

Estimation of Influence of Innovative Development on Growth of Agriculture



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Abstract— *This article substantiates the scientific and practical importance of innovation, offers analysis of research regarding the impact of innovation on economic growth, assesses current state of innovation in agriculture of our Republic along with econometric methods to evaluate impact of innovation on economic growth in agriculture.*

Keywords: *innovation, innovative activity, innovative activity, innovative products, agriculture, agricultural subjects.*

I. INTRODUCTION

In recent years, as known, the intensive growth rates of the global economy, the growth of economic development in many countries have occurred mainly due to unleashed potential of innovation.

In this regard, having formed the directions of innovative development of the economy in all sectors and spheres, including agriculture, it is possible to achieve a number tasks important for the state, including ensuring sustainable economic growth, food security, improving the quality of life of the population.

The experience of economically developed countries shows that the increase in knowledge-intensive production in agriculture, characterized by successful entry in the world agricultural markets, as well as the competitiveness of agricultural producers is determined mostly by the effectiveness of innovation and their involvement in the innovation process.

Taking this into account, our Republic has also taken the first steps towards the transition to innovation-based economy and created necessary conditions for innovation. In

particular, the decree [1] defines the Strategy of innovative development of the Republic of Uzbekistan in the future, the "Road map" for the implementation of the Strategy of innovative development of the Republic of Uzbekistan, the targets of innovative development of the Republic of Uzbekistan until 2030. In order to ensure the implementation of the tasks defined in this document, decisions have been made to develop innovative activities in agriculture [2,3], measures have been taken to introduce innovative technologies and ideas in all areas of agriculture. The adoption of these measures in the future will, undoubtedly, create the basis for the rise to a high level of not only the agricultural sector, but also the entire economy.

II. PURPOSE

The purpose of this article is to study and evaluate the impact of innovation on the efficiency of agriculture in the future using econometric methods.

III. THE LEVEL OF KNOWLEDGE ON THE MATTER

It should be noted that many studies have been conducted in this topic. In particular, one of the first economists who explained the impact of innovation and its financing on the process of economic growth of the state as a whole, is J.Schumpeter. According to the analysis of his work, the development of an innovative product will lead to qualitative changes in the economic system, to a new stage of development [28]. He notes that entrepreneurs, using the loan, created new industrial products, which subsequently entered the market.

R. Solow, J. Kendrick, E. Denison, S. Kuznets also made a great contribution to the study of the impact of innovation on economic growth in 1950-1960. According to their research conducted in the 20th century on economic growth in the United States, more than 50% of cash flows were provided by innovative products in the economy (1-table).

Table 1. Contribution of innovative products to U.S. economic growth [33]

Author	Study period	Year of publication of the study	Economic growth through innovation, %
M. Abramovich	1869-1953	1956	48

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R. Solow	1909-1949	1957	51
J. Kendrick	1889-1953	1961	44
E. Denison	1929-1957	1962	58
S. Kuznets	1929-1957	1971	78

According to estimates R. Solow, the impact of innovative products on the development rate of the U.S. economy in 1908-1949 (its annual growth rate averaged 3%) was 1.5%. Half of the GDP is achieved through the production of products that have no analogues in the market of goods and services. For comparison, it should be noted that the growth of labor productivity during the study period increased by 1.1% of GDP, the share of accumulated capital for this period amounted to 0.3% [29].

American scientist E. Denison is known for his research on the classification of factors of economic growth in a single state, the definition of sources of stimulation of economic growth. In total, he identified 23 factors, 14 of which are directly related to innovation. In his opinion, the increase in GDP growth rates of a single state is associated with better, rather than quantitative changes in the spheres of production activity. The scientist said that the increase in GDP of developed countries by about 60% allowed to create a new product, and then bring it to the market. Economic conclusions formulated by S. Kuznets confirm the conclusions of R. Solow and E. Denison. He noted that the economic growth of each state is associated with the use of production factors based on the achievements of scientific and technological progress [20].

In scientific works of N. Sakura, John.Bernstein, D. Cow, D. Gelleck, P. Monena [8, 9, 10, 11, 19, 27] a stable positive relationship between the import of technologies and the growth of labor productivity in the national economy was determined[11, 13, 14, 16, 23, 32]. The scientific ideas that technological changes in the long-term developing economy have become the main source of productivity growth are reflected in the scientific works of J.Fernald, S.Bazu and M. Shapiro [6].

