrating this new digital platforms landscape is shown in the Fig. 4. Digital platforms are divided into two groups: profit-oriented and non-profitoriented. The size of non-profit-oriented platforms is likely to be marginal compared with profit-oriented

platforms. Profitoriented platforms can also be subdivided depending on their main business focus. Some examples of the different categories are provided. As some platforms are multipurpose, they may appear in several places.

Wealth creation in the digital economy is highly concentrated in the United States and China, with the rest of the world, especially countries in Africa and Latin America, trailing considerably far behind. [13]

The United States and China account for 75% of all patents related to blockchain technologies, 50% of global spending on the Internet of Things (IoT), more than 75% of the cloud computing market and as much as 90% per cent of the market capitalization value of the world's 70 largest digital platform companies (see Fig. 5).
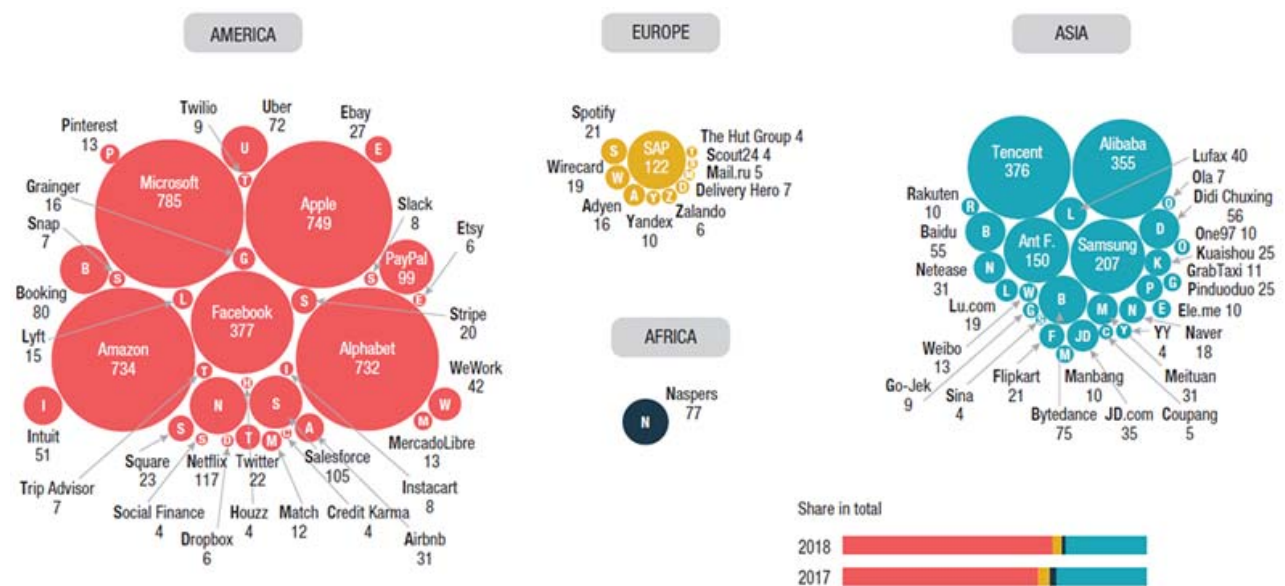
Figure 5 – Geographical distribution of the main global platforms in the world, 2018
Source: [13]

The transformative power of data in the sphere of economic and social interactions means that governments, businesses, and people must adapt to use emerging opportunities and avoid traps and risks. The ability of countries and various stakeholders to master digital transformation varies greatly and depends on their level of development

and digital readiness. Developed countries are in many ways better equipped to deal with the growing role of digital platforms than countries with limited resources and capabilities. Limited availability may be due not only to underdeveloped communications and skills shortages or from technological, financial or logistical aspects, but problems

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with local content creation and weak regulatory and institutional frameworks. There is a risk that the digital revolution will create benefits primarily for those who are already well equipped to create and retain value in the digital age, rather than contribute to more inclusive development. [14]

The world today is characterized by a wide gap between loosely coupled and hyper-digitalized countries. For example, only one in five people in least developed countries use the Internet, compared with four in five people in developed countries. Thus, while the situation is improving, there is still a lack of affordable and reliable digital communications in many developing countries.

In addition, many small business owners in developing countries, especially least developed countries, lack the necessary capabilities, skills and knowledge to take full advantage of the digital economy. Even if they have access to mobile phones or the Internet, they may not know how to effectively use such funds to grow their business.

In many developing countries, digital entrepreneurs have limited opportunities to develop basic digital technologies domestically and face various obstacles, especially if they seek to expand their activities. The main bottlenecks in the development of the digital ecosystem of entrepreneurship and innovation are a small and undemanding market, a lack of entrepreneurial knowledge and experience, a lack of qualified and inexpensive workforce, and limited access to finance.

The international ICT giant CISCO Company developed Global Digital Readiness Index. The Cisco GDRI has been created to help nations understand how well-positioned they are to take advantage of the benefits of digitization. A holistic view of digital readiness was taken, examining multiple factors that indicate the progress that a nation has made towards digital maturity, and demonstrating

areas of strength while providing guidance as to how they can invest to improve their overall readiness. [15]

A countries digital readiness score is determined by Cisco researchers examining countries against the seven components which are believed to indicate a countries ability to take advantage of digitisation. These components are:

—Basic Needs – this component is determined by life expectancy, mortality rate, population of people using safe drinking water and access to electricity.

—Business & Government Investment – this is evaluated by assessing the foreign direct investment, research and development expenditure, investment freedom.

—Ease of Doing Business – factors effecting this ranking include Rule of Law, Logistic Performance Index and Time to Get Electricity.

—Human Capital – this is ranked by evaluating labour force participation rate, adult literacy rate, education index and harmonised test score.

—Start-Up Environment – a countries ranking for this is determined by new business density, patents granted & trademarks registered and venture capital investment & availability.

—Technology Adoption – mobile device penetration, internet usage and cloud services.

—Technology Infrastructure – mobile broadband subscriptions, fixed broadband subscriptions, secure internet servers and household internet access.

