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## EMPIRICAL ANALYSIS OF THE DEVELOPMENT OF INNOVATIVE ACTIVITIES IN UZBEKISTAN

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***Abstract****. The article is devoted to the analysis of innovative activity and factors influencing it in the republic. It is aimed at analyzing the relationship between innovation, the relationship between business entities engaged in this activity, and the funds spent on it using the econometric module. The data of the Republic of Karakalpakstan, regions and the city of Tashkent for the last 5 years were used.*
***Key words****: innovative activity, economic growth, econometric analysis.*

**Introduction.** As an important part of the innovation process, economists have traditionally seen knowledge dissemination as a key factor in stimulating economic growth. This statement is also supported by several economic relations. First, innovative activity makes products competitive and allows them to reach more markets. In this sense, the division of labor, an important element of the wealth of nations, depends on the expansion of markets, which in turn depends on many innovative processes. Second, modern theoretical approaches emphasize the relevance of innovation by clearly introducing factors that stimulate innovation. In this case, events in the real economy, in addition to quantitative indicators, emphasize which qualitative variables should be taken into account. If the economic environment rejects or fails to take advantage of innovations, innovation activity will cease. Therefore, society will need to create a social environment that influences

innovation activity.

In the current era of globalization, economic growth is measured by GDP. The share of innovative activity in the GDP of our country is growing from year to year, so the econometric analysis of the factors influencing this activity at the brand level is relevant. We use the econometric (Random Effect) model for empirical analysis of innovation to find answers to questions such as how to determine the share of innovation in the indicators of innovative development of the economy, what factors affect innovation, how the development of innovation in enterprises affects entrepreneurship and economic growth .

**Innovation process and economic growth**

Innovative activity has been described by many scientists in their scientific work, as opposed to its definitions and other activities. In particular, Faberger highlighted the important difference between innovation and invention, saying, «Invention is the emergence of an idea for a new product or process, and innovation is the first attempt to make it happen» [7]. The two are closely related and different from each other. But in most cases, there is a significant delay between the two. Most importantly, the big difference between invention and innovation is that invention can occur anywhere, and innovation occurs mainly in conditions where several different capabilities, knowledge, resources, and skills must be combined. In this sense, entrepreneurs must be innovators, that is, constantly engaged in innovative activities. Entrepreneurs set forecasts as a prerequisite for making innovative decisions. In this regard, an economically strong entrepreneur achieves high profits, i.e., the improvement of product quality due to innovative activity is a good opportunity for an entrepreneur who has the opportunity to make high profits later.

Druker [3] and innovation is the main process of entrepreneurial activity, develops business, as a result of the implementation of innovative activities by enterprises, their innovations encourage other entrepreneurs to develop their activities and create more innovation. As a result, it creates new opportunities for bilateral economic activity and encourages innovative activity, which has a positive impact on the process of economic growth.

**Materials and methodology**. Enterprises in various sectors of the national economy are engaged in innovative activities. We will examine the analysis to what extent this activity will affect the growth of our national economy. The data in the analysis cover 5 years, ie 2015-2019, the number of observations is 70 [2]. For this purpose, using the econometric model, the volume of innovative products, works and services in the Republic of Karakalpakstan, regions and Tashkent (y), the number of innovations introduced by regions ($x_1$), the cost of innovative activities ($x_2$), enterprises engaged in innovative activities ($x_3$), the number of research staff ($x_4$), of which the number of doctors of science ($x_5$) and candidates of science and doctors of philosophy ($x_6$), and the period ($x_7$) are defined as independent variables. This panel has several advantages for econometric evaluation of data. In particular, it provides a link between periods and is individual in nature, allowing time to be managed.

To analyze the relationship between innovation activity and the factors influencing it, we use this research model and construct the following regression equation.

$$y= a_0+a_1x_{1+} a_2x_2 +e_i \quad (1)$$

$$y= a_0+a_1x_{1+} a_2x_{2+} a_3x_{3+} a_4x_4+e_i \quad (2)$$

$$y= a_0+a_1x_{1+} a_2x_{2+} a_3x_{3+} a_4x_{4+} a_5x_{5+} a_6x_6+ a_7x_7+e_i \quad (3)$$

In the equation for innovative activity

$a_0$ -free number, the level of innovation even in the absence of activity, ie when the free variables in the equation (xi) are equal to zero;

$a_i$ – are coefficients, which indicate the degree of influence of the influencing factors.

