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**METHODICAL APPROACH TO ESTIMATION OF INDUSTRIAL  
ENTERPRISES' TECHNICAL AND TECHNOLOGICAL  
DEVELOPMENT LEVEL**

*The article develops the methodical approach to estimation of industrial enterprises technical and technological development. Estimation sequence of technical and technological development of company is presented. The authors have proposed a two-dimensional matrix of technical and technological development estimation based on technical and technological components. The matrix areas are identified and characterized. On the basis of these areas the authors offer strategic and tactical actions for further development of industrial enterprises.*

*Keywords: technical and technological development; technical component; technological component; two-dimensional matrix; strategic management decision.*

*JEL Classification: L20, M21, O32.*

**Олег М. Олєфіренко, Євген І. Нагорний, Олена Г. Шевлюга  
МЕТОДИЧНИЙ ПІДХІД ДО ОЦІНЮВАННЯ РІВНЯ  
ТЕХНІКО-ТЕХНОЛОГІЧНОГО РОЗВИТКУ  
ПРОМИСЛОВОГО ПІДПРИЄМСТВА**

*У статті розроблено методичний підхід до оцінювання рівня техніко-технологічного розвитку промислового підприємства. Представлено послідовність оцінювання рівня техніко-технологічного розвитку підприємства. Запропоновано двовимірну матрицю оцінювання рівня техніко-технологічного розвитку на основі технічної та технологічної складових. Представлена матриця надає можливість позиціонувати підприємство за рівнем техніко-технологічного розвитку, оцінити його на певний момент часу. Виділено і охарактеризовано зони матриці, на основі яких запропоновано варіанти стратегічних і тактичних дій для забезпечення подальшого розвитку промислового підприємства.*

*Ключові слова: техніко-технологічний розвиток; технічна складова; технологічна складова; двовимірна матриця; стратегічне управлінське рішення.*

*Табл. 3. Рис. 2. Літ. 12.*

**Олег М. Олєфіренко, Евгений И. Нагорный, Елена Г. Шевлюга  
МЕТОДИЧЕСКИЙ ПОДХОД К ОЦЕНКЕ УРОВНЯ  
ТЕХНИКО-ТЕХНОЛОГИЧЕСКОГО РАЗВИТИЯ  
ПРОМЫШЛЕННОГО ПРЕДПРИЯТИЯ**

*В статье разработан методический подход к оценке уровня технико-технологического развития промышленного предприятия. Представлена последовательность оценки уровня технико-технологического развития предприятия. Предложена двумерная матрица оценки уровня технико-технологического развития на основе технической и технологической составляющих. Представленная матрица позволяет позиционировать предприятие по уровню технико-технологического развития, оценить его на определенный момент времени. Выделены и охарактеризованы зоны матрицы, на основе которых предложены варианты стратегических и тактических действий для обеспечения дальнейшего развития промышленного предприятия.*

*Ключевые слова: технико-технологическое развитие; техническая составляющая; технологическое составляющая; двумерная матрица; стратегическое управленческое решение.*

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**Introduction.** The current state of development demonstrates that industrial enterprises are in a situation where the problem of strategic management effectiveness becomes urgent, besides being triggered by outdated equipment and technologies, limited investment etc. Imperfect management decisions in assessing current situation and planning for future leads only to partial improvement in industrial production. All potential enterprises opportunities remain unused. Therefore, the task faced by enterprise management is managing industrial enterprise's technical and technological development (TTD), which aims at effective use of existing equipment and technology and their improving on the innovative basis. The methodical approach will enable companies to reach a new level or to enter new markets by upgrading equipment and using new progressive or improved technologies.

**Latest research and publications analysis.** Methods of fixed assets and new progressive technologies efficiency estimation were investigated in the studies by a number of scientists such as A.M. Rats (2012), L. Malyuta (2011), I. Stoyko and Y. Vovk (2012), P. Domeika (2008). Issues of strategic management and strategic management decisions were discussed in the works of such authors as Y.E. Petrunya et al. (2011), L.M. Romanyuk (2010), T.P. Goncharenko (2004), S.V. Tsutsura, O.V. Krivoruchko and M.I. Tsutsura (2012), O.S. Kolesov and A.V. Vatskivska (2012). However, scientific and methodological basis hasn't been sufficiently developed. Enterprises' transition to a new level should include various aspects of assessment and analysis of TTD components. This necessitates the development of instruments to assess the level of industrial enterprise TTD.

**The research objective** of the article is to develop methodical approach to assess the technical and technological development level of industrial enterprises, which enables quantifying the level and company's position in it, and to make an informed strategic management decision as for further development.

