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THE PRACTICE OF OPTIMIZING THE LOGISTICS PROCESSES OF FOOD SUPPLY CHAINS

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The article presents in general terms the reasons for increasing the importance of logistics processes optimizing mechanisms' development concerning the food supply chain participants, as well as the current trends in the development of the business environment that encourage research in this area. In this paper, I define the functional boundaries The functional boundaries of the competencies' implementation regarding the field of companies' logistics management, I paid special attention to the framework for the implementation of production logistics competencies. I also disclosed the principle of interaction between the logistics system and the production system at an enterprise. This principle is meant to be implemented in the field of production planning and the gradual movement of resources, accompanied by the value creation. As a result of the abovementioned interaction, the essence of the mechanisms and tools of process management in the field of procurement logistics is revealed to achieve a synergistic effect from the continuity of management activities. This explains the reasons why the implementation of lean manufacturing tools indirectly leads to the optimization of logistics processes. Next, the essence of the lean production concept is revealed and arguments are given for the complementarity of the concept with the tools of logistics management, but taking into account the differences in their functional contents. The subject of this study is the Kanban lean production method, so the next stage of the discussion is devoted to the analysis of the theoretical provisions of this management concept. The principle of implementation of the discussed concept in the production practice is also schematically presented. Based on review studies results about the Kanban system practical application success, conclusions were drawn about the possible positive effects of this system' application. Further, as a result of the analysis of a food supply chain participating company's financial statements, I determined the daily residual inventory for one of the finished products items, and it was compared with the daily order sizes. Subsequently, with the use of the Kanban system, logistics processes were optimized by eliminating excess production. Finally, I summarized the results with a list of the potential benefits brought by the use of lean manufacturing tools.

Keywords: Food Supply Chain, Logistics Management, Process Optimization, Business Management, Lean Manufacturing, Management Tools.

JEL Classification: D24; L23; L66; M11.

ПРАКТИКА ОПТИМІЗАЦІЇ ЛОГІСТИЧНИХ ПРОЦЕСІВ ПРОДОВОЛЬЧОГО ЛАНЦЮГА ПОСТАЧАНЬ

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У статті в загальному вигляді подано причини зростання важливості розробки механізмів оптимізації логістичних процесів учасників продовольчого ланцюга поставок, наведені стимули до досліджень в даній області, сучасні тенденції розвитку бізнес-середовища. Визначено функціональні межі реалізації компетенцій у галузі логістичного менеджменту підприємств, особливу увагу приділено рамкам реалізації компетенцій виробничої логістики. Також розкрито принцип взаємодії логістичної системи з виробничою системою підприємства, який реалізується в області виробничого планування і поетапного руху предметів праці, супроводжуваного додаванням вартості. У результаті згаданої взаємодії розкривається суть механізмів та інструментів менеджменту процесів у галузі закупівельної логістики для досягнення синергетичного ефекту від безперервності управлінської діяльності. Таким чином пояснюються причини, за якими імплементація інструментів ощадливого виробництва опосередковано призводить до оптимізації логістичних процесів. Далі розкривається сутність концепції ощадливого виробництва і наводяться аргументи на адресу комплементарності концепції з інструментами логістичного менеджменту, але з урахуванням відмінностей їх функціональних змістів. В якості предмета даного дослідження використовується метод ощадливого виробництва Канбан, тому наступний етап дискусії присвячений аналізу теоретичних положень даної управлінської концепції. Також схематично представлений принцип реалізації обговорюваної концепції в практиці виробничої діяльності. Ґрунтуючись на результатах оглядових досліджень щодо успішності практичного застосування системи Канбан, були зроблені висновки щодо можливих позитивних ефектів від застосування системи. Далі, в результаті аналізу форм фінансової звітності підприємства-учасника продовольчого ланцюга поставок, були визначені добові залишкові значення запасів за однією зі статей готової продукції, які порівнювалися з добовими розмірами замовлень. Згодом із застосуванням системи Канбан були оптимізовані логістичні процеси за рахунок усунення надлишків виробництва. Нарешті, були підведені підсумки з узагальненням потенційних переваг, принесених використанням інструментів ощадливого виробництва.

