Економічне становище. Економічна політика. Управління та планування. Виробництво. Послуги. Ціни

UDC 338.45+338.27
JEL Classification: L 600 + O 390

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INDUSTRIAL TECHNOLOGIES: MARKET ADAPTATION POTENTIAL

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Resource adaptation of industrial technologies to market conditions is studied on the basis of analytical and statistical research. Initial data of the study have been based on the study of such interconnected blocks: market conditions of management and the main production resources of processing enterprises of industry. The hypothesis about the gradual adaptation of industrial technologies to market conditions by changing the consumption (exploitation) of certain production resources: materials, labor (wages), fixed-capital assets was checked. It is substantiated that even taking into account the factor of time, separate interval trends of changes in the investigated production resources are more objective. In the long-term period of 2011–2017, two relatively stable time intervals 2001–2008 and 2014–2017, as the nature of changes in the use of productive resources, are distinguished. During this time, the nature of industrial technology has become less wage-intensive, and the degree of depreciation of fixed-capital assets has increased. Simultaneously, the formal signs of the economic efficiency of industrial technologies were carried out: the relative increase in labor productivity exceeded the increase of capital-labor ratio. Accordingly, in the period 2014–2017 compared to 2001–2008, more intensive exploitation of labor resources has taken place: such a technology-related resource as a fixed-capital asset has been slowly restored, while labor productivity increased. It is substantiated that under objective conditions of the scientific and technological development of industrial production and the replacement of live labor, the «under- equipment» of this labor in the processing enterprises contradicts the modern practice of effective management. Ensuring the economic efficiency of industrial technologies requires maneuvering of industrial resources of enterprises. Lack of one production resource (fixed-capital assets) is compensated by others (labor, wages). Market adaptation of industrial enterprises, thus, occurs as compensation of obsolete technological equipment by the exploitation of labor resources. The potential of the market adaptation of industrial technologies is based on their adaptability to the initial market conditions and appropriate resource support: the capital-labor ratio, the material intensity and the wage intensity of production products. In general, this is determined by the cost of production resources of processing enterprises.

Keywords: industrial technologies, processing enterprises, labor resources, material resources, potential, market adaptation.

DOI: 10.32434/2415-3974-2019-9-1-79-86

Introduction

Industrial technology, in the broad sense of the term, is a way of combining productive resources and a linking chain between scientific discovery and the obtaining of practical results or their commercialization, and a powerful economic resource that is included in the intangible assets of an enterprise. From the point of view of potential opportunities for the formation of economic results, industrial technology as a method of production, is of paramount importance both for individual workers, for the enterprise itself and for the economy as a

whole.

Industrial production, which embodies technologies, has always been the basis of Ukraine's economic independence. Even taking into account the specifics of modern economic relations and the growth of the intangible sphere in the economy, the role of industry can not be underestimated. Despite the emergence of new sectors of social production and consumption, industrial production remains the leading, providing both material and intangible sphere with means of labor..

Traditionally, the technologies of the 4th Industrial Revolution or «Industry 4.0» are already confronting raw materials and low-quality domestic technologies. They are based on mobile Internet, miniature production devices, artificial intelligence and self- learning machines. The introduction of such technologies leads to a radical transformation of global cost-creating chains, while virtual and physical production systems interact flexibly with each other globally [1]. Waves of further breakthroughs arise in a wide variety of fields of science and production: from the deciphering of information recorded in human genes, to nanotechnologies; from renewable energies to quantum computing. The leading resource of all these technologies is increasingly separated from the traditional labor-land-capital triad and is completely transformed into a synthesis of such untapped resources as science-intelligence-Internet, which provide the development of new technologies and their interaction in physical, digital and biological domains.

Formulation of the problem

Given the objective development of science and technology, in developed economies there is a transition to qualitatively new industrial technologies: these are the so-called neo-industrial, or technology of the 4th industrial revolution, 5–6 technological processes, and so on. Accordingly, there is a question of reflecting these progressive world trends in the development (changes) of industrial production technologies in Ukraine.

