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Econometric methods of assessing Innovation-Corporate Partnership of production enterprises with higher education institutions

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ABSTRACT: On the basis of the socio-economic policy of our state, it attaches great importance to education. On the basis of the conditions, opportunities created by the state for obtaining an education, it will be possible to ensure the formation, perfection of the individual and the realization of his goals and interests. It is important to establish innovative-corporate relations of higher educational institutions with production and service enterprises of various forms of ownership. This will help to increase the scientific potential of the educational institution and to publish a certain amount of material opportunities, mainly by studying and researching the existing problems in the production and service enterprises, along with defining the future development strategies of enterprises. The following factors were chosen when evaluating the development of Termez State University as a research object: Resulting factor - revenue from innovation and corporate activities of this university, million. sums (Y);- as influencing factors - number of enterprises in innovation-corporate partnerships (X_1), number of innovation-corporate partnerships (X_2), number of participants in innovation-corporate partnerships (X_3), number of innovation-corporate partnerships (X_4), innovation - The number of Qualification papers (X_5) completed in corporate partnerships, the number of Master's theses (X_6) in Innovation-Corporate Partnership, and the number of PhDs and DScs in Innovation-Corporate Partnership (X_7). At the Termez State University, the estimated and true values of the income from innovation and corporate partnerships in 2000-2018 are almost the same.

KEYWORDS: Econometric, Innovation-Corporate Partnership, Higher education.

I. INTRODUCTION

As stated in the resolution of the president of the Republic of Uzbekistan dated June 21,2017 № 3151 of the President policy “On measures to further expand the participation of economic spheres and sectors in improving the quality of training of specialists with higher education”, the quality level of National Knowledge is the main factor determining the future strategic development of the country, and the level of knowledge is formed as a result of the educational service. The competitiveness of the country in the world market is closely linked to the levels of the nation's intellectual and scientific potential. On the basis of the socio-economic policy of our state, it attaches great importance to education. On the basis of the conditions and opportunities created by the state for the acquisition of education, it will be possible to ensure the formation, development, and realization of its goals and interests

The main purpose of the law of the Republic of Uzbekistan “On the national program of Personnel Training” is radical reform of the educational sphere, complete liberation of it from ideological views and stalagmites of the past, creation of a national system of training of highly qualified personnel at the level of developed democratic countries, meeting high moral and moral requirements". In our country, too, attention has been paid to the use of innovative corporate cooperation as a key factor in improving the quality of education. Therefore, at the third stage of Personnel Training, the development of recommendations on improving the quality of education and the role of innovative corporate cooperation in it, its international experience and the use of advanced foreign experience is an urgent issue. The rapid development of all spheres of life of society and the state requires the implementation of reforms on the basis of modern innovative ideas, developments, and technologies that ensure rapid and qualitative development of our country among the leaders of world civilization. In order to modernize and diversify production, it is necessary to increase the volume of investments and expand competitive products in the domestic and foreign markets. Our country is not participating in the “Global Innovation Index ranking". The low level of interaction of economic and social spheres with scientific institutions, as well as the modern achievements of the World Science in the field of innovative

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development accelerated development of the country on the basis of innovative ideas, developments and technologies the achievement of the entry of the Republic of Uzbekistan into the ranks of 50 advanced countries of the world ensuring the adaptability of the personnel training system to the needs of the economy strengthening the scientific potential of scientific research and work and increasing the effectiveness of scientific research experience requires the creation of effective frameworks for the integration of education, Science and entrepreneurship for the implementation of the keg of the results of constructive and technological work.[1]