According to the results of econometric calculations J.Bernstein and I. Nadir [8], the increase in investment in high-tech industries in the United States by 1% leads to a decrease in variable costs by 0.07–0.24% per unit of innovation-products.

As shown by the research of C. Griliches, conducted at a separate industry level, showed that technological changes provided a third of productivity growth, half of production growth [16]. At the same time, the rate of return on capital invested in alternative innovative technologies was 2-4 times higher than the return on investment in traditional production tools, that is, in industrial production in the leading OECD countries (Organization for economic cooperation and development), this figure reached from 15% to 20%, and in the service sector - up to 150% [26].

Studies conducted by the Organization for economic cooperation and development at the end of the twentieth century have shown that capital investment in information and communication technologies (ICT)has become a key factor in the growth of productivity in the economies of the world's leading countries. In its report on the impact of innovation on economic growth, it was stressed that the ICT

sector plays an important role in increasing productivity at the current stage [5].

The results of the econometric analysis conducted by D. Gelleck show that the increase in the volume of investments of private companies in R&D (research) and their share in GDP increases their contribution to the growth of labor productivity and, as a result, increases the impact of innovation financing on the dynamics of macroeconomic indicators [17]. Similarly, the increase in government spending directed to R&D affects their use by private businesses. Studies have shown Janotta F. and N. Payne, an increase in government R&D expenditure in European countries by 1% leads to an increase in the share of innovative products in the trade structure of the country by 0.7% [18].

In addition, OECD studies show that the economic and social benefits of the national economy are primarily provided by the transition to innovative development [23, 24]. The widespread use of innovative technologies leads to a more effective organization of work and reduce the duration of production processes. The introduction of innovations leads to an increase in the standard of living of the population. In all sectors and spheres of the economy, the share of smart work, not physical, is growing, as well as the population engaged in the creation of high-quality material and spiritual values, especially in the scientific and technological spheres. The introduction of innovations into the national economic system can minimize such negative factors as economic growth, population ageing and lack of natural resources.

The results of the study conducted in recent years indicate that in recent decades, in the result of the growth of innovative activity of private business, the diffusion of innovation in the national economy of many countries has accelerated, which in turn led to an increase in innovative activity of private business, which indicates a positive impact on the dynamics of macroeconomic indicators [25, 31].

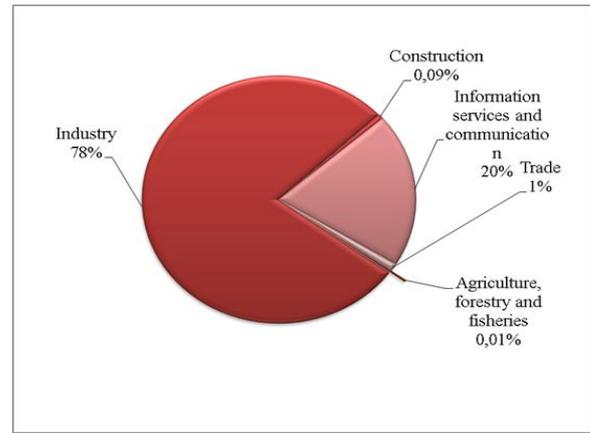
The results of a sample survey on the "Questionnaire survey of the impact of the results of innovation", conducted among enterprises and organizations in the last three years in the Republic of Uzbekistan, showed that the majority of respondents noted that as a result of the introduction of innovative products there was an increase in the range of products, works, services (54.7% of respondents), the expansion of markets (53.6 %), improvement in the quality of products, works and services (48.4%). %, as a result of the introduction of process innovations - increase in production flexibility (55.7 %), increase in production capacity (50.2%), reduction of wage costs (42.9 %), reduction of material and energy costs (53.3%), as a result of the introduction of marketing innovations - expansion of sales markets (46.4 %), as a result of joint implementation of General innovations - reduction of environmental pollution (45.7 %), ensuring compliance with modern technical procedures, rules, standards (48.8%) [41]. Thus, the analysis of studies has shown that there is an inextricable link between GDP growth and productivity growth with the funds allocated by different countries for innovative development.



