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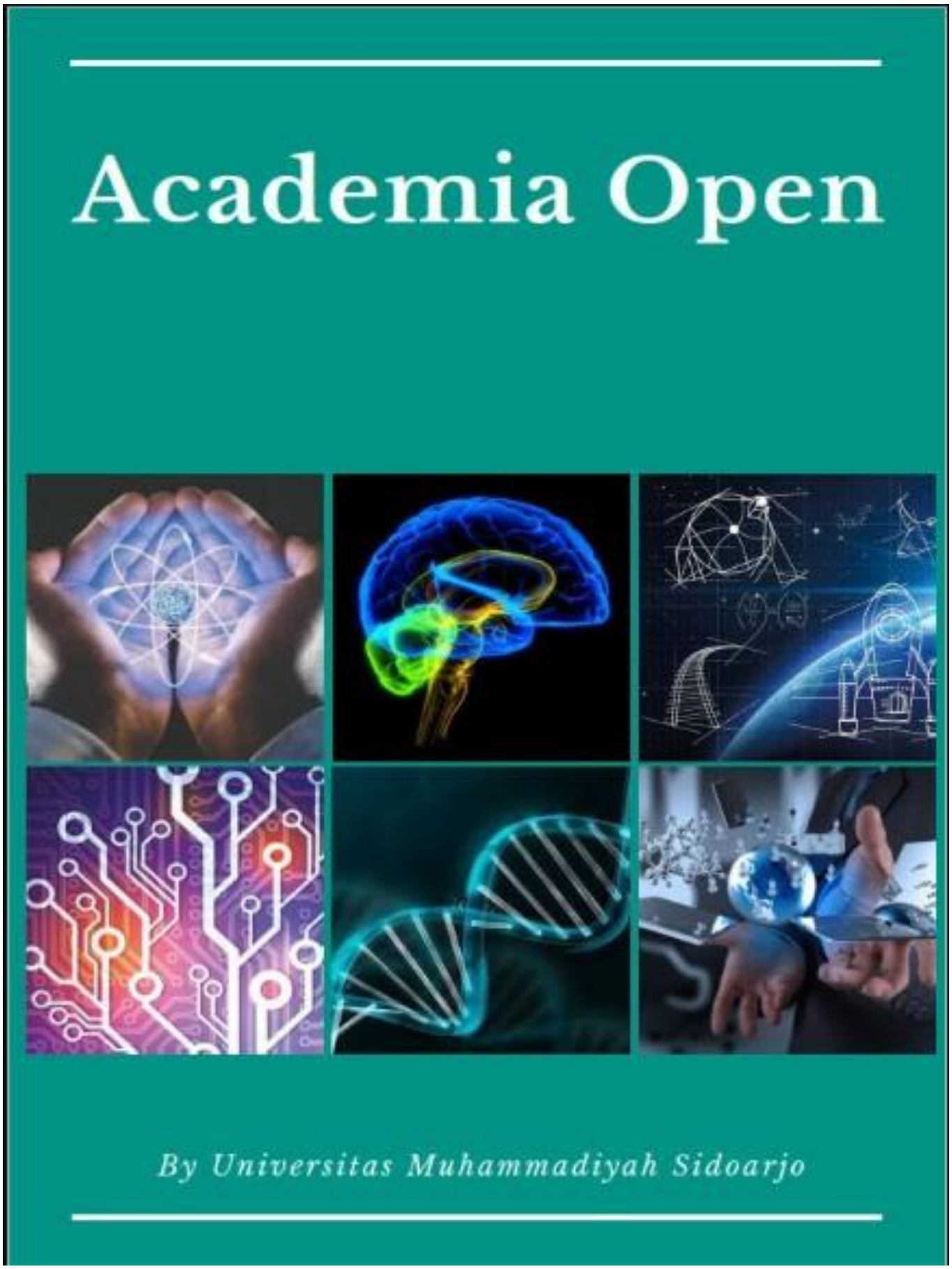

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Integral Model For Assessing The Effectiveness Of Women's Intellectual Labor Management In An Innovative Economy

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Abstract

General Background The transition toward an innovative economy highlights human capital and intellectual labor as central drivers of economic development. **Specific Background** Women's intellectual labor represents a significant yet underutilized resource, requiring systematic management and assessment frameworks. **Knowledge Gap** Existing studies primarily examine isolated indicators, lacking comprehensive integral models that combine economic, social, and innovative dimensions into a unified evaluation system. **Aims** This study aims to develop an integral model for assessing the management of women's intellectual labor using a multifactor and quantitative approach. **Results** The research formulates an integral index (I = 0.72), indicating an above-average level of management performance, with education and digital skills identified as dominant factors through correlation-regression analysis. Themodel integrates normalized indicators across employment, income, education, qualifications, research participation, and digital competencies. **Novelty** The study introduces a structured integral assessment model based on multi-criteria decision-making and statistical methods, enabling systematic aggregation of diverse indicators into a single analytical framework. **Implications** The findings provide a scientific basis for improving labor market policies, strengthening gender-oriented institutional mechanisms, and supporting strategic decision-making for the development of women's intellectual potential in an innovative economy.

