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**ECONOMIC ISSUES ON EQUIPMENT CAPACITY  
IN THE PROJECTS OF PRODUCTION DIGITALIZATION**

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**Abstract**

Production digitalization is a relevant world trend. The COVID-19 pandemic, which imposed restrictions on people's movement and requirements on social distance, jeopardized the digitalization issues. Owners and managers of production facilities now need to focus on digitalization of production projects. To implement effective digitalization projects, industrial enterprises should reasonably consider the cost of purchasing and operating equipment in the production process. As a rule, equipment costs occupy a large share in the investments structure of production projects. In addition, production equipment generates operation costs and risks costs which increase in the conditions of digitalization according to authors' opinion. Thus, the issues related to the justification of equipment capacity within the framework of digitization projects are economic. They are necessary to be solved in connection with risks' consideration, caused by equipment capacity in the projects of production digitalization. Inclusion of such risks should be implemented in several areas: choice of equipment that provides production in the project, it is necessary to take into account the aspects of technical possibilities and economic efficiency of its purchasing for the price defined by the company-manufacturer; formation of cash flows of the project: the frequency and cost of the repairs have to be accounted in addition to the cost of equipment purchasing. The article describes factors to be considered within each of these areas.

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*Keywords:* Equipment reliability, investment risk, the project of production digitalization



## 1. Introduction

On August 5, 2020, the publication "The digital industry has received the first standards" was published on the website of Ministry of Industry and Trade of the Russian Federation. The publication is aimed at effective implementation of digital technologies in the Russian industry, development of high-quality and independent solutions, as well as ensuring their compatibility. "Standardization, which directly affects the success of digital transformation, can bring the country's GDP up to 1% per year and about 3% in export development. We hope that this step will become a starting point for active development and implementation of digital solutions in industrial production", - said Minister of Industry and Trade of the Russian Federation Denis Manturov (Ministry of Industry and Trade of the Russian Federation, 2020).

It is not by coincidence that decisions made in respect of Russian production facilities at the state level are devoted to the issues of digitalization of the Russian industry. The article "Global challenges of the fourth industrial revolution" (Balatsky, 2019) fairly noted that the Russian Federation conditions to meet global challenges of the fourth industrial revolution are disadvantageous, also because of collapsing industries. For this reason, it is extremely crucial for country's leadership to focus on the problems of industrial enterprises and search for opportunities to support digitalization projects at Russian manufacturing plants. These issues are particularly urgent in 2020, when the whole world faced the COVID-19 pandemic, as industrial production in the conditions of digitalization is associated with the complication of technological chains and their embedding in more complex network structures (Kozlova et al., 2019).

On September 23, 2020 the results of the study conducted by the Digital Economy organization in cooperation with the Ministry of Industry and Trade of Russia and the State Corporation "Tsifra" aimed at identifying the most challenging problems and consequences of the COVID-19 pandemic for the Russian industry, as well as obstacles to industries' digitalization were published. According to the interviewed experts, the first place was occupied by the high cost of IT solutions for the digitalization of production processes (TAdviser, 2020). The observed results are not surprising.

Production digitization makes sense when production processes are synchronized together with other enterprise activities and integrated into the general information system. And the global processes' restructuring and digital technologies' introduction requires investments. For this reason, there are few examples of successful production digitalization projects in Russia. One of them is PJSC "KAMAZ". Active integration of digital technologies into production and business processes provided this enterprise with 50-fold EBITDA growth from 2015 to 2017 due to increased productivity and flexibility, improved quality and reduced rejects, and saved wages. Sales volume of this enterprise for the same period of time increased by 32% (Belzer, 2018).

## 2. Problem Statement

To implement effective digitalization projects, industrial enterprises should reasonably consider the cost of purchasing and operating equipment in the production process. Equipment costs are a significant item of expenses in the total amount of investments required to implement the project. In addition, production equipment generates costs related to its operation, as well as risks which increase with digitalization. This, in

turn, generates additional costs aimed at reducing the risk probability. The rationale for equipment reliability in digitalization projects takes a new meaning in comparison with projects aimed at using equipment which is not integrated with digital solutions in the production process. The given aspect has to be researched by investment project's developers at the stage of collecting of the initial data for technical and economic feasibility. And results of the conducted research are considered at designing of financial project model which is a basis for defining of economic efficiency indicators of the investment project.

### **3. Research Questions**

The research issues for this paper were:

- how production equipment capacity and project risks are interconnected,
- how equipment capacity affects cash flows of the project,
- how digitalization affects production equipment capacity,
- how to take into account the moral wear and tear of equipment in digitalization projects,
- equipment capacity as a category defined by its manufacturer,
- capacity as an economic category in the context of the enterprise which uses it in the production process,
- the rationale of equipment capacity in production digitalization projects is a task solved as a compromise between the development of scientific and technological progress and its opportunities in technical solutions, and the economic efficiency of such solutions.