IV. ANALYSIS OF THE RESEARCH

The next step of our research is to identify the link between innovative development and economic growth of agriculture in the Republic of Uzbekistan in order to achieve the goal of our research.

First, we will analyze the innovative activity in the agriculture of the Republic. It is known that from the first days of independence large-scale work on development of the agricultural sphere is carried out. But at the same time, the low level of scientific and technological developments in the agricultural sector, the low level of private and public investment, the creation of innovative structures, the development of mechanisms for the development and promotion of innovative activities hinder the growth of agricultural production. As can be seen from the data shown in Fig.1, the agricultural sector in terms of creating innovative goods, works and services in agriculture, accounts for only 0.01 percent. If we do not take into account forestry and fisheries, this figure will be even lower.



Rice.1. Distribution of the created innovative production on branches of economy of Uzbekistan, %

This indicates that innovation activity in agriculture is at a low level. Thus, in 2017, the number of enterprises and organizations engaged in the production of innovative goods in agriculture amounted to 1.8 percent of the total. At the same time, in 2013 this figure was 2.1 percent, i.e. decreased by 0.3 percent, which indicates a decrease in the number of enterprises engaged in this activity over the past three years (table 2).

Table 2. Indicators of innovation activity in the Republic and the contribution of agriculture to it ¹

Indicators	2013	2014	2015	2016	2017	2017 in relation to 2013 (+;-)
Number of enterprises and organizations engaged in the production of innovative products, units.						
Total	842	1601	2134	2374	2171	+2,6 times
Agriculture & forestry	18	26	53*	53*	40*	+2,2 times
percentage,%	2,1	1,6	2,5*	2,2*	1,8*	-0,3 p.p.
The volume of production of innovative products, million UZS						
Total	4614656,2	70442965	8023628,5	10688245,6	18543331,0	+4,0
Agriculture & forestry	6488,1	33912,1	16105,8*	35520,3*	47941,3*	+7,4 times
percentage,%	0,1	0,0	0,2*	0,3*	0,3*	+0,2 p.p.
The volume of implemented innovative goods (works, services), performed on their own (without VAT and excise), million UZS						
Total	4249669,0	6048147,8	7646674,7	10298930,2	18543331,0	+4,4 times
Agriculture & forestry	6488,1	14895,9	15323,8*	30871,2*	47941,3*	+7,4 times
percentage,%	0,2	0,2	0,2*	0,3*	0,3*	+0,1 p.p.
Costs of technological, marketing and organizational innovations, million UZS						
Total	4634230,1	3757372,2	5528278,7	2571405,6	4162263,7	89,8 %
Agriculture & forestry	3988,2	1841,9	1775,3*	8144*	15684,6*	+3,9 times
percentage,%	0,1	0,0	0,0*	0,3*	0,4*	+0,3 p.p.

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Number of enterprises, implemented technological innovations, units						
Total	725,0	819	894	956	975	134,5 %
Agriculture & forestry	15,0	8	20*	19*	18*	120,0 %
percentage,%	2,1	1,0	2,2*	2,0*	1,8*	-0,3 p.p.
Number of implemented technological innovations, units						
Total	1262	1382	1737	1799	1946	154,2 %
Agriculture & forestry	25	27	22*	21*	18*	72,0 %
percentage,%	2,0	2,0	1,3*	1,2*	0,9*	-1,1 p.p.

Note: *since 2015, the statistical collections of the Republic of Uzbekistan on agriculture and forestry include fisheries.

If we analyze the trend in the volume of innovative products in agriculture, this indicator (+7.4 times) is higher than the trend observed in all industries (+4.4 times). Therefore, the share of agriculture increased by +0.2 p.p.. However, it should be noted that here the share of agriculture remains low (0.1-0.3 %).

A similar trend was observed in terms of the introduction of innovative products. That is, in agriculture, the share of this indicator for the analyzed years increased by +0.1 p.p., and its share in the total volume of the introduced innovative product ranged from 0.2 to 0.3%.

It should be noted that, despite the growing costs of innovations in agriculture (during 2013-2017, the costs

increased 3.9 times), the level of their implementation is low and tends to decrease (i.e., during 2013-2017, the number of implemented technological innovations decreased by 28%, and marketing and organizational innovations were not created at all). There are also differences in the growth trends in the number of enterprises implementing innovations (the growth rate in agriculture was 120 %, and in all sectors - 134.5%).