Analysis and research of publications

Scientific researches and analytical assessments of the economic situation and the development of domestic industrial enterprises are thoroughly and deeply presented in the scientific papers of the Institute of Industrial Economics of the National Academy of Sciences of Ukraine and the Institute of Economics and Forecasting of the National Academy of Sciences of Ukraine [2–6]. The following is proved:

– the reduction of economic performance of industrial enterprises is a long-term, and the nature of industry is determined by the orientation of raw materials and low-refining production with the concentration of natural resources. The authors [7] reveal the external and internal reasons for this situation: weak external demand; a negative shock from the deterioration of trade conditions, as prices for the main export products (steel, chemical products) grew rather weak, while prices for imported energy remained at a high level; inadequate monetary and exchange rate policy;

– in the activity of industrial enterprises, the impact of corruption, offshore and monopolism in the economy had very negative consequences. It is proved [2] that this has led to the orientation of enterprises for the export of raw materials and goods with low value added; the alienation of the bulk of employees from property; reducing the participation of employees in the management of production, and, as a consequence, to the firm's immunity to innovation;

– there has been a decline in the efficiency of industrial activity, as evidenced by the trend of a faster reduction of value added in industry compared with the economy as a whole. This has been reflected in the reduction of the share of industry in the formation of gross value added in the economy [3]. Reduction of the production efficiency has made the Ukrainian industry extremely unattractive for any involvement in modern value added production chains with using the global mechanisms of TNCs;

– the disappearance of «long» money from production practically has stopped investment and innovation processes at industrial enterprises [4]. Instead, there has been an increase in the profitability of raw materials and extractive monopolies.

For years, accumulated technological contradictions in the economic activity of industrial enterprises eventually reflected in the socio-economic consequences and the situation throughout the economy: a deep differentiation of incomes, a decline in living standards, the limited financial resources of human development, and ultimately – an increase in social tension [5].

Thus, in the scientific literature, the issues of the economic status and dynamics of the economic activity of industrial enterprises in the industrial, innovative, and foreign economic directions have been studied in detail. The evaluations of the activity of these enterprises are generalized and the causal-consequential implications of economic phenomena are explained. Relative to the economic situation and trends in the development of the industrial technology themselves, the results of studies [2–7] can be presented indirectly: the observation of negative changes in the production activities of enterprises does not explain the development and adaptation of the industrial technology themselves to the market conditions.

A retrospective analysis of author's works on the economic efficiency of industrial production in

Ukraine revealed critical moments in the activity of industrial enterprises on the part of used technologies. Comprehensive assessment of the results of industrial production in [8] revealed not only its low efficiency, but also the lack of prospects for intensive development while maintaining the inertia and the existing level of material and technology base and technologies. The scientific basis for the potential of innovative changes in industrial technologies has been studied by studying the dynamics of the volumes of scientific and scientific and technical works, the science-intensive of GDP, the indicators of innovation activity of industrial enterprises. The research revealed negative trends in the development of scientific, scientific and technical and innovation spheres in Ukraine. It has been substantiated [9] that the volume of scientific and scientific and technical works in the medium-term (as an example, investigated in 2010–2015) in the comparative cost expression almost have not been change: the volume of scientific and technical developments increased by 1,08 times, the volume of research increased by 1.06 times, the volume of scientific and technical services increased by 1.11 times. This is due to the fact that in the given period the number of performed scientific and scientific technical works in natural terms decreased by 21%, of which the number of works on the creation of new types of equipment and technologies decreased by 40%. That is, the expectation of significant innovation changes in industrial technologies through the practical implementation of the achievements of domestic science, too, we consider unduly optimistic. Nevertheless, given the «invisible hand of the market», we can assume that in today's conditions new opportunities are emerging and there is a certain potential of industrial technologies in adapting or adapting to market conditions in Ukrainian realities.

The purpose of the article is to identify trends and potential opportunities for the development of industrial technologies to adapt to current market conditions.

Statement of the main material

Adaptation of industrial technologies in the present conditions of neo-industrialization should be considered from the side of maneuvering of productive resources, as suggested by the authors [6]. That is, the adaptation of industrial enterprises to market conditions should take place through adaptation of technologies. And this should be reflected in the consumption of the basic industrial resources by the enterprises, which in turn will be reflected in the statistical data for the corresponding type of economic activity. According to this hypothesis, the initial data of this study have been based on the following interconnected logical blocks:

– market conditions that include the market situation (competition), the supply of resources and scientific and technical development;

– industrial technologies – the main production resources and the potential of innovation improvement.