**Key research findings.** According to official data of the State Statistics Service, more than 70% of fixed assets of all enterprises in the country are outdated. Thus, the level of machinery, equipment, vehicles and other assets deterioration in 2012–2013 was 80–90% (State Statistics Service). In order to provide economic growth and competitiveness of industrial products innovation activity should be directed at the creation of new products and technologies (Kirdina, 2001).

Improvement of existing techniques and technologies and the use of innovative ones can be achieved by means of TTD. Its quantitative estimation is carried out to determine the level of industrial enterprise TTD at a certain time. For estimating the TTD level its technical and technological components are analyzed. Each component is based on a number of partial indicators combined into integrated indicators taking into account the relative weight of importance. Assessment of the current level of industrial enterprise TTD is carried out by a certain sequence that includes 5 basic stages. These assessment phases of industrial enterprises TTD level and their sequence are illustrated in Figure 1. Consider it in more detail.

Stage 1. Determination of the integral indicator assessing the level of enterprise TTD for technical component. The stage includes:

- selection, justification and calculation of partial indicators to assess the technical component of industrial enterprise TTD in 3 groups (indicators of enterprise providing estimation of fixed assets, indicators of state assessment of fixed assets, indicators of efficiency estimation of fixed assets);

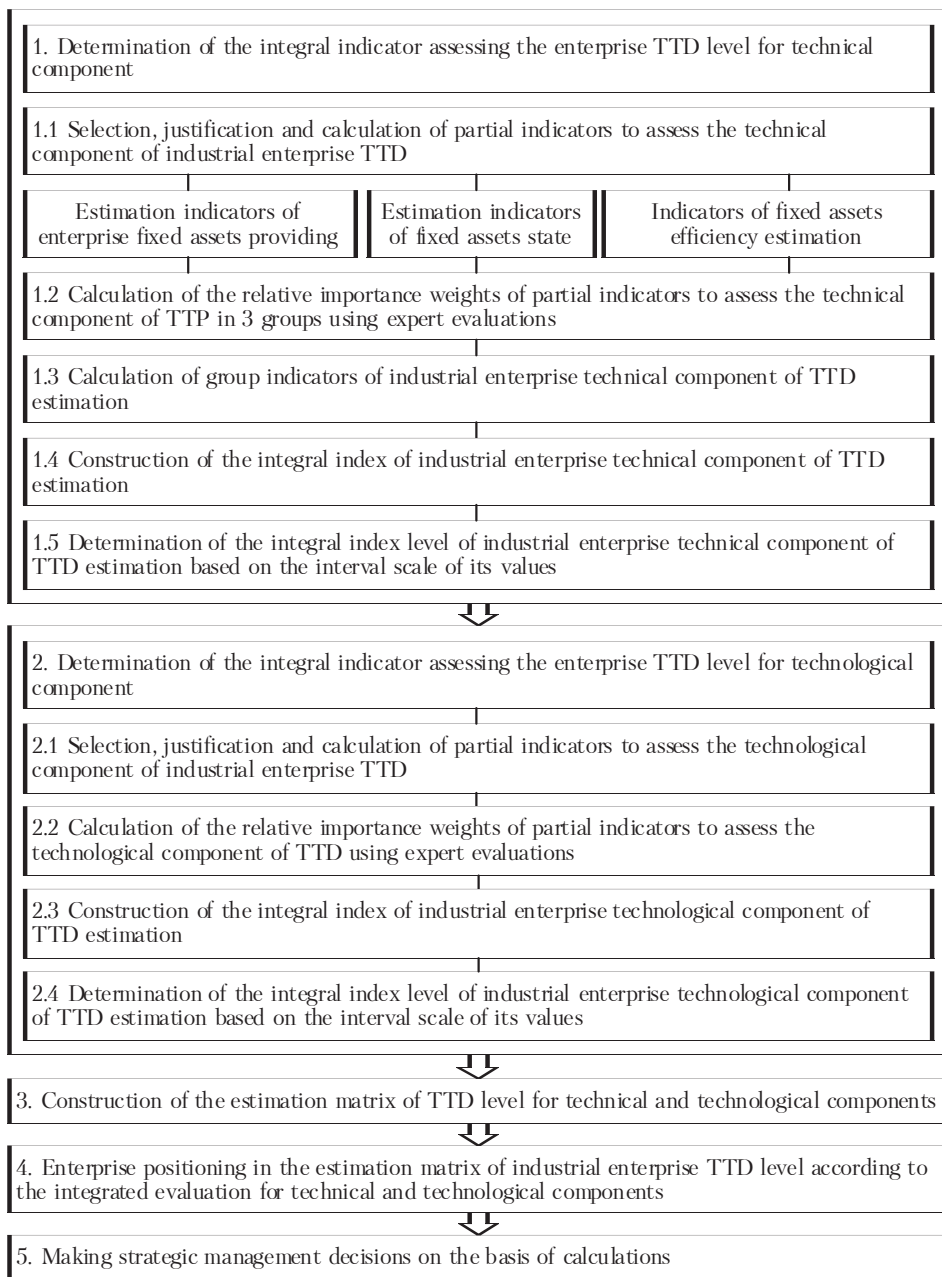


Figure 1. Sequence of stages in the estimation of industrial enterprise technical and technological development, authors' development

- calculation of the relative importance weights of partial indicators to assess the technical component of TTD in 3 groups using expert evaluation;
- calculation of group indicators of industrial enterprise technical component of TTD estimation;

- construction of the integral index of industrial enterprise technical component of TTD estimation;
- determination of the integral index level of industrial enterprise technical component of TTD estimation based on the interval scale of its values.

Stage 2. Determination of the integral indicator assessing the level of enterprise TTD for technological component. The stage includes:

- selection, justification and calculation of partial indicators to assess the technological component of industrial enterprise TTD;
- calculation of relative importance weights of partial indicators to assess the technological component of TTD using expert evaluations;
