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OPTIMIZATION OF BUSINESS PROCESSES FOR TRANSITION TO SUSTAINABLE DEVELOPMENT IN THE CONDITIONS OF THE FOURTH INDUSTRIAL REVOLUTION

ABSTRACT

The influence of technologies of the Industry 4.0 on optimization business processes of the industrial companies for achievement of a sustainable development is analyzed. Effects of the changes caused by technologies of the Industry of 4.0 in the Russian and foreign companies are considered. It is shown that achievement of a sustainable development is impossible without the process innovations caused by introduction of new technologies. The algorithm of carrying out audit and an assessment of the new technologies "business processes" most ready to introduction is offered for their introduction.

KEYWORDS BUSINESS PROCESSES, NEW TECHNOLOGIES, THE FOURTH INDUSTRIAL REVOLUTION, INDUSTRIAL COMPANY, INDUSTRY 4.0, INNOVATIONS

INTRODUCTION

Over the past decade, industrial companies have increasingly focused on the transition to sustainable development. Sustainable development is development in which "meeting the needs of the present does not undermine the ability of future generations to meet their own needs" [Kemp R., Loorbach D. (2003) 2003], that is a process of changes aimed at obtaining a competitive advantage through the development and implementation of production processes that meet the requirements of environmental safety and social values. At the same time, such a transition is not possible without radical changes in production business processes. Such radical changes are taking place now and are conditioned by the introduction of technologies of Industry 4.0.

Since the beginning of the industrialization of society, the paradigms of industrial development changed under the condition of technological breakthroughs, which later became called industrial revolutions (IR). Consistently passed three IR:

- high mechanization of production processes;
- transition to the use of electricity in production;
- digitalization of processes of production enterprises.

Today, scientists [Zhou K., Liu T., Zhou L., 2015; HofmannE., Rüsch M., 2017; Kondratyuk, 2018; Nalbandyan G. G., Khovalova T. V., 2018; Trachuk A. V., Linder N. V., 2017; Tarasov I. V., 2018; Tarasov I. V., Popov N.A., 2018] agree that the industry has formed the necessary prerequisites for the fourth IR, when highly digitized processes of industrial enterprises will be integrated with the Internet and "smart" technologies. The term "Industry 4.0" is often used in this regard. Industry 4.0 aims to create new value proposals, business models and solve a number of social problems by creating links between exogenous and endogenous factors of industrial production [Pfeiffer S., 2017].

Industry 4.0 involves the transformation of key aspects of production. Consulting company BCG identifies nine key technologies, which are aimed at the formation of the fourth IR: autonomous robotics, simulation modeling, horizontal and vertical integration of systems, augmented reality, Internet of things, cloud technologies, additive production, cyber security and big data [Embracing Industry 4.0, 2017].

Introduction of Industry 4.0 technologies will allow plants to reduce production costs by 10–30%, logistics costs – by 10–30%, quality management costs – by 10–20% [Rojko A., 2017]. Industry 4.0 technologies are designed to shorten the time to bring new products to market, improve customer interaction, promote economies of scale and more efficient use of resources [Trachuk A. V., Linder N. V., 2018a]. Already today the introduction of Industry 4.0 technologies has an impact on transformation as business models of production [Trachuk, 2014; Trachuk A. V., Linder N. V., Ubeiko N. V., 2017], and business processes of production companies [Trachuk A. V., Linder N. V., 2017; Tarasov I. V., Popov N.A., 2018; Khasanov A. R., 2018]. This article presents the analysis of model transformation and business process processes of production companies in the conditions of transition to Industry 4.0.