Ключові слова: продовольчий ланцюг поставок, логістичний менеджмент, оптимізація процесів, управління підприємствами, ощадливе виробництво, інструменти менеджменту.

JEL Classification: D24; L23; L66; M11.

Introduction. The object of this research is the management system of the food supply chain participant companies.

The subject of the study is the lean production management tools that are supposed to positively affect logistics processes when introduced at food industry companies.

The purpose of this study is to find out whether the implementation of logistics processes optimizing methods in the management system of a food supply chain participant can be efficient.

The main task is to give a practical evidence of the fact that the mechanism for implementing logistics processes optimizing methods in terms of studied entities is effective and thereby efficient.

Today, almost all national companies working in the goods production, trade, transportation, warehouse business, public services, provision of tourism, information, and various intermediary services (forwarding, agency) are forced to engage in logistics. At industrial and commercial companies, logistics issues are handled by special departments (units) of logistics (internal, external), services of warehouses for material supply and finished products, warehouses for long-term and temporary storage of goods and cargo, transport and forwarding departments, order acceptance services, sales and delivery departments, information services. But, probably, the most critical area of logistics competencies implementation in terms of value creation lies in the area of production logistics.

An overall improvement of production performance, and an accompanying achievement of high level of a firm's competitiveness today are oftentimes achieved by the lean production strategy development and the introduction of

appropriate tools and methods. It also means that the introduction of lean production tools and principles is expected to bring production efficiency and product competitiveness to a qualitatively new level.

Lean production itself is supposed to organize business processes in a way that increases performance of the company using it by 20-40% annually, along with other indicators noticeable improvement. Therefore, the relevance of the lean production strategy development is justified and the observation of this strategy tools' practical application is of the highest priority at the present time.

Literature review. A great number of science publications are devoted annually to various issues of logistics management in the food industry and agriculture both in Ukraine and worldwide. In particular, the work of P. V. Pavlovsky (Павловський, 2018) is devoted to deepening logistics concepts, improving methodological techniques and developing practical recommendations for the logistics tools development in order to manage business processes within the processing industry. Among other things, the results of the study determined the low level of the industry profitability and the independent implementation inefficiency of certain logistics business processes when operating material, information and financial flows.

T. A. Zinchuk and A. P. Glibko (Зінчук & Глібко, 2010) are devoted to the food industry entities in terms of their logistics concepts' general provisions as well as the development of the corresponding systems in market environment. They studied the main stages of logistics concepts development and the food industry systems evolutionary features. The key problems of implementing logistics systems at enterprises have been also substantiated. The role and significance of logistics concepts in ensuring the efficiency of food companies management have been justified.

Y. N. Popova and Y. A. Panyukova (Попова & Панюкова, 2018) are devoted to the issues of optimizing the logistics activities at food industry enterprises. The authors pay special attention to determining the role and place of the distribution center, as well as the optimal logistics chain development due to the efficient management of this logistics center. The analysis of the main indicators confirming the ability of the company to finance its activities is carried out. According to the results of the study, scientists came to the conclusion that competent logistics can significantly increase the profitability of the business, and thanks to serious investments in the development of logistics processes, the company under study made drastic changes to the promotion strategy: the product began to be positioned not just as a commodity, but was supplemented with a service component on the way to promoting it successfully to the end user.

A. V. Gritsishin's (Грицишин, 2020) work is devoted to the problems of accounting and analysis of logistics activities at confectionery industry enterprises. The author makes a theoretical generalization and offers a new solution to scientific and practical problems, which consists in improving the methodological, organizational and applied provisions of accounting and analysis of logistics activities in the context of digitalization of logistics services; internationalization and globalization of goods and services markets; complication of transport routes in connection with global economic, political, military and epidemiological events.

