

ARTICLE

IMPROVING THE EFFICIENCY OF THE ENTERPRISE PRODUCTION SYSTEM ORGANIZATION (ON THE EXAMPLE OF NIZHNEKAMSK TRUCK TIRE PLANT COMPANY LTD)

Guzel A. Khaziakhmetova*, Elnara E. Zainutdinova

Institute of Management, Economics and Finance, Kazan Federal University, Kazan, RUSSIA

ABSTRACT

The post-industrial vector of economic development and the intellectualization of economic activity would seem to create prerequisites for shifting emphasis to the improvement and development of the service sector, however, the basic and decisive importance of human needs even more strongly determine the need to implement the intellectual capital of the nation in a new, noospheric quality expanded reproduction of the industrial sector of the domestic economy. Rapid changes in the operating conditions of companies and fierce competition in the market set the rules of management, which state that ensuring the competitiveness of products of domestic enterprises again and again requires modernization. Moreover, it should also cover the production potential and, the introduction of new technologies and ways to stimulate labor, search for reserves to improve the organization of production. The positive decision in favor of the put-forward alternatives is mediated by the production system diagnosis results and the problem areas exact definition. In this regard, the research is devoted to implementation of the analytical potential of methods for assessing the efficiency of the production system organization on the example of the production workshop of the tire industry enterprise of the Republic of Tatarstan.

INTRODUCTION

As a result of the Russian economy transformation the economy manufacturing sector more suffered. It proved to be uncompetitive both on the price factor, and therefore production cost, and on qualitative and assortment parameters of the offered market of production. The sphere of trade in foreign-made products in the domestic entrepreneurs business ideas implementation came to the forefront, which yields profitability, calculated by tens of percent, while in production, this indicator hardly reaches to ten.

In such conditions, the remaining relatively small share of production workers in a pursuit of quantitative results, first of all, concerning prime cost, began to produce previously unknown actions, for example, related to outsourcing of the main business processes (systems of supply, distribution, economic providing, etc.), that within the undeveloped market more led to deterioration in production results (increase in the cost of the consumed services, increase in troubleshooting time, deterioration of the performed works quality). Thus, the knowledge and skills of the production system organizing and ensuring its effective functioning gradually began to be erased from the field of entrepreneurial competencies. At the same time, the resource potential of Russia, and also the country's historical production orientation, indicate the need to develop a system of knowledge about industrial production and production system.

An analysis of the theoretical works of domestic researchers in the field of production organization showed that the most significant results were achieved by several economists. It was they who gave the most comprehensive picture of the content and functions of the production system, revealed the principles of its organization and indicated the indicators for evaluating its effectiveness, revealed the design alternatives. However even in their works insufficient attention is given to binding elements and relationships of cause and effect between a production system, the enterprise functioning efficiency and factors of production. Despite the fact that the ideas of efficient production organization are quite well known and popular now, there is still a significant gap between theory and really used approaches in the enterprise activity.

MATERIALS AND METHODS

The methodological basis of the research presented in the article is represented by scientific achievements and the most famous research programs of domestic authors in the field of production organization. The conclusions and recommendations indicated in the work are proved by results of research received on the basis of economic-mathematical, abstract-logical methods and methods of system analysis.

The materials of periodicals and also regulations and reporting of tire business enterprises of PJSC TATNEFT formed information base of the presented research.

The practical significance of the research results is determined by basic provisions, generalizations, conclusions and recommendations that will help the enterprise to create competitive advantages, provided with increase performance indicators of production.

KEY WORDS

production system, organization of production, production efficiency, fixed assets.

Received: 16 Aug 2019
Accepted: 21 Sept 2019
Published: 26 Sept 2019

*Corresponding Author

Email:
Guzel7011@mail.ru
Tel.: +7 (917) 2678919

RESULTS AND DISCUSSIONS

In cybernetics, a system is understood anyway as ordered set of elements interacting among themselves, each of which can represent an independent system. The production system incorporates all system characteristics and has it only inherent features. So, M. Kh. Hasanov and A.I. Protopopov understand the production system as «a living cognitive system, a part of global nature-society-person system with function of useful powers generator ensuring the process of life evolution» [1].

