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Effectiveness of Digital Technologies in Managing Logistics Processes

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Introduction

To automate business processes and make effective decisions, small and medium enterprises (SMEs) are turning to various information systems that create a unified functional environment and allow management to run the organization using the best business practices and standards of the world.

One of the key benefits of digital technology in logistics is improved demand and supply forecasting processes. Data analytics and machine learning systems allow companies to more accurately predict which goods will be in demand and optimize inventories accordingly.

The most common information systems are ERP and CRM platforms. With an ERP system, a company is able to manage the supply chain and control requirements, effectively use labor resources, promptly manage the necessary information, and analyze revenues and expenses. As for CRM, this system allows companies to effectively manage customer-related processes, analyze sales figures and make appropriate assumptions. Depending on the functions of the mentioned platforms, their collaboration can be effective for any business. However, given the digital advances and transformations, how effective and appropriate the combination of such information systems is for the success and profitability of medium and small businesses is a matter of evaluation.

Key words: Intelligent Transportation System (ITS), logistics, ERP and CRM platforms, payment transport systems, automated control system, business processes, ITF-14, EAN-13 Technology.

1. The role of logistics in the global architecture of the economy

From the movement of raw materials to the delivery of finished products to consumers, logistics ensures the seamless flow of goods and services across borders, supporting international trade, economic growth, and everyday life.

Most of the products that we consume every day wouldn't reach us were it not for logistics -- the network of services that supports the movement of goods across or within national borders: transportation, warehousing, distribution, express delivery, and much more. Producers also rely on

logistics to move parts and components like keyboards and computer chips from far-flung suppliers along global value chains. So the performance of a country's logistics industry matters a great deal for its competitiveness on export markets, and its ability to reliably and affordably secure the importation of the goods it needs for production and consumption.

During the pandemic, and especially this last year, supply chain issues disrupted businesses and created shortages across many industries. It showed the importance of logistics to our global economy. The Logistics Performance ranks countries by considering several factors including customs, infrastructure, international shipments, logistics competence, timeliness, and tracking tracing **(Fig. 1):**

