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FORMATION OF AN INTELLIGENT CUSTOMER SUPPORT SYSTEM AS A COMPONENT OF INTELLIGENT LOGISTICS SERVICE ECOSYSTEM

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Mariia Hryhorak, Olga Karpun, Volodymyr Marchuk, Oleh Harmash. "Formation of an intelligent customer support system as a component of intelligent logistics service ecosystem". *The study analyzes the evolution of customer support systems in the logistics sector, which reflects the transition from traditional, reactive call centers to modern, integrated intelligent ecosystems. The work is based on a systems, process, and ecosystem approach, using methods of critical literature review, historical-logical, and comparative analysis to identify patterns in the development of service models.*

It is determined that the intellectualization of customer support is connected with the formation of a virtual business environment that integrates artificial intelligence, Big Data, and automation technologies. A conceptual model of an intelligent customer support system of logistics services (ICSSLS) is proposed as a multi-level structure that combines informational, analytical, operational, cognitive, and collaborative levels. It is emphasized that the ICSSLS fundamentally differs from traditional systems due to deep integration with other digital company services (CRM, ERP, TMS, WMS, etc.), the presence of self-learning mechanisms, and the ability to provide bidirectional feedback for optimizing logistics processes.

To evaluate the effectiveness of the ICSSLS, a set of metrics is proposed, including CSAT, CSI, NPS, SLA, CES, and IQS, as well as the level of automation. A practical analysis of the experience of leading international companies (Amazon, DHL and UPS) confirmed that the integration of such systems is a key factor in increasing transparency, effectiveness, and competitiveness.

The research also includes an analysis of the Ukrainian logistics services market (on the example of the companies Nova Poshta, Delivery, Zammler and Ukrposhta), indicating significant progress in digitalization, while also noting a lag in the level of implementation of AI analytics and service personalization compared to global benchmarks.

Overall, the research results prove that the ICSSLS is a strategic direction for the development of modern logistics companies. Its implementation not only optimizes operational processes but also creates long-term advantages, strengthening customer loyalty and the company's market position.

Keywords: intelligent ecosystem, logistics service ecosystem, intelligent logistics service ecosystem, intelligent customer support system, service metrics

Марія Григорак, Ольга Карпун, Володимир Марчук, Олег Гармаш. «Формування інтелектуальної системи клієнтської підтримки як складової інтелектуальної екосистеми логістичного сервісу». *У ході дослідження проаналізовано еволюцію систем клієнтської підтримки в логістичному секторі, що відображає перехід від традиційних, реактивних кол-центрів до сучасних, інтегрованих інтелектуальних екосистем. Робота ґрунтується на системному, процесному та екосистемному підходах, із застосуванням методів критичного аналізу літератури, історико-логічного та порівняльного аналізу для виявлення закономірностей розвитку сервісних моделей.*

Визначено, що інтелектуалізація клієнтської підтримки пов'язана з формуванням віртуального бізнес-середовища, яке інтегрує технології штучного інтелекту, Big Data та автоматизації. Запропоновано концептуальну модель інтелектуальної системи клієнтської підтримки логістичного сервісу (ІСКПЛС) як багаторівневої структури, що поєднує інформаційний, аналітичний, операційний, когнітивний та колаборативний рівні. Підкреслено, що ІСКПЛС принципово відрізняється від традиційних систем завдяки глибокій інтеграції з іншими цифровими сервісами компанії (CRM, ERP, TMS, WMS, тощо), наявності механізмів самонавчання та здатності забезпечувати двосторонній зворотний зв'язок для оптимізації логістичних процесів.

Для оцінки ефективності ІСКПЛС запропоновано комплекс метрик, що включають CSAT, CSI, NPS, SLA, CES та IQS, а також рівень автоматизації. Практичний аналіз досвіду провідних міжнародних компаній (Amazon, DHL, UPS) підтвердив, що інтеграція таких систем є ключовим фактором підвищення прозорості, ефективності та конкурентоспроможності.

Дослідження також охоплює аналіз українського ринку логістичних послуг (на прикладі компаній «Нова пошта», «Делівері», «Заммлер», «Укрпошта»), вказуючи на значний прогрес у цифровізації, але водночас відзначаючи відставання у рівні впровадження AI-аналітики та персоналізації сервісу порівняно зі світовими еталонами.

Загалом, результати дослідження доводять, що ІСКПЛС є стратегічним напрямом розвитку сучасних логістичних компаній. Її впровадження не лише оптимізує операційні процеси, а й створює довгострокові переваги, зміцнюючи клієнтську лояльність та позицію компанії на ринку.

Ключові слова: інтелектуальна екосистема, екосистема логістичного сервісу, інтелектуальна екосистема логістичного сервісу, інтелектуальна система клієнтської підтримки, сервісні метрики

Introduction. The modern logistics services market is characterized by high dynamism, intense competition, and rising customer expectations, which leads to increased demands for service quality. While speed and cost of delivery were once the key criteria, the focus has now shifted to a comprehensive customer experience, which includes transparency, information accessibility, service personalization, and integration with digital platforms. Clients expect continuous communication through convenient channels, prompt responses to inquiries, and the ability to independently track and manage logistics processes. At the same time, the spread of e-commerce and business globalization create additional pressure on logistics companies, forcing them to ensure not only the efficiency of physical transportation but also a high level of information and service support. The importance of parameters such as the accuracy of delivery forecasts, flexibility in choosing transportation conditions, adherence to service standards, and the possibility of integration with clients' IT systems is growing. As a result, service quality becomes a key factor in competitiveness, and a company's ability to combine innovative technologies with a customer-centric approach determines its market position and strategic development prospects.

Logistics processes in modern conditions are distinguished by high complexity and dynamism, which directly affects the quality and stability of logistics services. Their complexity is due to a multi-level structure that includes planning, transportation, storage, customs clearance, information support, and after-sales service. Each of these elements is closely interconnected, so even a minor failure at one stage can cause delays or additional costs at other stages or even throughout the entire chain. An additional factor of complexity is the integration of logistics with global trade networks and digital platforms, which requires coordination among various participants – carriers, warehouses, customs authorities, and trade and IT partners. At the same time, the complexity and dynamism of logistics processes manifest in constant changes in market demand, seasonal fluctuations, and unpredictable external circumstances, such as supply disruptions, military risks, or global crises. Modern clients expect service flexibility, the ability to quickly adjust delivery conditions, route adaptation, and a personalized approach to service. This requires logistics companies to have the ability to make quick decisions, use big data analytics systems, forecast risks, and apply artificial intelligence to optimize resources. Thus, the complexity and dynamism of logistics processes create a need for intelligent and integrated solutions that ensure not only the effective functioning of supply chains but also a sustainable competitive advantage in the market.