The overall average readiness score for 2019 year's report was 11.90. No country obtained a perfect score on any of the seven components examined. The analysis revealed three stages of digital readiness - Amplify, Accelerate, and Activate - based on their score's distance from the average result (see Fig. 6).
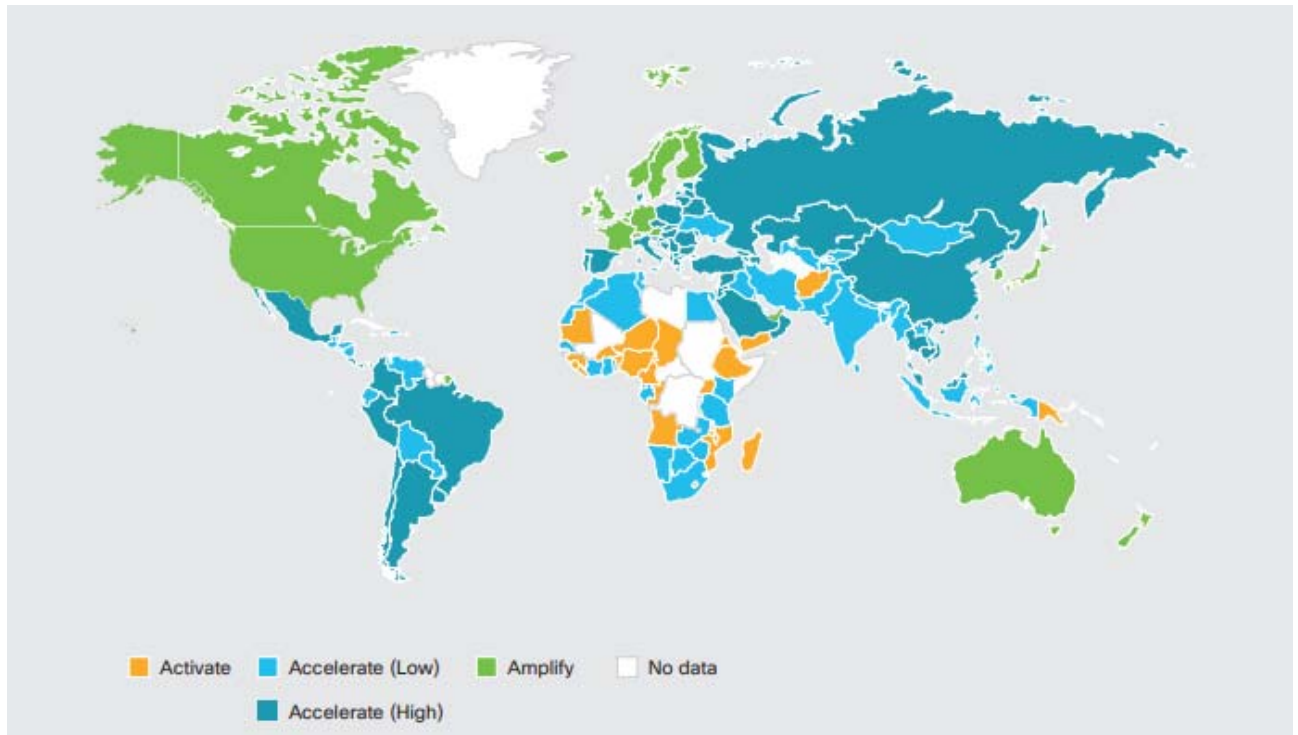
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Figure 6 – The world map of digital readiness stages
Source: [15]

Accordingly to Cisco Global Digital Readiness Index 2019 the overall top five countries are:

1. Singapore – scored 20.26;
2. Luxembourg – scored 19.54;
3. United States – scored 19.03;
4. Denmark – scored 18.98;
5. Switzerland – scored 18.86.

In 2019 Ukraine is on the stage Accelerate with GDRI 11.47. The score of Ukraine in world rank is 77th from 141 countries and it is between Botswana (76th) and South Africa (78th). The strongest components are Basic Needs (3,54 from 4) and Human Capital (2,79 from 4). The weakest components are Start-Up Environment (0,26 from 3) and Business and Government Investment (0,92 from 3).

It should be noted that in 2018 Ukrainian score of GDREI was 12.36.

Platformization is happening in all areas of business, but let's take a closer look at the aviation industry. Air transport is central to world tourism and trade. Tourists traveling internationally by air are estimated to have spent about $850 billion in 2018, an increase of more than 10% over 2017. [16]

The aviation, travel and tourism industry has been at the forefront of digital innovation, but industry and technology trends suggest that further change lies ahead. The sector has been an early adopter of digital technologies and platforms, but steep demand for travel, driven by a growing middle class in emerging markets and the increasing importance of digital experiences, implies that further digitalization will be vital if the expectations of tomorrow's consumers are to be met. [17]

