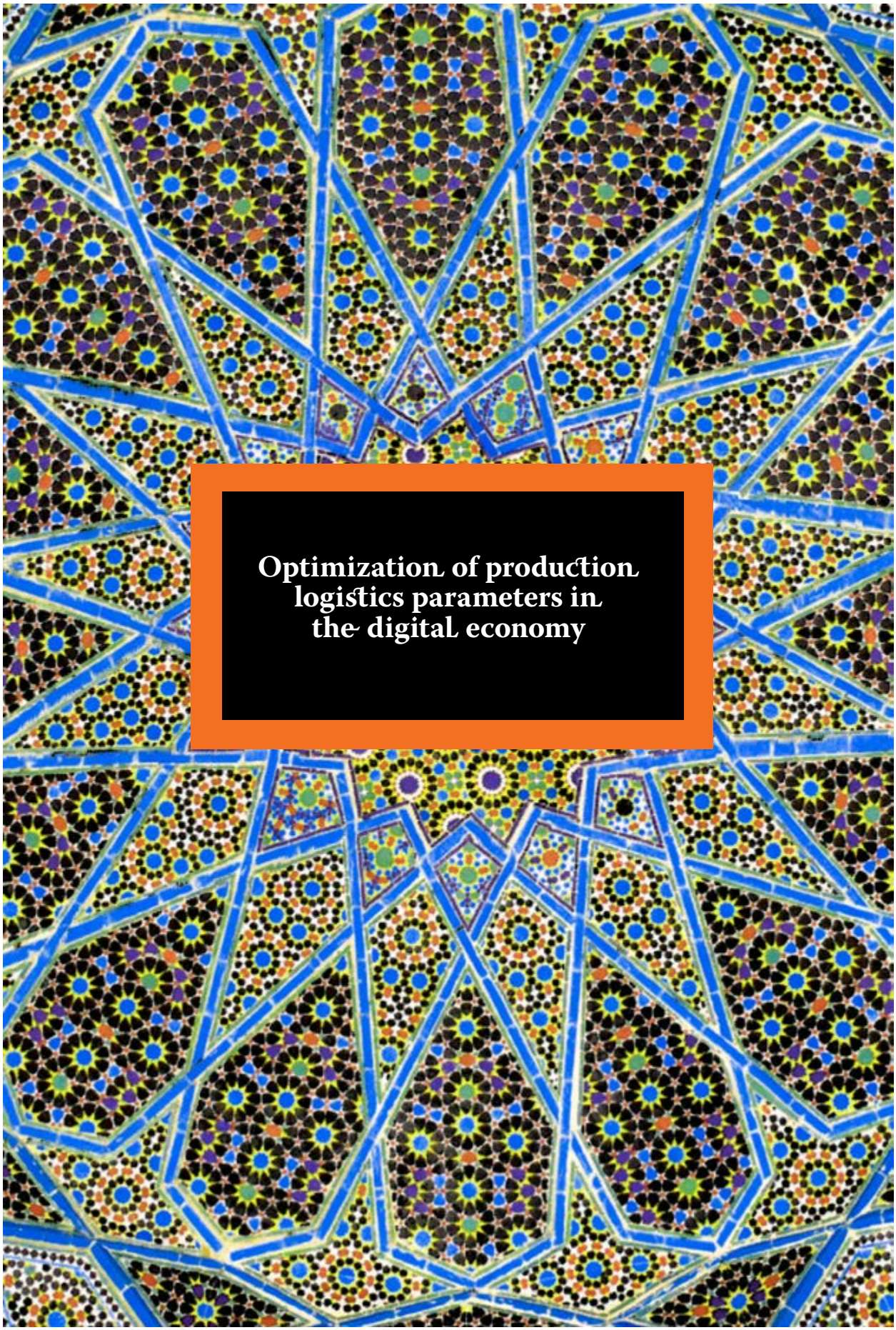
Optimization of production
logistics parameters in
the digital economy