In other words, there is little innovation and efficiency in agriculture. This we can clearly see from the data in figure 2. So, on average in the Republic for 1 enterprise there are 6624,2 million soums. but in agriculture the figure was 806,4 million soums, i.e. 8.2 times. This is directly related to the fact that less money is spent on innovation in agriculture.

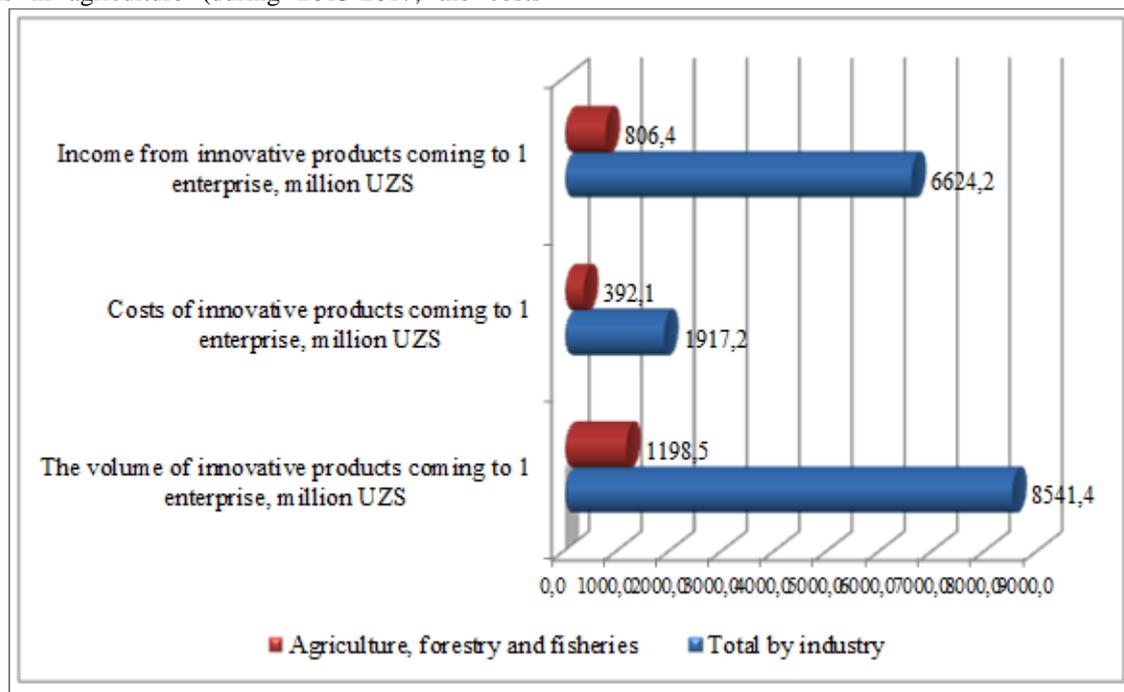


Figure 2. Comparison of innovative activity of enterprises in agriculture and in General by industry, %

Now let's analyze the reasons that caused this situation. Table 3 below presents the results of a survey conducted among entities engaged in agriculture during 2013-2017. According to this survey, among the factors constraining innovation, 48.6 percent of respondents noted a lack of financial resources, 43.6 percent - no need for new innovations, 15.4 percent - low demand for new products (work, services), 23.1 percent - lack of qualified personnel,

15.8 percent - underdevelopment of innovation infrastructure, 13.6 percent - high economic risk, 13.0 percent - the high cost of innovation, 12.4 percent - lack of information about new technologies, 8.8 percent - lack of information about markets.

As can be seen from above data, the main problem is the lack of funds and the lack of need for new innovative products. This situation, as we have already noted above, constrains the desire to create innovations in agriculture. Therefore, among the subjects of agriculture it is advisable to conduct explanatory work and promote the benefits of innovation.

V. RESEARCH RESULT

Therefore, in this study we will try to assess the impact of innovation on the development of agriculture. To do this, we will initially make a forecast of indicators of innovation activity in agriculture, as well as a forecast of gross agricultural output.