Highlights:
- Integral index reveals above-average performance with structured multi-indicator aggregation
- Education and digital competencies emerge as dominant determinants in regression results
- Model supports policy formulation for labor systems and gender-oriented strategies

Keywords: Innovative Economy, Women Intellectual Labor, Integral Model, Human Capital, Correlation Regression Analysis

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I. Introduction

In the context of modern globalization and digitalization processes, the formation of an innovative economy is becoming one of the priority areas of development of any country. Human capital, especially the potential of intellectual labor, is of great importance as the main driver of the innovation economy. From this point of view, the effective use of women's intellectual labor and the improvement of its management system is a pressing scientific and practical issue [1].

World practice shows that ensuring gender equality in the economy and the active use of women's intellectual potential accelerates innovative development and has a positive impact on economic growth. In particular, according to the World Bank, increasing women's labor activity makes a significant contribution to GDP growth[2]. At the same time, UNESCO studies emphasize that expanding women's participation in science and innovation is an important factor in sustainable development [3].

In Uzbekistan, in recent years, large-scale reforms have been carried out aimed at strengthening the role of women in society and the economy, developing their intellectual and professional potential. In particular, in the regulatory legal acts adopted at the initiative of the Administration of the President of the Republic of Uzbekistan, special attention is paid to supporting women, ensuring their employment, and developing entrepreneurial activity [4].

However, despite the measures being implemented, mechanisms for assessing the effectiveness of managing women's intellectual labor, comprehensive analysis of its effectiveness, and assessment based on integral indicators have not been sufficiently developed. In existing studies, mainly individual indicators are analyzed, and the need to systematize them into a single system and evaluate them based on an integral model remains [5].

In this regard, the purpose of this study is to develop an integral model for assessing the effectiveness of managing women's intellectual labor in the context of an innovative economy. To achieve this goal, the tasks of analyzing economic, social, and institutional factors in their interrelationship, as well as forming a comprehensive assessment approach based on correlation-regression methods, are set.

II. Metodology

Issues of the effective use of human capital and intellectual labor in the context of an innovative economy have been widely studied by foreign and domestic scientists. In particular, G. Becker, considered the founder of the theory of human capital, substantiated human knowledge and skills as the main source of economic growth[1]. The concept of a knowledge-based economy, put forward by P. Drucker, also emphasizes the priority of intellectual labor [6].

Issues of women's labor and gender equality have also been widely analyzed by international organizations. In particular, World Bank research notes that women's participation in the labor market has a significant impact on economic growth, and it is emphasized that achieving gender equality allows for a significant increase in national income[7]. Also, in the reports of the International Labour Organization, the need to increase women's participation in the labor market in Uzbekistan, create decent working conditions, and ensure gender equality is scientifically substantiated[8].

This issue has also been thoroughly studied by local researchers. In particular, K.Kh. Abdurakhmanov, in his scientific works on labor economics, emphasizes that the effective use of human capital and labor resources is the main factor in the development of the national economy [9]. In his research, issues of structural changes in the labor market and employment efficiency were analyzed.

Also, in a number of empirical studies, the participation of women in the labor market and its impact on economic growth have been analyzed. In particular, it has been shown that low female labor force participation limits economic growth potential and reduces overall productivity Labor Economics [10].

In recent studies, it has been substantiated that increasing women’s participation in the labor market contributes positively to economic stability and social well-being. At the same time, gender inequality, persistent social stereotypes, and institutional barriers continue to restrict women’s full participation in economic activities [11].

Furthermore, studies examining the status of women in the workplace highlight issues related to discrimination and unequal opportunities. These studies emphasize the importance of strengthening institutional mechanisms and ensuring gender equality policies to improve women's position in the labor market [11].

Analysis of the above studies shows that, although the issues of women's participation in the labor market and the development of their intellectual potential have been widely studied, the integral assessment of the effectiveness of managing their intellectual labor, especially analysis based on complex economic and mathematical models, has not been sufficiently covered. This circumstance determines the scientific novelty and significance of this research.