Optimization of production logistics parameters in the digital economy

Optimización de los parámetros logísticos de producción en la economía digital

ABSTRACT

In this work problems of an efficiency evaluation of logistic providing the production organizations in the conditions of digital economy are considered. Authors predict "digitalization" of management systems by organizational structures, synergy consolidation of field of production management and logistics, combined use at the entities of approach of Lean and ERP systems. For effective logistic providing the entity in the conditions of digital economy it is offered to organize deliveries by the principles of E2E ("End-to-End"). Approach of E2E covers all supply chain, the principle of pulling to the supplier is implemented, the supplier completes and sends details under structure of the conveyor in a special container. The basic principles of E2E are: reducing warehouses and inventories, reducing frequency and usage time of transport, more effective work of the supplier, outsourcing of components, minimization of subassemblies, release of space for picking zones. In article the basic concepts and provisions of production logistics are specified, the balanced scorecard of an efficiency evaluation of logistic providing the entities in the conditions of digital economy was offered and formulas of calculation of cost efficiency of use of this principle in practical activities of the entity are developed.

KEYWORDS: Production logistics, E2E, the extending planning system and deliveries, digital economy.

RESUMEN

En este trabajo se consideran los problemas de una evaluación de la eficiencia de la logística que proporciona a las organizaciones de producción en las condiciones de la economía digital. Los autores predicen la "digitalización" de los sistemas de gestión por estructuras organizativas, la consolidación de la sinergia del campo de la gestión de la producción y la logística, el uso combinado en las entidades de enfoque de los sistemas Lean y ERP. Para la logística efectiva que proporciona la entidad en las condiciones de la economía digital, se ofrece para organizar las entregas según los principios de E2E ("De extremo a extremo"). El enfoque de E2E cubre toda la cadena de suministro, se implementa el principio de tirar al proveedor, el proveedor completa y envía los detalles bajo la estructura del transportador en un contenedor especial. Los principios básicos de E2E son: reducción de almacenes e inventarios, reducción de la frecuencia y el tiempo de uso del transporte, trabajo más eficaz del proveedor, tercerización de componentes, minimización de subconjuntos, liberación de espacio para zonas de selección. En el artículo se especifican los conceptos básicos y las disposiciones de logística de producción, se ofreció el cuadro de mando integral de una evaluación de la eficiencia de la logística que proporciona las entidades en las condiciones de la economía digital y fórmulas de cálculo de la rentabilidad del uso de este principio en actividades prácticas de la entidad se desarrollan.

Palabras clave: Logística de producción, E2E, ampliación del sistema de planificación y entregas, economía digital.

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1. INTRODUCTION

In modern technological conditions of development of world economy there is a synergy integration of production management and logistics, "digitalization" of management systems by organizational structures, expansion of field of combined use of the Lean tools and ERP systems. It is connected with need of quick response to demand of the consumer, reaction to market changes taking into account customization of needs of the client and operational reducing logistic expenses. Integration becomes the main tendency of modern economy and implies broad cooperation between the organizations in the field of sales, service, management of supply chains. Therefore, production management and logistics require development of specialization of the entities, allocation of core competencies, reducing auxiliary processes with their subsequent transfer or acquisition from business partners according to modern concepts of outsourcing [Mingaleev G.F., Khayrullin I.R., Fattakhov Kh.I. 2012].

At the same time, in the conditions of digital economy especially relevant is a question of change of model of management systems, both at the level of production systems of the organizations, and at the national level. The basic principles of management in economy of new technological way, according to developers of the development program of digital economy, in the Russian Federation will become:

– Data acquisition in real time.

– The management of economic processes based on the automated analysis of big data.

– High speed of decision making, change of rules in real time.

– Orientation to the specific user.

The decision in one contact [The development of digital economy in Russia. The program until 2035 / [electronic resource]. - Access mode: http://spkurdyumov.ru/uploads/2017/05/strategy.pdf].

It is also important to understand that not technologies, but the new management models technologies and data allowing to perform rapid response and modeling of future challenges and problems become a key factor of success in digital economy[The program "Digital Economy of Russian Federation" / [electronic resource]. - Access mode: http://static.government.ru/media/files/ 9gFM4FHj4PsB79I5v7yLVuP gu4bvR7M0 .pdf].