$e_i$– standard error

**Analysis and results**

The selected econometric model is often used in macro-level analysis of countries or regions, thus allowing observations to be made at different levels [6]. We analyze the data using the STATA program (see Table 1).

Table 1

**Statistical analysis of aggregated variables ***

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| t | 70 | 2017 | 1.424425 | 2015 | 2019 |
| y | 70 | 618672.1 | 1627910 | 114.1 | 9674505 |
| x1 | 70 | 239.3143 | 467.1033 | 2 | 2166 |
| x2 | 70 | 297981.8 | 612515.7 | 1158.3 | 3565027 |
| x3 | 70 | 136.4286 | 192.2491 | 4 | 911 |
| x4 | 70 | 1886.229 | 2798.651 | 543 | 15361 |
| x5 | 70 | 114.7386 | 207.7244 | 11 | 899.3 |
| x6 | 70 | 459.3186 | 677.6269 | 67.2 | 3010.7 |

*** The number of observations in each group is N = 70.**

From the data in Table 1 above, we can see that the magnitude of the standard deviation in all variables is related to the magnitude of the difference between the minimum and maximum values of the variables, e.g. the situation can also be observed in the cost of innovation activity ($x_2$), so that the average value of the variables was smaller than the standard deviation. This indicates that the level of innovation in the regions varies.

We analyzed the results using a logarithmic-linear econometric model. Initially, the number of innovations ($x_1$) and the cost of innovation activities ($x_2$) and time ($x_7$) are added to the econometric model. Addition equation, the number of PhDs ($x_5$) and the number of DScs and PhDs ($x_6$) to form Equation 3.

Table 2

**Results of econometric model**

| | (1) | (2) | (3) |
|---|---|---|---|
| | ln_y | ln_y | ln_y |
| ln_$x_1$ | 0.518** | 0.200 | 0.105 |
| | (0.228) | (0.226) | (0.242) |
| ln_$x_2$ | 0.190 | 0.119 | 0.059 |
| | (0.203) | (0.183) | (0.188) |
| year | 0.306 | 0.180 | 0.140 |
| | (0.211) | (0.140) | (0.142) |
| ln_$x_3$ | 0.613*** | 0.673*** | |
| | (0.200) | (0.215) | |
| ln_$x_4$ | 0.513* | -0.138 | |
| | (0.292) | (0.703) | |
| ln_$x_5$ | 0.890 | | |
| | (0.590) | | |
| ln_$x_6$ | -0.422 | | |
| | (0.713) | | |
| _cons | 6.282*** | 2.573 | 7.024* |
| | (1.646) | (2.310) | (3.649) |
| N | 70 | 70 | 70 |

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

In Equation 1 of the econometric model, the number of innovations introduced by regions (x1) had a positive effect on the income from innovation activities. A 1% increase in x1 at a 95% probability level led to a 0.518% increase in innovative operating income (y), while in Equations 2 and 3 the probability level is less than 90% so the result obtained is not statistically significant.

**Expenditures on innovative activities ($x_2$)** the impact on the results of innovative activities

is positive, but not statistically significant, from which it can be concluded that the costs of these activities have not been used effectively.

**Number of enterprises engaged in innovative activities ($x_3$)**An increase of 1% in the number of enterprises, as shown in Equations 2 and 3, which had a positive effect on income from innovative activities (y), led to an increase in the resultant sign (y) by 0.61% and 0.67%, respectively.

**Number of research staff (x4)**90% probability level equationin (2) a 1% increase led to a 0.513% increase in revenue from innovation activities. In Equation 3, the number of employees is negatively correlated with the outcome factor (y), but is not statistically significant. The reason for thisthe result of adding to the model the number of doctors of science ($x_5$) and the number of candidates of sciences and doctors of philosophy ($x_6$) is the division of the main influencing factor.

**Doctors of Science ($x_5$) and PhDs.** The impact of ($x_6$) on innovation performance is not statistically significant, the main reason being the lack of PhDs and PhDs in enterprises engaged in innovation activity.

Although the average annual growth rate in the analysis of innovation activity for 2015-2019 ($x_7$) was 14.0%, this figure is not statistically significant.