The subject of the research on the study of the potential of market adaptation of industrial technologies has been selected the main productive resources of processing enterprises: material and labor ones. Quantitative characteristics of the use of these resources in monetary terms for 2001–2017 have been obtained from the official site of statistics of Ukraine [10], namely:

– material expenses of processing enterprises of industry (ME) are taken as intermediate consumption in calculations of gross domestic product;

– labor costs for hired workers (LC) and volumes of sold products (SP) are taken from the section «Activities of enterprises»;

– average annual residual value of fixed-capital assets (FA) is calculated according to the statistical collections «Fixed-capital assets of Ukraine».

Scientific analysis of empirical data, of course, must adhere to the principles of comparability of economic indicators of different time periods. One of the methods of taking into account the time factor

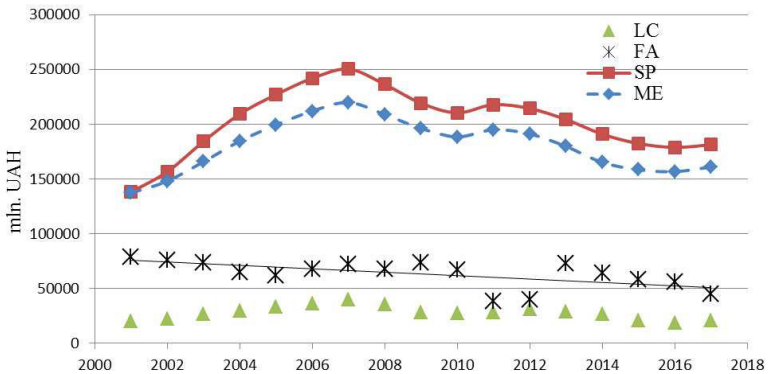

Fig. 1. Economic indicators of volumes of sold products (SP), material expenses (ME) and labor costs (LC), provision of fixed-capital assets (FA) of processing enterprises of industry

is the bringing of cost indicators in actual prices to a certain estimated year. In fig. 1 the economic indicators of volumes of products sold by processing enterprises and corresponding expenses (provision – in the case of FA) of the main productive resources with bringing to one accounting period of the year 2001 are given.

From Fig. 1 follows:

– the nature of changes in the volume of sold products and material expenses has a nonlinear dynamics with the maximum in 2007 and 2011. The growth of SP for the investigated time interval of 31% (from 138043 to 181246 million UAH in the comparative prices) confirms certain economic development of industrial production, but does not cover any changes in technology. More on this is the parallel course of the curves of the SP and ME, which shows that material costs are almost always proportional to the share of prices for manufactured products. Accordingly, there are no noticeable fundamental changes in the material intensity of technologies;

– the dynamics of wages looks stationary time series, and labor costs per unit of sales (specific labor costs) even decrease;

– the average annual residual value of fixed-capital assets has a downward trend with a corresponding reduction of cost by 40%.

To further solve the scientific problem and to identify reliable statistical trends in the processing of long-term dynamics, an index method has been used. The chain indexes of the use of the main productive resources of processing enterprises is shown in fig. 2

From the data of Fig. 2 it is apparent that fundamental changes in the dynamics of the use of productive resources have been observed in 2009–2011 and 2013. This refers to the reduction of the use of ME, LC (relevant indexes less than 1) and significant changes in the residual value of FA. But the system of accounting and revaluation of fixed-capital assets is one of the confusing in the statistical registration, therefore, more or less objective, probably, may be separate interval changes in the value of fixed-capital assets.

Two time intervals: the period 2001–2008 and 2014–2017 can be divided as similar in nature of changes in the use of productive resources and the relative stability of indicators of economic activity of enterprises. The close numerical values of the given indices allow us to calculate the average of their meanings as average geometric mean. These calculations for separated time intervals (Fig. 2) have been shown in table.