### **4. Purpose of the Study**

The authors propose to consider equipment capacity as an economic category closely related to the category "investment risk". In the conditions of digitalization, when digital innovative solutions are actively introduced into production, the probability of failures which is not always a value based on statistical data, the economic issues of equipment capacity's justification are updated. In our opinion, the task of economic feasibility of equipment capacity within the framework of production digitalization projects should be solved on the basis of a financial model of such projects. The financial model assumes determination of cash flows generated in the course of solutions implemented in the project. In turn, cash flows are calculated on the basis of input data, the reliability and completeness of which will determine accurate efficiency assessment results of the production digitization project. The results of the investment project efficiency assessment are economic efficiency indicators. They are the basis for making decisions on taking certain solutions and rejecting the others ones.

### **5. Research Methods**

The authors carried out the research, which has theoretical nature, but practical significance for the enterprises which implement the projects of production digitalization. Theoretical character predetermined the methods that were applied in in the study. These are problem statement, analysis of topical information, comparison and description of different scientific views on the issues, synthesis of different approaches to the problem. The solution proposed in the research is based on cash-flow methodology with the full range

of methods used in its context. The applied nature of this methodology provides the assessment results to justify equipment capacity and determine the economic efficiency of production digitalization projects. The consideration of various solutions in digitalization projects is built on the system approach, the essence of which is taking into account the enterprise, production, project as a set of interrelated elements mutually influencing each other. The result of such mutual influence produces the effect greater than each element operates separately.

## 6. Findings

In the conditions of digitization, when justifying investment projects in the real sector of economy, there are new issues related to the justification of equipment capacity used for the production. Justification of the equipment capacity (technical systems) is one of the areas which considers investment risks in the process of feasibility study (FS) of the investment project, which is a project in which all solutions are described using cash-flow methodology.

Inclusion of risks caused by the degree of equipment capacity is obligatory in the projects aimed at production creation and development, and should be implemented in several directions:

1. When justifying the choice of equipment type which will be used for production within the framework of the project, it is necessary to take into account the aspects of technical capability and the economic feasibility of purchasing it for a price determined by the manufacturing company,
2. When forming project cash flows, the frequency and cost of repairs have to be accounted in addition to the cost of equipment purchasing.
3. It is necessary to determine the most appropriate time to replace worn-out equipment with new ones.

There are a few other points to emphasize. Investment risks in the process of technical and economic feasibility study of investment projects should be considered both with the methods of equipment capacity's justification and with the tools of organizational and economic systems' justification of the project (in particular, here we are talking about the creation of stocks of raw materials and supplies to prevent the risk of their non-delivery (or delivery with the violation of terms), which will result in the violation of obligations to buyers of the products manufactured at the enterprise.

Besides, investment risks should be taken into account when justifying the rate of return ROR of the investor, which is an indicator directly influencing the results of economic efficiency of investment projects, as he/she participates in determining of such indicator as discount coefficient that is used for defining discount indicators. And, therefore, it is necessary to separate: which risks will be taken into account in ROR and which risks will be taken into account when justifying equipment capacity (technical systems) and organizational-economic systems.

We have to highlight the third direction of risk accounting in the investment project. These are the risks, which are impossible to assume. They comprise macroeconomic parameters that are included in efficiency calculations but do not depend on the solutions taken in the project. Due to the complex prediction of the probability of equipment failures, part of which are digital technologies, there can be a false idea that the risks associated with technical systems' capacity should be taken into account in the third direction. But we called it "false" not by chance. Within the framework of scenario analysis, sensitivity analysis of the project and determination of the break-even point, it is vital to use the external environment

indicators, which are the same for all subjects of the investment process and do not depend on the solutions that are realized within the framework of the project (prices for products and resources, MRT, etc.). Thus, the methodology of these types of studies and the logic of their interpretation are provided.

## 7. Conclusion

Digitalization of production, which involves the introduction of digital technologies (DT) in technological processes, creates difficulties with the implementation of these areas. As for the first direction, the correlation between technical capabilities and economic feasibility is complicated by the cost of digital solutions integrated into the equipment. Often, the increase in production volumes or cost reduction through the use of digital technologies is not obvious. Or there is a reduction of some types of costs, but at the same time increases the other. Digital technologies give industrial production a number of advantages. Thus, the introduction of DH can lead to a reduction in costs due to marriage during production, or reduce the cost of remuneration of production staff (in fact, a very controversial thesis, because for the smooth operation of equipment with integrated digital solutions requires highly qualified staff with skills to work with DH). But at the same time, there will be costs associated with security, and maintenance of digital solutions (the cost of maintaining the equipment takes place without digitalization, but digital technology requires a special approach).

