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EXPLORATION OF WOMEN'S EMPLOYMENT IN SCIENTIFIC RESEARCH IN UZBEKISTAN

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ABSTRACT

The paper presents an econometric analysis of female employment in Uzbekistan's research sphere and socio-economic factors affecting it, as well as draws relevant conclusions and recommendations for increasing female employment in this sphere.

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Introduction

At a time when the innovation economy is emerging, the effective development of women's intellectual labour is of great socio-economic importance. There are a number of features of intellectual work. intellectual work is based on intellectual, creative, innovative thinking, which results in new ideas, knowledge, innovations manifesting themselves as intellectual property, which is explained by the freedom of work, the impossibility of alienating the results and unlimited working time.

In this sense, research work can be divided into separate intellectual work. Not only does research produce innovations, high-performance equipment on the basis of which new production technologies are formed, but it also qualitatively changes people with new abilities and needs. In the innovation economy, science becomes a kind of "human capital generator".

The share of labour potential and scientific personnel in the economy plays an important role in a country's innovative development. Because a person engaged in science, in the course of their work, of course, not only creates innovations, but also looks for ways to apply them in life. The result of their work is the creation of new, competitive, low-cost products, through which investments will flow, new domestic and foreign (international) markets will open, and the economy will grow. The work of

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scientists is of an intellectual nature, and its products are major discoveries or radical innovations that form new directions in the development of science and technology, improving innovations that implement small inventions that contribute to the stabilisation of science and technology, and modification innovations that aim to modernise obsolete technologies. All these serve as the basis for the formation and innovative development of the country's intellectual capital [5].

In 2018, the number of people engaged in research and development in the Republic of Uzbekistan was 31,835, of whom 40.8% were women. This figure is slightly lower than in 2015 and represents only 0.2% of the total number of employed women.

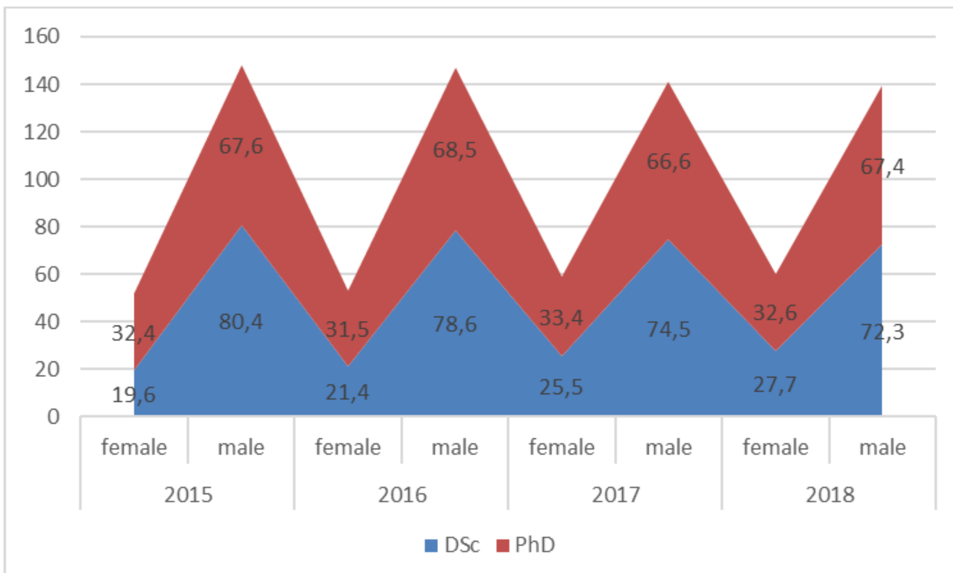


Figure 1: Gender dynamics of ITTKI personnel in the Republic of Uzbekistan

Source: Women and Men. Stat. collection. - 2019, B.187.

The analysis shows that in the last 4 years the share of PhDs among women has increased by 50%, while the share of PhDs has increased by 8.1%. Women are less likely than men to be engaged in research and development.

The research showed that women's employment was slightly lower than men's. The number of men working in science, technology, engineering and mathematics (STEM) and research is increasing every year [8]. Although 43% of graduate students are women, only 28% of the world's researchers are women [9]. There are gender disparities in salaries, research funding, research degrees and promotion [10]. At the same time, research effectiveness is a key indicator of academic career success and is widely used to quantify in research organisations. It is therefore important to empirically assess the factors influencing the number of women in research and to develop evidence-based recommendations on this basis.