With respect thereto special relevance transformation of management systems of the entity in digital economy purchases, optimization methods of production and logistic processes. A problem of adaptation of management of logistic flows in the conditions of new technological way, a way of development of effective logistics systems, methods of calculation of efficiency of actions for upgrade of logistic providing the entities require separate studying.

2.MATERIALS AND METHODS

For a productive efficiency evaluation of management systems authors it is offered to carry out by organizational structures in new technological conditions the analysis on the basis of the balanced scorecard "SQDCM" which is widely applied to goal-setting and assessment of a current status of production systems [Mingaleev G.F., Babushkin V.M. 2012;Fattakhov H.I. 2014;Domingo, Rene T. "THE QCD APPROACH TO OPERATIONS MANAGEMENT" design / [electronic resource]. – Access mode: http://www.rtdonline.com/BMA/MM/qcd.htm] recently.

The analysis was carried out by five main criteria: S-Safety, Q-Quality, D-Delivery, C-Cost, M-Morale. By each criterion the author offered key indicators, availability or lack of which (it is displayed by "-" and "+" symbols) allows to reflect essential differences in the considered management systems organizational structures. In a broader sense the provided matrix of assessment can be used as the check sheet of assessment of readiness of management systems for new technological

way ("digital economy"). Authors carried out comparison of suppliers of traditional forms of services of city passenger traffic and digital "Uber" platforms (Table 1). According to the conducted research in digital platforms of a management system become more adaptive, open, innovative, democratic, progressive, and the most customer-oriented. Not observance of formal rules is at the center asked about a customer satisfaction, but.

Table 1.Matrix of assessment of management systems organizational structures. (See Annexes)

The "digital" environment which assigns to the direct contractor of services of the heavy responsibility pushes to it management, but at the same time and gives it more freedom in the actions.

According to authors, upgrade of production logistics in the conditions of digital economy (category D-Delivery) will be directed to automation of a scheduling and control of task performance (information MES, WMS and Enterprise resource planning), to increase in overall performance of the direct contractor of the service/supplier of goods, to reducing number of intermediaries of services/overloads of goods, production transfer accessories/preparation of service on outsourcing [Carol A. Ptak ERP Tools, 2004;Baker, Alan Rushton, Phil Croucher, Peter. 2014: Yessembayeva, 2018 and Salavati-Niasari et al., 2015). Modern logistic concepts which are implemented at themselves by the western car makers confirm these conclusions [Waddington T. Lean and agile supply chain design / [electronic resource]. – Access mode: http://www.littoralis.info/iom/secure/assets/iom_iom20031201.236634_3fe97d8a17e03.pdf]. So, representatives of Daimler AG held a strategic session on integration of production systems of Daimler and "KAMAZ" where the concept of "E2E" which provides new approach of delivery of accessories to a conveyor line item was presented (passing all warehouses) in the necessary sequence, in due time, in the necessary quality [E2E system for «KAMAZ» / [electronic resource]. – Access mode: https://vestikamaza.ru/news/budni-kamaza/sistema-e2e-dlya-kamaza/].
E2E ("End to End") is the concept directed to optimization of all logistic processes between the supplier and the consumer. Approach of E2E covers all supply chain, the principle of pulling to the supplier is implemented, the supplier completes and sends details under structure of the assembly conveyor in in advance approved container. For the realization account of the concept of E2E the logistics system of the entity gets the following advantages:

– An exception of need for repackaging on line items.

– Reducing frequency and usage time of transport due to synchronization of production and suppliers.

– Minimization of subassemblies.

– Reducing warehouses and inventories due to synchronization of production and suppliers.

– Release of space for picking zones.

– Reducing number of contacts with components in case of accomplishment of warehouse operations.

– Reducing quantity of defective products, due to reducing number of contacts.

– Lack of need for accounting points, through a direct delivery from the manufacturer, passing intermediate storages.

– More outstanding performance of work of the supplier, due to entering of integrated assessment and search of alternative suppliers.