Unlike them, A.V. Bandurin considers the production system as «a special class of systems, including workers, tools and objects of labor, and other elements necessary for the functioning of system, in the course of which products or services are created» [2].

According to I.V. Shurtukhina, the production system represents «a part of the production process which stood apart as a result of the public division of labor and is able, independently or in conjunction with other similar systems, to satisfy these or those needs, requirements and inquiries of potential consumers with the help of goods and services produced by this system» [3].

Thus, some authors of educational literature consider production systems as a part of more global systems, others – as a special class of systems providing production and consumers satisfaction. As its content is considered a combination of human, natural and material factors that ensure reproduction of economic benefits.

The factors and resources are the human, natural, immaterial and material values by means of which the production process is carried out. Elements of the production system and stability of communications between them, ensure the system integrity and its property to keep the originality.

The efficiency of production system functioning depends on the mechanism and quality of feedback, the components of which can include offers and requirements of consumers of the enterprise's products, claims and new information in connection with the unsatisfactory quality of the produced goods and scientific and technical achievements.

Now the structure of production system can be represented as follows [Fig. 1].

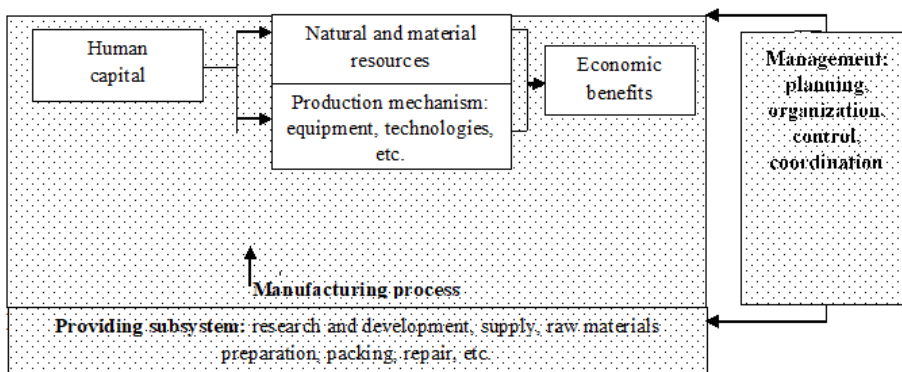


Fig. 1: Structure of the production system.

The aforesaid determines structure of production system of the country's tire industry enterprise.

Its prominent representative is Nizhnekamsk Truck Tire Plant Company Ltd (hereinafter referred to as OOO «H3ГЛ»), the history of which began from 1978 to this day is described by significant results of economic activity. So, according to a study by the marketing agency of DISCOVERY Research Group, the named company produces about 38% of the total truck tire production in the country [4].

So, the formation of OOO «H3ГЛ» production structure is dictated by tire production technology, which includes the processes for the manufacture of rubber compounds and the required components, the assembly and vulcanization of the tire [Fig. 3] [6].