The travel ecosystem (see Fig.7) has helped shape customer expectations for on-demand and convenient services through digital innovation, both within and across industry boundaries. The next step is for organizations that are lagging behind to change how they work, so that they too can capture the opportunities that digital transformation presents.
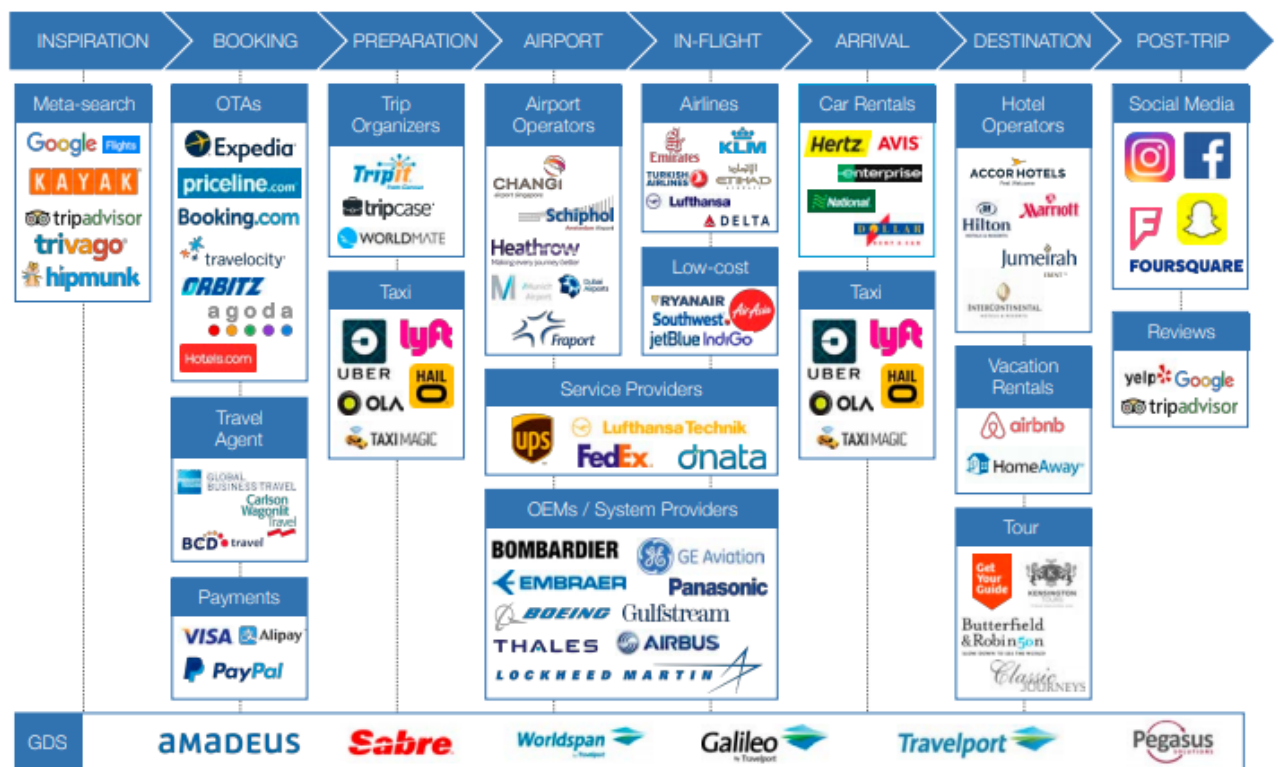
Figure 7. The aviation, Travel and Tourism Ecosystem
Source: [17]

For the aviation industry, the channels through which aviation enterprises market their services to customers are vital. Making airline offers available through a range of booking channels and methods is critical to reaching consumers. Airline websites are not the first place passengers search. When they are booking more than just flights, metasearch alone is not enough. Millennials are still turning to travel agents. [18]

Figure 8 shows what is most important for a potential passenger when choosing an air flight and where searches take place.

Figure 8 – The most important component for passenger when choosing airlines and first place they visit when searching for flights
Source: developed by own, based on data from [18]

There are a lot of platforms for flight searching (see Fig. 9).

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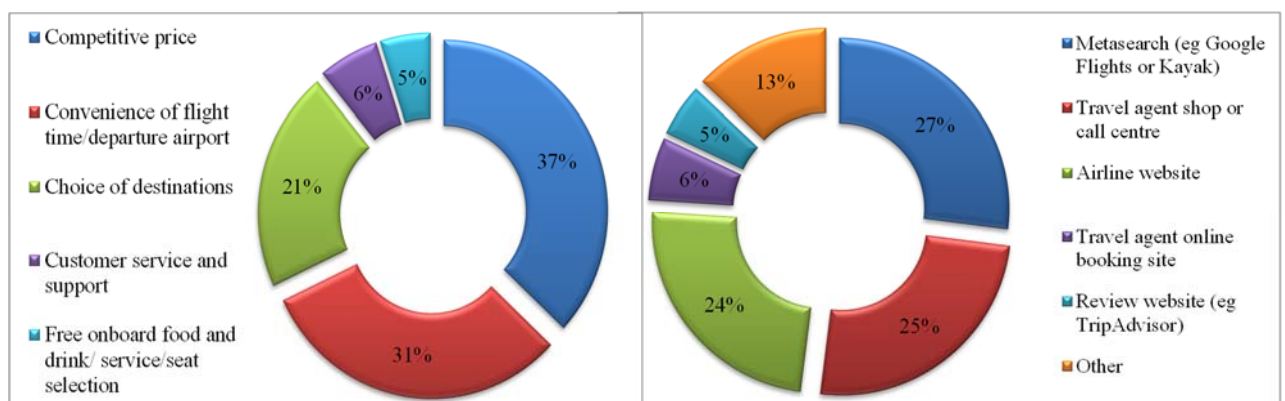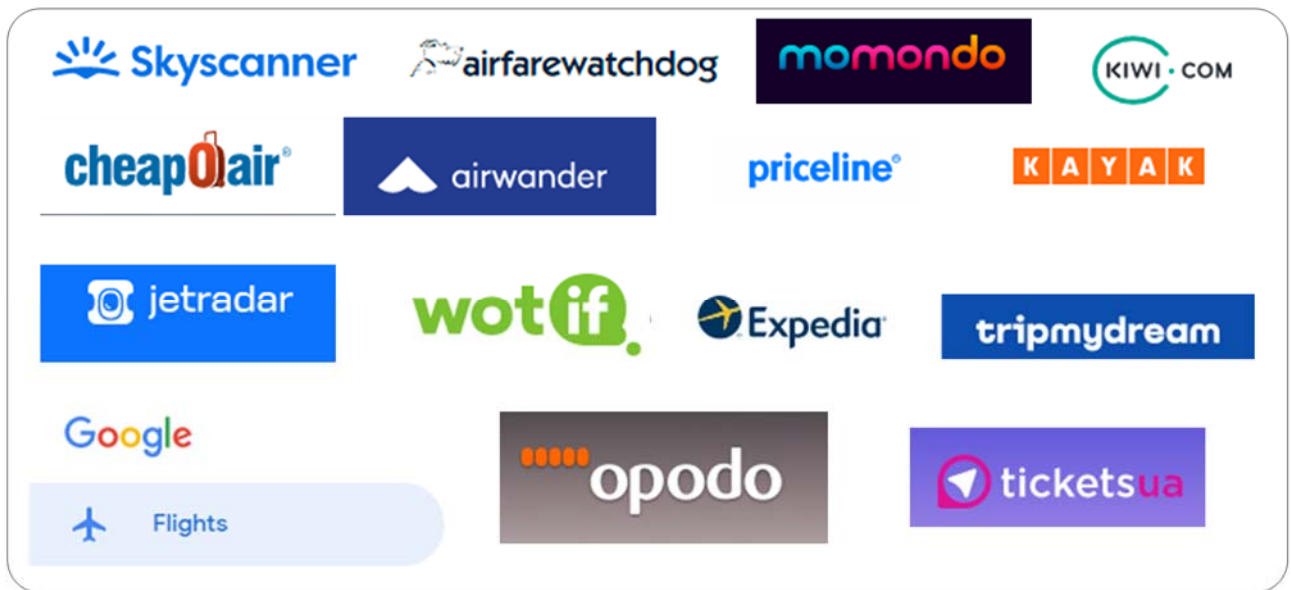https://smart-scm.org

