Abstract: The research in the field of logistic processes in the printing house will be focused on defined the improvement in the context of the „Industry 4.0” concept. In the industry, the growing complexity of production makes logistic processes more and more important. In every printing house industry certain processes which are implemented in the sphere of production can be systematized. The study will focus on the importance and goals of logistics processes; distribution; logistic chain; analysis of the efficiency of processes; selection of suppliers and organization of deliveries, creating networks of cooperators in the enterprise; computer support of processes at production; designing logistic systems. The study will present logistic processes in the printing house based on the „Industry 4.0” concept. "Industry 4.0” is often identified in the first place with the digital transformation of production systems - their digitalization. The production sphere is also moving towards increasing digitalization, first and foremost by using wider applications: data management (Big Data), and above all effective acquisition (via various types of sensors) and analysis of data; automation, e.g. the combination of traditional manufacturing methods with artificial intelligence, allowing to reduce errors and costs; communication using broadband links to connect the whole value chain; digital communication with clients. The conclusion of the research will be providing improvements of processes in chosen printing industry analyzing the solutions of the "Industry 4.0” concept.

KEYWORDS: LOGISTICS; LOGISTIC PROCESSES, PRINTING HOUSE; INDUSTRY; INDUSTRY 4.0

Introduction

The importance of the industry for global economies is enormous therefore companies are still looking for new solutions that simplify production processes and reduce costs and minimize the terms of order deadlines. For companies located in Europe where labor is a high cost, shortening the production cycle is very important from the perspective of the company's competitiveness.

Therefore, each of the world's distinctive economies runs its own industrialization strategy. In China, in accordance with the government FYP program (Five-Year Plan / 11-16) each "western" investment should result in a research and development center serving the development of the transferred technology. In turn, in the United States innovation is the main development strategy. In this country exists an efficient system supporting research and development based on cooperation between academic centers and business. Whereas in Europe, especially in Germany appeared the concept of creating a "smart factory" (digital factory), the assumptions which describe the concept of "Industry 4.0" which aims to connect industrial processes and digital technologies.

In the logistic sense, this means moving away from the value chains and preferring temporarily created virtual physical cyber networks. The production sphere in printing houses is heading towards digitization, using the following facilities: Big Data efficient data acquisition and analysis; automation is the integration of artificial intelligence into traditional production in the printing industry, will be discussed in greater detail later in the article; digital communication with clients.

The quintessential concept of "Industry 4.0" is the Internet of Things, which is to integrate people, products and machines into one unit in order to deliver the packaging which is final product expected by the customer and with satisfaction for the printing house in terms of production and cost.

Currently, it is estimated that the implementation of the "Industry 4.0" concept will achieve by 2025 an additional total profit of 260 billion euros.

The table shows the Industry section from 1.0 to 4.0 with assigned duration, technology, production system and different markets.

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1 B. Woliński, The concept of "Industry 4.0" as a strategy for reindustrialisation and implementation of next generation production processes
2 M. Wyrwicka, Revolution or evolution in logistics?
4 Yong Yin, Kathryn E. Stecke& Dongni Li, The evolution of production systems from Industry 2.0 through Industry 4.0
Logistics processes in printing industry

In order to meet the demands placed on the market, new technologies are being created to increase efficiency, decrease the price and improve quality. Most of data in printing house is sent via Internet. A modern printing house is one that is equipped with a modern machine park but is it only that? What is also important is a tightened relationship with the customer, flexibility to meet client’s requirements and environmental protection including lower energy consumption. In doing so, it is necessary to improve the logistic processes existing in the enterprise, on the most important ones we will focus below.

Distribution of ready-made packaging in the packaging printing house is delivered directly to the final customer or to the buffer warehouse. Often, deliveries are defined, for example, 2x a week under customer demand. Once a week, the customer sends an EDI call to the current call off which often changes the day before the planned delivery. Therefore it is essential role to be in close contact with the customer and change the demand depending on the customer's planned production and analyze data EDI and compare it with packaging which are on stock. The analysis of the EDI sent by the customer with the planned collection of packaging plays a significant role and decrease inventory levels secured in the event of sudden changes in production plans.

Analysis of the efficiency of processes using the ERP Print Manager System which is one of the most implemented system in printing houses in Poland, it is possible to analyze the profitability of each production orders and the efficiency of individual machines. Every station in each process in the printing house: printing machines, die-cutting and gluing machines are equipped with a computer with Print Manager system where all the data are collected and is associated with the entire system. Therefore, customer service have current access to data in the system and can check in what production process the order is located at the moment. Additionally, when the production order is completed, it is possible to analyze the reason in case the production costs were too high.