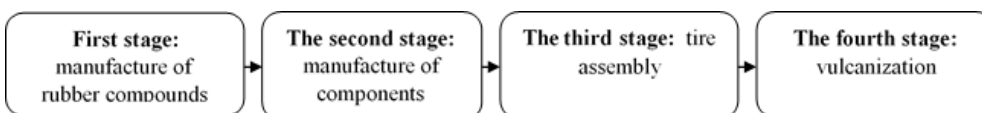
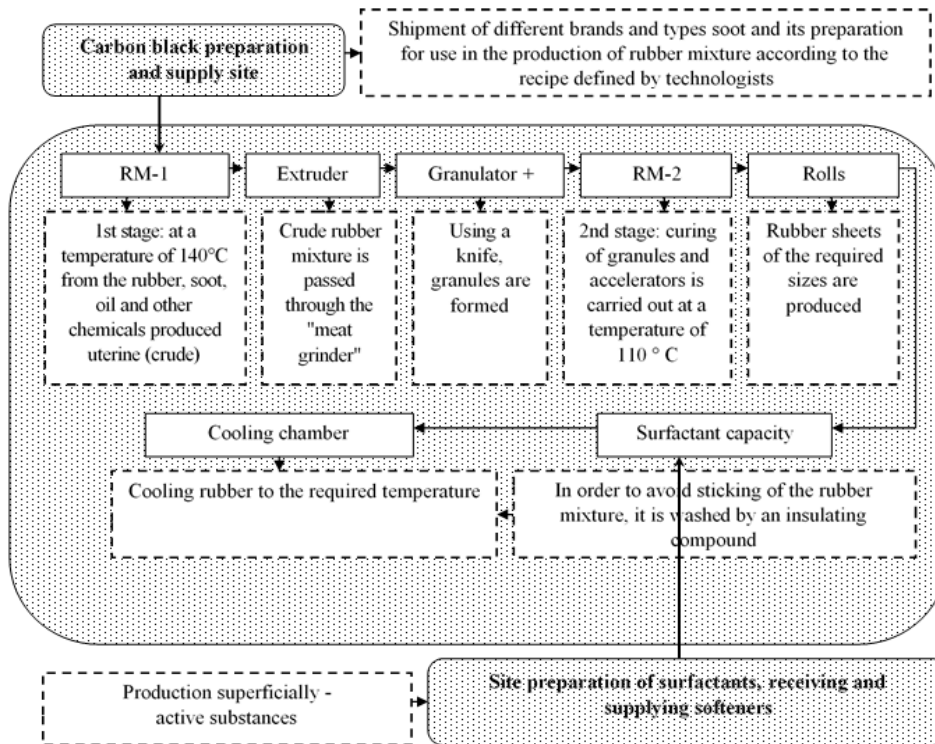


Fig. 3: Stages of tire production.

Significant production volumes and the complexity of the technical organization of the conditions for the implementation of each of the processes led to the creation of a workshop for the preparation of rubber compounds consisting of four sections: the preparation and supply of carbon black, rubber mixing and the preparation of surface-active substances (surfactants), the reception and supply of softeners; workshops for the manufacture of semi-finished products (assembly shop); tire vulcanization shop and auto chamber shop.

Detailing the production system to the level of the workshop indicated a research interest in the preparatory workshop of the enterprise in which the tire production process begins. The production structure of the workshop and the system of relationships and dependencies are presented in [Fig. 4].



Note: RM – rubber mixer

Fig. 4: Production structure of the preparatory workshop.

Analysis of the enterprise reporting information showed that the human capital of the workshop was formed from the composition of 215 employees, who annually produce about 130 thousand tons of rubber mixtures. The average annual output of the workshop workers is 611.8 tons of rubber compounds. Further, the analysis of the documents showed that the shop's costs for downtime due to equipment breakdown, seasonal fluctuations in demand for finished products and instability in the supply of raw materials only in 2017 amounted to about 11,187 thousand rubles [Fig. 5].

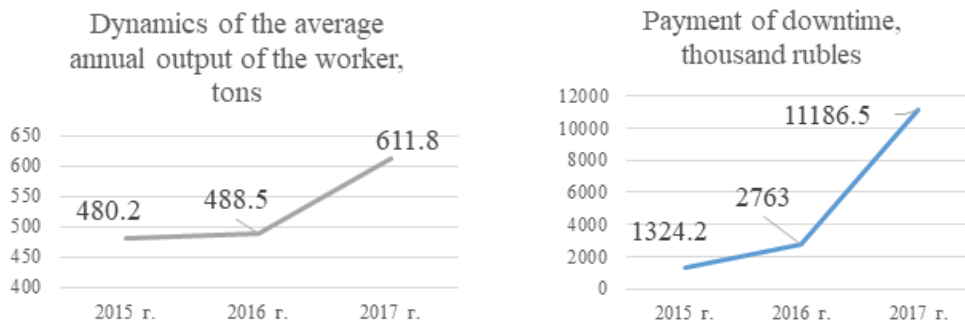


Fig. 5: The dynamics of the average annual output of workers and the cost of downtime in the preparatory workshop of OOO «H3ГЛ».