In the research process, the factors influencing women's intellectual labor were systematized using methods of analysis and synthesis. A comparative analysis was also conducted based on data from international organizations, including the World Bank, the International Labour Organization, and UNESCO [2,8,12].

With the help of economic-statistical and correlation-regression analysis methods, the relationship between factors influencing the effectiveness of women's intellectual work was determined. Also, the study used an integral assessment

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method, and a generalized assessment model was formed based on various indicators.This approach ensures the scientific validity and reliability of the research results.

III. Result a nd Discussion

In the context of an innovative economy, human capital and the effectiveness of intellectual labor are one of the main factors of economic growth. According to human capital theory, knowledge, skills, and competencies have a direct impact on economic results by increasing labor productivity[1]. From this point of view, assessing the effectiveness of managing women's intellectual labor requires a multifactorial and comprehensive approach.

In the concept of a knowledge-based economy, intellectual labor is of paramount importance, manifesting itself as the main driver of innovative development [6]. At the same time, research within the framework of gender economics shows that the effective use of women's intellectual potential is important not only for economic growth, but also for ensuring social stability and inclusive development [2].

Based on these theoretical approaches, an integral model for assessing the effectiveness of managing women's intellectual labor was developed in the study. This model allows combining indicators of different nature into a single assessment system and conducting a comprehensive analysis of their interaction.

1. Formation and normalization of indicators

In the study, evaluation indicators were selected based on the theories of human capital, labor economics, and innovative development. When forming indicators, their representativeness, measurability, and economic significance were taken as the main criteria.

They were divided into the following groups:

- economic indicators (employment rate, average income);
- social indicators (level of education, professional qualifications and competencies);
- innovative indicators (digital skills, research activity, participation in innovations).

This grouping allows for a comprehensive assessment of the interrelationship between the development of human capital, labor market efficiency, and innovative activity.

To ensure the possibility of comparing the indicators, the min-max normalization method was used. This method is a widely used statistical approach in the compilation of complex indicators and is recommended in international practice [14]:

$$xi = (Xi - X\_min) / (X\_max - X\_min)$$

here:

xi - normalized indicator;

Xi - original value;

X_min and X_max - minimum and maximum values, respectively.

With the help of this method, all indicators were brought to the interval from 0 to 1, which made it possible to compare them on a single scale and simplify the process of further aggregation. At the same time, in the normalization process, the influence of extreme values of the data was taken into account, and the relative differences in indicators were preserved.

It should be noted that the choice of normalization method has a significant influence on the results of the integral assessment. Therefore, the simplicity, accuracy, and ease of interpretation of the min-max method were taken into account in the study.

In the study, a system of indicators based on the theories of human capital, labor economics, and innovative development was formed to assess the effectiveness of managing women's intellectual labor. These indicators were divided into economic, social, and innovative groups and analyzed based on their practical values. Empirical data for the study were formed on the basis of reports from the State Committee of the Republic of Uzbekistan on Statistics and international organizations and Table 1 provides complete information [2,12,13]. (see Table 1)

Table 1. Indicators for assessing women's intellectual work

No	Indicators	Symbol	Value	Source
1.	Women's employment rate (%)	X1	43.5	State Committee of the Republic of Uzbekistan on Statistics, 2024

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2.	Average monthly salary (thousand soums)	X2	3550	State Statistics Committee, 2024
3.	Proportion of women with higher education (%)	X3	39.8	World Bank, 2023-2024
4.	Women with professional qualifications (%)	X4	47.2.	International Labour Organization, 2023
5.	Participation in scientific research (%)	X5	33.4.	UNESCO, 2021-2023
6.	Women with digital skills (%)	X6	40.6	World Bank Digital Development, 2024

The indicators presented in the table were selected for a comprehensive assessment of the effectiveness of managing women's intellectual labor, reflecting the development of human capital, the state of the labor market, and innovative activity. The data are mainly as of 2024, and some indicators were formed based on updated assessments based on the latest available reports from international organizations.

These indicators serve as an empirical basis for the integral assessment model, and the overall efficiency index is determined by normalizing and aggregating them. This approach is widely used in international practice in the compilation of complex indicators and ensures the reliability of the analysis results [14].

2. Integral Evaluation Model

Based on the theory of multi-criteria assessment, an integral index was used for a comprehensive assessment of the effectiveness of managing women's intellectual labor. This approach allows combining indicators of different nature into a single aggregated indicator and serves as an effective tool in decision-making processes [14,15].