The need to intellectualize logistics service support processes is driven by both the growing volume and complexity of logistics operations and the increase in customer expectations for service quality. Traditional support systems, based on standard algorithms and predominantly

manual request processing, are no longer capable of providing the necessary level of speed, flexibility, and personalization. In modern conditions, clients seek instant responses to their inquiries, access to complete and up-to-date information on the status of their shipment, and the ability to independently manage logistics services in a convenient digital environment. This requires the implementation of intelligent solutions that use artificial intelligence, machine learning, big data analysis, and business process automation. Intellectualization allows for increasing the efficiency of contact centers through the use of chatbots and voice assistants, reducing the number of routine operations, and freeing up resources to solve complex and individualized tasks. In addition, the use of predictive analytical models helps to timely identify potential problems, minimize the risk of delays, and increase customer satisfaction. At the same time, intelligent systems can accumulate and analyze the experience of interacting with customers, forming a knowledge base for improving service and increasing its personalization. Thus, the intellectualization of support processes becomes not only a tool for the operational resolution of inquiries but also a strategic factor in the development of logistics companies, ensuring their competitiveness, resilience to change, and capacity for innovative growth.

The necessity of an ecosystem approach to organizing logistics service customer support is due to the fact that modern logistics functions not as an isolated set of operations but as a complex network of interacting participants, digital platforms, and services, united in a single space for creating value for the customer. Traditional support models, focused only on solving individual inquiries, do not take into account the interdependence between the elements of the logistics chain and do not provide adequate flexibility and scalability in a dynamic environment. In contrast, the ecosystem approach allows for viewing customer support as an integrated component of the logistics ecosystem, where the key elements are action coordination, continuous information exchange, and the joint use of digital tools. The formation of logistics ecosystems, where carriers, warehouses, customs and financial structures, and trade and IT partners interact, creates the prerequisites for comprehensively satisfying customer needs, from ordering a service to after-sales support. In such a model, customer support ceases to be an auxiliary element and transforms into a strategic center of interaction that ensures process transparency, operational responsiveness, and service personalization. In addition, the ecosystem approach contributes to increasing the resilience of logistics systems to external challenges, as it allows for quickly restructuring supply chains, integrating new partners, and implementing innovative solutions.

In global practice, examples of such solutions are demonstrated by companies like Amazon, DHL, and Maersk, which combine digital platforms, predictive analytics, omnichannel interfaces, and personalized customer support. In Ukraine, similar approaches are being actively implemented by postal and logistics operators Nova Poshta, Meest, and Delivery, although their level of integration is currently inferior to global benchmarks. This confirms both the relevance of the ecosystem approach and the research gap in the scientific understanding of intelligent customer support systems for logistics services.

It is also important to emphasize that the development of such systems is taking place in the context of the global Industry 5.0 concept, which foresees the harmonious combination of technological innovations with a human-centric approach. It is precisely these intelligent customer support ecosystems that become a strategic element of this process, as they ensure personalized interaction, service adaptability, and the ability of companies to respond quickly to the challenges of a dynamic market. Therefore, the study of intelligent customer support

ecosystems is not only relevant but also necessary for increasing competitiveness and ensuring the sustainable development of logistics companies in the future.

Literature and researches review. The evolution of customer support systems in logistics reflects a gradual transition from traditional models to integrated digital solutions. Classical approaches were based on contact centers and manual request processing, where the key efficiency criteria were response speed and information accuracy [1]. With the development of digital technologies, omnichannel services, online tracking, and CRM systems have emerged, allowing customers to receive personalized information in real-time and independently manage logistics processes [2, 3, 4]. As M. Lamberjohann and B. Otto note, modern supply chain management practice demonstrates a gradual shift towards logistics ecosystems, where the interaction between participants is decentralized and focused on joint value creation [5].

The concept of service and business ecosystems is viewed in academic research as a synthesis of mechanistic and organic management approaches. J. Moore [6] and R. Adner [7] emphasize the importance of participant co-evolution and the dynamic capabilities of enterprises, which allow them to adapt their competencies to changes in the external environment. Instead of traditional competition, mutually beneficial cooperation gains importance in ecosystems, allowing for the substitution of scarce resources. The materialization of the value proposition occurs through a "structure of alignment" – the formation of a circle of partners with a shared vision and goals. Business ecosystems create value through decentralized social bonds and informal interconnections, integrating systemic logic and sustainable development [8, 9].

An important feature of modern ecosystems is their digitalization. S. Trimi and S.M. Lee proposed the concept of an innovative platform ecosystem that unites people, objects, technologies, and ideas [10]. It functions as a self-organizing mechanism for problem-solving and value creation based on end-to-end digital technologies – Artificial Intelligence (AI), the Internet of Things (IoT), Big Data analytics, e-learning, and more. Some scholars focus on automated problem-solving and value creation using artificial intelligence, big data analytics, and the Internet of Things [11, 12]. This approach demonstrates that business effectiveness increasingly depends on an organization's ability to engage in integrated and interactive activities within a digital environment. Digitalization not only accelerates the speed of logistics processes but also enhances the convenience and effectiveness of interaction. Mikl J. et al. highlighted that the speed of adaptation to digital technologies in logistics networks and ecosystems is a critical competitive advantage [13]. Logistics 5.0 promises to accelerate the paradigm shift towards intelligent and sustainable logistics and the formation of logistics ecosystems aimed at achieving the "6S" goals: safety, security, stability, sensitivity, service, and smartness in the logistics industry [14, 15, 16].

It should also be noted that Industry 5.0 stimulates the application of artificial intelligence, big data analytics, machine learning, and digital platforms in customer interaction processes, which allows not only for the automation of routine tasks but also for anticipating consumer needs, personalizing services, and increasing satisfaction levels [17].This approach creates an intelligent support environment where humans and technology function synergistically: technology provides fast analysis and forecasting, while humans make strategic decisions, handle non-standard situations, and create a unique customer experience [18, 19]. The literature emphasizes that the intellectualization of service support in the context of Industry 5.0 contributes to the formation of a new type of logistics ecosystem, where key performance indicators are closely linked to companies' digital capabilities and their ability to integrate the diverse resources and competencies of supply

chain participants [20, 21]. In their research on the development strategies of intelligent logistics systems, Ma Q. et al. (2024) drew attention to the fact that e-commerce has been the growth driver of interest in them [22].

In the logistics sector, the concept of ecosystems takes on special significance. Logistics providers, including 3PL, 4PL, and 5PL operators, are becoming drivers of digital innovations in supply chains [23, 24, 25]. The authors [26] argue that the formation of logistics networks involving 4PL providers allows for leveraging the core competence of the logistics business and implementing "service corrections" during the service innovation process. This helps in developing an industry value transfer strategy to achieve greater business revenue. Studies of Amazon's interaction with its 3PL partners show that strategic collaboration and innovative contracts create mechanisms for co-generating value, going beyond simple commercial transactions [27]. At the same time, the integration of AI, IoT, and blockchain technologies enhances the efficiency and resilience of logistics operations, promoting adaptability and resource optimization [28].The analysis of logistics process digitalization demonstrates that technologies not only accelerate the execution of operations but also ensure better interaction among participants in goods movement chains and increase customer satisfaction across different segments of the logistics services market [29, 30, 31, 32, 33].