TRANSFORMATION OF BUSINESS MODELS OF MANUFACTURING COMPANIES

In South Korea's innovative development strategy "Strategy 3.0", "smart" plants are defined as production systems, where all business processes are: planning, production, distribution and sales, are automated and integrated into a single information system. Cyber Physical Systems (CPS) provide the functioning of plants, which allow the creation of virtual doubles. CPS are designed for integration of computers that are directly integrated with the physical environment and operating processes, use of data collection and processing services via the Internet. Current CPS research focuses on the concept, applied technologies, building information architecture, existing challenges and new directions of development within Industry 4.0. A unified model of CPS implementation in production processes is proposed:

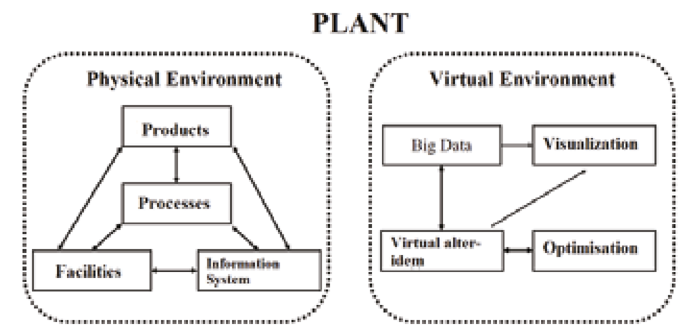
- smart connection;
- transformation of data into information;
- transition to virtual space;
- knowledge management;
- system configuration [LeeJ., Bagheri B., Kao H.A., 2015].

Conceptual scheme of interaction of smart plants with their virtual twins is described. Thanks to them it is possible to connect technologies of information and communication with production processes and databases within the enterprises. [Wiktorsson M., Noh S.D., Bellgrana M. et al., 2018] (Fig. 1). Three types of industrial plants are allocated depending on the approaches to the use of Industry 4.0 technologies: "smart" automated plants, customer-oriented plants and mobile plants [Tarasov I. V., 2018; Trachuk A. V., Linder N. V., 2017; Tarasov I. V. and others, 2018].

For implementation of CPS at the plants, a five-stage model is proposed:

- Smart connection. A system for collecting the necessary data to improve production is developed and adjusted through automated planning systems (ERP) or directly through specialized sensors;
- Transformation of data into information. It is necessary to use recognized methodologies to process data in information on the basis of which management decisions can be made.
- Transition to virtual space. A large amount of incoming information at the enterprise is subject to efficient processing and operational use. Through the transition of information flows, the quality of production is improved;
- Knowledge management. The processes of accumulation of acquired knowledge and their dissemination in the enterprise are developed.
- System configuration. Mechanisms of interaction between physical and virtual environments, through which hardware can operate autonomously and efficiently are described. Tools for prevention of technical failures are laid [Lee J., Bagheri B., Kao H.A., 2015].

Fig. 1. Interaction of physical and virtual environment of the "smart" plant



Intellectual and autonomous operation as an advantage of a "smart" factory requires analysis, forecasting and proactive activity of production system. The basis of research is data from production lines obtained in real time [Trachuk A. V., Linder N. V., 2018 a]. Productivity, quality of products and efficiency of logistics processes are taken into account. In practice, data is used in the construction of CPS, one of the key technologies for designing and operating a smart factory.

APPROACHES TO THE OPTIMIZATION OF BUSINESS PROCESSES

Essence and features of business processes modeling

Problem of business processes has been widely covered in the scientific literature has been widely spread in numerous scientific works. Among the first, it is necessary to highlight the works of M. Porter, where business processes were initially considered as an integral part of the strategic development of organizations [Porter M.E., 1991; Drucker P.F., 1986; Kaplan R.S., Norton D.P., 1996]. In the future, attempts were made to describe in more detail the essence of business processes. American economists M. Hammer and J. Champy defined business process as "an activity that uses one or more resources at the input and produces a result that is of value to the client" [Hammer M., Champy D., 2011]. Alternative wording was proposed by the German entrepreneur A.-V. Sheer: "Business process is a sequence of works characterized by a single natural or cost criterion of result" [Sheer A.-V., 1999]. Attention is focused on the set of consecutive works, content of business process. Not all business processes bring immediate value to consumers. As a rule, at industrial enterprises it is generated by the main processes, their occurrence is impossible without control and auxiliary processes. In the context of hierarchical structure, low-level business processes can be at all loss-making compared to higher-level processes. Focusing on processes that generate value

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does not allow a comprehensive view of the maturity level of the company's processes. To study the approaches to optimization, this approach is the most successful.

