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ON MANAGEMENT OF INNOVATIVE DEVELOPMENT OF INDUSTRIAL ENTERPRISES IN NON-STATIONARY REGIONAL ENVIRONMENT

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Abstract

In the increasing flow of global threats and innovative changes, industrial enterprises are exposed to risk of losing stability which results in analysts focusing their attention on searching and implementing a complex of the adaptive management providing their survivability and progressive development. The present-day theory and practice of management have an increasing need for understanding dynamics of activities of domestic enterprises in the non-stationary regional environment and developing an armory of means designed to protect the prospects of the entity's functioning from falsities of a vortex environment. And the reason for that is not only high sensitivity of industrial enterprises to business environmental disturbances, but also the disturbance of non-linear phenomena in our entities' behavior up to irreversible resource depletion and catastrophes.

The research results achieved in the non-linear fluctuations theory find their application for analyzing properties of efficiency and stability of the economic systems undergoing innovative development. Therefore, from the perspective of the catastrophism and synergetics, there arise discussions of the dynamic processes of economic evolution and the restructuring involved with it, as well as the operating efficiency of regional industrial enterprises.

Keywords: Industry, innovation, non-linearity, instability, region, stability

1. Introduction

Challenges of institutional and innovative transformations give rise to an anxiety for viability of industrial enterprises and induce them to search and implement the concepts of adaptive management. The response to the increased requirements of economic science and practice resulted in revival of discussions and a growing number of publications on issues of theoretical and methodological

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substantiation and development of applied tools of ensuring stability of the entities in the face of vagaries of the market environment. Indeed, a high disturbance of the non-stationary regional environment generates non-linear processes in behavior of our entities up to catastrophes and threatens degradation of their resources and decay.

In this respect, despite the attractiveness of the subject matter and numerous academic pursuits on the topic of management, the paradigm of investigating the industrial enterprises' behavior in a non-stationary environment and the development of their management in terms of dynamism and unpredictability of the business environment have not been fully implemented conceptually. In this regard, the task of building an adaptive management system for innovative development of industrial enterprises in the non-stationary regional environment acquires topicality and practical significance.

2. Problem Statement

Owing to the influence of the perturbing factors, the environment of domestic industrial enterprises abounds with risks which can weaken business activity and stability of their performance, worsen competitiveness and solvency of the entities. Therefore, the problem is in revealing the nature and features of their functioning which is becoming non-linear with sudden restructuring peculiar to them, with slow and fast, smooth and sharp phases of movement. At the same time, it is essential not to overlook characteristic phenomena of non-linearity of economic processes, in particular, when drawn together to the points of low and high efficiency depending on action of situational factors. At the same time, in view of developing corporate management concepts, it is reasonable to increase adaptive properties of its implementation tool in the space of not only destructive impacts, but within a powerful process of generating and developing innovations to which a great number of scientific conferences (5th International Conference on Leadership, Technology, Innovation and Business Management, 2015; Proceedings of the 4th International Conference on Leadership, Technology, Innovation and Business Management, 2015; World Conference on Technology, Innovation and Entrepreneurship, 2015) and publications of scientists (Akcali, Sismanoglu, 2015; Márquez-Ramos, Martínez-Zarzoso, 2010) have been recently devoted.

3. Research Questions

Within the research task set, the following questions are subject to studying:

1. What economic situation with manufacture of innovative products has developed in the industry of Irkutsk Oblast?

2. What non-linear processes are developing in functioning of the regional industry?

3. What do the distinctive features of managing innovative development of industrial enterprises in the non-stationary regional environment consist of?

The solution of these questions allows us to maintain an increment of new knowledge in the field of corporate management of industrial enterprises in a highly disturbed environment with innovative factors of impact.

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4. Purpose of the Study

The research purpose is to comprehend regularities and dynamics of the non-linear economic processes generated by the non-stationary regional environment for theoretical and methodological substantiation of innovative development of regional industrial enterprises and management systems for them.

5. Research Methods

Within natural-scientific and economic views of stability of dynamic system movements, achieving the goal of the research is carried out using conceptions of system analysis, cybernetics, non-linear dynamics, the catastrophism and synergetics.