Despite significant achievements in implementing the ecosystem approach, there are certain gaps in the scientific literature. In particular, there is a lack of systematic research on the integration of customer service support within logistics ecosystems. Most studies focus on the optimization of physical flows, resource management, and innovative technologies [34, 35, 36], but the service component – contact centers, omnichannel platforms, intelligent inquiry analytics – has not been sufficiently systematized. The development of digital technologies, e-commerce, and global markets has changed consumer expectations: today, clients demand a personalized approach, process transparency, service integration, and the ability to self-manage their orders [37, 38]. In modern logistics ecosystems, customer-centricity becomes a central value. Its integration with technological and process solutions determines the effectiveness of the entire ecosystem and its capacity for innovative development and resilience in a volatile market environment [39]. Identifying and addressing this gap is a relevant task for modern research, as the integration of intelligent services into logistics ecosystems can provide competitive advantages and sustainable company development.

Thus, the literature analysis confirms the gradual transition from traditional customer support models to integrated intelligent solutions, highlights the role of digitalization and the ecosystem approach in logistics, and at the same time reveals a gap in the systematic study of service support within logistics ecosystems. It is this gap that the current study is intended to fill.

Aim and objectives. The purpose of this study is to analyze and conceptualize an intelligent customer support system in logistics ecosystems, taking into account the trends of digitalization, intellectualization, and growing demands for customer-centricity, as well as to substantiate the methodological approaches for evaluating its effectiveness.

To achieve this purpose, the work addresses several interconnected objectives:

– to analyze the evolution of customer support systems in logistics and identify the key development trends of service models in global practice;

– to investigate the theoretical foundations and practical aspects of an ecosystem approach to the organization of logistics services;

– to determine the role of intelligent technologies (AI, Big Data, blockchain, automation, chatbots, predictive analytics,

etc.) in increasing the effectiveness of customer support;

– to build a conceptual model of an intelligent customer support system within logistics ecosystems;

– to substantiate the methodological approaches for evaluating the effectiveness of intelligent customer support using modern metrics (CSAT, CSI, NPS, SLA, IQS, CES, and the level of automation).

Research methodology. The research methodology is based on a systems, process, and ecosystem approach to analyzing customer support in logistics services. The study used a complex of general scientific and special methods. The theoretical foundation is a critical analysis of scientific literature on the development of logistics, service models, the intellectualization of business processes, and the formation of digital ecosystems. To identify the patterns of customer support evolution, a historical-logical method was applied, which allowed tracing the transformation of service systems from traditional call centers to intelligent ecosystems. The method of comparative analysis was used to compare the approaches of leading international logistics operators (Amazon, DHL, UPS, DB Schenker) and to identify the common and distinctive characteristics of their customer support models. A systems approach was used to view customer support as an integrated part of logistics ecosystems, within which carriers, warehouses, IT partners, and end-users interact. To build a conceptual model of an intelligent customer support system in logistics ecosystems, the modeling method was used, which allows for formalizing the relationships between participants in the service environment and digital technologies (AI, Big Data, blockchain, analytics and automation). The method of generalization was also applied to formulate conclusions about the development trends of service models and the prospects for their intellectualization. The practical aspect of the methodology is based on the analysis of best practices in the functioning of logistics companies and their digital support services, which provides an opportunity to test theoretical provisions in real business conditions.

Results, analysis and discussion. A review of scientific publications confirmed that customer support systems in the logistics industry have constantly changed, and their evolution reflects a gradual transition from simple reactive service mechanisms to integrated intelligent platforms that ensure personalized interaction and the optimization of logistics processes. This development can be conditionally divided into several key stages:

1. The first stage is characterized by traditional support systems that functioned primarily as call centers. Customer inquiries were processed manually, and the main tools were the telephone, fax, and email. The system had a linear "request-response" structure and limited integration with operational logistics processes. Interaction with the client was mostly reactive, and data analysis was minimal or non-existent.

2. The second stage is associated with the implementation of electronic Customer Relationship Management (CRM) systems, which made it possible to centrally store the history of inquiries, automate simple request processing scenarios, and improve communication through electronic channels. At this stage, the possibility of partial analytics and statistical quality control of service appears, but the systems remain limited in predicting needs and integrating with logistics processes.

3. The third stage is characterized by the implementation of automated and intelligent support systems, including chatbots, interactive portals, and analytical modules. At this stage, natural language processing (NLP) and machine learning algorithms begin to be applied for classifying inquiries, prioritizing them, and automatically generating responses. The systems are able to partially predict problems, integrate with internal logistics platforms, and provide faster and more personalized service.

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4. The fourth stage is the modern intelligent customer support system of logistics services (ICSSLS), which function as part of an integrated service ecosystem. They combine a multi-level architecture, analytical data processing, cognitive learning, and integration with the logistics network. At this stage, collective value creation, a closed feedback loop, dynamic adaptation to market changes, and the forecasting of customer needs are ensured. The systems can automatically optimize internal processes, routing, and inventory management, combining operational efficiency with a high level of customer satisfaction.

Thus, the evolution of customer support systems in logistics reflects a gradual development from manual, isolated, and reactive mechanisms to integrated intelligent ecosystems capable of providing personalized service, strategic optimization of logistics processes, and adaptation to a dynamic market environment. Table 1 contains the results of a comparative analysis of customer support business models that reflect the identified stages and features of providing logistics services to clients.

Each of the described business models has its own advantages and disadvantages. We are drawn to the point of view of [40], that the modern logistics services market represents an intertwined network of service providers, products, and additional innovations that may belong to different sectors of the economy and may not be bound by contractual agreements. This complex system of interactions leads to the formation of ecosystems that differ from one another, each with unique interconnections and interdependencies.

Table 1 – Comparative analysis of customer support models in logistics

Business Models	Description	Key features	Advantages	Disadvantages
Traditional Insourcing (1PL)	Complete internal logistics organization by the company	Own transport, warehouses, personnel	Full control, high flexibility	High capital costs, limited scalability |
Outsourcing (3PL)	Transfer of part or all logistics functions to a third-party provider	Specialized services for transportation, storage, order processing	Cost reduction, access to expertise	Reduced control, vendor lock-in
Integrated Platform (4PL)	Management of all logistics processes through a single platform	Supplier coordination, IT systems integration, strategic supply chain management	Process optimization, strategic management	Difficult to implement, high cost
Intelligent System (AI/ML)	Using artificial intelligence and machine learning to automate support	Chat bots, demand forecasting, service personalization	Fast request processing, cost reduction	Data requirements, potential technical failures
Hybrid Models	Combination of different approaches to achieve optimal results	Combination of internal resources, outsourcing and technology	Flexibility, adaptability	Difficult to manage, integration challenges

Let's consider the features of intelligent systems in more detail. We believe that the intellectualization of logistics is associated with the formation of a virtual business environment that involves industry-wide interconnectedness, shared use, and symbiosis of digital technologies through the automation, visualization, and digitalization of logistics services. In this case, an intelligent ecosystem will be understood as a complex of interconnected participants (people, organizations, technologies, and processes), united by a digital infrastructure and AI-based technologies that ensure self-adaptation, self-learning, and real-time decision-making to achieve a common goal. Based on this

definition, we can identify the main features of intelligent ecosystems:

– continuous collection, integration, and analysis of large volumes of data (Big Data);

– application of AI, ML, NLP, blockchain technologies, generative models, and predictive analytics;

– the system's ability to change algorithms and decisions without manual intervention;

– integration with physical processes of goods movement using IoT, sensors, digital twins, etc.