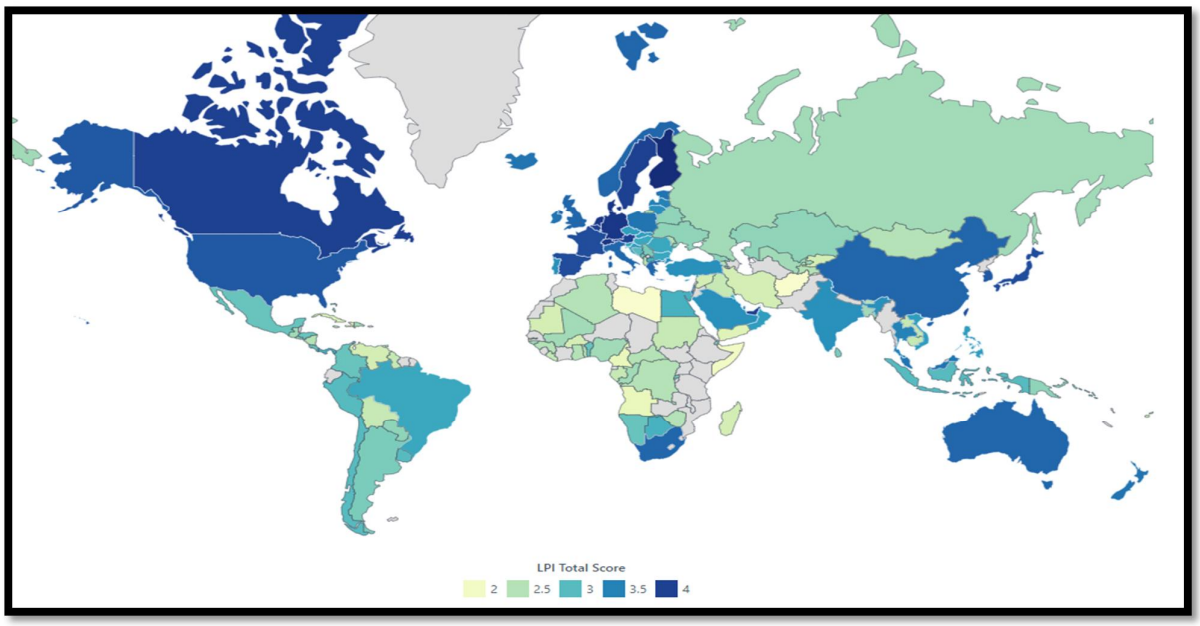

Fig.1. LPI Total Score

During the pandemic, and especially this last year, supply chain issues disrupted businesses and created shortages across many industries. It showed the importance of logistics to our global economy [1-4]. The Logistics Performance ranks countries by considering several factors including customs, infrastructure, international shipments, logistics competence, timeliness, and tracking tracing **(Fig. 2):**

COUNTRY	LPI TOTAL SCORE
Singapore	4.3
Finland	4.2
Germany	4.1
Netherlands	4.1
Switzerland	4.1
Denmark	4.1
Canada	4.0
Belgium	4.0
United Arab Emirates	4.0
Sweden	4.0

Fig. 2. Logistics Performance Index by Country 2024

Singapore is ranked first with a score of 4.30. Across all the evaluation areas, it ranked number one except for international shipments where it tied Hong Kong for second place. Finland is ranked second with a total score of 4.20. Interestingly, Finland was the country that beat out Singapore for the top international shipments score. Four countries tie for the next ranking with a score of 4.10: Germany, Netherlands, Switzerland, and Denmark.

The two countries with the lowest total scores are Afghanistan and Libya. Both have a 1.90. While Afghanistan scores higher in customs, logistics competence, and timeliness, Libya has stronger international shipments and tracking tracing. Both countries scored the same for infrastructure. After Singapore, Switzerland and Denmark scored highest in the customs category. Both scored 4.10. In that same category, Somalia scored a 1.5, while Angola and Yemen each scored a 1.7. For infrastructure, Switzerland came in second to Singapore with a score of 4.40. Germany and Canada both earned scores of 4.30. The lowest score for infrastructure was 1.70, scored by both Afghanistan and Libya. Yemen had the lowest score of 1.70 for international shipments, Somalia came in last with a score of 1.80 for logistics competence, and a score of 2.10 brought Angola and Cameroon to the bottom for timeliness.

The United States tied with South Korea with a score of 3.80 but beat out both China and the United Kingdom, both of which only scored 3.70. South Korea beat out the US slightly in customs and infrastructure, but the US scored slightly better at logistics competence and tracking tracing.

2. Logistics Information System (LIS)

Logistics is a relatively new economic science and, in fact, is in its infancy. Accordingly, for both theorists and practitioners there is a need for a deep study of logistics as a science in the process of economic management. The experience of developed countries shows the advantage of applying theoretical knowledge in the field of logistics in practice in terms of increasing economic efficiency. Logistics allows managers to form an effective strategy, to gain a competitive advantage in hard-to-predict market conditions. However, the logistics approach touches upon a wider range of issues: accordingly, the management of goods movement becomes more complete. Making decisions to improve competitiveness is difficult, so high-level planning is necessary. Origin of logistics: studying the demand, supply of resources, technical process and their management; Regulating the delivery of material flows, accumulating experience to develop future strategies, managing flows and making forecasts.

To make decisions, it is important to collect and process as much information as possible. To achieve the goal it is not enough to know only one direction, it is necessary to analyze all possible directions in order to choose the most economical one, the most suitable for solving the existing problem. The emergence of digital technologies has created great opportunities for the development of science, the development of perfect methods of planning and production management, but without a strict statement of tasks and mathematical description of processes, planning and management cannot be perfect. In modern conditions, the tasks of logistics are significantly expanding. In the management of

technological processes, the practical application of logistic knowledge makes it possible to promptly solve complex problems. In a market economy, the main role of these models is to find a compromise.

Information logistics is the part of logistics that organizes the movement of data (information) and follows the process of material flows. Information logistics is the link between supply, production and key.

The role of information logistics in the management of production, movement of goods and in all storage processes is great, which ensures timely delivery of goods in the required quantity, the required configuration and the required conditions. Quality from the place of production to the place of consumption with minimum costs and optimal service.