Average indices of the use of industrial resources by processing enterprises of industry

Time interval	Average value		
	I_{LC}	I_{FA}	I_{ME}
2001–2008	1.248	1.126	1.235
	1.122*	1*	1.109*
2014–2017	1.128	1.083	1.191
	1.045*	1*	1.108*

Note: * – the value is brought to a comparable view relative to I_{FA}

Since industrial technologies of processing enterprises are directly related to the technical level of equipment, the cost (index) of fixed-capital assets is a significant criterion for analytical conclusions. This is due to the bringing of other indices (I_{ME} and I_{LC}) to a comparable species of I_{FA}. The reduction of I_{FA} in the period 2014–2017 compared with 2001–2008 is logically associated with the deterioration of fixed-capital assets. When comparing the averages of the indices indexes studied in Fig. 2 and Table, from I_{FA}, it is evident that in the period of 2014–2017, material expenses were practically unchanged (1,108 versus 1,109), while wage growth was decreasing (1,045 against 1,122). That is, at the fixed value of I_{FA}, the nature of industrial technologies in

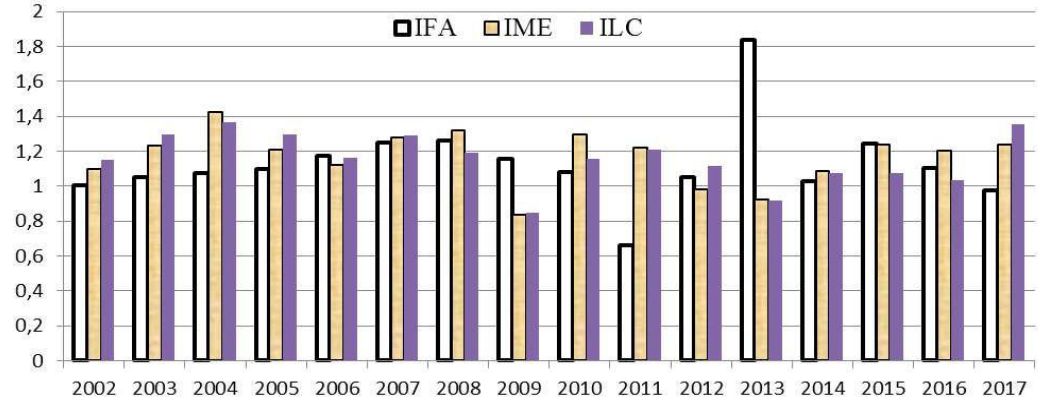

Fig. 2. Chain indices of the main productive resources of the processing industry enterprises (calculated by the authors according to [10])

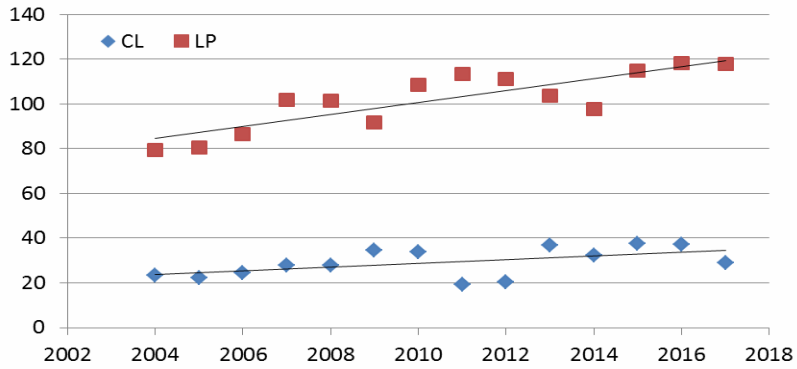

Fig. 3. Indices of capital-labor ratio and labor productivity at processing enterprises, ths. UAH / person