- construction of the integral index of industrial enterprise technological component of TTD estimation;
- determination of the integral index level of industrial enterprise technological component of TTD estimation based on the interval scale of its values.

Stage 3. Construction of the estimation matrix of TTD level according to technical and technological components.

Stage 4. Enterprise positioning in the estimation matrix of industrial enterprise TTD level according to integrated evaluations for technical and technological components.

Stage 5. Making strategic management decisions on the basis of calculations.

Integral indices of technical and technological components of industrial enterprise TTD level are presented in (Shevliuga, 2014).

Based on the calculation of integrated indicators to assess the level of industrial enterprise TTD interval scale of its relevant values is constructed (Table 1).

**Table 1. Table of indicators values of technical and technological components estimation according to technical and technological development level, authors' development**

Technical level		Technological level	
The value of the integral indicator for the technical component of TTD $K_{it}$	Level that corresponds to the value $K_{it}$	The value of the integral indicator for the technological component of TTD $K_{iT}$	Level that corresponds to the value $K_{iT}$
$0.75 \leq K_{it} \leq 1$	High	$0.75 \leq K_{iT} \leq 1$	High
$0.5 \leq K_{it} < 0.75$	Average	$0.5 \leq K_{iT} < 0.75$	Average
$0.25 \leq K_{it} < 0.5$	Below average	$0.25 \leq K_{iT} < 0.5$	Below average
$0 \leq K_{it} < 0.25$	Very low	$0 \leq K_{iT} < 0.25$	Very low

Based on interval scale values of integral indicators of industrial enterprises TTD estimation for technical and technological components a two-dimensional matrix "Integral indicator for technical component – Integral indicator for technological component" is formed (Figure 2).

The proposed matrix has 16 quadrants. Each level of technical component corresponds to a certain level in the technological component in each quadrant of the matrix. Quadrants of the matrix are combined in the following areas:

- zone of unacceptably low TTD level;
- zone of unsustainable TTD level;

- zone of average TTD level;
- zone of high TTD level.

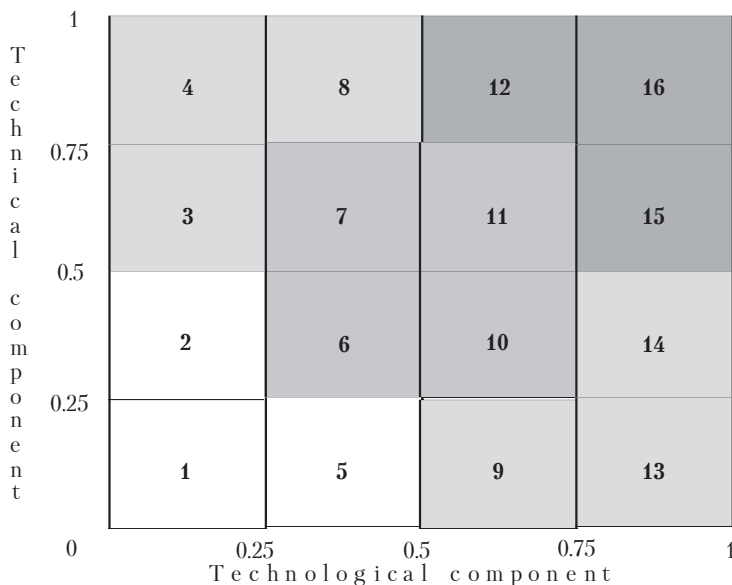


Figure 2. Matrix of TTD level estimation "Integral indicator for technical component – Integral indicator for technological component", authors' construction

Now we are to characterize the zones of the matrix and the TTD level, corresponding to each zone and propose strategic management decisions (Table 2).

