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TOWARDS THE INNOVATION-FOCUSED INDUSTRY DEVELOPMENT IN A CLIMATE OF DIGITALIZATION: THE CASE OF RUSSIA

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Abstract. Aims: the purpose of this paper is to determine, based on an analysis of innovation processes within industry, some of the key issues in and priorities for the management of the technological development of the national economy through the example of Russia. Results: the paper identifies some of the key trends in and characteristics of the development of Russia's industrial complex and the potential for integrating it into the world economic system using the tools of marketing. The authors prove that in today's realities it is advisable to develop appropriate organizational-economic forms of entrepreneurship to stimulate innovation activity. The paper identifies some of the key factors influencing investment processes in machinery manufacturing (workforce qualifications, production volume, dynamics of demand for the sector's output, level of innovation activity within the sector, etc.). Conclusions: the paper identifies a set of key marketing tools for stimulating innovation processes within the industrial complex in a climate of the development of a digital economy in Russia by reference to different phases in the lifecycle of the innovation process. The authors identify the key focus of innovation activity, which is a focus on the creation of network added value. The paper brings forward a client-oriented model of expanded innovation process based on the building of technological chains by industrial companies.

Keywords: industrial complex; technological development; tools of marketing; digital economy; technological platforms

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1. Introduction

The industrial complex, which has been the backbone of the economy in most developed and developing nations, performs a variety of functions, including economic, financial, scientific-technological, political, and social. At the same time, in the post-industrial economy the significance of industry is gradually declining. Yet, in Russia and in a number of other developing economies its role is, actually, augmenting. The significance of the industrial complex is determined by its special role in providing employment to able-bodied citizens, ensuring decent standards of living for the population, and overcoming the cyclical nature of the economy. Therefore, it is really important to ensure its sustainable operation, which ought to be based on advanced technological and innovation-driven development.

Russia's experience in managing the technological development of industry is specific due to a number of objective and subjective factors, like its historically emphasized industrial production (which it has maintained since the Soviet period), its developed fuel-and-energy complex, its qualified workforce, etc. Exploring of this experience contribute to understanding of regional development peculiarities.

The Russian economy and its principal sphere, industry, are currently faced with a number of tough issues. The nation's industrial production is under stiff pressure on the part of the external and internal markets, which have been implementing a number of restrictive measures. Notwithstanding that the introduction of these restrictive measures is caused by different factors (political, economic, etc.), the development of many sectors within the nation's industry has been impeded. Economic sanctions have been having quite a substantial negative effect on the operation of companies that are at the forefront of industry in Russia.

Under these conditions, the Russian economy and its backbone, industry, may require a change of strategy and an orientation toward the maximum use of internal potential based on boosts in industrial production with a focus on innovation and the use of digital technology. To boost innovation activity at industrial business entities, it may help to make a keener use of the tools of marketing.

This study's theoretical and methodological bases are grounded in works by scholars focused on innovation-driven development in companies, marketing, and instrumental-methodological solutions by research teams at research institutes and design organizations (Morrar, Arman, & Mousa, 2017; Pfohl, Yahsi, & Kurnaz, 2015; Qin, Liu, & Grosvenor, 2016; Anderson & Wladawsky-Berger, 2016; European Commission, 2014; Eddelani, El Idrissi & Monni, 2019; Zeibote, Volkova & Todorov, 2019; Tkachenko, Kwilinski, Korystin, Svyrydiuk & Tkachenko, 2019; Goncharenko, Tohochynskyi, Sirenko, Chebonenko & Tretiak, 2019; Goncharenko, Tohochynskyi, Sirenko, Chebonenko, &Tretiak, 2019; Zemlickiene, Mačiulis & Tvaronavičienė, 2017; Tvaronavičienė, 2017; Tvaronavičienė & Razminienė, 2017; Androniceanu & Krajčík, 2017; Razminienė & Tvaronavičienė, 2018; Petrenko, Vechkinzova, & Antonov, 2019). Managing the technological development of industry using the tools of marketing is a decidedly effective mechanism for driving economic development which is used in many countries around the world. In addition, the implementation of various technologies for digitalizing the economy enables those nations to achieve more effective interaction among the government, business, and society.