The frequent breakdown of the workshop equipment is due to a high percentage of not only moral but also physical deterioration of fixed assets. The company has been operating since 1978, despite the annual measures for the overhaul and partial replacement of equipment, the accounting data of the tire business enterprises of PJSC TATNEFT petrochemical complex, with the exception of the Nizhnekamsk All Steel Tires

Plant Ltd (since its launch dates back to 2009) indicate that the funds of the complex are almost 70% worn out, their active part is more than 80%. As was noted, the increase in expenses for capital and current repairs of the equipment of the workshop only for the period from 2015 to 2017 amounted to 27%, determining the increase in the share of these costs and equipment maintenance costs in the structure of shop cost to 55%. The decisive value of the cost of capital and current repairs of fixed assets of the shop for the cost of operating activities necessitates a search for reserves to reduce them.

Frequent equipment breakdowns and physical wear and tear of equipment affect the amount of primary and final rejects of rubber compounds, the value of which was respectively 0.50% and 0.011% [9]. The volume of defective products is affected by the state of not only the main technological, but also the auxiliary metrological, transporting equipment, which is reflected, for example, in measurement errors, the wakening of the supplied raw materials.

Thus, a point analysis of the production system of the preparatory workshop of OOO «H3ГЩ» showed that its economic losses are due to:

firstly, the work of the organization of the flow of resources along the technological chain of rubber mixtures, which determines the increase in the rates of consumption of raw materials, the cost of products, reducing the quality of incoming raw materials and materials;
secondly, the depreciation of the basic production assets of the enterprise and the used metrological equipment, most of which is at the age of more than 20 years;

thirdly, in the high costs of organizing the production of rubber compounds in the workshop (an annual increase in expenses by an average of 8%), a significant proportion of which is aimed at maintaining and repairing equipment (55%).

In this regard, to reduce costs and improve the efficiency of the production system of the enterprise at the stage of manufacturing rubber compounds, it is necessary to update the rubber mixing line; adjust the system of transportation and supply of carbon black into rubber mixers; work to improve the organization and rationing of labor of workers of the workshop [Fig. 6] [10].

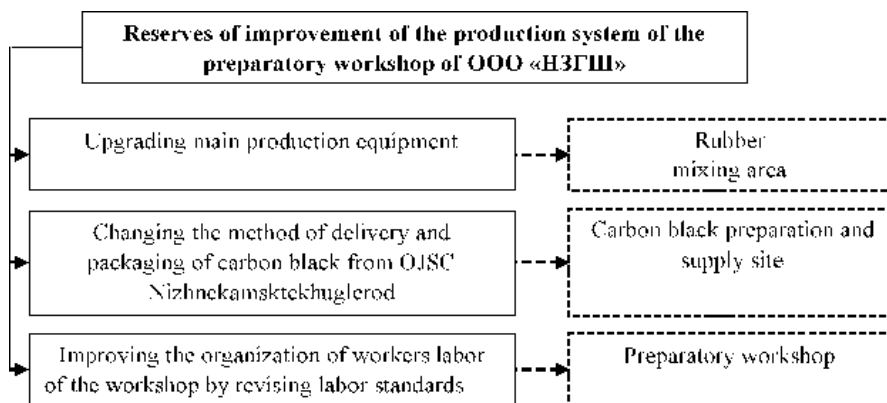


Fig. 6: Proposals to improve the efficiency of the production system of Nizhnekamsk Truck Tire Plant Company Ltd preparatory workshop.