Research on the integration and interaction of Science and production is being studied by foreign scientists. But acquaintance with their research shows that there are different approaches and views on this issue. In contrast to the material product, the process of preparing a higher education product and the determination of its quality has many specific features. The successful implementation of the tasks set out in each of the five priority areas identified in "The strategy of Action for further development of the Republic of Uzbekistan" determines the need to apply new approaches, innovative products, types of work and services, specific forms and methods of innovation-corporate cooperation that allows their creation. This is directly related to higher educational institutions, which are the focus of personnel supply to both science and education and enterprises, respectively, which are considered the initiators of innovation and corporate cooperation. Precisely these missions assigned to higher education institutions require the creation of innovative products in the areas of Science, Education and production, establishment of large-scale and large-scale innovative corporate partnerships for this purpose, in-depth study of the advanced experiences accumulated in the developed countries of the world in this regard, as well as the wide application of them in our exactly determine the relevance of the subject.[2][3]

Our research shows that very important to establish innovative-corporate relations of higher educational institutions with production and service enterprises of various forms of ownership. This will help to increase the scientific potential of the educational institution and to publish a certain amount of material opportunities, mainly by studying and researching the existing problems in the production and service enterprises, along with defining the future development strategies of enterprises.

II. MAIN CONTENT

Econometric modeling of the indicators of innovation-cooperativity of the educational institution is one of the areas of analysis and further development of the scientific potential of the educational institution. Econometric models allow not only to quantify the indicators of the development in an educational institution but also to determine the composition of the factor affecting it, as well as the percentage of each factor.The institution of higher education innovation-corporate activity – econometric modeling of the indicators of development-allows to quantify the impact of scientific activity on the income from innovation-cooperativity in this educational institution, as well as to develop optimal decisions to eliminate possible negative situations in their implementation. In assessing the development of the activity of the Termiz State University of the Republic of Uzbekistan, obtained as an object of study, the following factors were selected:

- the resulting factor is the volume of income from the innovation-corporate activity of this university, million. sum (Y);
- as factors affecting–innovation-number of enterprises incorporate cooperation (X_1), innovation-number of corporate cooperation agreements (X_2), innovation-number of participants incorporate cooperation (X_3), innovation-number of scientific-themes incorporate cooperation (X_4), innovation-number of Graduation qualification works incorporate cooperation (X_5), innovation-number of Master's dissertations incorporate cooperation (X_6), innovation-number of corporate cooperation number of executable Ph.D. and DSCs (X_7).

First of all, before establishing a multi-factor econometric model for the innovation and corporate activities of a higher education institution, it will be necessary to determine the intensity of the correlation between the factors that are included in this model. For this purpose, the following formula is used to determine the correlation coefficients in determining the correlation analysis, which allows determining the correlation between the factors to be determined Eliseev I.I.[4].

$$r_{xy} = \frac{\overline{xy} - \overline{x} \cdot \overline{y}}{\sigma_x \cdot \sigma_y} \qquad (1)$$

Here respectively, and the average square deviation of the factors. At a later stage, a correlation-regression analysis is carried out on these factors. Using the Excel spreadsheet, we calculate the correlation coefficients between factors (Table 1).

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	Y	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*
Y	1							
X1	0,9495	1						
X2	0,9472	0,9966	1					
X3	0,9286	0,9146	0,9146	1				
X4	0,9472	0,9966	1,0000	0,9146	1			
X5	0,9507	0,9155	0,9075	0,9710	0,9075	1		
X6	0,9505	0,9213	0,9212	0,9261	0,9212	0,9118	1	
X7	0,7314	0,7036	0,7149	0,5681	0,7149	0,5953	0,5511	1

Table 1. Matrix of correlation coefficients calculated among factors affecting innovation-corporate activity in Termez State University