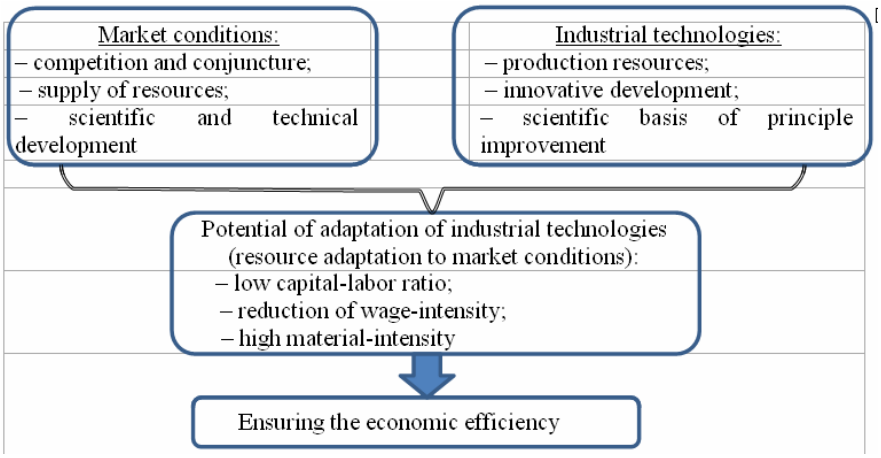

Fig. 4. The potential of market adaptation of industrial technologies

2014–2017 can be considered less wage(labor)-intensive. The reason for this situation, in general, may be:

– replacement of live labor by a machine with the use of more productive modern equipment;

– saving on wages.

Taking into account that $I_{FA2014-2017} < I_{FA2001-2008}$ (Table) and high depreciation of fixed-capital assets [10], the last assumption is more fair – the nature of industrial technologies of processing enterprises became less wage-intensive due to the high degree of depreciation of fixed-capital assets.

In fig. 3 the economic indicators of the efficiency of the use of fixed-capital assets of processing enterprises are given – capital-labor ratio (CL) and labor productivity (LP). Cost values in the calculations of CL and LP – volumes of sold products and the average annual residual value of fixed-capital assets – are brought to the prices in 2001. The values of CL and LP determined in this way are comparable with each other and take into account the factor of time. The clearly pronounced trend of LP (48% increase over the whole period under study, from 79 to 118 thousand UAH per person) is opposed to the weakly-defined trend of capital-labor ratio – an increase of 26% (from 23 to 29 thousand UAH / person).

To some extent, this is evidence of the effectiveness of industrial technologies, after all

$$\Delta LP > \Delta CL,$$

where ΔLP – relative increase of labor productivity; ΔCL – a relative increase of capital-labor ratio.

But a slight change in the cost of FA in combination with their high wear and tear of 60–70% [9] is unlikely to indicate an increase in the efficiency of the operation of process equipment. Most likely, this suggests adaptation and adjustment of industrial technology to available resources. That is, such resource as fixed- capital assets is directly related to technologies and is slowly restored, while labor productivity is rising, or there is more intensive exploitation of labor resources. This compensates to a certain extent the lack of one production resource for others and provides the overall economic efficiency of industrial technologies.

In accordance with the purpose of the study, the baseline conditions and the results obtained, we will present the potential of industrial technologies

in adapting to market conditions in graphical form – Fig. 4.

Logical scheme of fig. 4 we emphasize that the adaptation of industrial technologies to market conditions proceeds by reducing consumption of the most essential resource for the modern production – fixed- capital assets or process equipment. Also, there is a saving on labor resources. In objective conditions of the scientific and technological development of industrial production and the replacement of live labor, the «under- equipment» of this labor in the processing enterprises contradicts the modern practice of effective management. Adaptation of industrial enterprises to market conditions is thus occurs as compensation of labor resources for the use of obsolete technological equipment. The potential of such changes is due to the cost of resources in the Ukrainian economy.