In the preparatory workshop of OOO «H3ГЩ» there are two rubber mixing lines, each line is equipped with two rubber mixers, one extruder and a pelletizer, three pairs of rollers.

According to the price list of JSC Polymermash [11]. Completion of one line of rubber mixing will cost the enterprise 27 350 thousand rubles plus 50% – costs associated with the transportation and installation of equipment, total – 41 025 thousand rubles; two lines – 82 050 thousand rubles. Already in the first year of the implementation of measures, the savings will amount to 0.4 million rubles, in subsequent years, subject to a guarantee for the equipment for 5 years – about 80 million rubles annually [Table 2].

Secondly, the site for the preparation and supply of carbon black workshop was created specifically for the shipment of carbon black, which is transported from the Nizhnekamsk carbon black plant to the preparatory workshop of the plant. The cost of transporting one ton of carbon black according to accounting data for 2017 make up 340 rubles. With the help of shop transport and working personnel consisting of 13 people, carbon black is discharged into carbon black storage silos, which are vertically installed containers with a diameter of 5.64 meters and height of 15.4 meters. The capacity of one silage is 90 tons of carbon black. On the site there are 30 silos.

Table 2: The economic effect of the rubber mixing line modernization

Indicator	Current conditions (2017 conditions)	In terms of equipment modernization	Savings (-)
1	2	3	4=3-2
Annual costs for capital and current repairs of equipment (estimates of the workshop), million rubles	75,1	3	-72,1
Production costs from defect (with an average price per ton of rubber compound 30 thousand rubles * 106488 tons * 0.011%), million rubles	0,4	0,2	-0,2
Payment of downtime due to equipment failure (90% of 11.2 million rubles)	10,1	-	-10,1
Capital investment	-	82	+82
Total	85,6	85,2	- 0,4

Further, carbon black from silos is conveyed by belt to conveyor hoppers, which are tanks with a diameter of 3 meters, a height of 6 meters and a capacity of 2.3 tons, from which carbon black enters the rubber mixers of the first stage. In the preparatory workshop, 8 units of supply bins were installed [Fig. 7].

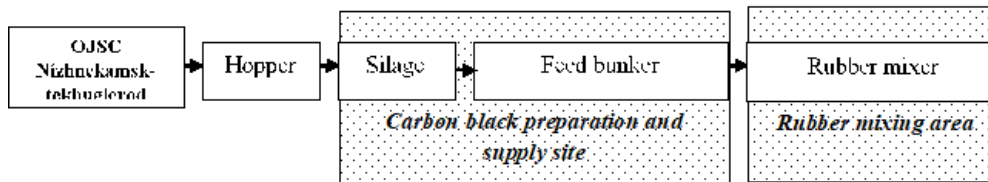


Fig. 7: Scheme of the organization of transportation and supply of carbon black to the rubber mixing area.

In the process of transporting and supplying carbon black to rubber mixers, their losses occur due to spillage. The cost of transporting carbon black by rail per year is $110 * 340 * 360 = 13,464$ thousand rubles.

In addition, the cost of labor of workers in the area of preparation and supply of raw materials is 16 million rubles.

Total expenses only for the preparation and supply of carbon black amount to 38,969.2 thousand rubles excluding the cost of purchasing carbon black.

In order to reduce these costs, it is proposed to use modern methods of transporting raw materials and materials in large rubber bags – Big Bag. Taking into account the needs of the company in the carbon black in the amount of 110 tons per day, the daily cost of purchasing big bags will be 22,2 thousand rubles, in a year 7992 thousand rubles.

During the development of the proposal to change the scheme of transportation and supply of carbon black in rubber mixers. First, carbon black will be supplied by road. In this case, transportation costs for the delivery of carbon black will be 1,650 rubles per day, per year 594 thousand rubles. Secondly, the need for silage maintenance will disappear, since carbon black will be immediately discharged into the feed bins by air forcing through pipes; thirdly, the loss of carbon black in the supply of carbon black in rubber mixers will be eliminated; fourthly, the number of the area of preparation and supply of carbon black for 5 people of the wage fund will be reduced by 1,170 thousand rubles. Fifthly, it will be necessary to install two crane beams, which will be mounted above the rubber mixers for shipment of carbon black into them from the feed bins. Their purchase and installation will cost the enterprise 400 thousand rubles. The proposed scheme for the transportation and supply of carbon black is presented in [Fig. 8].