6. Problems of innovative industrial development of Russia and Irkutsk Oblast

The impact of global and national destructive factors puts the domestic industry at risk of system decomposition, violation of business activities and stability of functioning. Against the background of disturbing expectation of the world crisis outcome and approach of forward growth stage in the Russian industry, there is deterioration to be seen in the innovative modernization environment in regard to the regional industry as a main direction of transformation and development of Russia's industrial complexes.

In Russia's economy, the amount of innovative goods, jobs, services in the industrial production in 2012-2014 made only 7.8%-8.9%, and the specific weight of industrial enterprises (without small-business entities) implementing technological innovations over this period was extremely small – from 9.7% to 9.9%.

A depressive picture is also represented by the process of manufacturing innovative products in Irkutsk Oblast. The labile price factor has strengthened the inflation load of financial and economic activities of the regional industry (the price index for commodity goods producers sold on the domestic market varied in a wide interval from 101.6% to 120.2% in 2012-2014), and specific weight of the entities that mastered technological innovations during these years among the enterprises in industrial production and service sector (without small-business entities) was in the range from 5.5% to 7.1%, whereas in Russia it was from 8.8% to 9.1%. Besides, in production of machines and equipment, the industrial production index in the region decreased from year to year (in 2012 – 89.7%, 2013 – 87.2%, 2014 – 78.0%, and in the first half of 2015 – 71.5%), while in production of electric equipment, electronic and optical equipment the index fell with a noticeable speed (113.5%, 104.5%, 86.1% and 90.1%, respectively).

In a word, the industry of the Irkutsk region continues to remain in a depression, losing growth rates under pressure by both the world crisis and the inactivity of internal modernization sources for the regional economic complex. On the one hand, a sluggish change of indicators and their sporadic increment testify the absence of a reliable and long-term base of innovative development of the regional economy. And on the other hand, a noticeable growth of industrial production of Irkutsk Oblast during a number of the previous years results only from activating the extracting industries. The basic industries of economy up to now are giants of extracting fuel and energy minerals, which assigns to Irkutsk Oblast the

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status of the region being conservative in its production structure and the one that is catching up in its economic growth rates.

As a result, timid signs of industrial revival in rare years did not get sufficient support of the high-tech industries capable to provide a high-quality turning point in industrial production orientated towards production of the knowledge-intensive products. Therefore, the prevailing tendencies in dynamics of economic indicators in recent years have an unstable character.

Non-linear processes in functioning of the regional production

Difficult processes inherent in the industrial complex processes generate both stable and unstable states which can essentially change the picture of industrial behavior and, in doing so, remove it from the depression. Recently, the range of problems of non-linear dynamics has become a subject of close attention on the part of analysts, and it offers an explanation for the nontrivial restructuring taking place in the economy (Brock, 1988; Pavlidis, Paya, Peel, Siriopoulos, 2011). At the same time, synergy perceptions help to gain the insight into the essence of economic dynamics, so when self-organization in the system results in displacing the chaos, it becomes ordered and displays the property of cooperating parts of the non-linear system (Haken, 1993; Nicolis, Prigogine, 1989).

For our research, synergetics is a valuable factor as it discloses the process of transferring economy from one stable state into the other. What is more, the first stable state is characterized by low productivity as it expresses repeated fall of product output and corresponds to minimum admissible level of the current assets. Unlike the first, the second steady state is highly productive, reflecting the maximum use of production capacities and high level of the current assets. In contrast to the first state, the second stable state is highly productive, reflecting maximum use of industrial enterprises and a high level of the current assets.

What features of the regional industry non-linear behavior make themselves conspicuous due to the necessity of searching for a scenario of removing the industry from the depression? The high-quality restructuring of its functioning can be caused by the following reasons with remarkable consequences in terms of the economic structure of the Russian society (Chernavskii, Starkov, Scherbakov, 1999):

• the tax burden on activities of industrial enterprises has influence on dynamics of the industry. An analysis of productive activity tax dependence on the taxation coefficient, carried out by specialists, shows that there appears a point of bifurcation in which the behavior of the industry changes completely: in the high-speed and irreversible mode, it makes transition from the highly productive state to the low-productive one. Meanwhile, the reverse transition from the low-productive state to the highly productive one requires more powerful reduction of taxes in comparison with the increase which "has dumped" the industry in the low-productive state;

