Definition of mutual influence of IT-Market and Market of Innovations

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ABSTRACT

The research is aimed at building an integrated imitation of processes occurring in the regional economy and assessment of the mutual influence of the most important parameters that allow explaining the nature of "disturbances" in the national economy to ensure the conduct of an effective and productive economic policy in the field of interaction of information technologies and innovation policy. We offer to use a modified system functional model of a market economy with the inclusion of the market of innovations and the market of information technologies in it in this article. The market of innovations and the IT-market fit into the economy model of the Republic of Tatarstan in connection with the classical markets of production factors at the same time: labor market, capital market and commodity market. This allowed discovering the interdependence of the cost and quantity indicators of these markets, describing these relationships in a mathematical form and giving a graphic representation of them. At the same time, we received both stable interdependencies and unstable and less stable ones, which made it possible to rely on them when drawing conclusions based on the results of model construction.The article shows the analysis results of statistical data and includes a formed system functional model of market economy with the inclusion of the market of innovations and the market of information technologies of the Republic of Tatarstan.The result of this work is the author's comments and recommendations for the construction of state policy of the Republic of Tatarstan.

Key words: economic policy, economic modeling, economy model, functional model of the market economy, market production factors, innovation, market of innovations, information technology, IT-market.

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1. INTRODUCTION

The relevance of this research topic is due to a number of features that are inherent in the Russian economic system today. Firstly, the instability of the processes taking place in the national economy is extremely high. The usual tools for analyzing the economic situation do not give a complete picture of the changes taking place in it. The high economy turbulence, in turn, does not allow providing a reliable forecasting of development and reasonable planning at the regional and national levels. Secondly, there is no clarity in the nature and mechanics of the emergence, development and decline of disproportions and crisis phenomena in the economy. These circumstances also introduce additional difficulties in forecasting and planning.

At present, in the conditions of world turbulence, the problems connected with the forecasting of the economic system and the influence of innovative factors and factors of the developing IT-market are becoming increasingly important. The used in-country average statistical values lead to a significant distortion of the information received and, as a result, to possible errors in forecasting when making critical decisions. In order to minimize such consequences, the authors attempted to search for the most stable quantitative proportions in the internal Russian territorial space. A macroeconomic mathematical model, called the system functional model of a market economy, is at the heart of the approach. The advantage of this approach is the study of each of market by determining the degree of mutual effectof their quantitative and qualitative characteristics (Garipova E. 2015). The use of the modified system functional model of the economy as a tool for assessing the influence of the market of innovations and the maket of information technologies on the region's economy has made it possible to determine how these markets actually interact and how this interaction will develop in the forecast period. In the course of study, we received new areas of inter-market interaction, gave their economic and mathematical description and determined the nature of disturbances occurring in them. The results of the development of modified model of the economy with the inclusion of the market of innovations and the market of information technologies made it possible to formulate key directions and recommendations for building the economic policy of the region. The conclusions and results of this work will be of interest to the expert scientific community, state authorities at the federal and regional levels implementing state policy in the areas of

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state planning and forecasting.

2. MATERIALS AND METHODS

Analysis of economic literature shows that the problems of assessing and forecasting the impact of various economic phenomena on the balance of economic development of the regions have been widely considered by both foreign and domestic scientists. The modern theories and approaches of management and forecasting are based on the methodology and approaches developed by J. M. Keynes. Later, the economy model according to J. M. Keynes was developed in the works of J. Hicks - A. Hansen. In addition, various approaches to the methodology of macroeconomic modeling were considered by F. Kane, A. Marshall, L. Walras, V. Pareto, P. Samuelson.In addition, it is possible to note also such Nobel Prize laureates as: R. R. Frisch, J. Timbergen, S. Kuznets, L. Klein, R. Solow, L.S. Shepli, E.E. Roth, W. Nordhaus,C. Shell among the scientists who touched upon the problems of balanced economic development in their works. In the Russian economic thought, the problem of assessing and forecasting the impact of various economic phenomena, especially regarding the impact of innovations and information technologies on the stability and balance of development in the modern economy, has not been adequately addressed. Some aspects were covered in the works of S.A. Ashmanov, L.E. Basovsky, a little earlier - in the works of A.G. Granberg, as well as G.B. Kleiner,2013; V.V. Egorov, M.R. Safiullin, S.A.Dyatlov et al. Despite the significant contribution of scientists to the development of theoretical and methodological foundations in the field of influence of innovations and information technologies on the development of the modern economy, it should be emphasized that these issues are not fully considered in modern literature and in the domestic space. Strengthening the influence of innovations and information technologies, their evaluation, interaction with classical markets determined the purpose and objectives of the study.