It is known that in our Republic "Strategy of development of agriculture of Uzbekistan till 2030" is developed and widely discussed. Also, in accordance with resolution No. 70 of the United Nations General Assembly adopted at the summit on sustainable development in September 2015, as

well as in order to organize systematic work on the consistent implementation of the sustainable development Goals of the UN global agenda for the period up to 2030, the Cabinet of Ministers of the Republic of Uzbekistan approved 17 national goals and objectives in the field of sustainable development for the period up to 2030, as well as approved the "Road map" for their implementation [4]. At the same time, the task of entering the Republic of Uzbekistan by 2030 into the 50 leading countries of the world according to the rating of the Global innovation index [1] is set. This serves as the basis for the establishment of the forecast period of the above indicators.

Three indicators were selected for forecasting (gross agricultural output, costs of innovative products and the volume of production of innovative goods in agriculture). Based on the current trend, five models (functions) have been compiled for each indicator, and one of the most optimal options has been chosen. The selection results are presented in table 4.

Table 3. Selected models for forecasting gross agricultural output and indicators of development of innovative activity in agriculture

	Gross agricultural output, billion UZS	Costs of innovative products in agriculture, billion UZS	The volume of production of innovative products, million UZS
Model type (equation)	$y = 971,87x^2 - 705,13x + 21495$	$y = 2969,5x - 2621,7$	$y = 8172,5x^{1,0672}$
Coefficient of determination	$R^2 = 0,9758$	$R^2 = 0,6429$	$R^2 = 0,7058$

As you can see, in all our selected models the coefficient of determination is high, which allows us to predict these indicators in the future.

According to our estimates, by 2030 the volume of gross agricultural output is expected to increase to 323688.5 billion

UZS, which is 7.5 times more than in 2017, the cost of creating innovative products in agriculture - 178641.2 billion UZS (i.e. 11.4 times more, respectively), the volume of production of innovative products - 50829.3 million UZS (3.2 times).

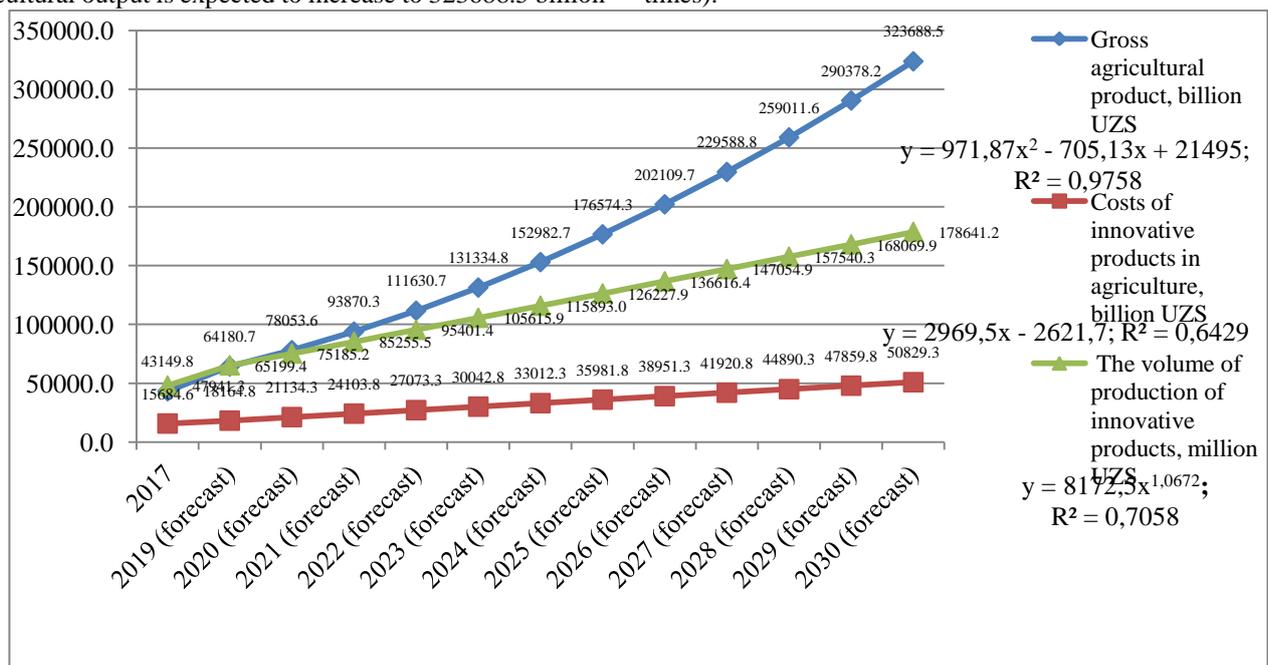


Figure 3. Forecast indicators of gross agricultural product and innovation, %

Thus, it can be concluded that the growth of innovation activity in agriculture is directly related to the increase in gross agricultural product.