Selection of suppliers and organization of deliveries The company needs to have a systematized group of suppliers. The main suppliers for the packaging printing houses are paper manufacturers and wholesalers. Depending on the order and the date of its implementation, the technologist or person from the customer service department decides where the raw material will be delivered from. Inks, varnishes and other articles directly related to printing are ordered on a regular basis within 24 hours delivery. Providers of industrial services (die-cut, matrix etc.) must establish partnerships with cloud solution providers and data analysis so that processes can proceed smoothly.

Creating networks of cooperators in the enterprise there is a common system in the enterprise which allows the employees to have access to the different modes of system depending on their permission. The communication within the company is conducted using instant messaging. Calculations in the system regardless of the person from customer service are made on the same formula previously created and constantly improved by the specialists. Technology cards for each product with access to technology, type and method of packaging, inventory of individual clients that interact and synchronize with system files from customers make it easier to check the position on the production for both side customer and customer service in the printing house. There is a platform available for customers to check stock levels, a list of structure drawings, each client has access to it after log in at any time.

Computer support of processes at production in the case of uncertainty regarding any of the processes, e.g. packaging, the knowledge can be copied from the existing product cards. In the case of the printing process and resumed work, all parameters are already in the system. In the case of new works, the knowledge of the printer as well as the measurement of the color intensity of the densitometer are necessary. In the case of die-cutting and gluing machines the knowledge of the operators of machines is required, machines do not automatically adjust themselves.

Designing logistic systems Creating a system database and then adding data and streamlining processes by analyzing these data is essential to start improve communication and processes. The printing process is always preceded by checking and processing the artwork by graphics in Prepress department. With the help of solution- PREFLIGHT artworks are distributed to individual graphic due to the level of difficulty. However, the printing process is closely related to the data on the printing machine in the case of printing resumption this process is more efficient and the data is collected from the system. Automatization may apply to this sphere but only in theory. While printing the entire printout, optimizing the ink-color, type of different varnishes checking the sheets every 10-15 minutes is compulsory. Each of printing stages has a lot of inflammatory elements which may occur errors. The printing process for packaging is the most important process because of the raw material (cardboard) often accounts for more than 50% of the whole package price. Therefore, incorrect printing and significant color difference which may be visible on the shop shelves cannot take place during production process. Example is to check all the files prepared by the customers. Early detection of any errors can secure at the initial stage before further consequences: waste of time, material and money. To achieve that is essential to know the realities of the printing house in order to optimize the entire production process. Of course, there are existing printing houses where the transfer of graphic files takes place directly to the printing machine without work of people, on the responsibility of the customer.

Other solutions that streamline processes include placing sensors on gluing machine to verify barcodes and packaging identical arrangements. This is used in manual packaging when the graphics are similar, therefore the bar code is the only determinant that the packages differ from each other. After sending packaging from the warehouse the invoices are automatically issued in the system, the worker must only check them. Then, some clients have platforms on which they want to have invoices attached. In the future, there will be probably possibility to combine these systems and invoices will automatically pop on the client's platform.

As stated, in advanced technology, we are dealing with technological improvements in Research and Development Industry such as 3D Printing: usage of codes from GS1 standards to help to unify and streamline processes within the company or implement technological solutions to automate production processes such as inserter or conveyors and industrial trucks.

3D Printing is the process to create three dimensional object with material. It is used on a logistics system for spare parts to avoid stocking and is useful in Research and development industry to create e.g. appropriate packaging model.

Under the new regulation of the counterfeit prescription directive, from February 2019, the labeling of the packaging of these products will change. The bar code symbol will change from linear to two-dimensional and the individual serial number of the packaging will be added. The use of this solution in the supply chain will guarantee greater transparency of all stages of the supply chain and will give the opportunity to verify the origin of a particular product and will protect the patient. Inconsistent identification systems increase the operating costs, reduce the effectiveness of activities aimed at protecting European borders against counterfeits. GS1 standards are compliant with ISO and communicate with other standards in the field of health and e-health and are in line with trends in the European Union. The use of

5 https://www.printnews.pl/znaczy-nowoczesna-drukarnia/
6 A. Gawrońska-Blaszczuky, How to effectively and effectively implement the requirements of the so-called false directive in the field of a unique identifier.
Conveyors and industrial trucks, inserters help in shortening production processes, eliminating errors and reducing costs.

In doing so, we cannot ignore the essential role of technology, which allows the consumers received information very easily and fast to reduce errors. On the demand side, customers will increase their awareness through easy access to information from the printing house. The solution for further improvement of logistic processes may be applied neural networks, which will map recorded data in order to repeat process activities.

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