2. Methods

To analyze and assess technological development within Russia's industry, the authors employed methods of economic-statistical research. Based on data from Rosstat and using ratio and statistical analysis, the authors explored the dynamics of key indicators of industrial development within the Russian economy. The dynamical method helped identify a set of key stages in technological development within industry, including some of the key trends in change in labor productivity.

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Using comparative analysis, the authors identified some of the key strengths and weaknesses of industrial development in Russia. Correlation analysis helped identify a set of key factors influencing the dynamics of investment processes in machinery manufacturing. Qualitative analysis helped identify the most effective tools of marketing for managing technological development in industrial companies by reference to different phases in the lifecycle of the innovation process.

3. Results

Reorienting Russia's economic system from its traditional model of development to an innovation-focused one is viewed by scholars and practicians as a key strategic area for the nation's development. Otherwise, the Russian economy may simply end up left long out of the world's scientific-technological progress, one of its key manifestations being Industry 4.0. The key strands of Industry 4.0 implemented in the industrial complex include the following: creating network establishments and integrating them across the entire value chain; building a global wide-band infrastructure comprised of global networks that are in a high-level relationship between each other; ensuring the safety of production; organizing labor at "smart" enterprises; ensuring education and advanced training; having in place a sound regulatory framework; ensuring the efficiency of use of resources (Lenchuk & Vlaskin, 2010; Ministry of Education and Science of the Russian Federation, 2009).
Internal factors governing Russia's economic development have yet to facilitate the fulfillment of its industrial-production and technological potential. In the global technological market, structural transformations have been implemented along the line of ascending complexification, with a focus on tapping into new markets for high-tech products. By contrast, in the last decade of the 20th century and in the early 21st century Russia followed a descending line of primitivization of production and copying of outdated industrial units that were in the late stages of the lifecycle.

Despite the fact that Russia's industry has a multiparadigm technological base and features production operations from the fifth and sixth paradigms, there is a need to overcome the nation's technological lags in the real sector of the economy. The findings from the authors' analysis indicate that, on the whole, in machinery manufacturing and machine-tool building Russia is currently trailing behind the rest of the world by between 1.5 and 2 technological generations, i.e. nearly 20–30 years considering that one generation is 10–15 years long.

The implications of the above-mentioned kind of restrictive measures, present or future, for economic growth in industry's top sectors and for the nation's GDP dynamics have been quite significant, having in consideration the effects of the economic crisis of 2014. In the period 2012–2016, the average annual rate of decline in the Russian economy was 0.2%, with quite a substantial role played in this regard by economic sanctions, which has only exacerbated the negative trend (Novikov, 2015; Rosstat, n.d.). When it comes to industrial production, there is, however, one positive consideration that is worth mentioning. Industry's sectors are adapting to negative consequences from the restrictive measures faster than the nation's economy, taken as a whole, is. More specifically, compared with 2015, when the nation's slump across all sectors of the economy totaled 2.8%, in 2016, despite the general downward trend that persisted, industry exhibited an increase of 1.1% in indices of the physical volume of production, including an increase of 0.1% in manufacturing. Labor productivity is a major indicator that reflects the level of technological development of industrial production. Table 1 illustrates the dynamics of labor productivity within the key sectors of Russian industry in the period 2006–2016 (Rosstat, n.d.).

Table 1. Index of Labor Productivity across Key Sectors within the Russian Economy for the Period 2006–2016 (% relative to the previous year)

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Indicators	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Overall across the economy	107.5	107.5	104.8	95.9	103.2	103.8	103.3	102.2	100.7	97.8	99.8
Extraction of mineral resources	103.3	103.1	100.9	108.5	104.3	102.7	100.3	100.8	102.8	98.4	98.3
Manufacturing	108.5	108.4	102.6	95.9	105.2	105.6	104.8	102.2	102.5	96.9	100.8
Production and distribution of power, gas, and water	101.9	97.5	102.1	96.3	103.0	99.8	100.2	99.1	100.2	99.9	102.1

On the whole, labor productivity in Russia was two times lower in 2016 than in the OECD member states. In 2015, productivity in Russia was down for the first time in six years (a drop of 2.2%). In 2016, labor productivity in the manufacturing industry rose by 0.8%, which is not enough for a shift from the lower to the upper path of technological development and may lead to the technological degradation of most industrial production operations.