Figure 9 – Flight metasearch

These platforms offer not only flight search, but also hotel and car rental selection. But as experienced travelers note, on such search engines, flights of local airlines may often not be represented. So choosing the optimal flight may take some time.

On the other hand, information is becoming the most important resource today. In recent years, the market for data analysis and predictive analytics within the aviation industry has significantly matured. Consider several aviation data platforms that are pushing for market dominance or looking to reshape areas of the industry that are lagging in digitization.

Skywise. The platform is built to collect, aggregate, and share airline data from work orders, spares consumption, component data, fleet configuration, sensor data and flight schedules. Additional data sources traditionally shared with Airbus and hosted only on isolated servers—such as aircraft condition monitoring reports, parts replacements, on-board aircraft data and technical documentation—can be integrated into the platform and combine with the full scope of platform data to allow operators a broader range of analysis and decision-making. [5 aviation data platforms to keep your eye on. SatAir. URL: https://blog.satair.com/5-aviation-data-platforms-to-keep-your-eye-on]

The platform is used by over 100+ airlines all across the globe, contributing to a vast and industry-wide data pool from which airlines and operators can utilise in the operations.

Honeywell Forge. The data analytics platform Honeywell Forge spans across several industries but was released for the aviation industry in 2019.

The platform provided predictive health monitoring capabilities through the collection, cleaning and analysis of streams of diverse data. This data is collected and aggregated based on its source—for example, aircraft, airport, government or general Honeywell sources.

The platform promises real-time insights and aircraft health data to improve an airline's understanding of its fleet, profitability and passenger experience.

AVIATAR. Lufthansa Technik, one of the world's leading MROs (Maintenance, Repair and Overhaul), is on the front line of innovation and well on the road to what's becoming known as MRO 4.0.

The company made waves when they launched their cloud-based digital aviation platform AVIATOR in 2017, and the progress on the project has been ramping up ever

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since. What started after an 18 month development period, and launched with seven apps that covered things like fault analytics, condition monitoring, and performance metrics, has grown into fully fleshed out aircraft health monitoring system which provides real-time support for complex fleet management and forecasting.

Contrary to the "under-lock-and-key" culture that is more common throughout the industry, AVAITAR allows more personal freedom with how it is used, even going so far as making a software development kit available to all airlines and potential partners.

Flight Deck. Beep Analytics' Flight Deck platform aims to compile a lot of data that originates from the supplier itself—data that relates to the aircraft, who are the MROs that are working on the components, how much aircraft is flying, etc.

This aviation data platform then aggregates and sorts all the data. It blends all the information together, to create insights on how the marketplace for a supplier looks. It shows what parts of the market the supplier is covering, and what part of the market they are not and could expand into.

It also shows who the competitors are, and where their strengths and weaknesses are—in regards to covering the aftermarket. It helps them to build the background data that they need to do better supply chain planning.

Enspan. Development on this supply chain digital ecosystem began as Parts Pedigree in partnership with Deloitte in 2018. Since then, the company, now called Enspan, has expanded its focus to encompass more supply chain industries, but narrows the focus of its Parts Pedigree solution is what they described as "mobile app solution that provides parts history, track and trace capability and stores digital documentation on a part chronology which creates a 'digital logistical twin."

And these are just some examples of digital platforms in the aviation industry. If the existing trends continue, then every day they will become more and more, with new aims and, possibly, new technologies.

Conclusion. Today it is taken for granted that the world is moving to digital reality. Information is becoming one of the world's main resources, and ways of monetizing it play a decisive role for business. The digital data and platforms are drivers of digitalization. The idea of platforms is far from new, it has its origins in ancient markets and bazaars. But now platforms became digital. Digital platforms are online businesses that facilitate commercial interactions between at least two different groups—with one typically being suppliers and the other consumers. Platforms have grown for several reasons, including increases in Internet adoption, the maturation of the online advertising industry, and the growth of cloud computing. A rapid rise in smartphone ownership also has provided consumers greater access to platforms.

Digital platforms enable much of the digital economy. Globally, platform companies have a combined market capitalization of $2.6 trillion [19], and they have a wide-ranging impact on businesses, workers, and consumers. Digital platforms make it easier for companies to find customers, monetize underutilized assets, and reduce transaction costs. Digital platforms have many pro-competitive effects, such as reducing barriers to entry and making it easier for small, flexible suppliers to reach consumers. By reducing the fixed costs needed to participate in the market, digital platforms also reduce prices and increase consumer choice.

The aviation industry certainly does not stand aside from today's digital transformation. The ability of new technologies to aggregate customer data, combined with a constantly connected consumer base, provides incredible potential.

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EVENTS AND SCIENTIFIC CONFERENCES

Marcin PAWĘSKA
The International University of Logistics and Transport in Wrocław (Poland)

THE JUBILEE INAUGURATION OF THE 2020/2021 ACADEMIC YEAR
at
The International University of Logistics and Transport in Wrocław

On October 5, 2020, the solemn, hybrid inauguration of the 2020/2021 academic year (Photos 1 - 3) took place, beginning the celebration of the 20th anniversary of teaching and research activity at **the International University of Logistics and Transport in Wrocław** (the IULT).