VI. SUMMARY

1. The analysis of studies of foreign scientists showed that innovative development has a positive impact on the national economy. Also, according to the results of surveys conducted in the Republic among enterprises, the introduction of innovations has led to the expansion of their activities and improvement of their quality indicators. With this in mind, the article attempts to assess the impact of the development of innovation in agriculture.

2. As shown by the analysis of the modern trend of innovative activity of agriculture in the Republic of Uzbekistan, in this area there is a weak innovative activity. This manifests itself in low cost of innovation, lack of the number of enterprises engaged in innovation activity, as well as in low volume innovative products. According to the results of surveys conducted between enterprises, one of the main reasons is the lack of funding from agricultural entities and the lack of need for new innovations. Therefore, among the subjects of agriculture it is advisable to conduct explanatory work and promote the benefits of innovation.

In order to assess the impact of innovation on the development of agriculture, we initially predicted indicators of innovation activity in agriculture, as well as gross agricultural output. Our calculations have shown that the increase in spending on innovative activities of agriculture in the country by 1% will lead to an increase in its volume by an average of 1.14%. And the increase in the production of innovative products by 1% will lead to an increase in agricultural production by 2.0%. In General, there is such a dependence where an increase in spending for innovative agricultural products by 1% will lead to an increase in the volume of gross agricultural output by 2.3%. That is, the hypothesis put forward in our study was confirmed, namely, there is a direct link between the increase in innovation activity in agriculture and the increase in gross agricultural product.

REFERENCES

1. Decree of the President of the Republic of Uzbekistan "On approval of the Strategy of innovative development of the Republic of Uzbekistan for 2019-2021". dated September 21, 2018 № 5544
2. Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated October 4, 2018 № 792 "On additional measures to expand sources of funding for projects in the field of innovative development and winemaking".
3. Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated October 11, 2018 "On measures for further development of the forest industry and introduction of innovative technologies in the Republic of Uzbekistan".
4. Resolution of the Cabinet of Ministers of the Republic of Uzbekistan of October 20, 2018 № 841 "On measures to implement national goals and objectives in the field of sustainable development for the period up to 2030".
5. A New Economy. The Changing Role of Innovation and Information Technology in Growth. – OECD, Paris. – pp. 49-72.
6. Basu S., J.Fernald, M. Shapiro, Productivity Growth in the 1990s: Technology, Utilization, or Adjustment // NBER Working Paper № 8359. 2001. – Cambridge, MA: National Bureau of Economic Research.
7. Bernstein J. Costs of Production, Intra- and Interindustry R&D Spillovers: Canadian Evidence // Canadian Journal of Economics, Canadian Economics Association. 1988. Vol.21(2). – pp.324-347.