Russia's technological development, as a key imperative for the nation, deals with the development of not just technology but markets as well. Interaction between the two processes may be facilitated by the use of the tools of marketing, which can help equilibrate demand and supply in the market for innovative products. The findings from the authors' factor analysis indicate that the greatest effect on the dynamics of investment in machinery manufacturing comes from the quality of manpower, the volume of production, the level demand for the product, and the level of innovation activity. Hence, the nation can hardly achieve economic growth on an innovative basis without implementing the marketing of innovations and making a keen use of marketing tools.

In today's climate of market transformations and an orientation toward the consumer, the marketing of innovations is the most significant tool of management, which links together and coordinates the operation of all functional units within a company based on a corporate strategy developed. It is aimed at the fulfillment of functions such as those related to determining consumers' informed preferences with respect to the innovative product, conducting integrated research into the market and economic conditions around industrial production, planning the consumptive qualities of an innovative product based on the preferences identified, working out and implementing a marketing plan for promoting the innovation, monitoring the efficiency of marketing activities, and adjusting the marketing plan by reference to the deviations detected.

Today, some of the key issues in the management of the marketing of innovations in Russia include:
- over 20% of high-ranking managers concerned with marketing at industrial companies do not have the practical skills required to implement it in the area of innovation;
- nearly 20% of companies have a shortage of qualified marketeers;
- nearly 10% of companies have no experience in commercializing technology (Stančík, 2007; Sekerin, Avramenko, Veselovsky, & Aleksakhina, 2014).

An effective innovative marketing mix incorporates such key elements as product and product policy, price and performance (productivity), sales channels, and promotion. Quite significant is the role of the tools of marketing in minimizing commercial risks around innovative products via testing, including conceptual testing, test marketing, and other types of tests, which may boost the likelihood of successful commercialization of novel solutions.

The average expenditure on the marketing of innovative products in domestic companies does not exceed 10–15% of their total expenditure on innovation activity, which is not enough to ensure the effective commercialization of novel solutions. In addition, the share of organizations that are engaged in marketing innovation does not exceed

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1.5% in Russia. Industrial companies prioritize technological innovation, which is followed in significance by organizational innovation, with marketing-related innovation bringing up the rear.

The cause behind the insufficient implementation of the marketing of innovations in the activity of industrial companies in Russia is the predominant use of outdated mechanisms for the management of innovation processes. The senior management of innovation-focused companies is focused primarily on the useful features of an innovation, then on looking for sources of funding, and only lastly on identifying potential sales markets and analyzing their capacity.

Thus, there is a contradiction between what innovation-focused organizations do and what end consumers of innovative products, actually, expect. A possible solution to this issue is using intermediaries in conducting innovation activity and developing new organizational-economic forms of entrepreneurship – centers for the commercialization of technology and technological platforms.

Discussion

In the leading nations of Europe and Asia, a key factor in industrial development is the generation of world-class technological innovations. It is from this standpoint that investing in fixed assets is implemented. In Russia, the situation is a bit different. The findings from the authors' correlation analysis helped identify some of the most significant factors influencing the dynamics of investment in machinery manufacturing, which are provided in Table 2.

Table 2. An Assessment of the Effect of Key Economic Factors on the Dynamics of Investment in Russia's Machinery Manufacturing in the Period 2006–2016

	Economic factors	Correlation coefficient	Strength of the relationship
1	Workforce qualifications	0.90	Direct strong
2	Production volume dynamics	0.88	Direct strong
3	Dynamics of demand for the sector's output	0.82	Direct strong
4	Level of innovation activity of companies within the sector	0.77	Direct strong
5	Profitability of economic activity	0.54	Direct tangible

Thus, of the greatest significance is the level of workforce qualifications, with high figures posted by production volume dynamics and the dynamics of demand for the product as well. The level of innovation activity in the sector is ranked 4th, meaning that this factor is less significant in Russia than in economically developed countries.

Depending on which phase in the lifecycle of the innovation process it is, it is possible to differentiate between strategies for investing at the early and final stages of the innovation-investment process. Industrial companies that pursue the first type of strategy have innovation business units which not only carry out the company's primary activity but conduct R&D as well. These companies possess significant resource and innovation potential, are distinguished by high investment attractiveness, and are viewed as pioneers and leaders in their sector.