In logistics, an "intelligent ecosystem" refers to a network of knowledge, innovation, and technology that supports and stimulates the effectiveness and efficiency of logistics operations. It encompasses the development and application of new ideas, data analysis, and technological achievements to optimize processes, improve decision-making, and enhance overall efficiency in the logistics industry.

In the development of intelligent logistics ecosystems, digital technologies play a key role, as they ensure the integration of participants, process transparency, and flexibility in service provision. Digitalization allows for the transformation of logistics systems from traditional operational structures into intelligent networks that operate in real-time and can adapt to changes in the environment. The use of tools such as the Internet of Things provides continuous monitoring of goods, transport, and warehouses, creating the conditions for precise tracking and control. Cloud platforms and API solutions facilitate the integration of various participants in the logistics chain, ensuring rapid information exchange and coordinated actions. No less important is the use of big data analytics and artificial intelligence, which allow for forecasting demand, optimizing routes, identifying potential risks, and forming personalized offers for clients. Thanks to this, logistics companies can quickly react to changes in demand, ensure planning accuracy, and increase the level of customer satisfaction. At the same time, blockchain technologies contribute to increasing trust and security, as they ensure the transparency and immutability of data about all stages of the logistics process. In addition, digital technologies create the basis for the development of omnichannel customer support, where interaction with the client occurs through various channels – mobile applications, chatbots, virtual assistants, or integrated online platforms. This creates a seamless customer experience and allows for combining the physical and digital components of the service. Thus, digital technologies in intelligent logistics ecosystems perform not only an instrumental but also a strategic function: they become the basis for integrating participants, automating processes, forming customer-oriented service models, and ensuring the competitiveness of companies in the global environment.

Therefore, we can define the intelligent logistics service ecosystem as a dynamically integrated environment for the interaction of clients, logistics operators, partners, and digital technologies. In this environment, key business processes of customer support and supply management are carried out using artificial intelligence, big data analytics, and the Internet of Things, which ensures the automatic adaptation of the service to changes in external and internal conditions in real-time to increase the efficiency, personalization, and stability of logistics operations. An indispensable component of such an ecosystem is the customer support subsystem (a lower-level ecosystem), as its functioning directly affects the efficiency of logistics processes and the level of satisfaction of end-users. While the intelligent logistics service ecosystem covers the strategic management of material and information flows, route planning, demand forecasting, inventory optimization, and coordination of the activities of supply chain agents, the customer support ecosystem focuses on direct interaction with service users, ensuring a prompt response to

inquiries and problems, and on personalizing the service based on analytical data processing. The relationship between these systems lies in the fact that the information collected and analyzed within the framework of customer support serves as a critically important source for optimizing the logistics network. Data on delivery delays, problematic cargo operations, or recurring user inquiries allow for improving demand forecasting, optimizing routes, and inventory management, which directly increases the efficiency of the overall logistics ecosystem. In turn, the efficiency of logistics processes determines the speed and quality of the response to customer inquiries, forming a feedback loop and ensuring a cyclical learning process for both systems.

The practical implementation of the described approach is the activity of the international logistics operator DB Schenker, whose logistics ecosystem covers a wide network of integrated transport and service solutions. It includes ground, air, and sea transportation, contract logistics, and supply chain management with a high level of process digitalization. A feature of this ecosystem is its focus on comprehensive service for clients from various industries – from automotive and high-tech to pharmaceutical and consumer. DB Schenker actively implements digital platforms and intelligent solutions that allow for transparent cargo tracking, risk forecasting, and route optimization in real-time. The company also develops an omnichannel customer support system that provides fast communication, personalized services, and integration with the information systems of clients. An important strategic priority of DB Schenker is sustainable development, which is realized through investments in environmentally friendly transport solutions, renewable energy, and innovations in the field of "green" logistics, in particular the use of electric trucks, biofuels, and energy-efficient warehouses. Such an approach not only forms the company's competitive advantages but also contributes to increasing the stability of the entire logistics ecosystem. The general structure of this ecosystem is presented in Fig. 1, which shows the interrelationship of transport, information, and service components integrated into a single customer-oriented space.

DB Schenker acts as a central hub, uniting various stakeholders in the logistics ecosystem, including manufacturers, suppliers, distributors, and end-clients. They leverage their global network, technological capabilities, and experience to facilitate the efficient and sustainable movement of goods and information. Essentially, the DB Schenker logistics ecosystem is a complex and interconnected system designed to optimize the flow of goods and information, as well as to implement sustainable development and innovations to meet the constantly changing needs of the global market. At the same time, it is possible to single out a customer support ecosystem that provides cognitive interaction between the consumer and the service, while also forming an analytical base for the strategic management of the logistics network. This integration creates a synergistic effect where operational efficiency and customer satisfaction mutually reinforce each other, ensuring the comprehensive optimization of the logistics process at all levels.