Features of implementing an integrated logistics concept at fat and oil enterprises were studied by A. S. Razvenko (Развенко, 2016). The author's work considers the spread of this concept on the example of leading foreign firms and multinational corporations and provides examples of creating their own logistics system. It was concluded that the economic results of the logistics concept implementation are determined by the individual functions that it performs, and the integration of these functions into a single mechanism for reducing logistics costs while ensuring a high level of market demand satisfaction.

R. Garcia-Flores, O. V. de Souza Filho and R. S. Martins (Garcia-Flores, de Souza Filho, & Maritns, 2015) reviewed logistics studies for agribusiness supply chains and presented them by food sector. They paid special attention to projects that address the distinctive problems faced by the food industry, such as perishability, safety, and variability caused by the biological nature of the raw material, regional climate, and socioeconomic aspects, emphasizing practical challenges. The scientists have concluded that because of expected population increases, changing dietary habits, and increasing scarcity of resources, the food production landscape will continue to evolve in the foreseeable future, with new industry initiatives involving interdisciplinary collaboration among experts in logistics, market economics, and food and environmental science. In their opinion, these initiatives increasingly rely on quantitative and analytical techniques tailored to the specific needs of each supply chain.

Research methodology. According to the applied lean production concept, all the activities of a company are divided into operations and processes that add value for a consumer (for which consumers pay), as well as operations and processes that do not add value for the consumer, however, still consume the resources. The goal of lean production principle is to systematically cut out processes and operations that do not add value, while achieving the release of resources.

One of the methods of lean production is value chain mapping. Value chain mapping is the most common method of identifying losses in the production of a particular commodity. The value chain mapping describes all the actions (that both add and do not add value), which are needed in order to produce a commodity. The main idea is to visualize the work that transforms the product so that consumers are willing to pay for it (value adding time). Anything that is not included in this time is a source of loss.

This study uses the Kanban system as a tool for implementing the "just-in-time" lean production method by mapping the value chain. At the same time, a number of polices were followed to implement the just-in-time principle via Kanban cards:

– the subsequent technological stage must "pull" the necessary goods from the previous stage in the required quantity, to the right place, and strictly at the specified time;
– the number of goods produced corresponds to a number of goods "pulled" by the subsequent stage;
– defective products should never be delivered to the subsequent production stages;
– the number of Kanban cards must be minimal;
– Kanban cards should be used to adapt production to small fluctuations in demand.

Main results. Optimization tools are numerous and include techniques for transforming systems through fundamental rethinking and radical redesign, as well as techniques for evolutionary change (Vasyurenko, Kuksa, & Danylenko, 2019). The need to develop logistics systems with optimization tools is due to a number of modern requirements, namely:

– introduction of management models that are adequate to the new "post-industrial era" economic interaction;
– ensuring a combination of optimal production and management processes and maintaining the competitiveness of supply chain participants with regard to high risk and turbulence of the external environment (Liu, Lei, Zhang, & Wu, 2018);
– flexibility, mobility, customer focus;
– intellectualization of company assets;
– the growing role of headwork and information component, the development of information technologies and systems in logistics and management (Пєтухова & Ткачук, 2018).

In terms of logistics management tools variety, the field of logistics deals with the production of raw materials, semiproducts, their storage, sale, transportation to the finished product manufacturers. It also involves production and sale of the finished product, its distribution and delivery to the end user on certain terms (Danylenko, 2020).

Production logistics, particularly, is engaged in all the types of production at a company, in planning and management departments activities, encompasses supply and sales departments competencies (Косарева, 2014). The movement of goods within its area of responsibility begins with a components and materials warehouse and ends with finished products warehouse. According to sales and marketing departments' data, management departments develop a production program for a certain period (decade, month, quarter). The production program contains planned figures for the product range, the number of products produced (Красноруцький & Онегіна, 2013). This program is further detailed in the form of release schedules for all production units that work according to the production program.