International Organization for Standardization has adopted a definition from the standpoint of the quality management system: “Process is a set of interrelated and/or interacting activities that use inputs to produce the intended result” [ISO 9000, 2015]. Business processes can be classified according to various criteria. Some large companies, such as Xerox and IBM, have analyzed their work and compiled lists of major business processes. Later it turned out that these are only special cases of solving different problems within companies. Later, application approach developed as a result of the implementation of the Norwegian industry productivity improvement program in comparative benchmarking (under supervision of Norwegian University of Natural and Technical Sciences) became most common. Based on Porter's value chain, all business processes were divided as follows:

- primary (basic) processes permeate all the activities of the company (from consumers to suppliers) and create value for consumers (product development, production and assembly, etc.);
- supporting (auxiliary) processes do not create value, are necessary to maintain the infrastructure of the entire organization (financial management, information management, etc.);
- developmental processes are designed to create a new value chain in the main and auxiliary processes at a new level of indicators (expansion of external relations, staff development, etc.).

Conscious improvement is possible and necessary for all groups of business processes. Comprehensive approach to optimization will allow to achieve maximum synergy effect and significantly increase the efficiency of the company [Trachuk A., Tarasov I., 2015].

Without understanding the internal structure of business processes it is impossible to proceed with improvement, as in this case it will not be possible to carry out a detailed analysis of sequence of work and establish relationships with contiguous processes. These problems can be solved by modeling business processes. The latter is understood as a set of actions that create a representation of an existing or intended business process. Modelling may cover the main, auxiliary, or control process, in whole or in part [Set, 2015].

Depending on the goals, the model of business processes can be presented at different levels of detail – from abstract to very detailed. Business processes at the selected level can be described graphically, with the help of various notations, the choice depends on the specific goals and organization. The most common and functional process notations are:

- VAD: notation is proposed by M. Porter and allows to model top-level processes directly involved in creating value for customers;
- EPC is used for modeling, analyzing, and further redesigning complex sets of business processes with multiple interfaces;
- BPMN 2.0 is designed to automate end-to-end business processes, supports simulation;
- IDEF is used for simulation at any level in automated production systems;
- UML is designed primarily for software design, IT system specification and job description.

Industry 4.0 dictates its requirements for the tools used, including the modeling of business processes to further optimize them through the introduction of digital technologies. To automate business processes, BPMN2.0 and IDEF are preferred, allowing multi-level modeling and having specific features. However, IDEF process notation family is outdated in terms of the breadth of functionality and graphical capabilities of visualization of created models, so the most priority standard for Industry 4.0 technologies remains BPMN2.0.

Approaches to the business processes optimization

Choice of methodology and approach to business process analysis depends on the initial data and the level of competence of the staff who will carry out the analysis. Formal and pragmatic blocks of methodologies can be singled out. Alternative classification may be the division of methods into quantitative and qualitative. The issue of choice is debatable and requires separate consideration.

Formal methodologies have developed templates, contain clear rules of analysis, application will require certain skills and experience. Formal approach is most appropriate if quantitative data are available for analysis, for example at production sites. In the absence of the necessary data, a pragmatic approach should be taken.

Pragmatic approach is traditionally based on the sequence of “planning – action – verification – correction”, it is inextricably linked to quality management and is used not only for analysis but also to optimize business processes. Process is analyzed from the point of view of compliance with existing requirements and standards; it is tested with the help of modern methods of research. Emphasis should be placed on compliance of the implemented changes with planned developments.

Business process optimization objectives are unique for each company and are determined by its specific needs, internal structure and individual problem processes. “Improving business processes – a set of methods and approaches that give managers the opportunity to improve their performance” [Subramanian N., Ramanathan R., 2015].