Photo 1 – The University's Authorities during the inauguration of the academic year
Source: the IULT's resources

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Photo 2 – The speech of his Magnificence The Rector, dr Marcin Pawęska, the Professor at the IULT
Source: the IULT's resources

Photo 3 – Gaudeamus Igitur
Source: the IULT's resources

The IULT in Wrocław was established in 2001. The need to set up this type of facility resulted mainly from the fact that there were no universities providing education in the profession of logistics in Poland. When creating the University, the Founders assumed their mission as educating managers prepared to manage modern logistics processes, ready to work in conditions of cooperation in an integrated Europe. The mission was supported by French partners, and the **creation of the International University of Logistics and Transport in Wrocław**, together with the French university, was awarded the prize of French Prime Minister Jean-Pierre Raffarin (Photo 4.).

Photo 4 – The French Prime Minister's award ceremony
Source: the IULT's resources

This distinction was one of the five awarded to international projects with French participation, but the only one in the field of education. The award is all the more valuable as 92 projects from all over the world were submitted. By way of elimination, the undertaking to establish the IULT in Wrocław took the first place awarded in Paris in 2003.

Owing to the cooperation with a strategic partner, the University of Lorraine in France, as well as universities and institutions from all over the world, the IULT educational program provides knowledge and qualifications in the field of logistics, transport and forwarding at the European level. The University, as a private university subordinate to the Minister of Science and Higher Education (currently the Minister of Education and Science), operates on the basis of *the Act of June 26, 1997 (Journal of Laws No. 96, item 590, as amended)*.

The education process at the University takes place within the first and second cycle studies. In 2007, the University succeeded in obtaining the possibility of conducting second-cycle (Master's) studies at

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major Logistics. The IULT in Wrocław was the first university in the country to be authorized to conduct Master's studies in the field of logistics.

Currently, the following **logistics majors** are offered at the IULT:

– *I cycle Bachelor's studies* that last 6 semesters, in specializations: Purchasing Logistics, Trade and Distribution Logistics, Production Logistics, Logistics Systems and starting from the current academic year 5 new specializations have been launched: Humanitarian Logistics, Aviation Logistics, Waste Logistics in Automotive Industry, Supply Chain Management in Automotive Industry, and Transport Security;

– *I cycle Engineer's studies* that last 7 semesters, in specializations: Automation and Warehouse Systems Maintenance and Information Systems in Supply Chain;

– *II cycle Master's studies* that last 3 semesters, in specializations: Supply Chain Manager, Production Logistics Manager, Transport Manager, Life-Saving Processes Logistics, Security Logistics and Uniformed Services Logistics.

Moreover, the University realizes the following I cycle studies:

– *Bachelor's* that last 6 semesters, at major Management – in specializations: Enterprise Management, Product Management, Crisis Management, Project Management, Management in Automotive Management;

– *Bachelor's* that last 6 semesters, at major Transport – in specializations: Forwarding and Transport Insurance, Transport Company Management, Organizing Special Transports, Rail Transport Management;

– *Engineer's* that last 7 semesters, at major Civil Engineering – in specializations: Road and Bridge Construction, Railways.

After obtaining the diploma, graduates can take advantage of the rich offer of 11 specialized postgraduate studies organized and conducted by the University.

The education of students is carried out by highly qualified, experienced academic teachers from Poland and abroad, as well as practitioners in the areas of logistics and transport.

The university has modern laboratories supporting education in the following areas: logistics engineering, basic technical problems, computer technologies and construction, including, among others, the ones with the use of RFID technology and 3D printers. Currently, laboratories are being created, where classes will be carried out as part of the new logistics specializations.

The IULT was the first in Poland to introduce the system of dual studies. The practice has shown that the offer of dual studies is a very attractive proposition for students who participate in full-time education 3 days a week (Monday, Tuesday, Wednesday), and who take part in paid internships in companies cooperating with the University 2 days a week (Thursday, Friday). The internship fee fully covers the tuition fees.

Thanks to modern technical solutions, the University is fully prepared to conduct classes and defend diploma theses and exams in the on-line system. Students have constant access to a modern e-learning platform, to all resources of the university library, the EBSCO Harvard Business Publishing database, and free De Gruyter e-books. All these undertakings and solutions are also a very practical educational tool in crisis situations.

The IULT in Wrocław is the only university in Central and Eastern Europe that has been accredited by the British logistics institute, i.e. The Chartered Institute of Logistics and Transport (CILT) for the field of Logistics - first-cycle Engineering and undergraduate studies, as well as Master's studies. This distinction confirms the high standards of education and the continuous increase in its level. CILT is an organization associating 33,000 TFL specialists in over one hundred countries. Graduates of Logistics studies receive a certificate issued by CILT (UK), which is an additional advantage on the labour market.

The University was the organizer of the largest CILT congress, attended by over 400

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people from the world of science and business from over 100 countries.

As part of its scientific activity, since the academic year 2002/2003, the International University of Logistics and Transport in Wrocław has published over 70 own specialist textbooks, monographs and conference materials from periodically organized international conferences, and since 2004 it has been publishing the scientific journal in English.

The university obtains funds from domestic and foreign funds. Projects include activities in the field of education, research, entrepreneurship support, career counselling. Projects are implemented / being implemented, among others under operational programs POWER and RPO, financed by The National Centre for Research and Development (Polish: NCBiR), Polish National Agency for Academic Exchange (Polish: NAWA), Marshal's Office for the Lower Silesia Region (Polish: UMWD), The Ministry of Science and Higher Education (Polish: MNiSW), The Ministry of National Education (Polish: MEN), The Lower Silesian Regional Employment Agency (Polish: DWUP). This results in paid internships in reputable partner companies, aimed mainly at the development of professional competences important from the point of view of employers, support for practical skills, study visits in leading industry companies, career counselling and improving competences through certified industry courses.

The activity of the IULT is noticed and highly appreciated by recognized assessment and certification bodies as the one oriented towards business and industry, providing logistics companies with trained professionals in the Transport - Forwarding - Logistics (TFL) industry.