Following the production program, the need for raw materials, semiproducts, and components for all planned goods should be calculated and a logistics plan should be developed. The task of the supply department is to ensure that all the components and materials arrive at the warehouse within the terms specified in the plan (Болотна & Ларіна, 2013). From this point on, it is necessary to ensure maximum efficiency while implementing all the processes aimed at adding value. The art of achieving this goal lies in eliminating all possible wastes that arise during working process. It is generally assumed that these wastes fall into seven main categories: inventory, waiting, defects, overproduction, over-processing, motion, and transportation (Tom, 2018). The lean production system is the most widely used management tool, which, using various methods, is able to positively influence the situation with wastes, taking into account all of their types listed above (Tiwari, Sadeghi, & Eseonu, 2020).

Lean production is a company management concept based on the constant desire to eliminate all types of losses (Hardcopf, Liu, & Shah, 2021). Lean production implies the involvement of every employee in the business optimization process and maximal customer orientation. The more often the demand changes, the faster the response of each link in the logistics chain should be (de Haan, Naus, & Overboom, 2012). And the application of the lean production concept helps get competitive for suppliers, manufacturers, and distributors. The concepts of lean manufacturing and logistics are mutually and harmoniously complementary. If logistics assumes the function of managing the material flow (organization, execution, control, correction), then lean production finds wastes and reduces/eliminates them, thereby helping logistics to follow one of the main principles, the principle of minimum costs (Gustavo et al., 2016).

One of the possible ways to develop a lean

production strategy is to introduce the Kanban system into the process. Kanban is a technique for maintaining an orderly flow of material and closely associated with the just-in-time philosophy (Wooten, 2015). To implement a Kanban-type control policy, a common approach is to aggregate process operations into several stages. As shown in figure 1, each stage consists of a production unit, which is comprised of a set of one or more machines, an input buffer and an output buffer. The production unit contains items that are either waiting for or receiving service at the different machines, referred to as the work-in-process of the stage. The output buffer contains the finished items of the stage, referred to as the finished goods inventory of the stage.

tem were developed as alternatives to the material and information flow control in stochastic and unstable demand environments. These variations have promoted the applications of Kanban systems to a large variety of industries (Rahman, Sharif, & Esa, 2013).

Due to the regular use of Kanban systems, it is possible, for example, to get rid of frequent and unnecessary control and overproduction inside the food supply chain. Eventually, it is supposed to decrease the final cost of the related products.

Kanban cards made up for each participant in the logistics chain allow them to reduce the production time by means of:

1. Unnecessary items removement.
2. Rational placement of objects.
3. Cleaning, inspection, troubleshooting.
4. Policies standardization.
5. Discipline and responsibility.