The integral evaluation model is presented as follows:

$I = \Sigma (wi * xi), i = 1...n$

where:

I - integral index of the effectiveness of managing women's intellectual labor;

wi - weight coefficient of the i-th indicator;

xi - normalized indicator;

n - number of indicators.

This model is based on the theory of multi-criteria decision-making (MCDM) and allows taking into account the degree of influence of each indicator on the overall result. This serves to reduce subjectivity in the assessment process and increase the reliability of the results.

Weight coefficients were determined by the method of expert assessment. This method took into account the opinions of experts in the field of economics, the labor market, and gender policy. The expert evaluation method is widely used in decision-making theory and allows for a scientifically based assessment of the significance level of indicators [15].

According to the analysis results, the level of education (human capital) and digital skills (innovative competencies) gained the highest weight. This situation shows that knowledge and digital technologies are the main resource in the context of an innovative economy. At the same time, employment and income indicators were assessed as important indicators reflecting economic performance.

3. Results of correlation-regression analysis

Within the framework of the study, economic-statistical, correlation, and regression analysis methods were used. These methods allow for the identification of interrelationships between factors, assessment of their degree of influence, and modeling of the resulting indicator [9].

According to the results of the correlation analysis, a positive and statistically significant correlation was revealed between the factors influencing the effectiveness of women's intellectual work:

- strong positive correlation between the level of education (X3) and effectiveness (r = 0.78);
- high correlation between digital skills (X6) and effectiveness (r = 0.71);

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• average correlation between the level of employment (X1) and efficiency (r = 0.65).

These results confirm the theory of human capital and show that education and skills are the main drivers of labor productivity.

Based on the results of the correlation analysis, the most significant factors were selected, and a multifactorial regression model was formed:

Y = 0.32X3 + 0.28X6 + 0.21X1 + 0.19X2

here:

Y - indicator of the effectiveness of women's intellectual labor;

X3 - level of education;

X6 - digital skills;

X1 - level of employment;

X2 - income indicator.

Analysis of regression coefficients shows that the level of education and digital skills are the factors that have the greatest impact on effectiveness. This situation once again confirms the decisive importance of human capital and innovative competencies in the concept of a knowledge-based economy[18].

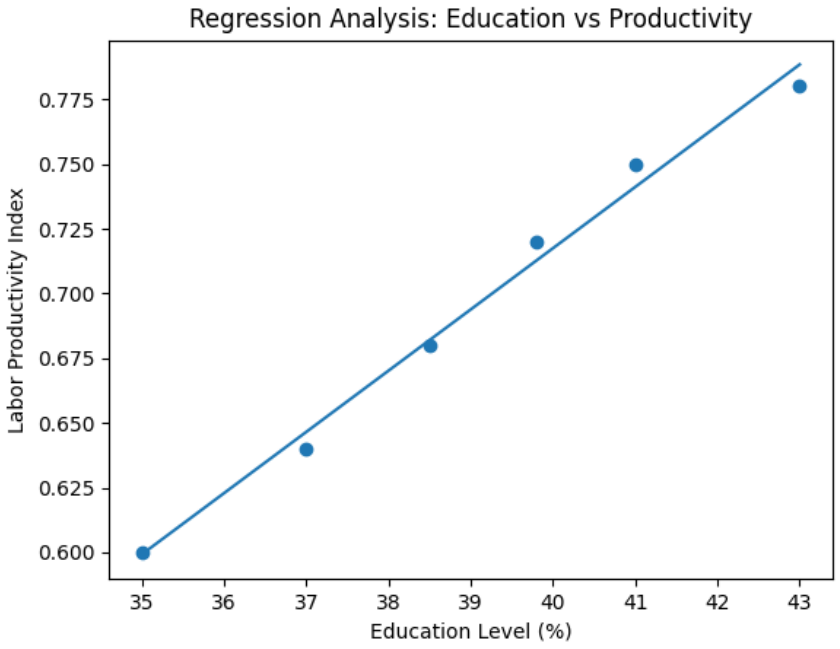
At the same time, this model plays an important role in forecasting and making management decisions in practice, allowing for the identification of priority areas for the development of women's labor potential.

This graph depicts the relationship between the level of education and the effectiveness of women's intellectual work based on regression analysis. The results of the analysis show that labor productivity increases proportionally with the increase in the level of education.

The trend line on the graph has a positive slope, which confirms that knowledge and skills are the main factors of labor productivity in accordance with the theory of human capital. The obtained results are also consistent with the high correlation coefficients (r ≈ 0.78), determined in the correlation analysis.