Business process optimization can be used to:

- increase the transparency of the company's activities for internal stakeholders, identify problem areas, establish the contribution of an individual employee to the overall result, etc.;
- classify processes by impact on the financial result of the company in order to determine the business processes that should be automated in the first place;
- improve the quality of finished products by identifying bottlenecks and eliminating them.

Quality improvements require a systematic approach. There are many views on the stages of optimization of business processes. They differ in specific conditions of activity and authors of researches. In general, it looks like this:

- Planning. Selection of process to be improved, with the definition of goals, objectives and scope of change. Analysis. Detailed study of the selected process.
- Redesign. Determination of changes that need to be made in order to achieve the objectives. Building a model of business processes “as it should be” (with a reflection of KPI).
- Attracting resources. Providing the project with all the resources necessary for its implementation: labor, material, financial, etc.
- Testing. Check initiatives at one site. Stage is necessary if the optimization affects several divisions of a large company.
- Implementation. Adjustment of activity according to the developed changes.
- Continuous improvement. Periodic assessment of the efficiency of optimized business process and making additional changes if necessary.

Implementation of all the above steps is appropriate only if the changes are substantial enough to cover a wide range of issues. The same applies to detailed elaboration and documentation of stages in case of significant changes in business processes. With a slight optimization, it is enough to think through each step.

in the conditions of introduction of Industry 4.0 technologies it is necessary to automate activity. It is one of the possible results of improvements, and it uses roughly the same scheme as when optimizing business processes. Depending on the problem to be solved there may be:

- reducing the number of process steps;
- exclusion of unnecessary steps from the process;
- reduction of matching points;
- changing the sequence of stages of execution;
- elimination of harmonization cycles;
- construction of parallel execution of processes;
- improving the performance of process stages;
- elimination of "bottlenecks";
- reducing unnecessary detail.

OVERVIEW OF BEST PRACTICES IN BUSINESS PROCESS OPTIMIZATION

Digital transformation has benefited most of the key financial indicators. For example, in relation to the cost of production, the effect is due to the optimization of operational processes: maintenance, production lines, quality control, internal warehouse operations.

Foreign companies' cases

We consider it useful to consider best practices of introduction of Industry 4.0 technologies in industrial production of foreign and domestic companies.

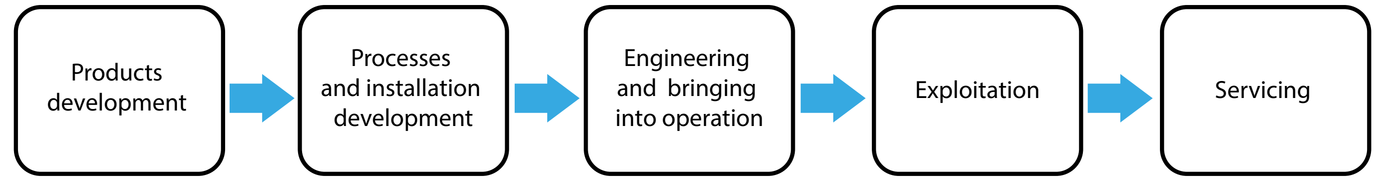
Thyssen Krupp AG is one of the world's leading elevator manufacturers, has developed a MAX system with Microsoft. It allows building models that predict the breakdown of the elevator. In real time, specific breakage code is passed to the mechanics that eliminates incident. In addition, additional value is created for the customer: more reliable and safe elevators reduce potential losses of companies (uptime of elevators increased by an average of 50%) [Thyssenkrupp, [s.a.]]. This approach to assessing the effectiveness of BigData technologies is well suited for maintenance and repair, as it allows you to compare “before” and “after” implementation.

Well-known manufacturer of computer components Intel is actively using BigData technology to reduce product costs. Every new processor model passes around 19,000 tests before entering the market. With Big Data predictive analytics and real-time analysis, test duration was reduced by 25%. You can save $3 million USD a year on testing IntelCore line.

German Siemens group is one of the leaders in the digital transformation of production. Company actively implements Industry 4.0 technologies in production processes, develops software and hardware for digital production.

For discrete and continuous production, Siemens offers its sets of information systems that cover different stages of the product lifecycle (Fig. 2).