Strategies for investing in the final stages of the innovation-investment process are normally implemented by industrial companies by way of process or product simulation and technological transfer of already existing innovative early majority solutions, which they tend to adapt to the conditions of their own economic system having in consideration the marketing niche they occupy and their established groups of consumers. This type of innovative strategies is practiced in their activity by followers and the late majority.

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In addition to factors that most influence technological development, Russia's industry has another distinctive characteristic – the insignificant role of the tools of marketing in promoting innovative products and cutting-edge production technology. To stimulate demand for innovative products turned out by industrial companies and ensure a predominant orientation toward the generation of world-class technological innovations, the pursuit of the two above-mentioned innovation-investment strategies may need to involve the use of various tools of marketing, like those listed in Table 3.

Table 3. A Classification of Marketing Tools Employed in Implementing Various Types of Innovation-Investment Strategies in Industrial Companies

	Tools of marketing	Types of innovation-investment strategies	
		Initial stages in the innovation-investment process	Final stages in the innovation-investment process
1	Tools for motivating investors to invest in industry	Setting up special agencies that will work with potential investors; investment guides	Catalogues of innovation-investment projects; special websites on innovation projects
2	Tools for cultivating innovation potential	Putting together and getting to developers "selling information" indicators in the form of a roster of its "selling aspects", which shape consumers' competencies and informed needs; developing fundamental functionalities using nontechnological innovations (e.g., marketing and organizational)	Forming a team of performers of fundamental functions at the enterprise; building up intellectual potential; managing cross-functional interactions; developing fundamental functionalities using technological innovations
3	Tools for minimizing innovation-investment risks	Conducting assessments and monitoring of innovation risks; working out appropriate measures for forestalling and countering risks across all stages in the innovation process	Conducting assessments of risks to business activity; working out appropriate measures for forestalling and countering risks across all stages in the innovation process
4	Tools for managing the efficiency of an innovation project	Providing support for the project up until it is paid off; developing appropriate methods for assessing the efficiency of a project from a standpoint of increase in shareholder added value	Developing appropriate methods for assessing the efficiency of a project from a standpoint of increase in shareholder added value
5	Tools of the digital economy	Fostering a culture of information security among staff and corporate units concerned with information security; introducing digitalized document flow	Putting together aggregated information on the current condition of the company's external and internal environment in a format that is common to all the subsystems; introducing digitalized document flow

Source: authors

Thus, based on the product's commercial viability, functionality employed in the innovation process may be viewed as fulfilled only after the innovation is perceived by the mass end consumer. Consequently, when the innovation is brought out into the marketplace, it is necessary to ensure an aggregate result for all of the five groups of marketing tools for stimulating innovative activity in industrial companies (PwC, 2017; Sölvell, Lindqvist, & Ketels, 2003).

Unfortunately, the share of projects that have been implemented in industrial production among the most significant investment projects which are to be implemented in Russia in the period through to 2025 is insignificant. A few noteworthy examples include the construction of a polymer production plant in Samara Oblast, a steel and pipe production plant in Belgorod Oblast, the Zvezda ship-building complex in Primorsky Krai, the Tayshet Aluminum Plant in Irkutsk Oblast, and a few others (Expert RA, 2018; TekhUspekh Top-15 Rankings in 2016, n.d.). In today's climate of the major significance of factors of demand, there is relevance in employing a client-oriented model of expanded innovation process. Based on this kind of model, in terms of

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boosting the likelihood of successful commercialization of innovations, the function of marketing is, above all, oriented toward the fashioning of consumers' preferences and informed needs. The concept of a client-oriented expanded innovation process ought to be implemented using a systemic approach and prior to the commencement of the R&D stage (in the phases of establishment and getting an innovation into the market). It implies close integration with the consumer of innovations at all stages in managing the lifecycle.

In the early phases of the lifecycle, of the greatest significance in a client-oriented model are indicators of "selling information" in the form of a roster of its "selling" qualitative and quantitative characteristics which shape consumers' competencies and informed needs. In the late phases, the function of marketing is reoriented toward extending the innovation's lifecycle. As a result of the use of the 4P complex of marketing activities, there is transmitted from the consumer, by way of two-way communication, information based on which a decision is made regarding either the technical modernization of the innovative product or its scientific-technological enhancement (R&D) (Buckley, Clegg, & Wang, 2007; Gnezdova, Kugelev, Romanova, & Romanova, 2016; Australian Trade and Investment Commission, 2010).