Research Methodology. The study used logarithmic methods of analysis and synthesis, statistical-economic, economic-mathematical, systematic analysis, comparison, SEM (Structural Equation Model). Using these methods, the main factors influencing the number of women employed in research based on intellectual work (Y1) were identified.

Analysis and results. The main economic and social indicators affecting the number of women engaged in research based on intellectual labour (Y1) were identified and data for a twelve-year period, 2009-2018, were analysed.

In our view, the number of women engaged in research (Y1), the number of marriages (xi1), fertility rate (xi2), average salary in research (xi3), ratio of women to men among university students (xi4), number of doctoral students (xi5), number of information and resource and information library centres (xi6), number of organisations implementing ITTKI (xi7). These figures were interpreted as the average and minimum/maximum values of the statistics for 12 years [2].

Table 1

Statistical analysis of indicators relating to the number of women involved in research

№	Variables	Number of observations	Average (Mean)	Deviation from the standard	Min	Max
1	Xi1	12	286822.8	20364.03	250159	311379
2	Xi2	12	22.608	0.885	21	23.6
3	Xi3	9	1056398	727587.7	399001.1	2547500
4	Xi4	12	.625	0.062	.6	.8
5	Xi5	12	712	326.143	356	1195
6	Xi6	12	2639.583	496.212	1521	2914
7	Xi7	12	384.583	100.915	301	668

Source: Developed by the author based on the STATA-15 program

Over 12 years, an average of 286 million marriages were registered, the average birth rate was 22.6 per thousand, the average wage in the area of research was 1056398 soums, the ratio of girls to boys in higher education was 0.6, and the number of doctoral students was 712. The number of information and resource and information and library centres was 2,639, and the number of organizations implementing ITTCI was 384.

To test the above hypothesis, we decided to conduct an analysis using the logarithmic SEM (structural equation model), i.e. the logarithmic method of the structural equation model. The reason is, firstly, that this model is based on regression analysis, which allows estimating the factors affecting the number of women participating in the studies; secondly, this model is implemented in the maximum likelihood method, which helps to create an optimal model given the absence of some data by year; thirdly, it allows graphical interpretation of the model, and finally, the SEM model is implemented using Z-test rather than t-test, which allows drawing higher conclusions when assessing the model adequacy.

SEM (Structural Equation Model) is one of the most powerful methods in multivariate comprehensive econometrics, including multivariate regression and factor analysis. The Structural Equation Model allows the creation of structural constructs from a database using mathematical models, computer algorithms and statistical methods. This model also helps to test hypotheses expressed by linear regression, assuming that there are causal relationships between variables. Expressing the regression coefficients arising from the model as an equation allows the degree of dependence and forecast for the near future to be realised. Most importantly, the SEM model is notable for its sharpness of vision and ease of fabrication.

The structural modelling process consists of several steps:

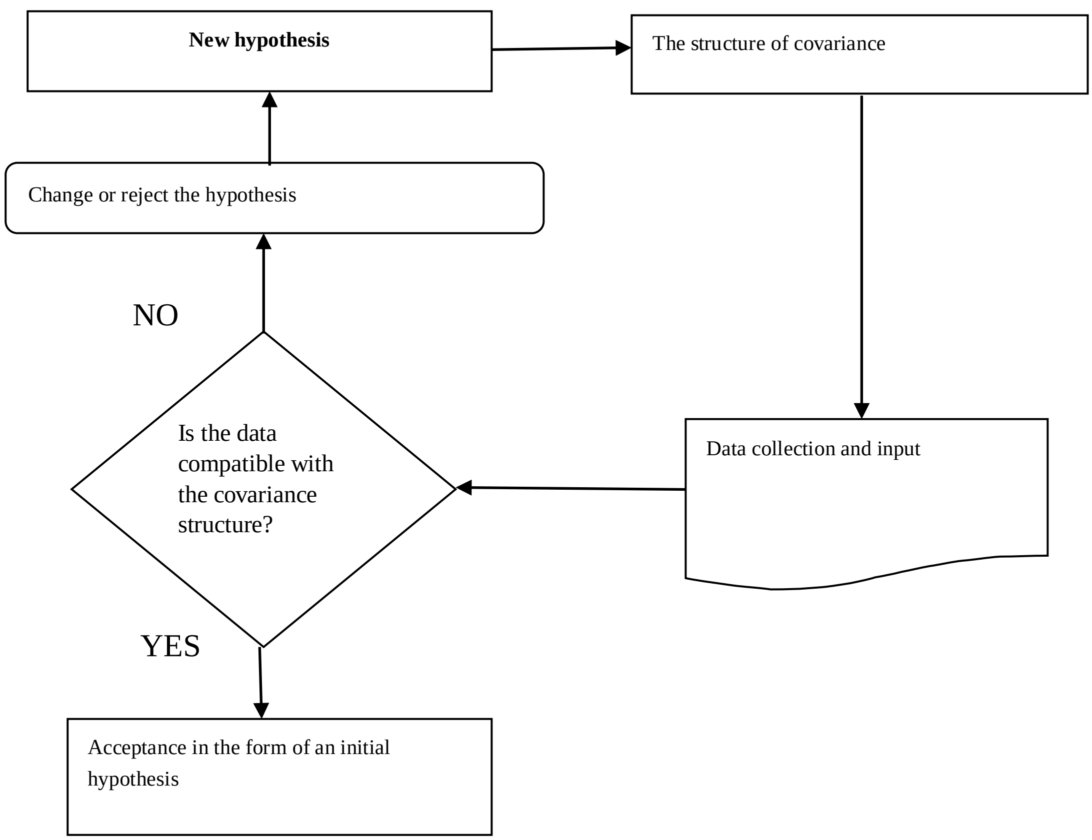
1. The hypothesis of a linear relationship between some variables is hypothesised;
2. Stata software determines the values of the differences and covariances of the variables in the current model based on the input data, using special internal methods, computer algorithms;

3. The software checks whether the differences and covariances obtained are consistent with our model;

4. The software presents the results of the obtained statistical tests and displays the estimates of the variables, the coefficients of the standard error of the linear equation and a number of additional diagnostic data.

5. Based on this information, the adequacy of the current model is checked and a decision on its fit is made.

The main steps of the structural modelling process are illustrated in the following figure:



Picture 2. The main stages of SEM (Structural equation model)

Source: made by the author

Although the mathematical logic of structural modelling is very complex, its basic steps are divided into 5 steps, as shown in the figure.

It is wrong to expect perfect compatibility between the model and the data, for several reasons. Structural models with linear relationships are close to real events, but may not fully represent them. Most economic and social processes are not linear. Consequently, the relationship between variables must be considered probable, not real. It is all a matter of how practical the models produced are and how competently they can be used.

Since the indicator under study and the associated variables are in different units, and this complicates analytical interpretation, we can logarithm all indicators.