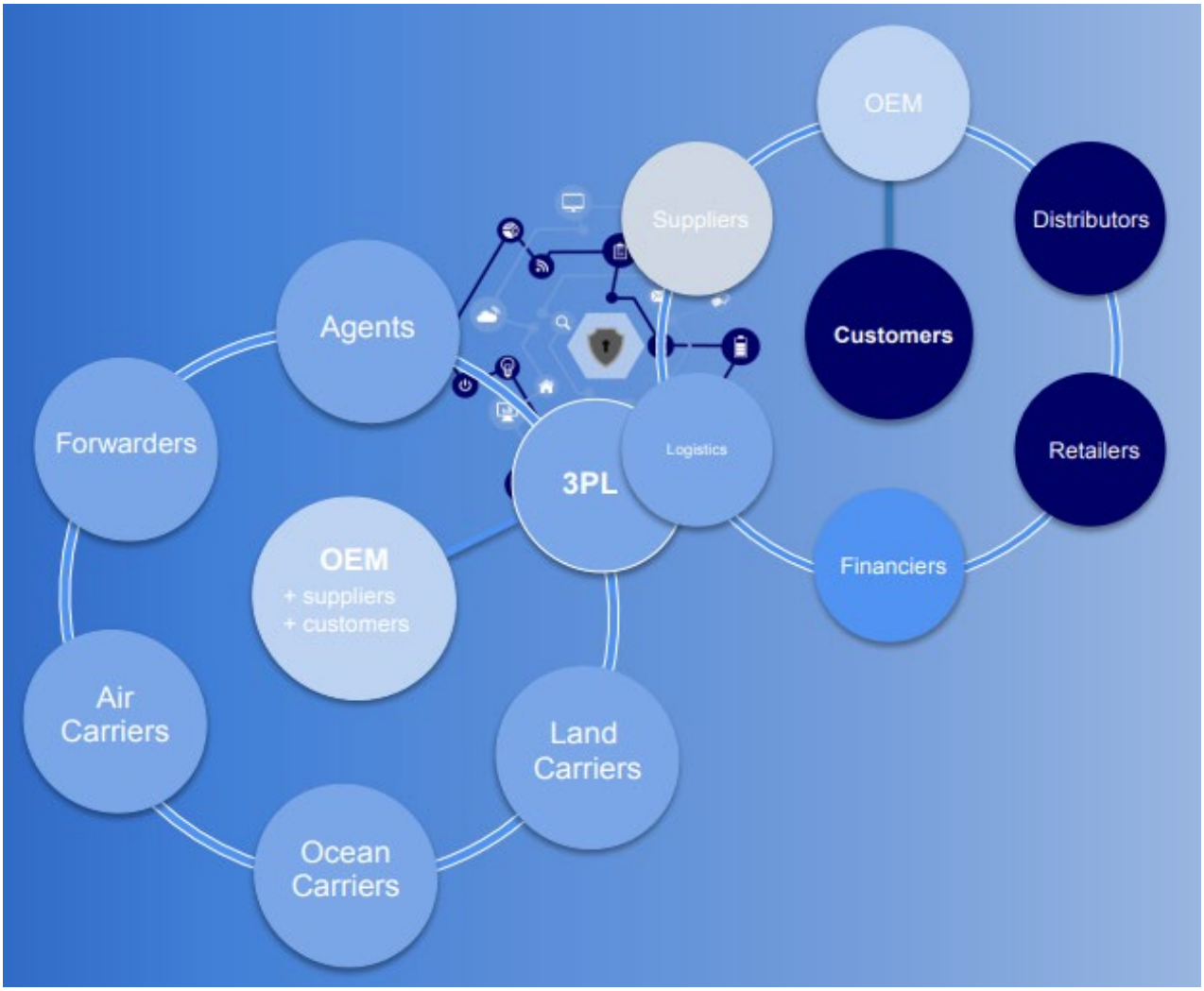

Figure 1 – Structure of the logistics ecosystem of DB Schenker
Source: [41]

Generalizing the above, we define an intelligent customer support system of logistics services (ICSSLS) as a multi-level integrated system that ensures effective interaction with clients and forms an analytical basis for optimizing logistics processes.

Note that our proposed ICSSLS fundamentally differs from traditional customer support systems in several key aspects that determine its high level of efficiency and adaptability:

1. ICSSLS is based on the integration of intelligent technologies, such as artificial intelligence, machine learning, and natural language processing, which allows it to automatically classify inquiries, forecast problems, and suggest optimal solutions. In traditional customer support systems, request processing is primarily manual, and automation is limited to simple response scenarios or standard application forms, which significantly reduces service speed and accuracy.

2. ICSSLS provides multi-level analytical data processing, which includes collection, systematization, forecasting, and cognitive learning based on historical data. This allows the system to adapt to changing customer needs, predict potential problems, and improve service quality in real-time. Traditional customer support systems usually lack the capabilities for self-learning or forecasting and are limited to reactive responses, which prevents them from effectively managing risks and meeting high customer expectations.

3. ICSSLS is integrated into the company's overall logistics ecosystem, which allows it to use customer support data to optimize routes, manage inventory, plan resources, and forecast demand. Traditional systems typically function as isolated subsystems that do not provide close interaction with operational logistics processes, which limits their strategic value to the company.

4. ICSSLS creates a closed feedback loop, where the results of customer inquiry processing influence the optimization of internal processes, and the efficiency of logistics operations, in turn, improves service quality. Traditional customer support systems primarily operate on a linear "request-response" scheme, which does not provide systemic interaction between customer service and the company's operational activities.

An intelligent customer support system of logistics services forms a complex network of interactions, in which several categories of participants can be distinguished, each performing specific functions and ensuring the effective functioning of the system.

1. First of all, clients are participants who are the main source of inquiries and information for the system. They not only receive a service but also actively influence its formation by providing data on their needs, service quality assessments, and feedback on logistics operations. In this context, clients become active participants in the value creation process, which is realized through the principle of collective value creation in the service ecosystem.

2. The second group consists of operators and customer support specialists, who control the processing of inquiries, interact with clients through various communication channels, and perform complex tasks that require human intervention. They work in close cooperation with the system's automated modules, receiving analytical recommendations from artificial intelligence algorithms and using them to optimize the service process.

3. The third group is comprised of automated modules and intelligent agents, including chatbots, inquiry routing systems, and natural language processing (NLP) algorithms. These components are responsible for the initial classification of inquiries, problem forecasting, automated response generation, and decision-making support for operators. It is thanks to these modules that the system can ensure a high speed of inquiry processing, adapt to changing loads, and integrate with the company's logistics infrastructure.

4. The fourth group consists of logistics units and operational modules of the company, which are responsible for order fulfillment, inventory management, transportation, and other key processes. Data received from the ICSSLS regarding client inquiries, complaints, and forecasted needs are used by these units to optimize routes, plan resources, and increase operational efficiency.

5. The system's participants can also include partners and third-party service providers, who provide additional services such as transport outsourcing, IT support, or integration with external e-commerce platforms. Their participation allows for expanding the system's capabilities, increasing its flexibility, and creating additional value for clients.

6. Finally, the system's analytical and cognitive modules play an important role, implementing machine learning and artificial intelligence algorithms. They analyze accumulated data, forecast inquiries and problems, form recommendations for operators and automated modules, and ensure continuous system learning to increase service effectiveness.

Structurally, the ICSSLS covers several interconnected levels: informational, analytical, operational, cognitive, and collaborative (Fig. 2).