Conclusions

The scientific hypothesis about the adaptation of processing enterprises to market conditions through the resource adaptation of industrial technologies is proved on the basis of analytical and statistical research. Initial data of the study have been based on the study of such interconnected blocks: market conditions of management and the main productive resources of processing enterprises of industry - material and labor ones. It is substantiated that even taking into account the factor of time, separate interval trends of changes in the investigated production resources are more objective. In the long-term period of 2011–2017, two relatively stable time intervals 2001–2008 and 2014–2017, as the nature of changes in the use of productive resources, are distinguished. During this time, the nature of industrial technology has become less wage-intensive, and the degree of depreciation of fixed-capital assets has increased. Nevertheless, the formal signs of the economic efficiency of industrial technologies have been carried out: the relative increase in labor productivity exceeded the increase of capital-labor ratio. Accordingly, in the period 2014–2017 compared to 2001–2008, more intensive exploitation of labor resources has taken place: such a technology-related resource as a fixed-capital asset has been slowly restored, while labor productivity increased. According to the available statistical information [10], the studied economic indicators for the period up to 2018 can only be extrapolated. In our opinion, taking into account the inertia of the economic activity of industrial enterprises, the identified temporary patterns on the adaptation of industrial technologies in 2014–2017 are relevant for the period 2014–2018.

Adaptation of industrial enterprises to market conditions is thus occurs as compensation of labor resources for the use of obsolete technological equipment. But according to the law of decreasing marginal productivity, the continued extrapolation of such a trend is limited. That is, the disclosure of the potential of industrial technology to market conditions in the direction of more intensive use of labor resources has a natural exhaustion - the supply of hired workers labor will not continuously exceed market demand. The accumulation of labor resources in other types of economic activity or labor migration, which in the conditions of comprehensive development of science and technology is quite anticipated, will otherwise change the way of combining the economic resources of industrial production.

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Received: 1.04.2019
Reviewer: Prof. Kolesnikov V.P.

ПРОМИСЛОВІ ТЕХНОЛОГІЇ: ПОТЕНЦІАЛ РИНКОВОЇ АДАПТАЦІЇ

Іванова М.В., Саннікова С.Ф.

Ресурсну адаптацію промислових технологій до ринкових умов вивчено на основі аналітико-статистичних досліджень. Вихідні дані дослідження спирались на вивчення таких взаємопов'язаних блоків: ринкових умов господарювання і основних виробничих ресурсів переробних підприємств промисловості – матеріальних і трудових. Обґрунтовано, що навіть з урахуванням чинника часу, більш об'єктивними є окремі інтервальні тенденції змін досліджуваних ресурсів виробництва. В довгостроковому періоді 2011–2017 рр. виокремлено два відносно стабільних часових інтервали 2001–2008 рр. і 2014–2017 рр. За цей час характер промислових технологій став менш зарплатоємним, а ступінь зносу основних засобів зросла. При цьому формальні ознаки економічної ефективності промислових технологій виконувалися: відносний приріст продуктивності праці перевищував приріст фондоозброєності. Відповідно, у період 2014–2017 рр. порівняно з 2001–2008 рр. мала місце більш інтенсивна експлуатація трудових ресурсів: такий безпосередньо пов'язаний з технологіями ресурс, як основні засоби, повільно відновлювався, натомість продуктивність праці підвищувалася. Обґрунтовано, що в об'єктивних умовах науково-технічного розвитку промислового виробництва та відповідного до цього заміщення живої праці, «недоозброєння» цієї праці на переробних підприємствах відбувається всупереч сучасній практиці ефективного господарювання. Забезпечення економічної ефективності промислових технологій вимагає маневрування виробничими ресурсами підприємств. Недолік одного виробничого ресурсу (основних засобів) компенсується іншим (працею, оплатою праці). Ринкова адаптація промислових підприємств, таким чином, відбувається як компенсація трудовими ресурсами експлуатації застарілого технологічного обладнання. Отже, потенціал ринкової адаптації промислових технологій визначається вартістю виробничих ресурсів переробних підприємств. Згідно з законом спадної віддачі, висловлено думку, що потенціал таких змін має природню вичерпаність. Пропозиція праці найманих працівників очікувано буде скорчуватися, вартість праці зросте, відповідно, і спосіб поєднання підприємствами економічних ресурсів в промислових технологіях зміниться.