Table 2. Characteristics of the matrix "Integral indicator for technical component – Integral indicator for technological component" zones, authors' development

Quadrant of the matrix	TTD level	Characteristics of TTD level	Strategic management decisions
Quadrants 1, 2, 5	Zone of unacceptably low TTD level. Critical situation at an enterprise.	Absolutely inefficient use of fixed assets, physically and morally outdated fixed assets, use of outdated technologies. Consideration of the expediency of further enterprise functioning.	Implementation of enterprise bankruptcy procedure or total reorganization.
Quadrants 3, 4, 8, 9, 13, 14	Zone of unsustainable TTD level.	Use of outdated fixed assets or outdated technologies. One of the components of TTD is at very low level or below average, and another is on a high or average level. There have been some changes in TTD level, it is not stable.	Detailed analysis of individual indicators estimation of TTD level for technical or technological component with the aim of a corresponding increase of one of them. Orientation on the efficiency improvement indicators.
Quadrants 6, 7, 10, 11	Zone of average TTD level.	The use of fixed assets and advanced technologies is at the average level.	Investments in technical rearmament, automation, modernization of equipment. Acquisition of new technologies. Orientation at new market segments.

Continuation of Table 2

Quadrant of the matrix	TTD level	Characteristics of TTD level	Strategic management decisions
Quadrants 12, 15, 16	Zone of high TTD level.	Efficient use of fixed assets and advanced technologies. Enterprise has a stable TTD level with possible insignificant deviations of one of the components.	Keeping TTD at the current level or extension of material and technical base to fulfill new strategic objectives, reorientation on new markets.

In the frames of strategic management decisions it is proposed to perform the following tactical actions (Table 3).

Table 3. Options of tactical actions for matrix quadrants, authors' development

Quadrant	Appropriate tactical actions
Quadrant 1	Enterprise bankruptcy procedure or total reorganization
Quadrant 2	Enterprise bankruptcy procedure or total reorganization of its technological component (production technologies)
Quadrant 3	Keeping material and technical base at the current level or its improvement and acquisition of new technologies or modernization of the existing ones
Quadrant 4	Acquisition of new technologies or modernization of the existing ones
Quadrant 5	Implementation of the enterprise bankruptcy procedure or total reorganization of its technical component (material and technical base)
Quadrant 6	Exemption from outdated equipment, acquisition of new technologies and equipment
Quadrant 7	Modernization of existing technologies, updating single technologies
Quadrant 8	Acquisition of new advanced technologies
Quadrant 9	Modernization of existing equipment or acquisition of the new one
Quadrant 10	Modernization, automation, technical rearmament of equipment
Quadrant 11	Partial renewal of equipment, use of new technologies
Quadrant 12	The material and technical base maintaining and manufacturing technologies updating if necessary
Quadrant 13	Total substitution of outdated equipment
Quadrant 14	Modernization or additional acquisition of new equipment
Quadrant 15	Material and technical base updating if necessary
Quadrant 16	Maintaining of equipment and technologies at the current level

**Conclusions.** The methodical approach to the assessment of industrial enterprise TTD level allows determining the level of enterprise TTD and complex of measures on its improvement in the frames of tactical and strategic actions. Authors proposals: to ensure the effectiveness of strategic management decisions, enterprise management should analyze the existing fixed assets and technologies used in manufacturing processes. The main purpose in this case is the rejection of those technologies which are outdated (or their modification) to an acceptable efficiency level. The same concerns the optimization of enterprise material and technical base, i.e. the technical component of TTD. Having defined the level of TTD according to the proposed methodology, managers can use the decision making matrix for choosing the most appropriate options on further strategic enterprise development and choose a complex of tactical actions to achieve its strategic objectives, to increase or maintain the TTD level. Prospects for further research lie in practical testing of the proposed approach and its adaptation to the conditions of real economy with possible correction of strategic and tactical actions depending on the type of organizational structures of manufacturing enterprises or their affiliation to specific industries taking into account branch specificity.

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Стаття надійшла до редакції 16.04.2014.