As mentioned earlier, the system of national reproduction is now inseparable from the mechanism of the market of innovations, its interaction with the market of information technologies, and the innovations and IT-methods play an increasing role in the economic process (GaripovaE.N. 2015, GaripovaE.N.2014). The introduction of innovations and IT in any of the sides of economic life of the society generates an expectation of their quick return, achievement of a fair economic effect, increasing the competitive advantages (Kreng V. B., Wang B. J. 2013, Porter M. E., Kramer M.

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R. 2006, Uzava H. 1965).

In this regard, we consider it extremely relevant to include the mechanism of the market of innovations in the system functional model of a market economy. Under the market of innovations, we mean that the interaction in this market is nothing but innovations of a different nature. Such a product as innovations is quite difficult to determine, which causes certain difficulties in the system of accounting for market indicators. The object of exchange in the field of innovation activity can be represented by the results of any stage of implementing the innovation process: fundamental research, applied research, implementation, and development. The innovative market is organizational, i.e., both enterprises and various institutions act both as suppliers and buyers. The economic entities in the field of innovation can act as consumers of some innovations (lower level) and suppliers of some innovations of a higher level. At the same time, the quality of final innovative products and services is determined by the quality of innovation throughout the innovation chain (GaripovaE.N., SafiullinM.R. 2015).

In the system model of a market economy, the market of innovations is represented by the number of innovative enterprises as a quantitative indicator and the volume of output of innovative products as a value indicator.

The most important tool for improving modern competitiveness is not only and not so much the use of innovations in the daily life of the organization and society, but also the active involvement of information technologies in it. The modern economic environment is inextricably linked with the use of IT tools. At the same time, the participants of IT-market are able to play more than an appreciable role in the formation of inter-market interaction. In this regard, it seems to us extremely important to present the market of information technologies in the system functional model of a market economy.

The market of information technologies implies the interaction of the volume of information technologies being developed and the level of investments in them. It is clear that the information technologies will be the goods in this market. In the Russian conditions, such a product as information technologies is not very transparent and difficult to define. Given this circumstance, we consider it necessary to calculate the interaction in the IT-market by the ratio of the level of costs to IT-production and the number of enterprises using information technologies in their activities.We should note that this choice is due to rather complex determinateness of IT products and a meager

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set of statistical data that allow creating a system functional model of a market economy taking into account the IT-market factors.

When calculating the system functional model of a market economy with the introduction of the market of innovations in it, we obtained the following quadrants: market of innovations itself; influence of the output volume of innovative products on the value of fixed production assets; influence of the output volume of innovative products on the price index; impact of the output volume of innovation products on the number of people employed in the economy; influence of the number of innovative enterprises on the labor cost; influence of the number of innovative enterprises on the GRP; influence of the number of innovative enterprises on the interest rate (SafiullinM.R.1996, Republic of Tatarstan, 2014).

Inclusion of the market of information technologies in the system functional model of the market economy led to the formation of the following quadrants: IT-market itself; capital intensity of IT-costs; mutual influence of the level of costs on IT and GRP; IT-labor provision; dependence of motivation and IT; mutual influence of inflation and the number of enterprises using IT; mutual application of IT and the interest rate.

In addition, we obtained the quadrants, describing the mutual influence of the number of innovative enterprises and IT costs, as well as the interdependence of the number of enterprises using IT and the output volume of innovative products.

Thus, we included additional sectors in the nine-sector system functional model of the market economy.

3. RESULTS AND DISCUSSION

The use of the modified system functional model of the economy as a tool for assessing the influence of the market of innovations and the market of information technologies on the region's economy has made it possible to determine how these markets actually interact and how this interaction will develop in the forecast period (Fig. 1):

- interdependence of the number of enterprises engaged in the innovation activities and costs in IT;
- interdependence of the number of enterprises using IT, and the release of innovative products.

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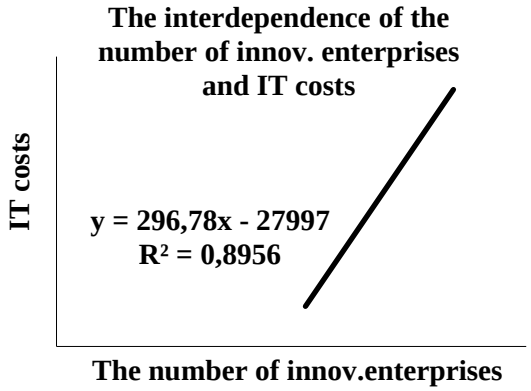