Fig. 2. Product Lifecycle Chain [The Digital Enterprise, 2015]



For the production of discrete type the most important software systems are:

- Teamcenter. System supports product lifecycle: from design to post-sales service. Allows to model the product and establish communications between all participants in production process without using paper documentation.
- Techomatrix. Comprehensive package of solutions for digitalization allows to solve the problems of simulation modeling, programming of industrial robots and perform virtual start-up and adjustment of production lines.
- SIMATICIT. Package is designed to build a production process control systems (MES systems). Advantage is the ability to simulate complex business processes and production structures, their transparency and independence from the functioning of real management systems are preserved.
- MindSphere cloud system. Using the system in conjunction with the technology of the Internet of things allows to link real production sites with their digital counterpart. Examples of using this cloud system are presented in Table. 1 [MindSphere, 2017].

Developments for Industry 4.0 are primarily used by Siemens. Feasibility of switching to digital technologies is demonstrated by Electronics Works Amberg factory in Germany. Company produces a wide range of products: sensors, regulators, controllers, etc. Production processes are automated by 75%,

Table 1
Effect of implementing MindSphere cloud system

Scope of use	Effect
Konecranes	
Prediction of equipment failures to avoid downtime. Offer of additional services for customers	Reduced downtime by 10%. 12% increase in revenue from services
Coca-Cola	
Monitoring of small engines. Forecasting engine failures to avoid downtime	5% reduction in maintenance costs. 15% reduction in downtime
Siemens	
Increase the life of equipment. Improvement of the maintenance process. Forecasting failures to avoid downtime	Reduction of equipment downtime by 10%

automatic production of more than 1200 products. Quality level reaches 99.9% [As a smart plant, [b.g.]].

Manufacturer of exclusive cars Maserati also successfully implements digitalization tools. New Maserati Ghibli digital double produced by Siemens PLM Software's NX, Technomatrix and Teamcenter software solutions enabled:

- reduce financial and temporary resources for testing;
- reduce development period of the car by half, from 30 to 15 months;
- increase maximum volume of production of machines by 3 times.

Despite lower operating costs, the company manages to maintain high quality standards. Digitalization technologies ensure efficient organization of mass production, even if the batch consists of a single product. This allows to increase the flexibility of production and take into account individual customer preferences. So, now about 70000 unique modifications of MaseratiGhibli, one of the most popular cars of the company, have been released.

Russian companies' cases

Gazprom Neft PJSC pays close attention to Industry 4.0 technologies. An example of the successful use of BigData toolkit was the pilot project "Analysis of self-start of electric centrifugal pump installations after emergency power outages". Its implementation was carried out by specialists from Gazprom Neft PJSC and Teradata LLC [Hasanov M. M., Prokofiev D. O., Ushmaev O. S. and others, 2017]. More than 200 million records were used from control system controllers in 1649 wells, as well as recording of voltage restarts from emergency logs. Within the framework of the project it was possible to form and test a complex of hypotheses about the causes of failures at autostart [Grishina A., 2017].

Gazprom Neft PJSC implements Industry 4.0 technologies to manage production processes [Digitalization, 2018]. Company introduced "Cognitive Geologist" system based on artificial intelligence in order to reduce time for routine analysis of geological objects. As a result, the procedure for collecting, processing and interpreting information will be reduced six times (from one year to two months).

Since 2017, SIBUR Holding PJSC has been actively engaged in improving business processes in the field of gas processing and petrochemistry. Widespread digital transformation is one of the strategic goals of SIBUR. Digital Technology Division provides creation and implementation of Industry 4.0 technologies (augmented and virtual reality, Internet of things, machine learning) in all business processes.

Company has the IT foundation necessary for further digitalization, but full integration of systems has not yet been achieved. Existing information system allows testing and implementing various initiatives: from digital logistics to artificial intelligence.