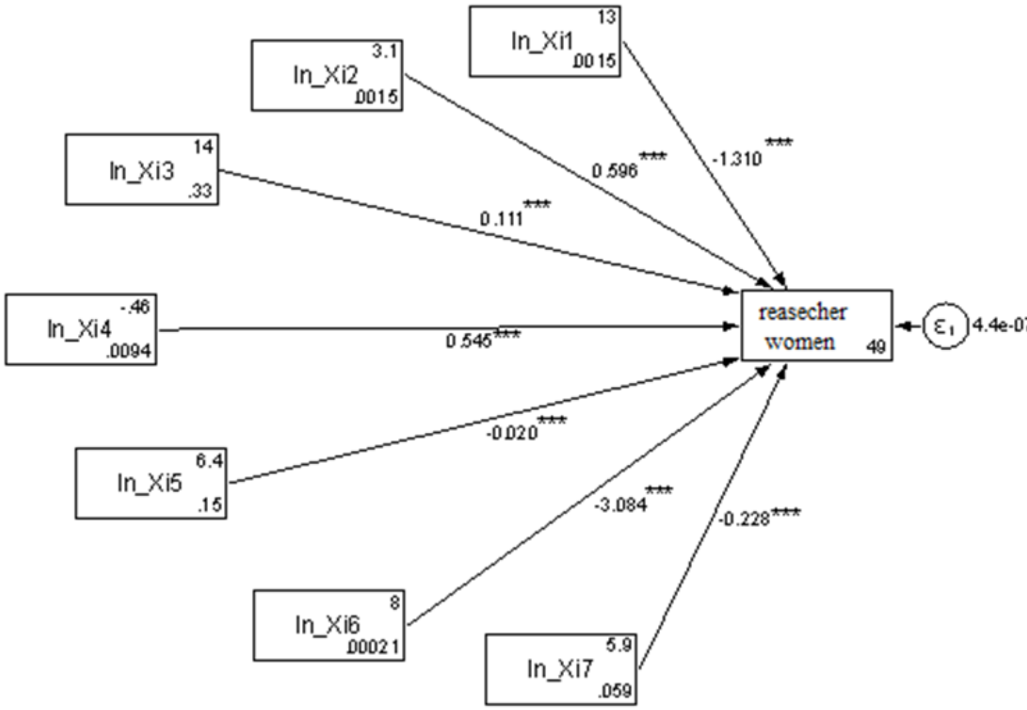


Figure 3: SEM Women's Research Employment Model

Source: Developed by the author based on the STATA-15 program

Note: N = 12 (number of observations), *** - r <0.001, R2 = 99, ln_Xi1 - logarithm of number of marriages, ln_Xi2 - logarithm of birth rate, ln_Xi3 - logarithm of average salary in research, ln_Xi4 - higher education institution ln_Xi5 is the logarithm of the number of doctoral students, ln_Xi6 is the logarithm of the number of information resource and information-library centers, ln_Xi7 is the logarithm of the number of organizations implementing ITTKI, ln_Xi is the number of women engaged in research (Y1).

Taking these factors into account, we construct the regression equation, which has the following form:

$$\hat{Y}_1 = 48,85 - 1,310*Xi_1 + 0,595*Xi_2 + 0,111*Xi_3 - + 0,544*Xi_4 - 0,019*Xi_5 - 3,083*Xi_6 - 0,228*Xi_7 + \varepsilon \quad (1)$$

The regression equation coefficients showed that they were all significant (r <0.001).

The following indicators were used to test the adequacy of the model:

- Based on the R-square values, the model was found to be 99 per cent significant for all selected variables. In particular, the percentage change in women engaged in scientific research is explained by the variables selected in 99 per cent (Xi1, Xi2, Xi3, Xi4, Xi5, Xi6, Xi7).

- According to the results of the correlation analysis, multicollinearity, i.e. high correlation between the independent variables and linear correlation between the arguments, is observed in the sum of the original factors. The Bentley-Raikoff multicorrelation coefficient between the values obtained was determined to be 0.99, which is explained by the presence of correlation between all variables.

- The comparative comparison index (CFI) is 1, which is a very good indicator, i.e. all obtained values are explained by the fact that they are independent and do not overlap.

- The Root Mean Square Error Approximation (RMSEA) is 0 (assuming an error of 0.05), meaning that the errors in each variable in the calculations are zero.

- The model chosen by the Estate mindices team (advanced statistics reporting modification indices) shows the most efficient ways of ensuring compatibility of variables to obtain better results. Accordingly, our model was found to be the most accurate and optimal (no modification indices to report).

The following conclusions were drawn from the analysis of the implemented SEM model:

- A 1% increase in marriage reduces the number of women employed in research by 1.31% and a 1% increase in fertility rates increases the employment of women in science by 0.59%. According to the analysis of these demographic factors, the study area consists mainly of middle-aged women with several children who have strengthened their family status, have sufficient knowledge and knowledge.
- A one per cent increase in the proportion of female and male university students increases female employment in science by 0.11%, while a one per cent increase in the number of doctoral students decreases employment in the field by 0.01%. There is therefore a need to increase opportunities for women and girls to pursue higher and post-secondary education respectively, and to pay particular attention to the quality of doctoral student research.

- Interestingly, the increase in the number of information resource and information library centres and the number of organisations implementing ITTKIs has a negative impact on women's employment in research, each increasing by 3.08% and 0.23% respectively. In today's digital economy, increasing access to information, making fundamental, analytical, statistical data open has become a critical issue. At the same time, it is desirable to improve the quality of research and development organisations and to attract more women into this field.

Conclusion

The proportion of women in leadership positions has increased significantly over the past few decades in almost all countries of the world. While the increase in women's leadership power in developing countries is due to an increased focus on education and health, in developed countries the increase in women's share of management is influenced by public policy [3]. Women in management are more focused on social issues, such as improving the quality of education, staff training, health and social protection.

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