The main task of information logistics is to provide information produced within the control system and, conversely, to receive information occurring outside the system. Each level of the structural hierarchy should receive only the necessary information at the necessary time.

Information logistics should perform the following functions:

- collect information;
- analyze information;
- process information;
- sort and store necessary information;
- filter the information flow, i.e. store data, documents and necessary information for one or another level of management;
- combine and separate information flows;
- manage information flows **(Fig. 3):**

Fig. 3. Steps of Logistics Information System (LIS)

Information (economic) functions together with various information about economic objects (about the general process of production; exchange and consumption of material resources and services), which can be recorded, transmitted, processed and used in this way. For the implementation of management functions such as planning, analysis, regulation, control, etc.

3. Automated _Barcode Identification_Utilizing ITF-14; EAN-13 Technology

A large number of units of goods will pass through each link in the logistics chain. In addition, within each ring, goods move several times to storage and processing locations. The entire system of goods movement is a continuously pulsating discrete flow, the speed depends both on the production

potential (capacity), the rhythm of orders and the size of available inventories, and on the speed of sales and consumption. To be able to effectively manage this dynamic logistics system, it is necessary to have detailed information on incoming and outgoing material flows, as well as material flows moving within it, at any given time.

According to world experience, this problem is solved in material movement, in the implementation of logistics operations, through the use of microprocessor-based equipment capable of identifying (recognizing) a single unit of cargo. We are talking about a device capable of scanning various bar codes. This device allows you to get information about the work of logistics at industrial enterprises, wholesale bases, warehouses, stores, on the transport at the time of its movement. The information received is processed in a timely manner, which allows the control system to respond promptly[5-8].

Automated information sets are based on different types of barcodes, each of which has its own technical advantages. For example, the code with a rectangular outline ITF - 14 is easily printed on other codes, which allows it to be used on a corrugated base. It is used for coding of a commodity batch. For coding information on a limited surface we can use the code “alternation 2-5” **(Fig. 4):**

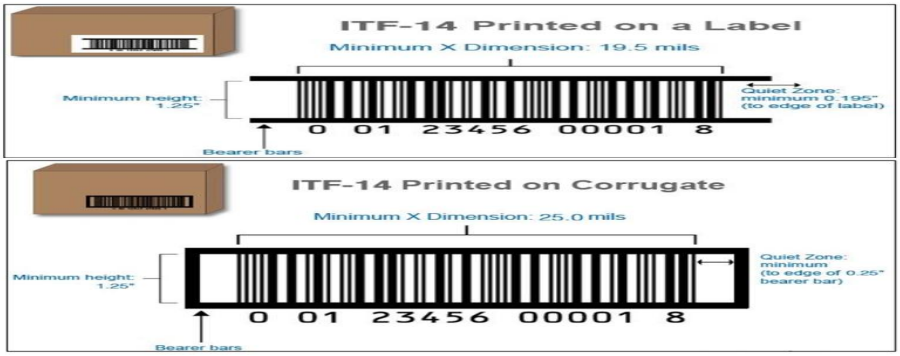

Fig. 4. Code ITF _ 14. Used for downloadable packages for coding

In logistics, among other codes, we can use code 128. With this code we can make batch number, production date, realization period, etc. coding. In the sphere of circulation, the EAN code, which can often be found on mass consumption goods, is widely used. Let's dwell more on the technology of using EAN code in logistics processes.

There is a code alphabet EAN, in which each digit corresponds to a certain set of stripes and lines. The 13-digit numerical code is assigned to the product at the production stage and is marked on the product in the form of stripes and lines. The first two or three digits stand for the country code assigned to it by the EAN association. This part of the resulting code is called the flag. The table shows the meaning of the different country codes. The next four digits are the manufacturer's index. The combination of country and manufacturer codes is a unique combination of digits that uniquely identifies the production output of the labeled product. The remaining digits of the code are provided to the manufacturer to code its products as it sees fit. At the same time, coding can be accomplished. Let us start from zero and go up to 99,999. Thus, the first twelve digits of the EAN code uniquely identify any product. The last 13th digit of the code is the control digit. It is calculated by a special algorithm based on the previous twelve digits. Incorrect decoding of one or more digits of the bar code

will cause the computer, after calculating the twelve digits for verification, to find that it does not match the control number. With the number listed on the item. Receipt of the scan will not be validated and the code will have to be calculated again. Thus, the check digit ensures reliable bar code operation and guarantees the stability and reliability of the entire system.