For an efficiency evaluation of optimization of parameters of production logistics by means of the concept of E2E authors were the balanced scorecard of an efficiency evaluation of logistic providing the entities in the conditions of digital economy is offered. Assessment is conducted in parameters which, according to authors, are exposed to optimization as a result of implementation of the concept of E2E. In the table formulas of calculation of costs and economic effect are this and also the applied variables are listed.

Economic effect of the offered actions is calculated by a basic formula: Economic effect (I) = [Costs to – Costs after] – Costs for implementation of an action where it is meant costs: Costs = [Physical expense of resources

* Cost of resources]. The overall performance of suppliers is estimated on an integrated efficiency evaluation of work of the supplier created on the basis of expert evaluations.

3.RESULTS AND DISCUSSION

The received results are provided in table 2. Authors consider that this system of indicators allows in case of work on upgrade of production logistics in digital economy, to build multiple-factor model of future condition, and on the basis of the offered formulas to estimate efficiency of the offered changes.

Table 2.The system of indicators of an efficiency evaluation of logistic providing the entities in the conditions of digital economy. (See Annexes)

4.CONCLUSIONS

According to the constructed matrix of assessment of management systems organizational structures, in the conditions of digital economy in production logistics it is necessary to pass to automation of logistic processes, to increase overall performance of the supplier, to lay off number of intermediaries. Fully the concept of production logistics of E2E (End-to-End) in which by means of use of the principle of pulling optimization of all logistic processes between the supplier and the consumer is performed meets these requirements. The quantitative indices allowing to estimate possible economic effects, arising from application of the offered actions are developed and provided by authors. This system of indicators can be applied as multiple-factor model in case of assessment of future condition of production logistics within the optimizing actions.

The world economy is on the threshold of serious infrastructure changes. Advantages are got by the economic agent who will be able during the shortest period of time to receive a request from the consumer of service/goods, to execute it and to deliver in the shortest period [Rother Mike. Toyota Kata. 2010]. Digital technologies do possible the handling of big data, the Internet of things complemented with reality, a robototization, a 3D seal, etc. In these conditions it is extremely important to adapt management systems organizational structures, including management of production logistics of the entity, to do it more flexible, customer-oriented, cost-efficient [Imai, Masaaki. 1997.]. Approaches for similar optimization of parameters of production logistics of the entity were covered in article, the balanced scorecard, formulas for calculation of possible economic effect of the offered actions is offered.

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ANNEXES

Criterion	Key indicator	Description	Traditional service providers	Digital platforms
S	*The filter of suppliers*	*The possibility of operational refusal of suppliers of services/goods on the basis of estimates of consumers*	–	+
	Conscious responsibility	*Orientation on increase in conscious responsibility in case of execution of service/delivery of goods*	–	+
	Rating of consumers	*Availability of a possibility of assessment of consumers by suppliers of services/goods*	–	+
Q	*The built-in quality*	*Orientation on quality assurance in the course of value creation, minimization of checks*	–	+
	Rating of suppliers	*Rating assessment of the supplier of services/goods consumer online*	–	+
	Reaction time	*Orientation on reducing time of reaction from the moment of receipt of a signal of goods/service delivery*	–	+
D	*Automation of scheduling and control*	*Automation of scheduling of Deliveries and Control over goods/service order fulfillment*	–	+
	Overall performance of the supplier	*Orientation on increase in overall performance of the direct contractor of the service/supplier of goods*	–	+
	Direct work with the consumer	*Reduction of number of intermediaries of services/ overloads of goods*	–	+
C	*Management function digitalization*	*Use of digital technologies for implementation of management functions*	–	+
	Reducing management costs	*Minimization of management costs due to reducing levels of management*	–	+
	Outsourcing	*the Maximum transfer of production accessories/ preparation of service on third-party suppliers of services/goods*	–	+
M	*Operational feedback*	*Orientation for 100% operational feedback from the consumer*	–	+
	The culture of servicing	*Orientation on the high culture of servicing as an independent quality category*	–	+
	The social Orientation	*Technologies for comprehensive work with the consumer on social networks and platforms communicative online*	–	+