Hence, the link density between the factors, that is, the values of the coefficients of the private correlation, is the same:

$$r_{yx_1} = 0{,}9495\ ,\ r_{yx_2} = 0{,}9472\ ,\ r_{yx_3} = 0{,}9286\ ,\ r_{yx_4} = 0{,}9472\ ,\ r_{yx5} = 0{,}9507\ ,\ r_{yx6} = 0{,}9505\ ,$$

$$r_{yx7} = 0{,}7314\ .$$

Among the factors, the special correlation coefficients are obtained from innovative-corporate cooperation at the universityandaroma (Y) and innovation-number of enterprises incorporate cooperation (X1),innovation-number of corporate cooperation agreements (X2),innovation-number of participants incorporate cooperation (X3),innovation-number of participants incorporate cooperation (X3).the number of undergraduate research diploma works being executed (X4), the number of Postgraduate research diploma works being executed in collaboration with and innovation-corporate (X5) indicate strong correct connections. However, as long as there is a correct link between innovation and corporate partnership Income (Y) and Innovation-Corporate Partnership Performance by the number of Ph.D. and DScs (X6) at the University.It is also worth noting that between the factors there can be seen dense connections between Double correlation links, that is, as long as there is multicollinearity between the factors. This means that one of these factors should not be included in the established econometric model. This problem can be solved by drawing up a multi-factor econometric model on factors.

Now we draw up a multi-factor econometric model according to the above factors. It has the following appearance:

$$Y = 0{,}5849 + 0{,}244 \cdot X_1 - 0{,}248 \cdot X_2 + 0{,}084 \cdot X_3 + 0X_4 + 0{,}180 \cdot X_5 + 0{,}302 \cdot X_6 + 0{,}557 \cdot X_7$$

$$R^2 = 0{,}9905\ ;\ F_{\text{хисоб}} = 165{,}54\ . \qquad (2)$$

The coefficient of 0,5849 in the model shows the influence of factors that are not taken into account, that is, if we deny the criteria above, innovation in the university will be derived from corporate cooperation with a profit of 0,5849 million sums. He would have made up the sum.

On the basis of this model, it can be concluded that if the number of innovative-corporate partnership enterprises (X_1) increased by one unit, the University's revenues increased by an average of 0.244 million sums. the so would have increased. Innovation-the number of corporate partnership agreements (X_2) increased by one unit, while university revenues increased by an average of 0,248 million. the so would have decreased. If the number of participants in the Innovation-Corporate Partnership (X_3) increased by one unit, the University's revenues amounted to an average of 0,084 million sums. the so would have increased. If the number of SMEs implemented in innovation-corporate cooperation (X_4) increases by one unit, the University's revenues are on average 0,18 million TL. the so would have increased. If the number of MD (X_5) implemented in the innovation-corporate partnership increases by one, the University's revenues will be 0.302 million on average. the so would have increased. Innovation is an increase in the number of Ph.D. and DSCs (X_6) carried out in corporate cooperation, the average University income is 0.557 million. would have led to an increase in som. $R^2 = 0{,}9905$ - the coefficient of determination indicates that the revenue from innovation-corporate cooperation at Termez State University is 99, 05 percent, due to the factors included in the multi-factor econometric model. The remaining 0,95 percent is the influence of factors not taken into account.

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III. MODEL VALIDATION

We will examine whether the structured multi-factor econometric model corresponds to the process under study or whether it is statistically significant. For this, Fisher's F-criterion is used. With the help of the Fisher F-criterion, it is possible to check the full adequacy of the model, that is, its compliance with the real economic process Eliseeva I.I.[4].

$$F_{\text{хисоб}} = \frac{R^2(n-m-1)}{(1-R^2)m} \qquad (3)$$

Here, n - is the number of observations;
m - number of factors affecting the model;
R^2- deterministic coefficient.

The calculated Fisher criterion is compared with the value in the tables. To find the Fisher coefficient in the table, it is necessary to determine the row coulomb. If there is, a structured econometric model is called statistically significant or corresponding (adequate) to the process under study. If there is, it is said that the structured econometric model is statistically insignificant or does not correspond to the process under study. Eliseeva. I.I.[4]. In this case, instead of a linear econometric model, a non-linear econometric model is chosen. (2) for the model $k_1 = n-m-1 = 19-7-1 = 11$ and $k_2 = 7$ considering that it is, it is possible to determine that its value in the table is equal to 2,62. From this, it became known that it was, namely. This means $F_{sum} > F_{\text{table}}$ that the structured econometric model is statistically significant, which directly $F_{\text{sum}} = 6,97 > F_{\text{table}} = 2,98$ determines the state of innovation-corporate cooperation at Termez State University. In addition, with the help of this model, innovation and corporate cooperation can be projected for future periods[5]–[7].