Graph 1 once again demonstrates the decisive role of the education system in the development of women's intellectual labor[16,17]. (see graph 1).

Graph 1. Regression analysis between education and labor productivity



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4. Results of integral assessment

As a result of the calculations, the integral index of the effectiveness of managing women's intellectual labor was determined as follows:

I = 0.72

The obtained result shows that the effectiveness of managing women's intellectual labor is formed at an above-average level. This situation is explained by the development of human capital in the country, the improvement of the education system, and the increasing participation of women in the labor market.

At the same time, when analyzing the results of the integral assessment in terms of indicators, it was revealed that there are some discrepancies. In particular, despite the relatively high level of education and overall employment indicators, indicators of digital skills and innovation activity are insufficiently developed.

This situation indicates the presence of the following problems in the context of an innovative economy:

- Limited participation of women in digital transformation processes;
- low proportion of women in innovation activities and scientific research;
- insufficient programs aimed at developing digital competencies.

From this point of view, the result of the integral index appears as an important analytical tool that allows identifying not only the general situation, but also structural problems.

The research results show that the effectiveness of managing women's intellectual labor in the context of an innovative economy is formed on the basis of the interdependence of human capital, digital competencies, and the institutional environment.

If the elements of human capital, in particular education and professional skills, are manifested as the main factor of effectiveness, then digital competencies acquire strategic significance in the context of an innovative economy. At the same time, the institutional environment and gender policy are important factors ensuring the sustainable development of this process.

The proposed integral model allows for a comprehensive assessment of the effectiveness of managing women's intellectual labor, analysis of its structural elements, and identification of priority areas of development. In practice, this approach has important scientific and practical significance in the formation of state policy, the development of the labor market, and the effective use of women's potential in making strategic decisions.

Also, the research results can serve as a scientific basis for the development of programs and policies aimed at the development of women's intellectual work in the future.

IV . Conclusion

The results of the conducted research show that the effectiveness of managing women's intellectual labor in the context of an innovative economy is a multifactorial and complex socio-economic process. This process is inextricably linked with the development of human capital, the formation of digital competencies, and the stability of the institutional environment.

In our opinion, the effective use of women's intellectual potential in the modern economy not only ensures economic growth, but also forms the strategic basis of innovative development. From this point of view, traditional approaches to women's labor management are insufficient, and it is necessary to use complex and integral models in its assessment.

The integral model developed during the study offers a new scientific approach to assessing women's intellectual work. With the help of this model, it was possible to combine indicators of different nature into a single system, determine their interaction, and objectively assess the level of effectiveness.

According to the results of the empirical analysis, the level of education and digital skills became the main factors determining the effectiveness of women's intellectual work. This once again confirms the priority importance of human capital and the digital economy.

At the same time, the research results showed that women's participation in innovation activity and digital competencies are not sufficiently developed. This situation means that the existing potential is not being fully utilized in the context of an innovative economy.

From the author's point of view, it is necessary to introduce a systematic, long-term, and institutionally supported approach to increasing the effectiveness of managing women's intellectual labor.

Based on the results of the conducted research, the following practical proposals and recommendations were developed:

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1. Education and Human Capital Development

To increase the effectiveness of women's intellectual work, it is necessary to further improve the system of higher education and professional training. In particular, it is advisable to expand the participation of women in STEM areas and introduce educational programs aimed at the formation of modern knowledge and skills.

2. Development of digital competencies

In the context of an innovative economy, digital skills are crucial. Therefore:

- Expand digital literacy programs for women;
- Organization of special training courses in the field of IT and digital technologies;
- It is necessary to increase the possibilities of using online educational platforms.

3. Stimulation of innovative activity

In order to increase the participation of women in research and innovation activities:

- expansion of grants and startup programs;
- Strengthening support mechanisms for female scientists and researchers;
- ensuring gender equality in the innovation ecosystem is important.

4. Improvement of the institutional environment

For effective management of women's labor:

- Strengthening state policy aimed at gender equality;
- ensuring equal opportunities in the labor market;
- It is necessary to implement mechanisms that maintain a balance between work and family.

5. Implementation of the integrated assessment model into practice

Proposed integral model:

- as a means of monitoring by state bodies;
- in labor market analysis;
- in strategic planning

can be widely used.

6. Expansion of scientific research

Upcoming:

- development of dynamic models;
- conducting an analysis by region;
- conducting international comparative research

is considered appropriate.

Women's intellectual labor is a hidden, but very potential resource of the innovative economy. Effective use of this potential will serve as a decisive factor in ensuring the country's sustainable economic growth and competitiveness.

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