In the maintenance and repair processes are actively implemented:

- NFC tags. With the help of tags, employees can quickly get information about the unit and the work to be performed.
- Predictive maintenance of equipment. Existing database made it possible to create a mathematical model that predicts with an accuracy of 72% when an extruder, shaft or granulator failure occurs. As a result, the number of emergency stops decreased by 5 times.
- Mobile solutions for equipment repair. Pilot project was launched in Voronezh: repair teams send photos via mobile devices to the appropriate service, which provides real-time advice to employees.

Production process has also been optimized with the help of Industry 4.0 technologies. A large array of data is collected from sensors installed on polypropylene production lines. Analysis with the help of BigData technologies revealed correlations between some production parameters and the number of film breaks. Adjustment of the identified parameters allowed to reduce the number of breakdowns by 10 times and significantly increase the speed of operation of the equipment.

Optimal mode of operation of the pyrolysis plant is quite problematic because the process requires different sets of initial parameters and raw material quality. To improve production efficiency, a system has been introduced, which gives operators recommendations on how to adjust some production parameters. Based on the analysis of the previous production cycles, information on the influence of the technological regime on the economic efficiency of production is provided to the information panel.

NLMK Group is one of Russia's largest steel producers. The main directions of the investment cycle, which was formed in 2017, are improving the efficiency of business processes, developing the raw material base, strengthening positions in strategic markets and improvement of production safety. To achieve its goals, Group plans to use Industry 4.0 technologies in all production processes. Complex digitalization will allow achieving a synergistic effect from the implemented changes.

At design and development phase, company implements technology of visualization and creation of project documentation (Building Information Modeling). This technology allows to create a three-dimensional model of the unit, to digitize all engineering, technical, cost and operational characteristics of the object; to form a communication platform for effective interaction of all stakeholders. A distinctive feature is the combination of all information systems of the company, which allows determining automatically the amount of required materials and costs in modeling.

NLMK Group pays great attention to the maintenance and repair of equipment, especially the transition from reactive maintenance to preventive and proactive maintenance. At the heart of a proactive system is the implementation of reliability tools. For their effective functioning, it is necessary to:

- collect information about equipment;
- establish a link between hardware failures and service systems.
- accurately determine the actual residual life of the equipment;
- repair or update a part of the equipment only with a critical level of residual life.

Introduction of a proactive system allows increasing significantly the economic efficiency: losses caused by the shutdown of equipment for various repairs are reduced, useful life of the equipment is increased, need to change spare parts ahead of time is reduced. However, it is not advisable to abandon preventive and reactive maintenance because it is effective for certain types of machines.

Proactive system of maintenance and repair was realized thanks to the forecast model, which allows to predict failure of the furs of the blast furnace "Rossiyanka" for 20 days in advance. Effect of the project: increase in blast furnace productivity, decrease in unplanned downtime, increase in the useful life of the furs by 20%, which in monetary terms amounts to more than 60 million rubles savings per year [Artificial Intelligence, 2018]. In the future, it is planned to scale the solution to other blast furnaces of the company with a planned forecast accuracy of 40% and the expected savings of 150 million rubles per year. High level of automation of this equipment allows to introduce into production processes technologies based on artificial intelligence. Analysis of current practices and data collection obtained with the help of sensors and laboratory studies allowed to identify the most significant predictors – key factors for forecasting. They formed the basis of the model of tuyere failure – the main components of the furnace through which air is supplied. Model was built using machine learning and two SAP solutions:

- SAPPredictiveAnalytics is creation and training of forecast models in semi-automatic mode;
- SAPMaintenance & Services is analysis of input variables and forecasting of technical condition of equipment.

NLMK sees great potential in the use of BigData technologies, machine learning and artificial intelligence in production processes. Optimization is aimed at saving ferroalloys, expensive additives, CHP operation and finding the causes of production defects. Expected economic effect from the implementation of ten projects involving the use of Industry 4.0 technologies is estimated at 3 billion rubles.