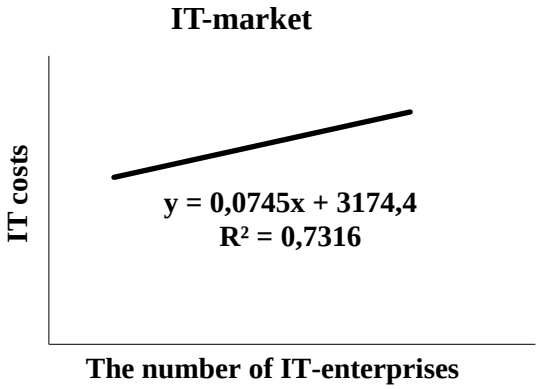

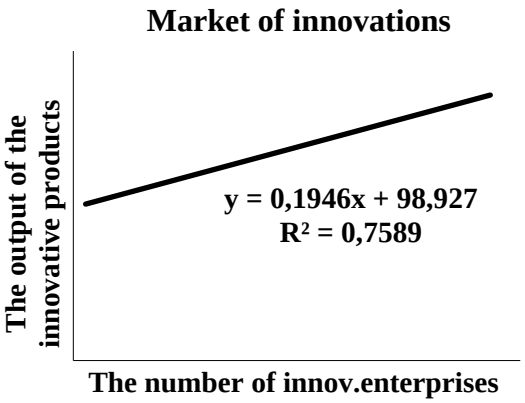

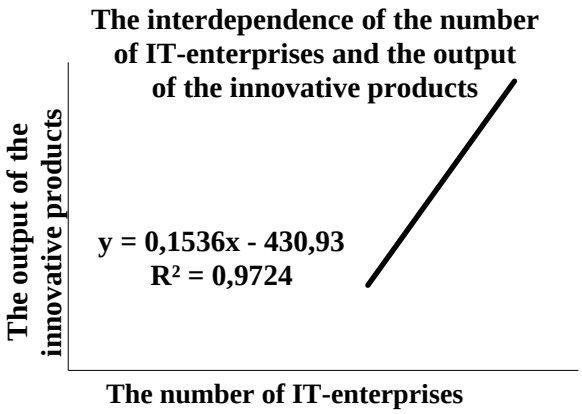

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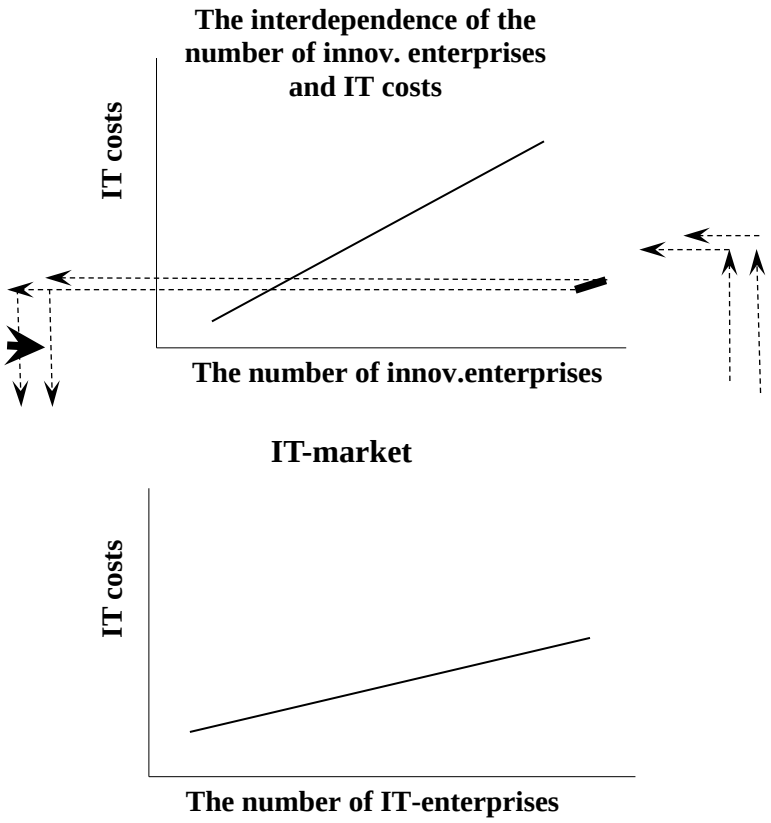
Fig. 1. Interaction of IT-market and market of innovationsin system model of economy of the Republic of Tatarstan

In the course of study, using the proposed approach, we revealed the interdependence of the IT-market and the market of innovations in the regional economy.

We revealed and determined the features of occurrence and propagation of inter-market disturbances, which are of a multiple helical nature (Fig. 2).

With an increase in the number of enterprises using the information technologies, there is also an increase in the number of innovation enterprises, the growth of which cyclically causes the subsequent even greater growth of enterprises using IT.