Ключові слова: промислові технології, переробні підприємства, трудові ресурси, матеріальні ресурси, потенціал, ринкова адаптація

ПРОМЫШЛЕННЫЕ ТЕХНОЛОГИИ: ПОТЕНЦИАЛ РЫНОЧНОЙ АДАПТАЦИИ

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На основе аналитико-статистических исследований изучена ресурсная адаптация промышленных технологий к рыночным условиям. Исходные данные исследования опирались на изучение таких взаимосвязанных блоков: рыночных условий хозяйствования и основных производственных ресурсов перерабатывающих предприятий промышленности – материальны и трудовых. Обосновано, что даже с учетом фактора времени, более объективными для аналитических выводов являются отдельные интервальные тенденции изменений исследуемых ресурсов производства. В долгосрочном периоде 2011–2017 гг. выделены два относительно стабильных временных интервала 2001–2008 и 2014–2017 гг. За это время характер промышленных технологий стал менее зарплатоемним, а степень износа основных средств возросла. При этом формальные признаки экономической эффективности промышленных технологий выполнялись: относительный прирост производительности труда превышал прирост фондовооруженности. Соответственно, в период 2014–2017рр. по сравнению с 2001–2008 гг. имела место более интенсивная эксплуатация трудовых ресурсов: такой напрямую связан с технологиями ресурс, как основные средства, воспроизводился медленно, а производительность труда повышалась. Обосновано, что в объективных условиях научно-технического развития промышленного производства и соответствующего замещения живого труда, «недовооруженность» этого труда на перерабатывающих предприятиях идет вразрез современной практике эффективного хозяйствования. Обеспечение экономической эффективности промышленных технологий требует маневрирования производственными ресурсами предприятий. Недостаток одного производственного ресурса (основных средств) компенсируется другим (трудом, оплатой труда). Рыночная адаптация промышленных предприятий, таким образом, происходит как компенсация трудовыми ресурсами эксплуатации устаревшего технологического оборудования. Таким образом, потенциал рыночной адаптации промышленных технологий определяется стоимостью производственных ресурсов перерабатывающих предприятий. Согласно закону убывающей отдачи, высказано предположение, что потенциал таких изменений имеет естественную исчерпаемость. Предложение труда наемных работников ожидаемо будет сокращаться, стоимость труда возрастет, соответственно, и способ соединения экономических ресурсов в промышленных технологиях изменится.

Ключевые слова: промышленные технологии, перерабатывающие предприятия, трудовые ресурсы, материальные ресурсы, потенциал, рыночная адаптация.

INDUSTRIAL TECHNOLOGIES: MARKET ADAPTATION POTENTIAL

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Resource adaptation of industrial technologies to market conditions is studied on the basis of analytical and statistical research. Initial data of the study have been based on the study of such interconnected blocks: market conditions of management and the main production resources of processing enterprises of industry. The hypothesis about the gradual adaptation of industrial technologies to market conditions by changing the consumption (exploitation) of certain production resources: materials, labor (wages), fixed-capital assets was checked. It is substantiated that even taking into account the factor of time, separate interval trends of changes in the investigated production resources are more objective. In the long-term period of 2011–2017, two relatively stable time intervals 2001–2008 and 2014–2017, as the nature of changes in the use of productive resources, are distinguished. During this time, the nature of industrial technology has become less wage-intensive, and the degree of depreciation of fixed-capital assets has increased. Simultaneously, the formal signs of the economic efficiency of industrial technologies were carried out: the relative increase in labor productivity exceeded the increase of capital-labor ratio. Accordingly, in the period 2014–2017 compared to 2001–2008, more intensive exploitation of labor resources has taken place: such a technology-related resource as a fixed-capital asset has been slowly restored, while labor productivity increased. It is substantiated that under objective conditions of the scientific and technological development of industrial production and the replacement of live labor, the «under- equipment» of this labor in the processing enterprises contradicts the modern practice of effective management. Ensuring the economic efficiency of industrial technologies requires maneuvering of industrial resources of enterprises. Lack of one production resource (fixed-capital assets) is compensated by others (labor, wages). Market adaptation of industrial enterprises, thus, occurs as compensation of obsolete technological equipment by the exploitation of labor resources. The potential of the market adaptation of industrial technologies is based on their adaptability to the initial market conditions and appropriate resource support: the capital-labor ratio, the material intensity and the wage intensity of production products. In general, this is determined by the cost of production resources of processing enterprises.

Keywords: industrial technologies, processing enterprises, labor resources, material resources, potential, market adaptation.

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