8. Bernstein J., Nadiri I. Product Demand, Cost of Production, Spillovers, and the Social Rate of Return to R&D // NBER Working Paper. 1991. № 3625.
9. Boskin M., Lau L. Capital, Technology and Economic Growth // Technology and the Wealth of Nations. – Stanford, 1992. – P.33.
10. Castellacci F. Innovation and the Competitiveness of Industries: Comparing the Mainstream and the Evolutionary Approaches // Technological Forecasting and Social Change. 2008. № 75. – pp. 984-1006.
11. Chesbrough H., W.Vanhaverbeke, J.West Open innovation: researching a new paradigm. – Oxford, Oxford University Press, 2006.
12. Dosi G., Pavitt K., and Soete L. The Economics of Technical Change and International Trade. – London, Harvester Wheatsheaf, 1990.
13. Duijn J.J. van The Long Wave in Economic Life. – Unwin Hyman, 1982.
14. Freeman Ch., Clark J., Soete L. Unemployment and the Technical Innovation: A Study of Long Waves and Economic Development. L., 1982.
15. Freeman C. Technology Policy and Economic Performance. – London, Pinter Publishers, 1987.
16. Griliches Z. R&D and Productivity: Econometric Results and Measurement Issues // Handbook of the 9000 Economics of Innovation and Technological Change, ed. by P.Stoneman. – Cambridge, MA: Blackwell, 1995.
17. Guellec D., van Pottelsberghe de la Potterie B. R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries // STI Working Papers. OECD. 2001/03.
18. Jaumotte F., Pain N. From ideas to development: The determinants of R&D and patenting // OECD Economics Department Working Papers. 2005. № 457.
19. Khan M. and Luintel K. Sources of Knowledge and Productivity: How Robust is the Relationship? // OECD STI Working Paper. 2006.
20. Kuznets S. Economic Growth of Nations. – Cambridge, Harvard University Press, 1971.
21. Mensch G. Stalemate in Technology: Innovations Overcome the Depression. – Cambridge, 1979.
22. Nadiri M.I. Innovations and Technological Spillovers // NBER Working Paper. 1993. № 4423. – pp. 27-33.
23. OECD Science, Technology and Industry Outlook. – Paris, OECD, 2010. – P. 23,33, 90-99.
24. OECD estimates based on Research and Development Database, August 2011; OECD Science, Technology and Industry Scoreboard 2011, based on OECD R&D tax incentives questionnaires, January 2010 and June 2011; and OECD, Main Science and Technology Indicators Database, June 2011.
25. Papaconstantinou G., Sakurai N., Wyckoff A. Embodied Technology Diffusion: An Empirical Analysis for 10 OECD Countries // STI Working Papers. OECD. 1996/1.
26. Romer P. Endogenous Technological Change // Journal of Political Economy. 1990. Vol. 98. (5). – pp. 71-102.
27. Sakurai N., Ioannidis E., Papaconstantinou G. The Impact of R&D and Technology Diffusion on Productivity Growth: Evidence for 10 OECD Countries in the 1970s and 1980s // STI Working Papers. OECD. 1996/02.
28. Schumpeter J.A. Business cycles: a theoretical, historical, and statistical analysis of the capitalist process. – New York and London, McGraw-Hill Book, 1939.
29. Solow R. Technical Change and the Aggregate Production Function // Review of Economics and Statistics. – 1957. – Vol. 39, № 3. – pp. 312-320.
30. The Global Innovation Index 2014: The Human Factor In innovation, Fontainebleau, Ithaca, and Geneva. Printed and bound in Geneva, Switzerland, by the World Intellectual Property Organization (WIPO) and in New Delhi, India, by the Confederation of Indian Industry (CII) (2014).
31. Verspagen B. Economic Growth and Technological Change // STI Working Papers. OECD. 2001/01. – P. 16.
32. UNIDO (2014) Industrial Development Report 2013/2014. Vienna: UNIDO.
33. Monetary circulation and credit of Russia: textbook / A.G. Ivasenko, Y.I. Nikonova, E.S. Dimakova. - Rostov-on-Don, 2009.
34. Ivasenko A.G. Investments: sources and methods of financing: textbook / A.G. Ivasenko, Y.I. Nikonova // International Journal of Applied and Fundamental Research. 2010. № 11. pp. 104-105.
35. Kondratyev N.D. Large cycles of conjuncture and the theory of foresight. - Moscow: Economics, 2002.

36. Nikonova, Ya.I. Investigation of the interrelation between the innovations and the economic growth of the national economies. Scientific-methodical electronic journal Concept. 2016. T. 15. pp. 2001-2005
37. Nikonova Ya.I. Innovative development of the national economy: models, mechanisms and scientific and technological forecasts // Siberian Financial School. 2011. № 2 (85). pp.157-162.
38. Nikulina O.V. Strategic guidelines for innovative economic development. - Krasnodar: Education-South, 2010.
39. Tarakanov, G.I. Evolution of the theory of the economic growth in the second half of the XX century (in Russian) // Problems of the modern economy. 2007. № 3. - – pp. 50-54.
40. Tashmatov, R.H. Innovation rivozhlanish: Problems and solvings. Risola/Tashmatov R.Kh. - T.: "LESSON PRESS", 2017. – p. 62.
41. Main indicators of scientific-technical potential and innovative development of the Republic of Uzbekistan: Annual Statistical Book. State Statistics Committee of the Republic of Uzbekistan for 2014, 2015, 2016, 2017, 2018.