The University has received distinctions in the report of the international Organization for Economic Co-operation and Development (OECD) as the one providing logistic companies with trained professionals.

According to the Perspektywy 2020 Ranking of Private Universities, the International University of Logistics and Transport in Wrocław is the best logistics university in the country. Ranking of Private Universities - Perspektywy 2020, is one of the most prestigious and authoritative educational rankings in Poland. The ranking reflects all the important functions of universities: research, teaching, social and knowledge transfer, and also takes into account the economic fate of graduates. Among all non-public universities in Lower Silesia participating in the qualification, the IULT in Wrocław received the highest marks in such areas as: employers' preferences, academic staff with the highest qualifications, the effectiveness of obtaining external funding for research and internationalization. The high position in the Perspektywy 2020 Ranking is a confirmation of the University's commitment to the implementation of education in accordance with modern academic standards, and also proves the highest quality of studies and places the university among the leaders on the Higher Education market.

The Central National Certification Bureau awarded the University with the title of "**THE UNIVERSITY OF THE YEAR 2020**". The aim of the program implemented by the Central National Certification Bureau is to select and award the best universities.

The IULT has been awarded the **University of Leaders 2020** certificate for the 10th time as the best non-public university in Poland. The IULT is the only non-public, university in Lower Silesia to be certified in this edition.

The University is also a laureate and holder of the "The Prospective Studies" Certificate and Quality Mark in the field of LOGISTICS for first-cycle studies. The accreditation certificate has been awarded to a field of study that stands out from the fields of study of other universities, creates opportunities for the development of professional skills which are valued today by employers, and meets the following criteria:

— is distinguished by the concept of education and high quality of the program of study,

— is adapted to the needs of the labour market and the expectations of the socio-economic environment of the university,

— provides students with current knowledge and develops their skills and social competences, uses modern didactic methods in the curriculum.

Having such a prestigious accreditation proves the highest quality of studies, and also places the University among the leaders in the Higher Education market.

The Polish Accreditation Committee assessed in detail the activities of the IULT in accordance with the applicable program evaluation procedure. The commission assessing the degree of fulfilment of individual criteria has acknowledged seven of them as very well met, and the criterion of internationalization of education at an outstanding level.

The IULT in Wrocław cooperates with over 60 logistics institutions and companies as well as 38 universities around the world. The cooperation covers a number of activities, including teacher exchange, student exchange, organization of scientific conferences and implementation of scientific and didactic projects.

As part of the international cooperation, only in the 2019/2020 academic year, despite the pandemic, 60 open lectures were organized by scientists and logistics practitioners, including from the following countries: the Philippines, the UK, France, China, India, the United States, Ukraine, Germany, Slovakia, Morocco, Armenia, Poland, Ghana, Kosovo, Albania, Russia and New Zealand.

Last academic year, 87 student and academic teacher mobilities to the following countries were carried out under ERASMUS + programs: Armenia, Belarus, China, France, the Philippines, Georgia, Ghana, Gabon, the Netherlands, Spain, India, Kosovo, Lithuania, Lesotho, Mongolia, Portugal, Peru, Ukraine, Uzbekistan, Slovakia, the USA, Turkey, Hungary, Vietnam, Russia.

Photo 5 – NAU – following the cooperation agreement
Source: the IULT's resources

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As far as the cooperation with foreign universities is concerned, the one which is considered to be very precious and effective is the collaboration with NAU in Kiev (Photo 5).

Apart from various forms of joint activity with NAU, we carry out, the following projects:

– **An Integrated University Development Program as a Guarantee of Students' Success** - a project co-financed by the European Union. It assumes the preparation and implementation of 5 new specializations in the field of logistics at the I cycle studies, including the specialization Aviation Logistics;

– **Master in Logistics 2.0** - project financed by the National Agency for Academic Exchange under the Academic International Partnerships program. The aim of the project is to create new tools for distance learning at the master's level in the field of logistics, including the development of complete programs of 22 courses from the Master in International Logistics program in English, in the e-learning version, and the development of four models and case studies in the field of international logistics, which will be used in individual seminar works. The project is implemented in an international partnership of 9 universities, including NAU, which is the co-author of some of the programs.

– **II Cycle Logistics Studies** - a project financed by the National Agency for Academic Exchange under the Catamaran program, including joint international master's studies.

There is a widespread belief at the University that cooperation with NAU brings positive results for each party.

Summarizing the above considerations and the facts cited, it should be stated that The IULT is a modern university for students and an attractive partner for cooperating institutions. This is evidenced by the fact that: graduates of The IULT can count on employment with the best employers in the TFL industry around the world; 97% of students and graduates remain professionally active, 86% of them find jobs in specialist positions in companies in the sector; students win international competitions and Olympiads; The University is friendly to students, partners and the region.

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XIII International Scientific and Practical Conference
"MARKETING AND LOGISTICS IN THE SYSTEM OF MANAGEMENT"
at
Lviv Polytechnic National University

On October 22-24, 2020, the XIII International Scientific and Practical Conference "MARKETING AND LOGISTICS IN THE SYSTEM OF MANAGEMENT" was held at Lviv Polytechnic National University, dedicated to the 75th anniversary of the Department of Marketing and Logistics.

The Department of Marketing and Logistics, together with co-organizers and with support of partners has been holding the International Scientific and Practical Conference "Marketing and Logistics in the System of Management" every two years since 1996.

The conference participants are scientists, teachers, post-graduate students, students of higher educational institutions of Ukraine, as well as universities in Poland, Germany, Slovakia, Estonia and other countries, representatives of business, authorities, entrepreneurs, etc.

The conference topics are always relevant and reflects modern economic trends and applied aspects of logistics and marketing practices implementation in Ukraine and the world.

The purpose of the conference: coverage of the latest theoretical and practical results on modern innovative technologies application in domestic and foreign enterprises operations, generalization and development of scientists' research results on current trends and prospects for marketing and logistics in nowadays environment.