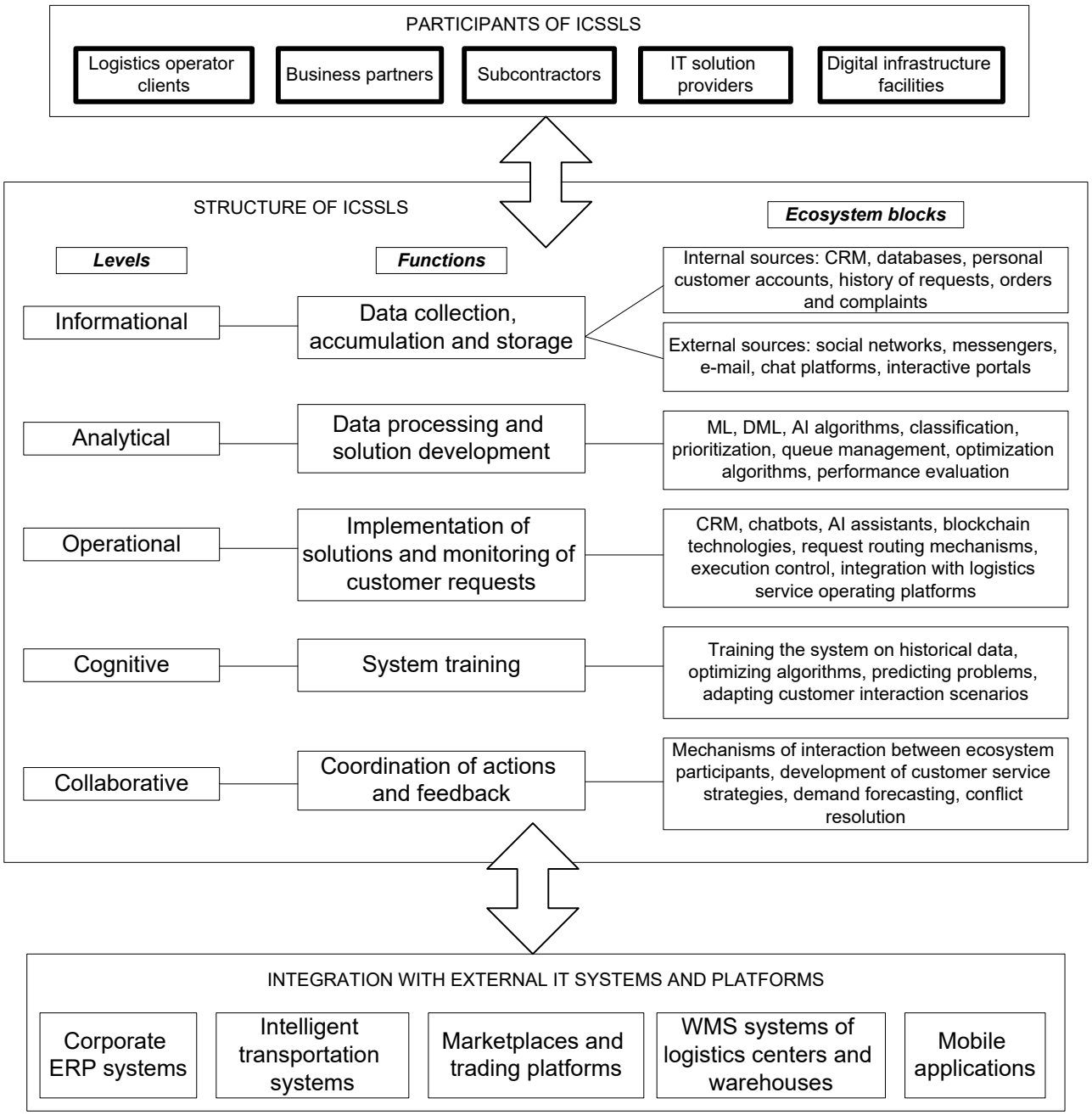

Figure 2 – Conceptual model of intelligent customer support system of logistics services (ICSSLS)

Source: authors' development

At the informational level, data on clients, their inquiries, requests, and complaints are collected and centralized, along with information from external sources such as social media, messengers, email, chat platforms, and interactive portals. This level forms the basis for analytical processing and decision-making.

At the analytical level, information is systematized and processed using artificial intelligence and machine learning algorithms. Natural language processing (NLP) algorithms are used for classifying and recognizing inquiries, machine learning models (ML, DML) for forecasting potential problems and determining the most effective scenarios for client interaction, as well as systems for evaluating performance indicators of inquiry processing. This level allows the system to adapt to the dynamic nature of inquiries and ensures data-driven decision-making.

The results of the analytical processing are passed to the operational level, where the practical implementation of solutions takes place: automated chatbots and CRM systems process inquiries, route them to the appropriate units, control the execution of requests in real-time, and ensure interactive client interaction. This level provides a quick response to client needs and continuous support for logistics service operations.

The cognitive level is responsible for training the system on historical data and optimizing client interaction scenarios. Thanks to the use of artificial intelligence algorithms, the system can forecast problems, offer recommendations for operators and automated processes, and increase the efficiency of inquiry processing based on accumulated experience.

At the collaborative level, coordination among the company's support, logistics, and management departments is carried out, and rules for feedback and internal procedures for optimizing service processes are formed. This level ensures the integration of the ICSSLS into the overall structure of the logistics company and contributes to its strategic adaptation to changing market needs.

An intelligent customer support system of logistics services does not function in isolation but is integrated into a wide network of digital services that ensures the effective management of information flows and interaction among various elements of the logistics ecosystem. A primary area of interaction is data exchange with CRM systems, which store the history of client interactions, allowing the ICSSLS to receive up-to-date information on orders, previous inquiries, and individual client needs. This ensures service personalization and increases the speed of response to inquiries.

Interaction with ERP systems is also important, as they are responsible for managing company resources, inventory planning, order processing, and coordinating logistics processes. The data received from the ICSSLS allows ERP modules to adjust delivery routes, forecast resource needs, and optimize supply chain management. In turn, ERP systems provide the ICSSLS with real-time information on product availability, delivery times, and order status, which increases the accuracy and effectiveness of customer service.

The ICSSLS also integrates with Transport Management Systems (TMS) and cargo tracking systems, which allows for real-time monitoring of cargo movement and provides clients with up-to-date order statuses. This ensures process transparency, reduces problem-response time, and increases client trust. Furthermore, the system interacts with e-commerce platforms, where a significant portion of client inquiries are generated. This integration allows for the automatic processing of orders, tracking of complaints and inquiries, and the analysis of user behavior to enhance service personalization. No less important is the interaction with analytical platforms and artificial intelligence modules, which provide for the processing of large volumes of data, problem forecasting, and the creation of recommendations for ICSSLS operators and automated modules. Thanks to this integration, the system is constantly learning, improving service effectiveness and optimizing logistics processes. Thus, the ICSSLS acts as an integration hub among various digital services of the company, ensuring bidirectional data exchange, process automation, forecasting, and service personalization. This interaction allows for the creation of a unified, coordinated digital ecosystem where logistics efficiency, responsiveness to client needs, and the strategic value of service are all enhanced.

To measure the effectiveness of ICSSLS implementation, we can propose metrics that are a key tool for evaluating service quality and the operational performance of the ecosystem. They not only allow for a quantitative determination of the level of customer satisfaction but also for an assessment of the effectiveness of internal processes, the identification of bottlenecks, and the well-founded adoption of

management decisions regarding service optimization.

These metrics include:

1. CSAT (Customer Satisfaction Score) is a metric of customer satisfaction with a service or a specific interaction. The metric is measured using short post-service surveys where clients rate their experience on a scale, for example, from 1 to 5 or from 1 to 10. A high CSAT indicates effective support, fast inquiry processing, and high-quality customer interaction. For the ICSSLS, this metric allows for an assessment of how well the system, including its automated modules and operators, meets user expectations.

2. CSI (Customer Satisfaction Index) is a metric that measures the level of consumer satisfaction across various aspects of a company's operations. This includes an analysis of product quality, service level, pricing policy, staff competence, and service efficiency. To determine the CSI, surveys are typically conducted where clients express their impressions of their interaction with the company through a series of specific questions. From an ICSSLS perspective, the data obtained from the CSI can be analyzed to form a final index that reflects overall customer satisfaction.