This means that the structured econometric model is statistically significant, which directly determines the state of innovation-corporate cooperation at Termez State University. In addition, with the help of this model, innovation and corporate cooperation can be projected for future periods. It is necessary to check the reliability of each factor in the model, for this, the T-criterion of the Student is used and it is calculated using the following formula Valentinov V. A.[8]:

$$t_R = \frac{R\sqrt{n-k-1}}{1-R^2} \qquad (4)$$

In this, $n-k-1$ = number of degrees of freedom;

t_R = compared with the value in the table;

$n-2$ = degrees of freedom, which have a reasonable distribution

$$t_{a_j} = \frac{a_i}{\sigma_{a_j}} \qquad (5)$$

The value of the regression coefficients is included. The values of Student criteria calculated by the values of regression coefficients in the structured (2) econometric model are as follows:

$$t_{x_1} = 0,296\ ;\ t_{x_2} = -0,323\ ;\ t_{l_3} = -1,54\ ;$$

$$t_{x4} = 65535\ ;\ t_{x5} = 3,71;\ t_{x6} = 5,94\ ;t_{x7} = 5,32\ .$$

To check the reliability of these calculated parameters, we refer to the Student distribution table. If in the case $t_{\text{sum}} > t_{\text{table}}$ Valentinov V. A. [8], the regression coefficients are called reliable, otherwise they are called unreliable. Student distribution is equal to 95 percent accuracy according to the table. Since the calculated t-denominator values of some of the values in the structured (2) econometric model are greater than the table value (in addition, the probabilities of these coefficients inaccuracy are smaller than 0.05). But since the calculated t-criterion value of some factors is smaller than the value in the table (the probability of accuracy of these coefficients is greater than 0.05). This will be the basis for the exclusion of this factor (1) from the multi-factor econometric model. (2) we use the Darbin-Watson (DW) criterion to check the autocorrelation in the residues of the causal factor by model. Valentinov V. A.[8].

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$$DW = \frac{\sum_{t=2}^{T}(\varepsilon_t - \varepsilon_{t-1})^2}{\sum_{t=1}^{T}\varepsilon_t^2} \quad (6)$$

If there is no autocorrelation among the residues of the causative factor, then in positive autocorrelation it seeks to zero, and in negative autocorrelation, it seeks to 4.If there is no autocorrelation in the remnants of the resultant factor, then the value of the calculated DW criterion will be around 2. In our example, the value of the calculated DW criterion is equal to 1,848. This suggests that there is no autocorrelation from the remains of the causative factor.The correlation coefficients between factors after subtraction from the insignificant criteria's (2) model are as follows (Table 2).

	Y	*X1*	*X2*	*X3*	*X5*	*X6*	
Y	1						
X1	0,9262	1					
X2	0,9287	0,9716	1				
X3	0,9286	0,8457	0,8850	1			
X5	0,9507	0,8687	0,8832	0,9710	1		
X6	0,9505	0,8763	0,9103	0,9261	0,9118	1	
X7	0,7314	0,7529	0,7033	0,5681	0,5953	0,5511	1

Table 2. Matrix of correlation coefficients calculated among the factors affecting innovation-corporate activity in Termez State University

Among the factors, the coefficients of private correlation are as follows:

$$r_{yx_1} = 0{,}926\ ,\ r_{yx_2} = 0{,}929\ ,\ r_{yx_3} = 0{,}928\ ,\ r_{yx5} = 0{,}951\ ,\ r_{yx6} = 0{,}951\ ,\ r_{yx6} = 0{,}731\ .$$