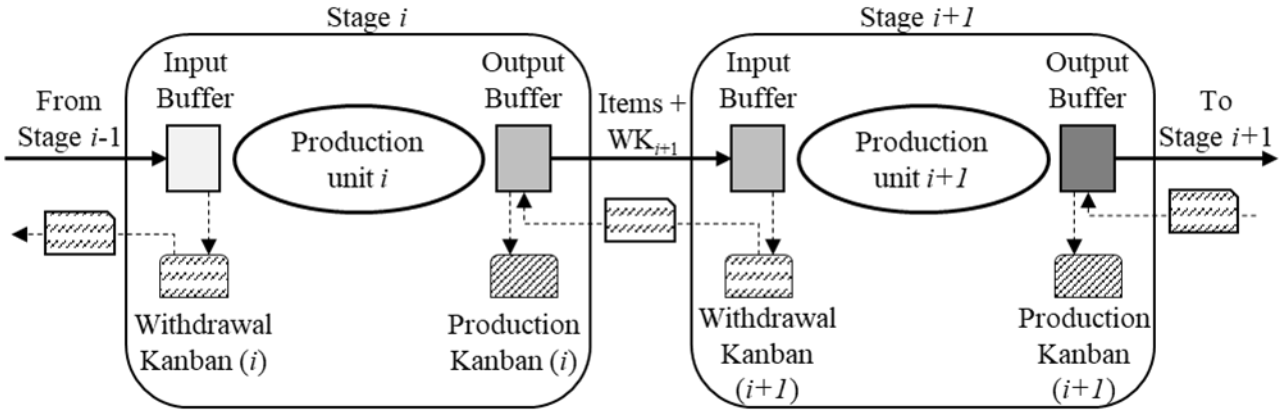

Fig. 1. Kanban process operations' aggregation
Source: revised based on (Li, Yi, Song, & Liu, 2013)

The Kanban system described above has proven to be successful in deterministic production environments with a smooth and stable demand and lead time. Whereas in many practical situations, production systems are filled with numerous types of uncertainties such as demand variations, breakdowns and other types of planned or unplanned interruptions (Fursa, Larina, & Danylenko, 2020). In order to minimize the variation caused by a variety of factors, more than thirty variations of the Kanban sys-

Before the introduction of Kanban cards into the cakes baking unit at Private JSC "Confectionary factory "Kharkovchanka", the overproduction of finished products, which were not sent to stores reached 1000 units. All finished products were sent to the refrigerator for freezing. Weekly balances in the finished product inventory are shown in Table 1.

Table 1. The cakes baking unit's weekly balances

Date	Balance for the next day	Order for the day	Produced
05.04.2021	868	930	880
06.04.2021	819	614	815
07.04.2021	1020	547	638
08.04.2021	1112	1312	850
09.04.2021	650	1048	1012
10.04.2021	615	546	667
11.04.2021	934	1077	975
Total	**6018**	**6074**	**5837**

Source: developed based on the financial statement data

The introduction of Kanban cards at the production unit is supposed to entail minimizing the finished products inventory. At the moment the average balance of products on the next day is 860 cakes weekly.

The process of movement of Kanban cards at the company is shown in Figure 2.

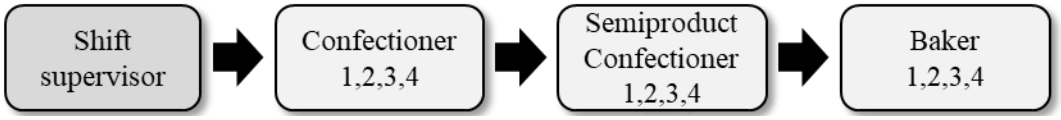

Fig. 2. Kanban cards transfer

The selection card comes to the production unit for each confectioner. It contains the request for the certain number of finished products and thereby an appropriate number of semiproduct is drawn from the next site. The movement of the card from the shift manager (picking) is shown in Figure 3-a). The next card comes from the finished product unit to the semi-finished product unit, the movement of the card is shown in Figure 3-b), determining the desired number of semi-finished products. The next selection card comes from the semiproducts unit to the bakery, as shown in Figure 3-c).

The products and components are delivered from the unit to the unit with a reference card attached to a mobile container. An example of a Kanban reference card is shown in Figure 3-d).

Order name Cake | *Previous site* Finished product unit

Confectioner no. 1

Article	Quantity
252133113	1
252240114	9
252533415	8
252535103	2

Next site Orders completing

a)

Order name Semiproduct | *Previous site* Semiproduct unit

Confectioner no. 1

Article	Quantity
252133113	1
252240114	9
252533415	8
252535103	2

Next site Finished product unit

b)

Order name Cake base | *Previous site* Bakery

Confectioner no. 1

Article	Quantity
252133113	1
252240114	9
252533415	8
252535103	2

Next site Semiproduct unit

c)

Previos site Bakery | *Next site* Semiproduct unit

Order name Cake base | *Tray capacity* 40

Article	Quantity
252133113	1
252240114	9
252533415	8
252535103	2

d)

Fig. 3. Kanban cards examples at the examined enterprise

An order of movement of Kanban reference cards attached to “Kanban” containers, which are meant to be transported from unit to unit (Figure 4) is implemented by controlling supervisors at the enterprise.