• a sharp change in price at some point of time in regard to the results of a model experiment can lead to rapid transition of the industry to the attraction area for the low-productive state after which it rushes towards it. The values of critical growth of commodity prices and the time of system transition to this state depend on the current industrial indicators. It is of no little interest that the shifting of the regional industry into the low-productive state possesses stability, i.e. it is rather insensitive to changes of other industrial indicators;

• a one-stage change of the money supply amount can serve as a cause of qualitative restructuring of the industry, which makes it possible to achieve noticeable accumulation of the entities' current assets. It

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is determined that an increase in the money supply (address emission) and investments by 25% "pushes out" the economic system from the low-productive state to the attraction area for the highly productive state. If investments do not reach a threshold value, such kind of restructuring will not happen;

• it is shown that bifurcation and shifting of the economy from the low-productive state into the highly productive one is found in case of reducing production costs of raw materials, transport and taxes by 50% higher.

• interpretation of the received results from the perspective of feasibility of real qualitative restructuring of the regional industry and its transfer into a highly productive state becomes a logical step after the model experiment. As the experiment substantiates, a decrease in export duties on raw materials prevents movement to the highly productive state.

Let us notice also that from the perspective of the entropy approach and the theory of information, one makes possible an argumentation of non-linear (exponential) dependence of an industrial entity's performance effect on the amount of the accumulated information and substantiation of the terms of maintaining the stability of this effect due to which a regular connection between the latter and innovative development of the entity is formalized and analyzed (Chuprov, 2016).

7. Distinctive features of innovative development management for industrial enterprises in the non-stationary regional environment

From the point of view of the catastrophism, the evolution of an economic system in the non-stationary environment proceeds "along a curve", drifting from the low productivity provision to its higher level. This process occurs along with mobilizing all resources of the system. And only while transiting through "the non-return point", it is attracted to a stable advantageous position (Arnold, 1992). Of a necessary prerequisite of such a progressive climbing of the industrial entity is effective management and resource potential capable to kick-start sufficient acceleration of its activities and to provide transition of the entity to the highly productive state.

Meanwhile, it is known that the growing flow of changes in the regional entities' environment generates not only favorable opportunities, but also threats to its activities fraught with violation of the entity's resource exchange with the external environment and loss of its stability. Therefore, the entities are forced to adapt to disturbances and to hold their competitive positions, without having guaranteed prospects to take their equilibrium rank on the market.

As a result, in accomplishing the management function, first of all, there arise questions about the dynamic picture of the transition process, in particular, the duration of the transition period for the system over to the final state after influence of the disturbances. The matter is that because of a delay and a lag effect of the processes taking place in the system, the managed subsystem responds to the managing effects indirectly, therefore the similar transition occurs not instantly but during some time.

Obviously, an enormous variety of systems also involves a multiplicity of its movement trajectories. They can have specifics in stability of the direction, speed of change, and other characteristics. The transition processes are determined by the properties of the studied system and the character of the effects imposed on it which become the cause of its disturbed movement.

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Specific nature and parameters of this dynamic process and restructuring of the Russian industry regional industry with its transition from the low-productive state to the highly productive one depend on the macroeconomic situation in the country and in the region.

Successful overcoming destructive processes in the non-stationary environment of the regional industry from the perspective of non-linear dynamics and economic practice assume a constructive dialogue of the federal and regional authorities and management of the entities in regard to institutional conditions, resources and rates of innovative modernization of the industrial complex.

8. Conclusions

Research studies show that attracting views and tools of non-linear dynamics allows a better understanding of the role and nature of innovation impact on functioning of industrial enterprises in the environment with restructuring that is specific to them (Scheinkman, 1990; Martynyuk, Mazko, Rasshyvalova, Teo, 2011). An increased sensibility of the regional industry to innovations implies developing knowledge-intensive productions and forming the economy of knowledge. Nowadays, the evolving economy in its behavioral character is non-stationary, which is a source of its changes, findings and losses of stable functioning. It is plain to see the increasing dynamism of the regional industry, the rigidity and turbulence of its environment: industrial enterprises are surrounded by the non-stationary environment that causes in them non-linear processes with features inherent in them, opening for the entities' management favorable conditions and incentives for slow and rapid phases of innovative transformations in the industrial sphere.

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