Studies show that product data entered manually from a computer keyboard has an average of one error for every 300 characters entered. When barcodes are used, that rate is reduced by 1 with an error rate of 3 million. The average cost of labor to detect and prevent one such error is $25, according to the American Management Association. According to other studies, the cost per error is 100 dollars exceeds.

Barcoding and data collection technology is based on simple physical laws. A bar code is an alternation of dark and light stripes of different widths, built according to certain rules. The barcode image is made on an object that is the subject of control in the system. A scanning operation is performed to register this subject. At the same time, a small bright spot or laser beam of the scanning device is alternately moved across the barcode.

It crosses the dark and light belts. The light beam reflected from the bright belts is picked up by a photosensitive device and converted into a discrete electronic signal. Changes in the received signal depend on changes in the reflected light. The bar code decodes the electronic signal and converts it into a digital code. The numeric code of a product usually does not contain information about its properties. The unique 12-digit number is the address of a cell in the bar code's memory and contains all the information about the item. The combination of this information forms a commodity database. The database must subsequently be transmitted to the supply chain via an electronic communication network [9-13].

The technology of using the automated identification of bar codes in logistics allows to significantly improve the management of material flows at all stages of the logistics process.

4. Logistics in Internet mode

The development of trade relations through the Internet has formed a qualitatively new type of logistics and introduced a number of corrections in traditional business logistics. Business logistics is based on the joint actions of Internet logistics and computer or other automated means of communication. - Such a form of organizing logistics is called **"internet logistics".**

Electronic banking operations based on SWIFT and SWIFT II, as well as EDI (Electronic Data Interchange - Electronic Data Interchange) and EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport) systems.

Logistics information-computer technology is an internal material flow in a unified logistics system - about characteristics and stocks of resources, work in progress, finished products, freight shipments, order parameters, etc. in real time. A set of operations for obtaining and processing information.

In developed countries, the **Global Satellite Communication System (Inmarsat)** is used for transport monitoring and dispatching.

This system includes:

- direct communication with the dispatcher;
- storing information in a database;
- location and status of the vehicle and cargoreceive situational awareness;
- group recall of vehicles.

The **Inmarsat** provides two-way text and data transmission from anywhere on Earth. The connection is made by dedicated stations.

The program part of the commercial operations department includes:

- for automatic determination of the transportation route (electronic atlas);
- calculation of delivery cost and evaluation of route efficiency;
- calculation of optimal vehicle load;
- multimedia delivery route development;
- automated processing of transportation documents.

Organization of Internet access in international transportation is considered a very promising direction in logistics. A single database is being created that combines information data from geographically remote locations. such databases a vivid example is a **hyperactive database [14-17]**.

The hypertext database consists of three sections: **1. Representative, 2. Advertising** and **3. Commercial.** Each of them corresponds to a specific operation. Together, the sections and operations form the structure of a hypertext database **(Fig. 5):**

Fig.5. Hypertext database structure

5. Conclusion

Information technologies are in the active phase of their development. In addition, they have given impetus to a new trend in the economy called “digital economy”, which is currently being developed in state programs and government documents. The term “digital economy” goes beyond the concept of “informatization”, is a new global ideology, and implies more global integration processes that connect

the information (digital) systems of business process participants to form a single information-technological (digital) space.

Optimization and automation of logistics processes can improve efficiency and reduce costs. However, with the increasing use of digital and electronic technologies, the threat of cyber attacks and potential data breaches is also increasing. Information security becomes an important step in the digitalization of logistics.

Technology in logistics offers new opportunities, but there is a need to secure them. The introduction of innovations and digital solutions must be accompanied by comprehensive measures to protect against cyber threats and unauthorized access to data. Protection systems, encryption and multi-level authentication processes are an integral part of security in the digital transformation of logistics.

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