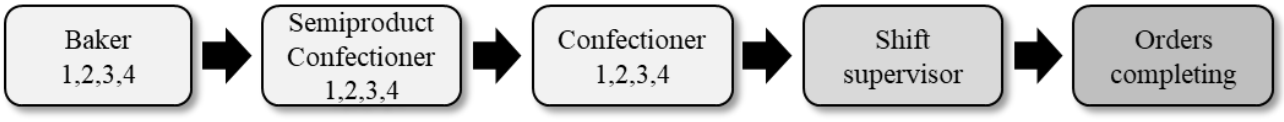

Fig. 4. The reference cards transfer

As shown in Table 1, the order for finished products per day is 100% fulfilled by the enterprise, thus the surplus of finished products is not appropriate. A sharp fluctuation in demand can be corrected by emergency cards though.

The average cost of 1 item of finished product is 25 UAH. The salary of the confectioner for 1 completed item of finished product is 6.50 UAH. Consequently, excess per day = 860 * 25 * 6.50 = 139 750 (UAH).

Thus, the average surplus per day costs the company 139 750 UAH.

As was mentioned above, the overall lean production philosophy centers on the minimization of all forms of waste in the workplace. As a specific lean method, Kanban scheduling system aims to improve the production logistics coordination. Besides the described advantages there are many other things the lean production system's introduction may bring as a competitive advantage, thereby optimizing close management operations.

Beyond simply reducing costs and improving efficiency, lean production techniques introduce systems and develop skills with the staff that support changes in the workplace that new sales create. Space saved on warehousing may be used to add new product lines. The same is true of time savings. The staff can absorb new work and react quickly to changes in client demand. Producing work quickly, in short iterations, without waste and delivered on time enhances firm`s advantage over its competition (Chen, Cheng, & Huang, 2013).

The aggregation of the lean production methods implementation advantages looks like that:

– increased profits: more productivity with less waste and better quality ultimately leads to a greater profitability;

– sustainability: less waste and better adaptability makes for a company which is better equipped to thrive well into the future;

– customer relations improvement: focus on the needs of loyal customers allows to build and maintain a constant stream of incoming revenues;

– increased product quality: improved efficiency frees up employees and resources for innovation and quality control would have previously been wasted (Shpak, 2019);

– strategic goals achievement: creating value for customers allows to develop the company's competitive advantages;

– employee satisfaction: it negatively affects morale, when the daily routine is packed with unnecessary work;

– improved lead times: as production processes are streamlined, businesses can better respond to fluctuations in demand and other market variables (Garcia, Moyano, & Maqueira, 2021).

Conclusion. Despite the successful experience of implementing lean production among global companies, few entrepreneurs in Ukraine chose to use its benefits. Nevertheless, the interest in this optimizing system in the scientific community is constantly growing. The right transition to lean production is accompanied by a correct understanding of its philosophy (that is, an understanding of the principles and purpose of the tools and methods) and a willingness of management to make significant changes.

Overall, our example has shown that the principles of lean production can be successfully applicable in any field and by any companies, even the small ones. Our research made it possible to successfully avoid unnecessary expenses of the enterprise by 2 960 000 UAH per year, and reduce the cost of finished products by 5,95 UAH per item of finished products.

Key guidelines for introduction the lean production tools and methods are: a thorough analysis of the problems, the help of experienced specialists in the field, an emphasis on strengthening vulnerable areas, a focus on long-term results, continuous changes and the realization that the introduction cannot be done once, but must constantly develop the process.

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