The conference was held in a remote format under the existing quarantine conditions. More than 180 scientists took part in the work of the international conference this year, including representatives of higher educational institutions from many regions of Ukraine and participants from different countries - Germany, Poland, Estonia, Lithuania, Belarus, Slovakia, Great Britain, Turkey, Tajikistan.

The working languages of the conference were Ukrainian, English, Polish and German.

Modern market trends, actual problems of marketing management, logistics processes management efficiency improvement vectors were considered during the speeches of the conference participants.

International conference participants' reports were discussed at the plenary session and section meetings. The Sections were held in two thematic areas.

Section 1. Logistics and Supply Chain Management (within the framework of the project Logistics and Supply Chain Management: Dissemination of the European Experience (610856-EPP-1-2019-1-UAEPPJMO-MODULE).

Taking into account the actual problems of the modern economy and the need to generate innovative logistics solutions with the aim of adaptation to rapidly changing external conditions, the areas of the Section's work were: 1) Logistics and supply chain management. Ukrainian enterprises in global supply chains. Logistic concept of using the

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transit potential of the country. Implementation of the best European and world practices in Ukraine; 2) Adaptation of the logistics activities of enterprises to the modern challenges of the world economy. Sustainable development of logistics systems in a pandemic; 3) The impact of the digital economy on the adoption of logistics decisions.

Scientists, teachers, post-graduate students, students had the opportunity to gain valuable information about the best European practices and experience in the field of logistics and supply chain management, and the wide geography of the conference participants will facilitate the deepening of cooperation and establishing closer relationship with partners from other countries.

An offline round table was held within the framework of the section "Logistics and Supply Chain Management: Dissemination of The European Experience" on the topic: "Deregulation and liberalization of the transport services market of Ukraine".

Section 2 "Marketing support for the development of systems of various integration levels in the context of modern challenges" organized work in the following areas: 1) Marketing: theory and practice; 2) Marketing in banking, insurance, investment activities; 3) Marketing solutions in non-traditional areas; 4) Marketing in the field of education.

There were reports that touched on the relevance of digital marketing and digital technologies in the operations of modern enterprises, considered the prerequisites for the formation of conscious behavior and the marketing aspects of social responsibility and conscious consumption. Marketers talked about the impact of the Covid-19 pandemic on modern business, ways out of the crisis by marketing tools adaptation to new realities, ways of enterprises survival in the post-crisis period. In addition, the participants discussed modern technologies in banking, opportunities for financial marketing and the possibilities of integrating marketing,

logistics and financial solutions in the educational sphere.

In total, about 40 reports were heard and discussed at the conference, in which the following problems were highlighted: theoretical and applied aspects of marketing and logistics, specifics of marketing and logistics activities of enterprises in the domestic and international dimensions, aspects of social responsibility in marketing and logistics, problems of supply chain management, the specifics of training specialists in marketing and logistics, new applied areas of marketing and logistics, modern digital marketing tools, problems of adapting the marketing and logistics activities of enterprises to the modern challenges of the global economy, aspects of the impact of the digital economy on consumer behavior, etc.

Owing to the efforts of the program and organizing committee of the conference, the event was successful.

Co-organizers and Conference Partners:

– State Institution «Institute of Regional Research named after M. I. Dolishniy of National Academy of Sciences of Ukraine»;

– Institute of Industrial Economics of National Academy of Sciences of Ukraine;

– Association "Ukrainian Logistics Alliance";

– Ukrainian Marketing Association;

– Cracow University of Economics, Poland;

– University of Social Sciences, Lodz, Poland;

– Technische Hochschule Ostwestfalen-Lippe University of Applied Sciences and Arts, Lemgo, Germany;

– West Saxon University of Applied Sciences, Zwickau, Germany;

– Maria Curie-Skłodowska University, Lublin, Poland;

– Poznań University of Technology, Poznan, Poland;

– Matej Bel University, Banská Bystrica, Slovakia;

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– Kaunas University of Technology, Kaunas, Lithuania;

– Heilbronn University of Applied Sciences, Heilbronn, Germany;

– Technological University of Tajikistan, Dushanbe, Republic of Tajikistan.

The results of the conference will become a reliable basis for initiation of interesting scientific debates and discussion around the problems of finding relevant solutions in order to ensure the effective development of marketing and logistics practices. Participation in the conference of both representatives of the academic community and representatives of government and business will contribute to the formation of high standards of education and training of specialists in Ukraine by introducing innovative approaches based on the synergy effect of education/science - business - government.

The Department of Marketing and Logistics thanks you for your interest in the conference, hopes for further fruitful cooperation and wishes health, inspiration and scientific achievements to all participants!

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Department of Logistics National Aviation University (Ukraine)

LOGISTICS - RELEVANT, GLOBAL, VIRTUAL AND REAL!

On October 23-24, 2020, the National Aviation University on the basis of the Department of Logistics held the 18th International Scientific and Practical Conference "Problems of training professionals in logistics in a global competitive environment", which was held this year in Internet format. In total, the conference was attended by 136 participants, including representatives of Italy, China, Moldova, Poland, Rwanda, the United States and other countries, as well as teachers and students from 16 universities in Ukraine:

- National Aviation University;
- Vasil' Stus Donetsk National University;
- Kyiv National University of Construction and Architecture;
- Lviv State University of Internal Affairs;
- Kharkiv Petro Vasilenko National Technical University of Agriculture;
- National Transport University;
- National University of Pharmacy;
- Pryazovskyi State Technical University;
- Lviv Polytechnic National University;
- Kremenchuk flight college of Kharkiv National University of Internal Affairs;
- National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute";
- Institute of Industrial Economics of the National Academy of Sciences of Ukraine;
- Cherkasy State Technological University;
- Kharkiv O.M. Beketov National University of Municipal Economy;
- Separate structural subdivision "Slavic Vocational College of the National Aviation University";
- Kyiv National University of Trade and Economics.

The conference was held under the scientific and methodological guidance of the Head of the Department of Logistics Professor Mariia Hryhorak.