Table 1.Matrix of assessment of management systems organizational structures

ANNEXES

Indicator	Variables	Calculation Formula
1	2	3
Repackaging on line items	T_p - time spent for repackaging for the period, hour. Z_h – average salary of workers, rub/hour. C_p - cost of one packaging of a container, rub. N_p - the number of the workers who are engaged in repackaging, persons. Q_p – number of packagings of a container for the period, шт. X1 – costs before implementation of actions, rub. . X2 – costs after implementation of actions, rub. I - economic effect of implementation of actions, rub. W - costs for implementation of actions, rub.	The costs connected with need of repackaging: $X_1 = Z_{час} * T_{rap} * K + (Q_{rap} * C_{rap})$ Economic effect of reducing repackaging: $I = X_1 - X_2 - W$
Usage time of transport	T_r – a regulation of time of 1 flight, hour. Ca – a rate of work of motor transport, rub/hour N_{r1} – number of flights before implementation of actions for the period, piece. N_{r2} – number of flights after implementation of actions for the period, piece. I - economic effect of implementation of actions, rub. W - costs for implementation of actions, rub.	Economic effect of reducing number of flights: $I = C_a * (N_{r1} - N_{r2}) * T_r - W$ $Э = \frac{(Ц_1 - Ц_2)}{60} * Р_{кг} * Ц_{кв} - ЗП_{час}$
Subassemblies	L- Labour input of transactions of subassembly, N/h.C_{wa} - Average cost of a hour of the worker, rub. Z - average salary of one worker, rub. G_1 - a regulation of accomplishment of orders before implementation of actions for the period, N/h. G_2 - a regulation of accomplishment of orders after implementation of actions for the period, N/h. I - economic effect of implementation of actions, rub. W - costs for implementation of actions, rub.	The costs connected with need of subassembly: $G_1 = L * C_{hp} * Z$ Economic effect of minimization of subassemblies: $I = G_1 - G_2 - W$
1	2	3
The number of contacts with the components	Tr – expenses on time of performance of works for the period, rub. Pr – expenses on repackaging for the period, rub. Mr – Transportation expenses for the period, rub. O_{r1} – total expenses before implementation of actions, for the period rub. O_{r2} - total expenses after implementation of actions for the period, rub. I - economic effect of implementation of actions, rub. W - costs for implementation of actions, rub.	The total expenses connected with contacts $O_r = T_r + P_r + M_r$ Economic effect of decrease in number of contacts $I = O_{r1} - O_{r2} - W$
Quantity of defective products	B_1 quantity of defective details before implementation an action for the period, piece. B_2 - quantity of defective details after implementation an action for the period, piece. J_B – cost value of defect minus returnable waste for the period, rub. I - economic effect of implementation of actions, rub. W - costs for implementation of actions, rub.	Economic effect of decrease number of level of defective products: $I = (B_1 - B_2) * J_B - W$
Overall performance of the supplier	F_1 – reliability of the supplier F_2 – the price F_3 – the number of returns F_4 – terms of payment F_5 – a possibility of unplanned deliveries F_6 – a financial condition of the supplier F_7 – compliance the supplier Y_i – specific weight of criteria O_i – assessment of values of criterion (min 1; max 10) Values of criteria are exposed on the basis of expert evaluations and supporting documents by the following services: F_1 – production and ???? service F_2 – service of supply F_3 – service of quality F_4 – financial service F_5 – production and dispatching service F_7 – security service	Integrated efficiency evaluation of work of the supplier $F = \sum_{i=1}^{7} (Y_i * O_i);$
Points of accounting	N_i – the number of the employees occupied with accounting process for the period, persons. Z – average salary of employees for the period, rub. Y_1 – costs before implementation of actions Y_2 – costs after implementation of actions I - economic effect of implementation of actions W - costs for implementation of actions	The costs connected with accounting points: $Y = \sum (N_1 * N_2 * N_3, \ldots N_i) * Z$ Economic effect of cost reduction connected with accounting points: $I = Y_1 - Y_2 - W$

Table 2.The system of indicators of an efficiency evaluation of logistic providing the entities in the conditions of digital economy