3. NPS (Net Promoter Score) measures clients' willingness to recommend a company or its logistics service to others. The metric is calculated based on clients' answers to the question: "How likely are you to recommend our company?" on a scale from 0 to 10. Clients are divided into Promoters (9-10), Passives (7-8), and Detractors (0-6). NPS allows for the evaluation of long-term client loyalty and service effectiveness in terms of creating a positive customer experience. In the context of the ICSSLS, NPS reflects the support system's impact on the logistics company's reputation and clients' willingness to use its services again.

4. SLA (Service Level Agreement) defines the level of service a company guarantees to its clients, in the form of specific parameters: response time to an inquiry, order processing time, and the percentage of problems resolved within a specified period. Monitoring the SLA allows for an evaluation of the ICSSLS's performance, the compliance of processes with established standards, and the effectiveness of automated algorithms in providing service. Non-compliance with the SLA can indicate weak points in the system or insufficient integration with logistics processes.

5. IQS (Internal Quality Score) is an internal quality metric that relates to Key Performance Indicators (KPIs) and measures the effectiveness of employees or teams to evaluate service quality and achieve set goals. In a business context, IQS helps to assess how well employees perform their tasks, ensuring a high level of customer service quality. It can include indicators such as the quality of responses to inquiries, the speed of response to client requests, their satisfaction, and other aspects of client interaction. However, unlike the previous metrics, the evaluation is from the perspective of the employees themselves. This metric is used to monitor and improve the work of employees within the ICSSLS, helping to understand where there are opportunities for process optimization.

6. CES (Customer Effort Score) measures how easy it was for clients to interact with the company to resolve their needs or problems. The metric is calculated based on clients' answers to the question: "How difficult was it to resolve your problem?" on a scale from 1 to 7, where 1 means "very easy" and 7 means "very difficult." A low CES score indicates ease of interaction and, as a rule, a higher level of satisfaction and loyalty, while a high score indicates that clients have to make significant efforts, which can lead to client churn. CES focuses on how convenient it was for clients to find information, resolve a problem, or make a purchase. Research has shown that reducing the effort a client puts into solving their problem has a stronger effect on loyalty than attempts to "delight" the client. This metric is relevant for any interaction within the ICSSLS.

7. Automation Level. This metric reflects the proportion of support processes that are

performed automatically, without operator involvement. The automation level is evaluated as a percentage of the total number of inquiries or processes that are handled by the system independently, for example, by chatbots, forecasting algorithms, or automatic inquiry routing scenarios. A high automation level allows for reducing the workload on operators, shortening inquiry processing time, and increasing the accuracy of standard procedures. At the same time, it is important to ensure a balance between automation and human control in cases of complex or non-standard inquiries.

In combination, these metrics allow for evaluating service quality, client loyalty, the effectiveness of service standard fulfillment, and the degree of process automation, all of which are critically important for assessing the operational effectiveness of the ICSSLS and its integration into the logistics ecosystem. The use of these metrics ensures systematic control over the functioning of the ICSSLS, promotes increased customer-centricity, resource optimization, and forms the basis for the strategic development of logistics companies in a competitive environment.

Implementing an intelligent customer support system of logistics services provides numerous advantages for both the company and the end-users. First, the integration of intelligent technologies enhances the speed and accuracy of client inquiry processing. Automated processes that use artificial intelligence and machine learning algorithms can significantly reduce response time, optimize the routing of requests, and provide personalized service tailored to the individual needs of each user.

Second, the ICSSLS contributes to increasing the transparency of logistics processes. Clients receive up-to-date information on delivery status, product availability, and potential risks, which builds trust in the service and reduces the number of repeated inquiries. Third, the system enables the accumulation and analysis of data, which allows logistics companies to forecast demand, identify problem areas in delivery processes, and optimize inventory management.

In addition, the ICSSLS creates feedback mechanisms that ensure the cyclical learning of the system and the adaptation of logistics processes to changing market conditions. This increases the efficiency of the entire logistics network, as data-driven decisions help to reduce costs, improve delivery accuracy, and enhance interaction among all participants in the supply chain.

A key advantage of implementing the ICSSLS is the creation of synergy between customer satisfaction and the efficiency of logistics operations. Clear, fast, and personalized support increases user loyalty, while the optimization of internal processes helps to reduce operational costs and increase company productivity. Thus, the integration of an intelligent customer support system allows for the comprehensive optimization of logistics services, increases a company's market competitiveness, and creates a stable foundation for the development of an intelligent logistics ecosystem.

In modern logistics practice, examples of forming customer support ecosystems can be seen in the experience of leading international companies. Amazon, for instance, has built its own service ecosystem based on a combination of e-commerce, logistics capabilities, and high-tech customer support. Its key feature is the integration of digital platforms with tracking and delivery management systems, as well as the use of artificial intelligence for service personalization and fast response to client inquiries. In turn, DHL has created a comprehensive logistics ecosystem that combines transport, warehousing, and information services with an extensive network of customer support centers. The system is based on the principles of omnichannel, where a client can access the service through mobile applications, online platforms, or contact centers, while digital tools ensure transparency and flexibility in

interaction. An example of successful customer support integration into a logistics ecosystem is also UPS, which actively applies digital technologies to automate service, tracking, and supply forecasting. Its ecosystem covers not only logistics processes but also a developed infrastructure of service centers and virtual assistants, which ensures a high speed of inquiry processing and forms a sustainable customer-centric service model. Thus, Amazon, DHL, and UPS demonstrate different approaches to building customer support ecosystems, but all are based on a combination of innovative technologies, integrated platforms, and a focus on client needs (Table 2).

Therefore, Amazon Logistics demonstrates the most complete integration of digital platforms, a high level of automation, and advanced analytics, making it a global benchmark for the ICSSLS. DHL and UPS also have strong systems for integration and automation, but compared to Amazon, they are less personalized and less focused on large-scale analysis of customer behavior. In general, giants like Amazon, DHL, UPS, or DB Schenker have already formed their own intelligent customer support ecosystems, which combine a high level of digitalization, automation, and customer-centricity. Their practices include the integration of multi-channel communications, the use of artificial intelligence to forecast customer needs, service personalization, and big data analytics to increase operational efficiency.

In Ukraine, where the logistics services market is in a phase of active transformation and adaptation to digital challenges, the implementation of similar approaches is strategically important. Using international experience will help to accelerate the formation of intelligent customer support systems, avoid common mistakes, and immediately aim for the highest service standards. This will increase the level of consumer trust, boost the competitiveness of Ukrainian companies, and facilitate their integration into global supply chains.