This means that the exclusion of the X_4 factor from the multi-factor econometric model, on the one hand, led to the elimination of multicollinearity between the factors affecting it on the other hand, while maintaining the link density between the factors.(2) from the model, we will build a new multi-factor econometric model on the excluded factors[5]–[9]. And it looks like this:

$$\hat{Y} = 0{,}487 + 0{,}075 \cdot x_1 - 0{,}126 \cdot x_2 - 0{,}085 \cdot x_3 + 0{,}184 \cdot x_5 + 0{,}311 \cdot x_6 + 0{,}559 \cdot x_7 \quad (7)$$

$$R^2 = 0{,}9888\ ;\ F_{\text{хисоб}} = 177{,}72\ ;\ t_{x_1} = 0{,}209\ ;\ t_{x_2} = -0{,}450\ ,\ t_{x_3} = -1{,}515\ ,\ t_{x_5} = 3{,}772\ ,\ t_{x_6} = 5{,}788\ ,$$

$$t_{x_7} = 5{,}127$$

The resulting (7) multi-factor econometric model (2) is much more statistically significant than the model, model parameters were found to be reliable.(7) on the basis of the model, the actual summarized values of revenue derived from innovation corporate partnership in universities are as follows (Figure 1).

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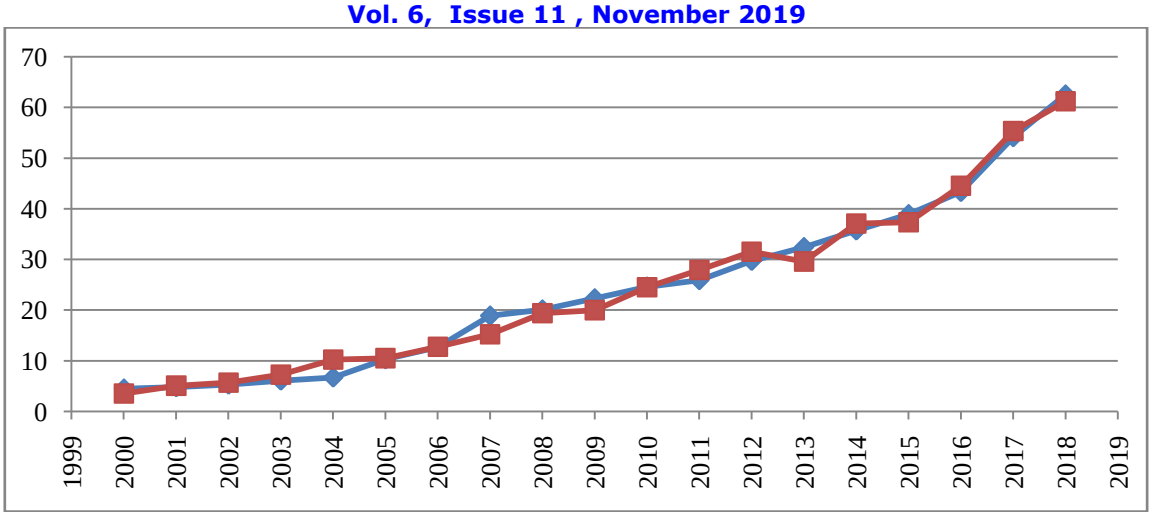

1-figure. Real and calculated values of revenue from innovation-corporate cooperation at Termez State University

VI. CONCLUSION

According to the research, we can assume that it is important to establish innovative-corporate relations of higher educational institutions with production and service enterprises of various forms of ownership. This will help to increase the scientific potential of the educational institution and to publish a certain amount of material opportunities, mainly by studying and researching the existing problems in the production and service enterprises, along with defining the future development strategies of enterprises. Various factors were chosen when evaluating the development of Termez State University as a research object. As can be seen from picture 1, the Termez State University reported that the revenue generated from innovation-corporate cooperation for the years 2000-2018, is summarized and the actual values are almost the same values. That is, the differences between them are not so great.

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