Influence of other factors not reflected in the econometric model 1-equation1% increase in p <0.01 at 6.282% increase in innovation activity income, 3-equationand increased by 7.024% (p <0.1). The higher this ratio, the economic incentives in the Republic will lead entrepreneurs to expand their activities, economic activity creates new opportunities for entrepreneurs and increases interest in taking advantage of these opportunities.

Now we determine the time variable of the free variable to calculate the forecast indicators, take the average volume of innovative products, works and services in Table 3 as a forecast indicator for the previous five years, and forecast the forecast for 2021-2025. calculate.

Table 3

**Forecast values of the volume of innovative products, works and services in the republic**

| Years | Volume of innovative products, works and services, million soums | Number of introduced innovation | Expenditures on innovative activities, million soums | Number of enterprises | Number of employees engaged in scientific research | Number of Doctor of science | Number of PhD |
|---|---|---|---|---|---|---|---|
| 2015 | 3623097.962 | 2193 | 5394983.02 | 2189 | 20844 | 1446 | 5832 |
| 2016 | 5096374.736 | 2727 | 2066341.08 | 2514 | 19769 | 1227 | 4891 |
| 2017 | 6303464.803 | 2761 | 2347707.81 | 2050 | 16028 | 1097 | 3701 |
| 2018 | 5544683.002 | 3114 | 2240411.27 | 2030 | 18988 | 1165 | 3935 |
| 2019 | 6525707.986 | 4418 | 4454075.19 | 2462 | 31202 | 1867 | 7277 |
| 2020 | 7126209.392 | 4923 | 5206508.36 | 2689 | 35256 | 1998 | 9356 |
| **2021** | **8312741.441** | **5646** | **4097878.7** | **2541** | **34480** | **1915** | **7925** |
| **2022** | **9318013.397** | **6628** | **4348710.88** | **2611** | **38839** | **2082** | **8788** |
| **2023** | **10444854.36** | **7781** | **4614942.69** | **2684** | **43749** | **2264** | **9744** |
| **2024** | **11708082.92** | **9134** | **4897424.48** | **2758** | **49279** | **2462** | **10805** |
| **2025** | **13123958.48** | **10722** | **5197249.02** | **2834** | **55509** | **2678** | **11981** |

Based on these data, we estimate that by 2025 the volume of innovative products, works and services will increase by 84.1% compared to 2020, and the number of innovations will increase by 2.2 times, assuming that the impact of factors other than variables in the other econometric model is constant. – The graph shows the change in the volume of innovative products, works and services in the Republic. It shows the x-axis years, and the y-axis the logarithmic value of the volume of innovative products, works and services.