The purpose of the conference is to assess the current state of training of bachelors, masters and highly qualified personnel in the educational and professional program "Logistics", exchange of experience in developing and implementing innovative methods of teaching logistics courses and training materials, discussing major trends in logistics science and practice. The plenary session was moderated by Deputy Director of the Institute of International Cooperation and Education of NAU Associate Professor Dmytro Bugayko and Associate Professor of Logistics Lidiia Savchenko.

Professor Volodymyr Kharchenko, Vice-Rector for Research of NAU, welcomed the conference participants, noting the relevance and role of the conference in the system of logistics training, as well as emphasizing the prospects for international educational and scientific cooperation of universities in the context of globalization.

Dean of the Faculty of Transport, Management and Logistics Professor Oksana Ilienko congratulated the conference participants, wished fruitful discussions and expressed hope that this year's conference opens new opportunities for unlimited scientific dialogue and will make a significant

contribution to further strengthening the relations between the National Aviation University and world logistics universities as well as logistics business environment and will improve the quality of educational and professional training of new generation of specialists for global, regional and national logistics.

The speech of the rector of the International University of Logistics and Transport in Wroclaw (Poland) Dr. Marchin Paweska was extremely interesting and thorough. His university is a leader in the training of Polish logistics personnel. Dr. Marcin Paweska dwelled on the 10-year cooperation with the National Aviation University and noted the prospects and feasibility of expanding cooperation in educational, scientific and methodological activities.

The report of the Deputy Director of the Institute of International Cooperation and Education of NAU Assoc Prof Dmytro Bugayko, which was devoted to proactive risk management in the field of civil aviation, provoked a lively discussion. Various scenarios for the development of the industry in the context of the COVID-19 pandemic and ways to counter its consequences were considered.

Head of the Department of Marketing and Logistics of the National University "Lviv Polytechnic" Professor Eugene Krykavsky presented his vision of trends and prospects for the development of logistics in Ukraine.

The high status of the conference was confirmed by the participation of one of the founders of logistics in the USSR and later in the post-Soviet space, Professor Leonid Mirotin. He came up with his own vision of basic terminology, concepts of logistics.

Volodymyr Kulyk, Professor of the Logistics Department of NAU, continued the discussion of the conceptual principles of logistics, substantiating the spiral dynamics of supply chains.

Further speakers – Petro Nikolyuk (Professor of Vasyl Stus Donetsk National University), Oleksiy Goryainov (Associate Professor of Kharkiv National Technical University of Agriculture named after P. Vasylenko), Oleksandr Krasnoshtan (Associate Professor of the National Transport University) and Yevhen Fedorov (Professor of Cherkasy State Technologies) - shared their latest research in the field of logistics training and solving current problems of logistics management.

The second day of the conference was held in the form of a student scientific forum "Youth creates the logistics of the future" within the frames of two professional conferences:

- 13th International Scientific and Practical Conference "Marketing and logistics in the management system" (Lviv, National University "Lviv Polytechnic" 22.10.2020) and

- 18th International Scientific and Practical Conference "Problems of training professionals in logistics in a global competitive environment" (Kyiv, National Aviation University, 23-24.10.2020) with the support of the Council of Professionals in Supply Chain Management.

The main purpose of the forum was to start the project of forming an ecosystem for training professionals of the future for the field of logistics and supply chain management. Due to this the forum gathered about 100 participants from 8 universities of Ukraine and the representatives of the CSCMP Ukraine Roundtable.

Vira Dobachevska, President CSCMP Ukraine RT and also CEO & Founder of Kyiv Logistics School, presented mission of the organization which is to promote supply chain professions through the interaction, training and development of Ukrainian supply chain management professionals throughout their careers and integrate them into the global CSCMP network, as well as engage global supply chains in Ukrainian business and economy. Main tasks, according to this, are the following:

– to be a leader in the development, definition, understanding and improvement of the supply chain and logistics management

profession, which is part of the world community.

– to increase value for members and customers by providing content, education, research, networking and transparent interaction.

– to ensure the application of good business practices for financial well-being.

CSCMP Ukraine RT supports youth projects and events, because they see our modern generation as interested in new knowledge and skills, proactive, effective, ambitious, effective in working with information and aware of opportunities in logistics and supply chains.

Margarita Romanova, Board Member at Large of CSCMP Ukraine RT, Head of Logistics and Distribution GSK in the Middle East / CIS region (12 countries), Leader of transformations in the Export region (ME / CIS / Africa), not only presented different opportunities for international certification programs of CSCMP, but also participated actively in the discussion.

Andriy Aleksieiev, Young Professional Chair of CSCMP Ukraine RT, Logistics Department Director in Milk Alliance Group, described all Young Professionals Initiatives of the council, which are devoted to the looking for talented students, who could be attracted to the industry. On the other hand, CSCMP Ukraine RT supplies career assistance and mentoring, debating society, internship and volunteer work. Andriy helped the students to understand main trends in job landscape, emphasized on top skills of 2025 and paid attention that all of them connected

somehow to logistics and supply chain management.

But not only the invited speakers were active, effective and informative. The youth proved to be as effective and productive as possible. Two teams of students were participating in scientific debates, showing the results of deep analyze of all aspects of the problems of green logistics prospects and smart logistics possibilities. The team of the Marketing and Logistics Department from National University "Lviv Polytechnic" was represented by Flyk Iryna, Prokopenko Karyna, Petryshyn Yaryna, Snitko Oksana, Synyshyn Roman, Kishchuk Vitalii and Petryk Tetiana. The team of the Logistics Department from National Aviation University was represented by Skotarenko Zakhar, Lakomova Mariia, Zhyhula Sofiia, Sirko Roksolana, Kuznietsov Nazar, Hordiienko Nastia and Krupyna Sofiia.

To conclude, all members of the forum, as well from the teachers' side, business side and students side, noticed that students have shown good analytical skills, critical thinking, ability to find out proper facts and figures to build the persuasive line of argumentation.

This year's conference proved that no pandemic or crisis can stop logistics and its apologists. Closed borders between countries encourage the involvement of information technology, in particular, Internet conferencing technology.

Based on the materials of the conference, the conference proceeding with 96 abstracts was published with the ISSN code 2617-7927 (print), 2617-7935 (online).

Scientific publication

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