It is also possible to note the use of advanced foreign practices in domestic companies. KAMAZ PJSC has been actively working on modernization of its own production since 2006. In particular, a project on the use of software products of the German concern Siemens has been implemented. At the first stage of digitization the software products of the German concern (NX, Teamcenter and Technomatrix) were introduced, the technology of electronic layout was mastered, 3D modeling was implemented, the processes were debugged electronically and gained experience in conducting calculations in CAE systems.

- Further, it is planned to automate the technological preparation of production, including the design of technological processes of manufacture and assembly of the product, calculation of control programs for the mill CNC, preparation of libraries.

Implemented technologies were used in the development and design of new main trucks KAMAZ-5490. All the units involved applied only digital solutions. One of the priority directions was the work on creation of digital doubles of the product and production process [KAMAZ, 2017]. Table 2 provides a summary of the considered practical cases.

CONCLUSIONS AND PRACTICAL APPLICATION OF THE RESULTS OF THE STUDY

Result of a successful simulation should be a process description of the production process suitable for analysis. Analysis, as well as modeling, can be done at different levels:

Table 2
Cases of introduction of Industry 4.0 technologies in production

Company Case	Introduced Industry 4.0 technologies	Effect
Foreign companies		
ThyssenKrupp	Simulation modeling	• Reduction of costs for repair of one unit of product by $300; • Increase the uptime of elevators by 50%
Siemens	Cloud technologies	• Reduction of equipment downtime by 10%
Maseratti	Digital double	• Reduced prototype development time by 30%.
Russian companies		
Sibur	Forecasting analytics based on BigData	• Reduction of emergency stops of equipment by 5 times; • Reducing the number of cases of defects by 10 times.
Gazprom Neft	Artificial Intelligence	• Reducing the time of data collection and analysis by 6 times (expected effect)
KAMAZ	Creating Digital Doubles	• Number of improvements to the rigging of trucks decreased by 50%; • time of implementation of projects of medium complexity decreased by 2 times.
NLMK	Machine learning and predictive analytics based on BigData	• Increasing the useful life of components of the equipment by 20%

from an abstract understanding of gaps in flowcharts to a detailed description of all low-level processes. Analysis should create value for business, so it is always necessary to determine its scope and depth based on the task. In the case of introduction of Industry 4.0 technologies, analytical study of business process can reach a concrete action. To introduce innovations in the most promising business processes, the latter should be ranked by priority. The most common criteria are:

- Importance of the business process, which is determined by the contribution of a particular process to the achievement of the key objectives of the organization. How will the optimization of the invoice processing process affect KPI on profit growth – whether it is worth improving this process, or there are processes which optimization will give a greater effect;
- Problem of business process, that is, what is the gap between the actual and planned state of things (the difference "as is" from "as should be"). Depending on the developed criteria for evaluating the result, the problem can be expressed in percentages, monetary units, points, etc.
- Ability to implement changes that are measured in resource costs to improve business process efficiency.

Developed criteria for analysis and the list of business processes that can be improved is convenient to present in the form of a matrix with an evaluation system (table. 3).

Table 3
Example of Business Process Evaluation Matrix

Process	Importance	Problematicity	Ability to change	Total
Purchase of raw materials	5	2	3	10
Polymers production	4	4	3	11
Search and selection of personnel	4	3	5	12

Each process is evaluated according to the criteria from 1 to 5, where 1 is the minimum and 5 is the maximum score. Points are awarded by the expert method. There are several approaches to the implementation of this procedure. Budget allocation method allows experts to make assessments against established criteria. Hierarchy analysis method is often used, which involves a pairwise comparison of processes by selected factors [Subramanian N., Ramanathan R., 2015]. Sum of points will allow to determine the sequence of their optimization based on the resulting effect. The use of such a matrix will significantly simplify the procedure for assessing the problematic business processes.

Thus, the introduction of Industry 4.0 technologies should ensure: reduction of repair costs, reduction of time for collecting and analyzing data, reducing the number of defects, reducing emergency stops and the number of repairs, increasing the useful life of equipment and components. However, any change must be justified and pursued for certain purposes. Otherwise, there is a significant increase in the risk of inefficient improvements, accompanied by additional costs.

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