Determination of the frequency of maintenance and various types of repairs in the conditions of digitalization also takes on new aspects (Chudaeva et al., 2021). Digital technologies require updating. And in some cases, the frequency of such updates can be measured in months or even weeks. It is important to take into account the cost and frequency of such upgrades, as well as the ability to conduct them in-house, by outsourcing or by entering into a contract with the supplier/producer of the relevant solutions, when determining the economic efficiency of projects aimed at creating or developing production. Such problems are easier to solve for the production enterprise during the warranty service of the equipment - in this interval of time the responsibility and costs associated with repair, maintenance and preventive maintenance lie with the manufacturer / supplier of equipment (which, of course, they put in the price). Outside the warranty period (the moment when the manufacturer/supplier warranty is completed should be reflected in the project life cycle), it is necessary to form a clear idea of the steps of the calculation period at which the costs associated with maintenance and repair will appear.

It should be noted that the use of digital technology in production, including through the installation of sensors installed on the production equipment and allowing the collection of analytical data on the functioning of this equipment, makes it possible to apply new approaches to the operation of such equipment and determine the costs associated with repair work. Digital technologies serve as a basis for creation of autonomous control systems of technical condition of equipment. Such systems are adjusted in such a way that at certain conditions of production machines signals about the state of equipment are transmitted and perform functions of support and restoration of working condition.

The authors of the publication "Production machines maintenance based on digitalization" (Tugengold et al., 2019) proposed the construction of digital images of the machine in accordance with the basic stages of its life cycle, and the study "Prognostic approach to equipment maintenance as a leading element of digitalization of production processes" (Reznikova & Rashoyan, 2019) describes a predictive

approach, which widely uses statistical control of production processes and allows forecasting trends in the state of equipment. Application of such approach will allow to reduce the percentage of defects, to carry out preventive maintenance of equipment in time, which, in turn, will reduce the probability of unforeseen costs due to the onset of failure of technological equipment.

It is necessary to notice that any system of repair and preventive maintenance of the equipment, constructed with application of digital technologies, demands realization of a number of actions which set can be presented in the form of the project. Realization in a life of such project demands expenses. Hence, the project is investment. And realization of the project should be preceded by its efficiency assessment. And only if the results of the calculation have shown the expediency of investment of funds, it is necessary to start its implementation.

## References

- Balatsky, E.V. (2019). Global challenges of the fourth industrial revolution. *Terra Economicus*, 17(2), 6–22. <https://doi.org/10.23683/2073-6606-201917-2-6-22>
- Belzer, M. (2018). Digitalization of industry: Fashion trend or a necessary condition for maintaining competitiveness? <https://promdevelop.ru/industry/tsifrovizatsiya-promyshlennosti-modnyj-trend-ili-neobhodimoe-uslovie-dlya-sohraneniya-konkurentosposobnosti/>
- Chudaeva, A. A., Svetkina, I. A., & Zotova, A. S. (2020). Russian enterprises development based on European experience of labor productivity enhancement. *European Proceedings of Social and Behavioural Sciences*, 79, 960-966.
- Kozlova, T., Zambrzhitskaia, E., Simakov, D., & Balbarin, Y. (2019). Algorithms for calculating the cost in the conditions of digitalization of industrial production. *IOP Conference Series: Materials Science and Engineering*, 497, 012078. <https://doi.org/10.1088/1757-899X/497/1/012078>
- Ministry of Industry and Trade of the Russian Federation (2020). The digital industry has received the first standards. [https://minpromtorg.gov.ru/press-centre/news/#!cifrovaya\\_promyshlennost\\_poluchila\\_pervye\\_standarty](https://minpromtorg.gov.ru/press-centre/news/#!cifrovaya_promyshlennost_poluchila_pervye_standarty)
- Reznikova, I., & Rashoyan, I. (2019). Prognostic approach to equipment maintenance as a leading element of digitalization of production processes. In W. Strielkowski (Ed.), *Proceedings of the 6th International Conference on Social, economic, and academic leadership (ICSEAL-6-2019), Advances in Social Science, Education and Humanities Research*, 441 (pp. 363-369). Atlantis Press.
- Svetkina, I. A. (2021). Smart city: Ensuring economic security of administrative center of the Russian entity. In S. Ashmarina & V. Mantulenko (Eds.), *Current Achievements, Challenges and Digital Chances of Knowledge Based Economy. Lecture Notes in Networks and Systems*, 133 (pp. 539-547). Springer.
- TAdviser (2020). The digitalization in the industry of Russia. [https://www.tadviser.ru/index.php/Статья:Цифровизация\\_в\\_промышленности\\_России](https://www.tadviser.ru/index.php/Статья:Цифровизация_в_промышленности_России).
- Tugengold, A. K., Voloshin, R. N., Yusupov, A. R., & Kruglova, T. N. (2019). Production machines maintenance based on digitalization. *Vestnik of Don State Technical University*, 19(1), 74-80. <https://doi.org/10.23947/1992-5980-2019-19-1-74-80>