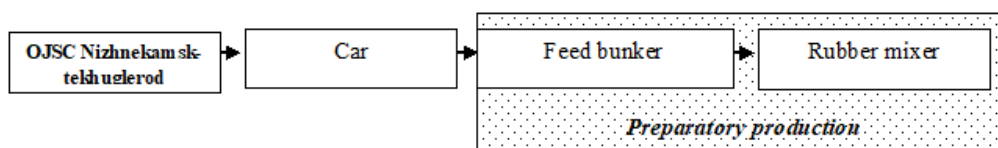


Fig. 8: The proposed scheme of transportation and supply of carbon black.

Thus, the update of the rubber mixing line will save about 80 million rubles annually, change in the method of transportation and supply of carbon black – 7 million rubles, which will reduce the cost of production and increase its competitiveness in the domestic and foreign tire market.

CONCLUSIONS

Thus, the production system is a structured set of factors and resources involved in a targeted production process and service delivery. Evaluation of the effectiveness of the production system organization is made on indicators reflecting the results of production, as well as relative indicators of the efficiency of using the capabilities of the staff, working capital and non-current capital of the company.

The economic analysis of the production organization in Nizhnekamsk Truck Tire Plant Company Ltd allowed to identify the main shortcomings in the activities of the workshop and to develop solutions aimed at improving the economic efficiency of production and ensuring the competitiveness of the products of the workshop in terms of quality and price.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

FINANCIAL DISCLOSURE

None.

REFERENCES

- [1] Hasanov MH, Protopopov AI. [2010] The device of steadily developing production system. MH Hasanov, AI Protopopov. Journal for shareholders. 5:32-35.
- [2] Bandurin AV. Manufacturing and production systems. URL: <http://www.mybntu.com>
- [3] [2001] Production management: a short course of lectures. IV Shurtuhina. Ivanovo. 15.
- [4] Analysis of the truck tire market in Russia. URL: <http://www.prnews.ru>
- [5] Hasanova GA, Mindubaeva ER, Khaziakhmetov AZ. [2010] Improving the management system of the territorial production complex (on the example of the enterprises of the petrochemical complex of PJSC TATNEFT): monograph. Kazan: Publishing House of the State Unitary Enterprise of the Republic of Tatarstan ИИЦ УДП РТ. 34.
- [6] Tire manufacturing process. URL: <http://www.nokiantyres.ru>
- [7] Alsu Shafigullina, Guzel Khaziakhmetova, Maria Pavlova. [2017] Balanced scorecard as management tools of the enterprises of a petrochemical complex «Tatneft» Modern journal of language teaching methods. 7(12). URL: http://mjltm.org/files/cd_papers/r_459_171218152555.pdf
- [8] Khaziakhmetova GA. [2018] Alternatives to improve the efficiency of use of assets of the enterprise (for example, PJSC Nizhnekamskshina) Vestnik of Economics, Law and Sociology. 4:50.
- [9] Hasanova GA, Khaziakhmetov AZ. [2010] Analysis of the quality management system at the enterprises of the petrochemical complex of the Republic of Tatarstan (on the example of the preparatory production of a truck tire plant of OJSC Nizhnekamskshina) Bulletin of Kazan State Energy University. 4:46-48. DOI: 10.1088/1757-899X/570/1/012102
- [10] Gabdullina GK, Hasanova GA. [2010] Improving the wage system as a condition for the development of industrial complex of the Republic of Tatarstan: monograph. Kazan: Kazan State Tech Univ.162.
- [11] JSC Polymermash (official website). URL: <http://www.polymermash.ru>