Table 2 – Comparative analysis of logistics service customer support ecosystems

Characteristics	Amazon Logistics	DHL	UPS
Digital Platform Integration	Full integration of CRM, ERP, TMS, AI analytics	Integration with client ERP/CRM, digital platforms	Integration of mobile applications, web portal and CRM
Process Automation	AI chatbots, routing, sorting centers, robotic warehouses	Automated sorting centers, real-time cargo tracking	AI chatbots, route optimization, partial sorting automation
Transparency and KPIs	Clear SLAs, CSAT, CSI and NPS monitoring, blockchain technologies, real-time reports	SLA, delivery tracking, blockchain technologies, KPIs for business customers	SLA, CSAT, CSI and NPS monitoring, blockchain technologies, reporting for corporate clients
Customer Focus	Personalized services, demand forecasting, fast feedback	Information services, status notifications, integration with business processes	Personalized services, operational support via mobile application and web portal
Analytics and Improvement	AI for delay forecasting, route optimization, big data analysis	Routing analytics, logistics problem prediction	Using data to optimize logistics and customer service
Level of Automation	High (about 70–80% of routine processes automated)	High in sorting and tracking	Medium–high, automation of routine operations and routing

In Ukraine, there are already logistics companies that are actively adopting and adapting international experience to national realities, forming their own intelligent customer support systems. For example, Nova Poshta demonstrates a high level of digitalization, developing mobile applications, chatbots, and real-time shipment tracking services that align with the practices of global leaders. Delivery focuses

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on optimizing service processes for business clients, implementing digital tools for managing logistics services and automated customer support. The company Zammler, focused on international transportation and complex logistics, applies modern approaches to supply chain management, introducing elements of integrated information systems to increase transparency and efficiency. Ukrposhta, as a national operator, is modernizing its infrastructure and digital services, expanding the possibilities of electronic communication with clients and implementing the automation of key processes.

A comparison of Ukrainian logistics companies with the benchmark global ICSSLS systems (Amazon, DHL, UPS) can be made using key criteria of effectiveness and technological level, as presented in Table 3.

Table 3 – Comparative analysis of the use of intelligent customer support systems by international and Ukrainian companies

Features	International companies (on the example of Amazon, DHL, UPS and DB Schenker)	Ukrainian companies (on the example of Nova Poshta and Delivery)
Digital Platform Integration	Full integration of CRM, ERP, TMS, AI-analytics. Real-time data access allows you to predict problems and automatically route cargo.	CRM and ERP integration mainly for business clients, mobile applications and chatbots for B2C. AI analytics integration is limited, real-time data automation is developing.
Process Automation	High level of automation of warehouse processes, sorting and routing; AI processes a significant part of customer requests	Automated sorting centers (especially at Nova Poshta), chatbots and request routing scenarios. The level of automation is lower, approximately 40–60% of routine processes.
Transparency and KPIs	Clear SLAs, regular monitoring of CSAT, CSI, NPS, blockchain technologies, big data analytics for predicting problems.	Open KPIs, SLAs in Nova Poshta and Delivery, CSAT, CSI and NPS are being gradually implemented, analytics are mostly internal.
Customer Focus	Personalization of service, recommendation algorithms, fast feedback.	Main focus on delivery speed and service availability; personalization is still limited (notifications, push notifications, branch evaluation).
Analytics and Improvement	AI for predicting delays, optimizing routes, analyzing customer behavior.	Analytics mainly for logistics optimization and resource planning, AI is used in limited scenarios (chatbots, basic forecasting).

Therefore, Ukrainian companies, such as Nova Poshta and Delivery, show significant progress in implementing digital services and automation, especially in cargo tracking and client communication. However, in terms of the level of AI analytics integration, service personalization, and full process automation, they still lag behind global benchmarks (Amazon, DHL, and UPS).

In general, we can say that the formation of an intelligent customer support system of logistics services is a strategic direction for the development of modern logistics companies. Its implementation will not only make it possible to optimize operational processes, but also create long-term benefits, strengthening customer loyalty and the position of companies in the market.

Conclusions. The study found that the evolution of customer support systems in logistics from traditional call centers to intelligent ecosystems reflects the general trends of digitalization, increasing demands for customer-centricity, and the growing complexity of logistics processes. The key stages in the development of service models were analyzed, and it was determined that modern logistics operators are increasingly

integrating intelligent technologies, particularly artificial intelligence, Big Data, automation, and predictive analytics, to enhance the speed, accuracy, and personalization of customer service. The research confirmed the importance of an ecosystem approach, which allows for comprehensive interaction among supply chain participants and the creation of additional value for clients.

Intelligent customer support systems of logistics services (ICSSLS) continue to develop rapidly in response to growing market demands, the digitalization of business processes, and heightened customer expectations for service speed and quality. The prospects for the development of such systems are primarily related to the deeper integration of artificial intelligence and machine learning, which allows for automatically processing larger volumes of inquiries, forecasting problems, and creating personalized solutions for each user. The application of AI analytics opens up new opportunities for optimizing delivery routes, planning resources, monitoring service metrics and managing customer loyalty.

A conceptual model of an intelligent customer support system of logistics services (ICSSLS) was developed, which considers the multi-level structure of interaction among digital platforms, service modules, and ecosystem participants.

Methodological approaches for evaluating the effectiveness of such systems were determined using modern metrics, including CSAT, CSI, NPS, SLA, IQS, CES and the level of automation. A practical analysis of case studies of leading international companies (Amazon, DHL, UPS) and Ukrainian operators (Nova Poshta, Delivery) showed that the implementation of intelligent customer support ecosystems contributes to improved service quality, cost optimization, and stronger competitive positions in the market.

Overall, the results of the study prove that the intellectualization of customer support is a strategic direction for the development of modern logistics ecosystems. It not only ensures a business's adaptation to new market conditions but also creates long-term advantages by combining technological innovation with a focus on customer needs.

The strategic development of the ICSSLS involves a deeper integration with the company's digital ecosystem, including CRM, ERP, TMS, and analytical platforms. This allows for the creation of a single information space where all data on clients, orders, and logistics processes are interconnected and available in real time. This integration ensures not only increased efficiency in inquiry processing but also the forecasting of peak loads, reduced delivery times, and decreased operational costs.

An important component of strategic development is increasing the level of automation, which includes not only processing routine inquiries through chatbots and routing scenarios but also the automatic creation of recommendations for operators in complex or non-standard situations. This helps to achieve a balance between the efficiency of automated processes and human control in critical cases, increasing the accuracy and quality of service.

Additionally, a promising direction is the use of Big Data analytics to assess customer behavior, forecast demand, and develop new service offerings. Such data can be applied to create personalized proposals, adapt pricing plans, optimize delivery routes, and increase the level of customer satisfaction and loyalty.

The key driver of ICSSLS development is artificial intelligence, as it provides automation, personalization, forecasting, analytics, and continuous system improvement. Its application allows for increased service effectiveness, reduced inquiry processing time, lower costs, and the creation of a competitive advantage in the logistics services market. In the long term, AI integration becomes a strategic element of the digital transformation of logistics companies.

At a strategic level, the development of the ICSSLS also involves an orientation toward

interacting with partners and integrating into global logistics ecosystems. This allows for expanding the service's geographical reach, increasing the speed of order processing, and ensuring the transparency of logistics processes at all stages of delivery.

In conclusion, the prospects and strategic development of the ICSSLS are focused on the maximum integration of digital platforms, an increased level of automation, the application of AI analytics, and service personalization, which allows companies to create highly effective, adaptive, and customer-oriented logistics ecosystems. In the long term, this forms a competitive advantage, reduces costs, increases service speed and accuracy, and strengthens a company's reputation in the market.

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