In addition, utilizing the tools of the digital economy opens for companies exciting vistas in terms of boosts in efficiency in the area of managing their technological development, namely: (1) enhancing the management of production reserves (45–50% of the total magnitude of the economic effect); (2) extending equipment's lifecycle (10–15%); boosting equipment's technical availability (10–15%); (3) optimizing after-sales service (4–10%); (4) boosting labor productivity (1.5–5%); (5) enhancing R&D and production (1.5–5%). Thus, the joint use of digital technology and marketing tools leads to a synergy effect in industrial production (Veselovsky, Abrashkin, Aleksakhina, & Pogodina, 2015; Veselovsky, Gnezdova, Menshikova, Izmailova, & Romanova, 2015).

A key role in assessing the efficiency of for-profit companies ought to be played by analyses of the rate of increase in economic added value, and in the case of stock companies – in shareholder added value, following the implementation of an innovation project. This stance is based on that it is added value that reflects in full measure the attractiveness of a project from the perspective of a value-oriented approach and helps ensure boosts in the quality of decisions made which are oriented toward the achievement of strategic objectives on the industrial company's development. In recent years, the world economy has been dominated by processes that are related to the integration of efforts by various companies aimed at turning out radically innovative products. This interaction is taking place based on the pursuit of an innovation-investment strategy of building technological chains. A client-oriented model of expanded innovation process based on the building of technological chains by industrial companies is illustrated in Figure 1.

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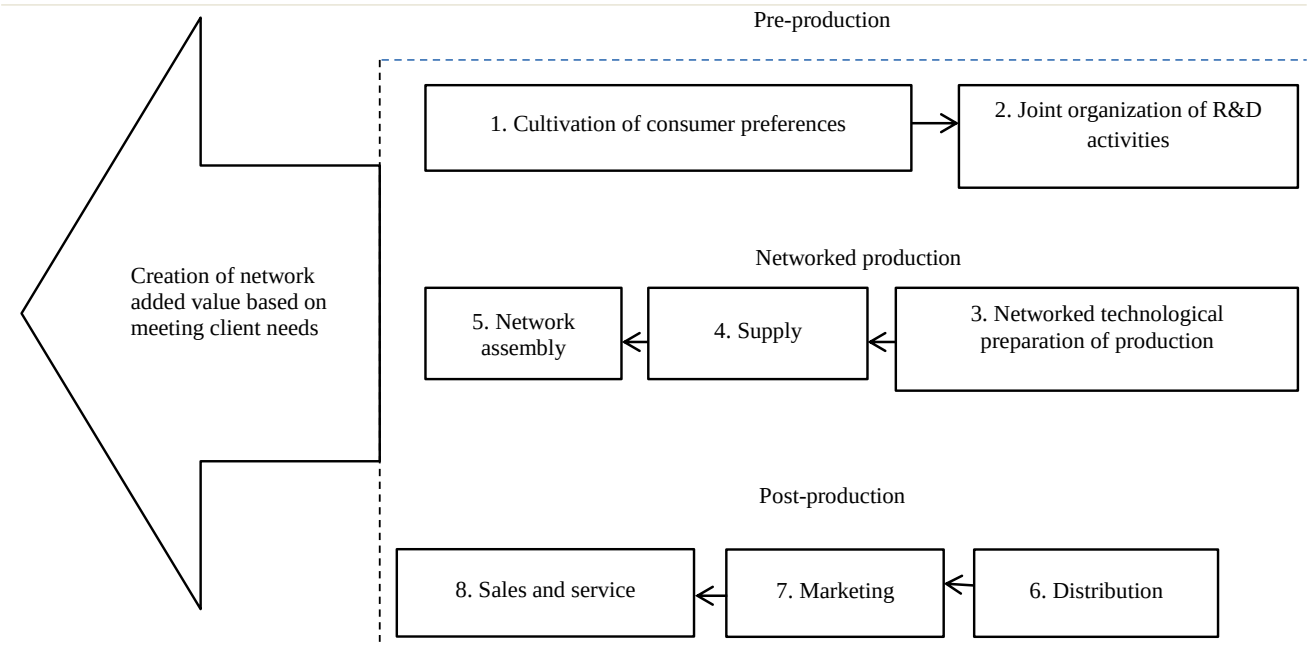

Fig. 1. A client-oriented model of expanded innovation process based on the building of technological chains by industrial companies

In Russia, a strategy of building technological chains is quite keenly employed by certain industrial companies operating within the metallurgy and machinery manufacturing sectors. However, there is a growing need for implementing this strategy on a systematic basis, which may require the development of special organizational-economic forms of entrepreneurship, like technological platforms. A key purpose behind the use of a technological platform is to optimize expenditure on the development of innovations and eliminate the gaps among science, society, and production.

