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ADR CARGO HANDLING CONCEPT, PROSPECTIVES AND CHALLENGES

КОНЦЕПЦІЯ ОБРОБКИ НЕБЕЗПЕЧНИХ ВАНТАЖІВ (ADR), ПЕРСПЕКТИВИ ТА ВИКЛИКИ

Анотація. ADR (Acceptance, Release, and Delivery) cargo handling involves essential logistics processes to receive, store, and distribute cargo accurately and efficiently. Streamlined ADR handling reduces errors, saves time, and improves service quality by following strict protocols and leveraging modern technologies. This study examines the impact of optimized ADR cargo handling on operational efficiency and customer satisfaction in logistics companies.

Abstract. ADR (Прийом, Випуск і Доставка) обробка вантажів включає ключові логістичні процеси для точного та ефективного прийому, зберігання та розподілу вантажів. Оптимізована обробка ADR зменшує кількість помилок, заощаджує час і покращує якість обслуговування завдяки дотриманню чітких протоколів і використанню сучасних технологій. Це дослідження аналізує вплив оптимізованої обробки ADR вантажів на операційну ефективність і задоволеність клієнтів у логістичних компаніях.

Ключові слова: ADR cargo handling, logistics optimization, cargo management, process efficiency, transport logistics, supply chain operations.

Key words: Обробка вантажів за ADR, оптимізація логістики, управління вантажами, ефективність процесів, транспортна логістика, операції в ланцюгу постачання.

Modern transport and logistics companies face increasingly high demands for speed and quality of customer service. Optimizing the processes of cargo acceptance, release, and delivery (ADR) is essential to enhancing operational efficiency and competitiveness. This study's relevance lies in the need to streamline ADR processes, minimizing errors, reducing handling time, and ensuring high accuracy in cargo management.

The primary goal of this study is to examine ADR processes in transport and logistics companies and identify key stages for optimization to improve overall efficiency. To achieve this goal, it is necessary to analyze current practices in cargo acceptance, release, and delivery, identify the main challenges affecting productivity, and propose solutions to address them. The task also includes assessing the impact of advanced technologies on ADR process automation.

The study aims to develop recommendations for improving ADR processes in logistics companies by introducing modern technological solutions and optimizing procedures. Enhancing ADR processes can boost productivity, reduce operational costs, and improve customer service—an essential factor in maintaining a competitive edge in the logistics market.

In transport and logistics, the processes of cargo acceptance, delivery, and release (ADR) are central to the efficient handling and distribution of goods. Currently, many companies follow structured but often manual methods, which include verification of documents, visual inspection of cargo, and manual recording of details in the acceptance phase. While this approach ensures a basic

level of control, it often lacks efficiency, especially under high volumes, as human intervention can slow the process and introduce errors. Automated tracking systems are gaining traction, but many firms still rely on outdated methods, leading to operational bottlenecks.

The delivery phase, similarly, often faces challenges. Security and compliance checks are essential to ensure the cargo is prepared for its next stage; however, traditional verification processes can be slow and resource-intensive. Many logistics operators rely on physical paperwork and manual handling, which not only increases processing time but also leaves room for potential errors. Companies with limited technological integration may struggle to manage high cargo volumes without impacting productivity and accuracy. The release process further reveals inefficiencies, especially in last-mile delivery where time constraints are tight and customer expectations are high. Manual scheduling, route planning, and limited real-time communication contribute to delays. Some companies have adopted digital tools for route optimization and real-time tracking, but these tools are not uniformly implemented, creating inconsistencies in service quality.

A major challenge in ADR processes is the reliance on manual labor and paper-based systems, which slows processing and increases errors. As cargo volumes grow, these systems become less scalable, reducing productivity and raising costs. Additionally, limited visibility and traceability hinder proactive issue resolution, causing delays and lowering customer satisfaction. Compliance and security requirements further complicate ADR stages, as meeting regulatory standards adds documentation and verification steps, slowing operations and increasing costs.

One effective solution to enhance productivity in ADR processes is the adoption of digital and automated systems. Using RFID tags and barcode scanners during cargo acceptance and release can streamline documentation and reduce human error. Digital recording of cargo details and automated verification processes allow faster and more accurate cargo tracking, providing real-time data that enhances visibility across the logistics chain.