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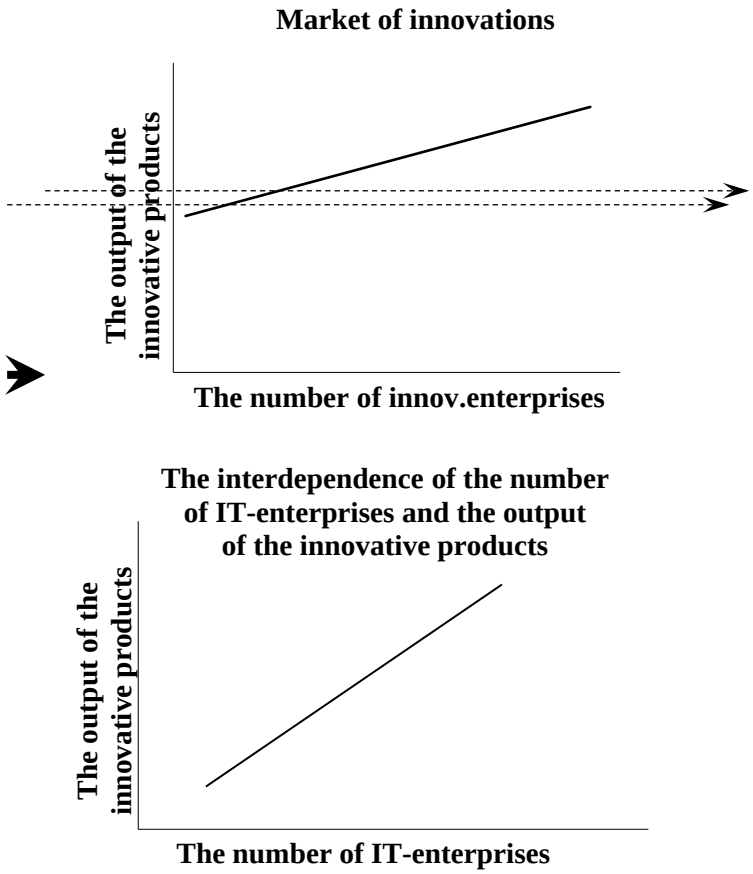

Fig. 2. The principle of emergence and spread of USD/CAD for perturbations of interaction

IT-market and market of innovations

The use of influence tools for at least one of the indicators of the market of innovations or the IT-market will lead to strengthening the positions of other indicators. This gain can be calculated and the dynamics of changes can be displayed in a graphic form.
In addition, in the course of study, we revealed and described the economic and mathematical patterns in the interaction between the IT-market and the market of innovations, representing changes in percentages as a result of movement of one of the IT-market indicators by 1%. The study results are presented in Table 1.

Table 1.Economic-mathematical characteristics of the interaction of IT-market and market of innovations

Interdependence	Behavior of the detected dependence

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	Nature of addiction	Behavior of indicators of the classical markets at change of an indicator of the market of innovations by 1%	Probability of changing the indicator of classical markets due to changes in the innovation market
The interdependence of the number of innov. enterprises and IT costs	Resistant dependency	The increase in the number of innov. enterprises, to 1% will increase costs in IT's 0.99%	89,56%
The interdependence of the number of IT-enterprises and the output of the innovative products	Resistant dependency	The increase in the number of IT-enterprises, at 1% of the volume of product innovation by 1.003%	97,24%

4. CONCLUSIONS

Proceeding from the above, it is possible to note the following stable interrelations and levers of influence in the system model of a market economy with the inclusion of the market of innovations in it. Firstly, the stable production function of the market of innovations allows speaking about a close relationship between the output volume of innovative products and the value of the basic production assets. We can also confidently assert that the growth in the number of people employed in the economy makes it possible to increase the output of innovative products (a stable ratio of the isoquantum of production function). In addition, we can note a strong dependence of the output of innovative products and GRP.

The revealed interrelationships of the market of information technologies when it is included in the system functional model of a market economy allow speaking about the following key levers of influence. Firstly, the confident interdependence manifested itself in the construction of production function of the IT-market, which indicates an increase in the costs for information technologies with an increase in the value of basic production assets. In addition, there is a steady dependence of wages on the number of enterprises using IT: an increase in the number of such enterprises raises wages and vice

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versa. In addition, the number of enterprises using information technology affects the GRP volume: an increasein the number of such enterprises causes an increase in the production volume in the republic. In addition, there are stable links between the value and quantity indicators of the market of innovations and the market of information technologies.

The most important conclusion is the definition of close interconnection in the inter-market interaction of the IT-market and the market of innovations, which allows estimating and predicting the behavior of these markets in the shortest possible time, which certainly can improve the efficiency of the current economic policy.

5. SUMMARY

During the construction of systemic functional model of a market economy, we revealed a number of key interdependencies, which made it possible to expand and refine the mechanism for the formation of the republic's economic policy. The obtained results of constructing the system functional model of a market economy open a number of tools for managing certain aspects of the economy of the Republic of Tatarstan.

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