In essence, a technological platform is a platform where all interested economic entities can get together and discuss relevant major areas for the development of a specific sector of the economy, all the way to working out a common strategy for development. Technological platforms make it possible to assess the competitiveness of a potential innovative product and determine the level of demand for it. Russia is making a keen use of best practices from European nations on creating technological platforms. In 2012, an official decision by the Presidium of the Government Commission on High Technology and Innovation put a stamp of approval on 30 technological platforms representing various areas, like medicine and biotechnology (3 units), information-communications technology (2), photonics (2), aerospace technology (3), nuclear and radiation technology (3), power generation (4), transportation technology (2), technology related to metallurgy and new materials (2), extraction of mineral resources and oil refinement (3), electronics and machinery manufacturing (3), and environmental development (3).

Despite being in operation formally, a major portion of technological platforms appear not to be living up to their full potential at this time. Still, there are a number of positive examples, like the performance of technological platforms such as Meditsina Budushchego (‘medicine of the future’), BioTekh 2030 (‘BioTech 2030’), and Fotonika (‘photonics’). These platforms are not only focused on network interaction inside Russia but are oriented toward international cooperation as well, which enables them to be among the leaders in the world economy. Among the technological platforms which are quite active at the moment are Bioenergetika (‘bioenergy’), Ekologicheski Chistaya Teplovaya Energetika Vysokoi Effektivnosti (‘high-efficiency ecologically clean thermal power’), Perspektivnye Tekhnologii Vozobnovlyaemoi Energetiki (‘promising renewable energy technology’), Malaya Raspredelennaya Energetika (‘small-scale distributed power generation’), Materialy i Tekhnologii

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Metallurgii ('metallurgy materials and technology'), and Glubokaya Pererabotka Uglevodorodnykh Resursov ('advanced processing of hydrocarbon resources'). This is testimony that technological platforms are developing quite actively within the industrial sector of Russia's economy. However, it may help to amplify their activity in the direction of boosting the innovation and marketing potential of industrial companies that are part of a technological platform. This kind of integration of activities by industrial companies within the framework of a technological platform should help create network added value based on working out a common strategy for the development and implementation of joint R&D activities.

Considering that the technological development of the Russian economy is hardly possible without the use of relevant marketing tools at the federal and regional levels, it may be advisable to conduct marketing research by way of technological platforms, which could help facilitate boosts in the commercial efficiency and implementation rate of innovation projects. A key purpose of the tools of marketing in this context is creating a favorable environment for the efficient operation of high-tech production operations within the Russian economy via the implementation of horizontal and vertical integration and optimization of business processes in industrial companies.

Conclusions

The findings from the authors' analysis indicate that the potential for and efficiency of innovation activity in industrial companies are largely determined by the level of their innovation and marketing potential. Therefore, to be able to make appropriate changes to the structure of their output and boost their innovation component, companies need to, above all, focus on ramping up their innovation and marketing potential.

The key areas for enhancing the strategic approach to managing an industrial company that is oriented toward an innovation-focused path of development include the following:

- identifying a "key link" in the enterprise's production-business process and focusing on it a major portion of the company's managerial efforts;
- expanding the sphere of application and use of new methods for analyzing activity;
- implementing a system of managing the innovation processes based on deviations;
- forecasting in the early stages the potential for and the degree of risk of negative trends emerging in the event certain production-business indicators fall below the established limits;
- making active use of the tools of marketing to stimulate innovation activity by reference to the type of innovation-investment strategy implemented by the industrial company;
- being orienting toward maximizing economic (shareholder) added value, as a criterion for the efficiency of implementation of innovation projects and an innovation strategy in industrial companies as a whole;
- ensuring systemicity in the operation of the company's production and functional units with a focus on the targeted orientation of their activity toward the effectuation of long-term plans on innovation-investment development.

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