Another improvement is the integration of cloud-based platforms that enable centralized data access for all departments involved in ADR processes. By using a unified system, logistics operators can share and update information in real-time, reducing communication gaps and improving workflow coordination. These platforms can also facilitate compliance by ensuring that all cargo data and documentation are stored and accessed as required by regulations. [4]

For the delivery process, implementing advanced route optimization tools and real-time tracking solutions can significantly reduce delivery times. These tools allow companies to plan optimal routes, adjust schedules based on traffic conditions, and communicate with drivers in real-time. This improves efficiency in last-mile delivery, meeting customer expectations and reducing fuel costs. [1]

The adoption of technologies such as Artificial Intelligence (AI) and Internet of Things (IoT) in ADR processes has a profound impact on efficiency. AI can be used to automate decision-making in route planning, cargo sorting, and predictive maintenance, which helps to prevent delays. IoT sensors placed on cargo containers provide continuous monitoring of cargo conditions and location, improving transparency and allowing for real-time adjustments when disruptions occur.

Blockchain technology is another innovation with promising potential for ADR processes. By creating a transparent and immutable record of all cargo movements, blockchain ensures that all stakeholders have access to accurate and up-to-date information. This not only improves trust in the supply chain but also reduces delays caused by documentation errors and compliance issues.

Robotic Process Automation (RPA) can also be utilized to handle repetitive tasks, such as data entry and verification, thereby freeing up employees to focus on more complex duties. By automating routine processes, companies can reduce labor costs, minimize errors, and enhance overall process speed, particularly during the acceptance and release stages.

The integration of these advanced technologies is expected to improve accuracy, reduce operational costs, and increase speed in ADR processes. Automation and real-time data access will lead to better resource allocation, as employees will spend less time on repetitive tasks and more on value-added activities. This shift not only enhances efficiency but also allows logistics

companies to handle higher cargo volumes without compromising quality or compliance standARDS.

Furthermore, the use of predictive analytics and IoT-enabled tracking can lead to proactive decision-making, allowing companies to address potential delays or issues before they impact the delivery timeline. The enhanced visibility provided by these technologies will improve customer satisfaction by offering precise tracking information and minimizing unexpected delays.

ADR regulations are applicable in countries that have ratified the treaty, which includes a majority of European nations, parts of Asia, and some regions in Africa and South America. Notably, these regulations do not cover North America; there, alternative regulations such as the Hazardous Materials Regulations in the U.S. and the Transportation of Dangerous Goods (TDG) Regulations in Canada govern the transport of hazardous materials.

The ADR framework classifies dangerous goods into several categories, including explosives, gases, flammable liquids, toxic substances, and corrosive materials, each with specific labeling and handling requirements. Each dangerous good is assigned a unique four-digit UN number for easy identification. However, the hazardous class of goods beyond Class 1 cannot be determined directly from these UN numbers and requires reference to the ADR list.

The cost of ADR transport includes various surcharges, such as a dangerous goods surcharge, specific hazardous class surcharges, and documentation fees, leading to a total price structure that encompasses base freight rates plus these additional costs. The surcharges can range from 10% to 50% of the base rate, with minimum fees often between 200 to 250 euros. [2]

International transport of dangerous goods is regulated based on the mode of transport. For road transport across Europe, the ADR (Agreement concerning the International Carriage of Dangerous Goods by Road) sets the regulations. For maritime transport in regions not directly connected to mainland Europe, the IMDG Code (International Maritime Dangerous Goods Code) applies. Rail transport adheres to the RID (Regulations concerning the International Carriage of Dangerous Goods by Rail), while the IATA (International Air Transport Association) Dangerous Goods Regulations (DGR) govern air transport.

Various national agencies oversee compliance with ADR regulations. The UK's Health and Safety Executive (HSE) provides comprehensive information on ADR, including safety guidance and training requirements. Germany's Federal Institute for Materials Research and Testing (BAM) focuses on technical safety in dangerous goods transport. France's Ministry for the Ecological Transition (MTE) oversees environmental and transport policy, while the Netherlands' Human Environment and Transport Inspectorate (ILT) offers information on enforcement and inspections. Other notable agencies include Spain's Ministry of Transport, Sweden's Transport Agency, and Norway's Public Roads Administration, among others. These agencies serve as vital resources for companies involved in the transport of hazardous materials, ensuring that they adhere to safety standARDS and comply with national and international regulations. [3]

In conclusion, optimizing ADR processes through technological advancements is essential for logistics companies seeking to remain competitive in today's fast-paced market. By transitioning from manual, paper-based systems to automated digital platforms, logistics firms can overcome many of the productivity challenges inherent in traditional ADR handling. The adoption of technologies like AI, IoT, and blockchain not only streamlines the handling process but also positions companies to meet evolving industry standARDS and customer expectations effectively.

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