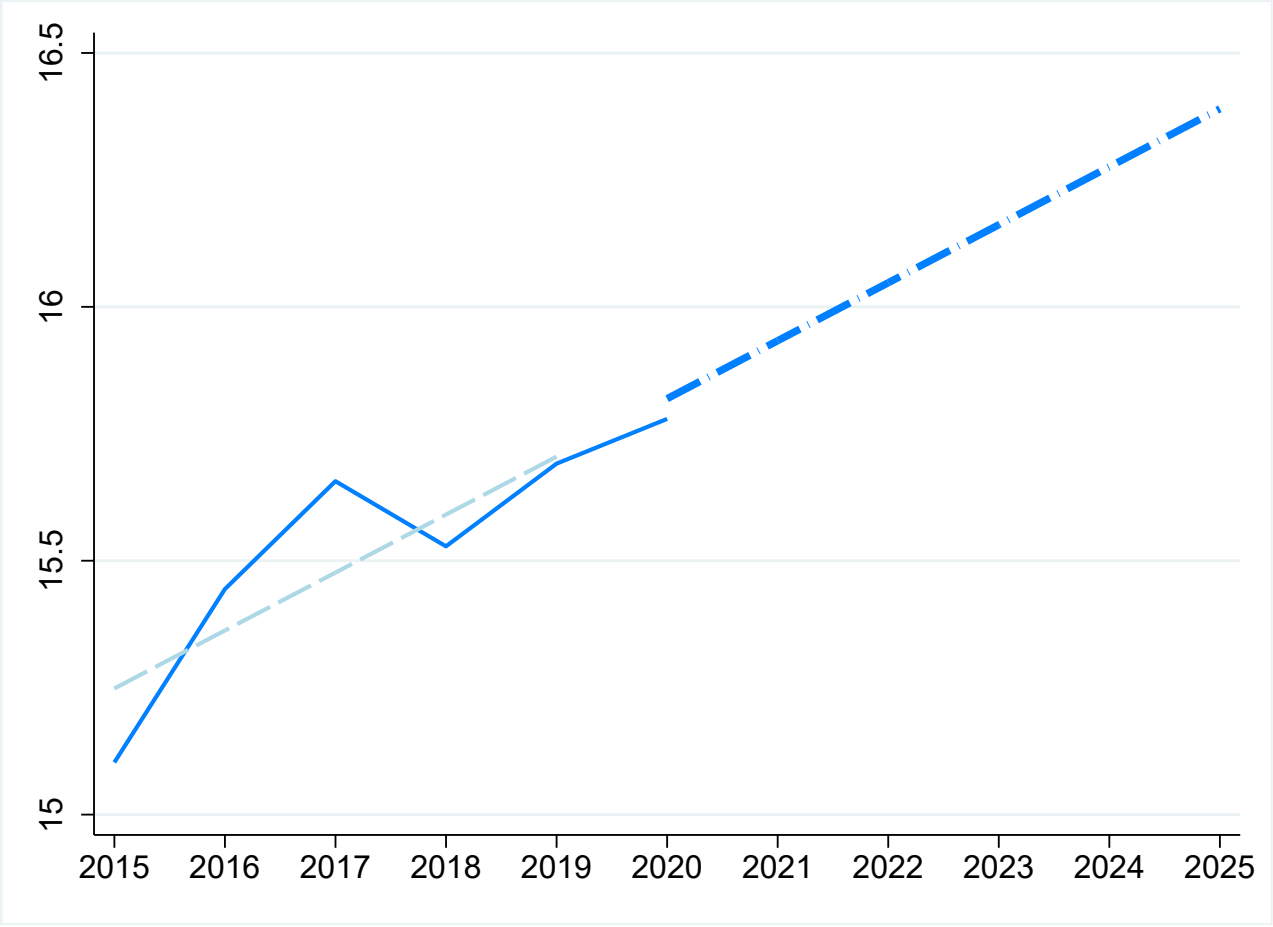


**Diagram 1. Forecast of the volume of innovative products, works and services in Uzbekistan**

The above was analyzed using an econometric model to study the impact of innovation activity and the factors influencing it on the income of innovative activity, and the following results were obtained:

Innovative activity and entrepreneurship enhance economic activity, which in turn has a positive impact on entrepreneurial activity. Increasing the number of enterprises engaged in innovative activities through economic support will increase the income from innovative activities, as well as the country's GDP.

**Conclusions.** The above was analyzed using an econometric model to study the impact of innovation activity and the factors influencing it on the income of innovative activity, and the following conclusions were drawn:

1.To the volume of innovative products, works and servicesthe number of enterprises engaged in these activities was found to be affected by 67.3%. Ia high level of innovative activity creates new business opportunities, i.e. entrepreneurs are interested in entering new markets and business opportunities by supplying highly competitive products. Innovations facilitate this opportunity and thus increase the interest of entrepreneurs in the introduction of new technological processes. Therefore, it is expedient to increase the number of enterprises engaged in innovative activities, to stimulate the activities of existing enterprises.

2. From year to year, the level of innovation activity has increased, which averaged 14% over the last 5 years. As a result of currency liberalization in 2016, sharp differences in periodic figures were observed, so the change in time (years) (x7) showed that it was not statistically significant.

3. There is no separate system of accounting for the collection of costs associated with innovative activities, as a result of which there are difficulties and inaccuracies in the completion of reporting indicators for innovative activities. Analyzes have shown that the efficient use of funds spent on innovative activities is

not high. Therefore, the costs incurred in these activities were not statistically significant.

4. Doctors of Science on the results of innovative activities ($x_5$)The impact is positive, the number of science candidates (x6)which has a negative effect, but is not statistically significant. So, we can conclude from this that the combination of production, science and innovation is not going well. Therefore, in order to enhance the role of the system of production, science and innovation activities, it is necessary to increase the cooperation of higher education, research centers with manufacturers, to introduce a practice-based education system.

Innovative activity and entrepreneurship enhance economic activity, which in turn has a positive impact on entrepreneurial activity. Increasing the number of enterprises engaged in innovative activities through economic support will increase the income from innovative activities, as well as the country's GDP.

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