

Development of agricultural scientific potential to ensure the competitiveness of the agricultural sector of Kazakhstan: gender aspect

Dana Kangalakova^{1*}, *Zaira Satpayeva*¹, *Kanat Kangalakov*², and *Nazym Battalov*¹

¹Institute of economics Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan, Almaty, Kazakhstan

²Satbayev University, Almaty, Kazakhstan

Abstract. In the context of climate change and growing environmental challenges, agriculture requires introducing innovative technologies to increase production efficiency and conserve natural resources. The main engine for creating innovative technologies is the scientific personnel in the agricultural sector. In this regard, this study aims to analyze the potential of scientific personnel in agricultural science and its gender characteristics and develop practical recommendations that will contribute to scientific research and implementation effectiveness. The results of the study show that the level of scientific human resources in the agricultural sector has a moderate development trend. However, from a gender perspective, it was revealed that female researchers have hidden potential and can contribute to activating scientific potential and diversifying research and development in this sector. The article recommends the modernization of the educational program to train future scientists, which focuses on internships as the key to a rapid exchange of knowledge in the agricultural sector.

1 Introduction

The agricultural sector is one of the most critical factors in economic development. Agriculture is not only engaged in producing products but also ensures food security, increases export potential and adheres to the principles of sustainable development by introducing innovative advanced technologies. Proper resource use will create a sustainable, socially oriented, economically developed State. It should be noted that the driving force in this process is human capital. Knowledgeable human capital, including scientists, will lead to the creation of new knowledge within the framework of sustainable development, the development of technology and technology, and the development of the agro-industrial complex of Kazakhstan [1]. Many CIS countries strive to develop basic science, while all developed countries focus on applied science. The classical type of researcher is more suitable for fundamental research. In contrast, in applied science, a researcher is not only a scientist but also a developer, participates in political decision-making, and is an entrepreneur. Kazakhstan has developed a classic researcher model; in this regard, to expand

* Corresponding author: danakangalakova@gmail.com

scientific potential, women scientists should be activated, expanding their opportunities and access to infrastructure, thereby diversifying research and development.

The shape of agricultural products in GOD was 4.5% in 2019 and 5.4% in 2020; the trend has started the same in subsequent years. In this regard, this sector requires transformation. Special attention should be paid to scientific research and personnel, which can drive the sector's development. A unique role is played by the training of scientific personnel in this sector [2]. Research organizations and postgraduate education should focus on the effective use of scientific personnel to achieve innovative solutions in the development of the agricultural sector in Kazakhstan [3]. This study sets a task that provides for the analysis of the scientific personnel potential of agricultural science and its gender characteristics and, based on the analysis results, the development of practical recommendations that will contribute to the effectiveness of scientific research and development in this area.

2 Methodology

The research methodology is based on generally accepted scientific methods such as comparative statistical analysis and method of inductive reasoning. In this method, indicators such as Kazakhstan's scientific personnel potential by gender, the scientific personnel potential of the agricultural sector by gender, and the average monthly salary by gender and by profession were analyzed. This analysis shows the popularity and relevance of the sector and its capabilities to ensure the competitiveness of the agricultural sector of the Republic of Kazakhstan (Figure 1).

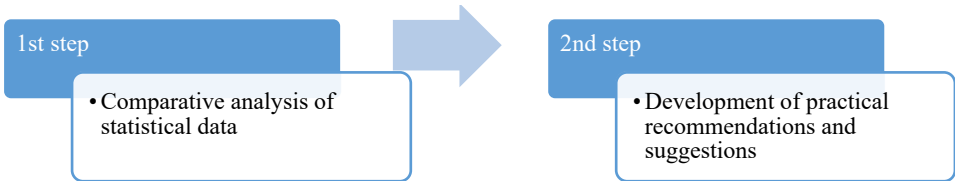


Fig. 1. Research design.

The second stage of the study includes the method of inductive reasoning, which, based on the analysis results, contributed to the development of practical suggestions and recommendations that will improve the agricultural sector's competitiveness.

3 Results and discussion

Kazakhstan has extensive resources and natural data for developing the agricultural sector. To increase the competitiveness of this sector, Kazakhstan needs to develop R&D in the agricultural sector. New knowledge and new ideas for the development of the sector are formed through human capital, in this case, through researchers who are concentrated in the agricultural sector. Table 1 shows data that describes the dynamics of the number of scientists in the agricultural sector. However, Kazakhstan, a young and developing country, has little scientific potential, and this potential in the agricultural sector is relatively minimal. The data show that in 2022, 18,014 research specialists were registered in Kazakhstan, and 53% were women researchers. In addition, the number of scientists in the agricultural sector is 1,555, of whom 812 are women researchers and account for about 8% of all scientists. The situation in 2018 shows that there are 1,847 people in agricultural science, of whom 903 are female researchers and 944 are male researchers, making up 10% of the total number of researchers.

In this context, an attempt was made to find studies by Kazakhstani authors on the attitude of women engineers. However, six publications were found that have similarities to the researched problem.

Table 1. Dynamics of the number of researchers on gender and in agricultural science.

By year/by gender	2018		2019		2020		2021		2022		Growth, %	
	man	woman	man	woman	man	woman	man	woman	man	woman	man	woman
Total number of gender researchers, thousands	8.2	9.2	8.1	8.9	8.4	9.7	7.7	9.3	8.3	9.6	1%	5%
% of the total number of researchers	48%	52%	48%	52%	47%	53%	46%	54%	47%	53%	-	-
Number of researchers in agricultural science	944	903	921	749	938	776	779	822	743	812	-21%	-10%
% of the total number of researchers	11%	10%	12%	11%	11%	10%	12%	10%	11%	10%	-	-
Total scientific staff in Kazakhstan	17 454		17124		18228		17092		18 014		-	

During the analyzed period, the number of researchers in Kazakhstan shows a positive trend, namely an increase of 1% among men and 5% among women. At the same time, there is a negative trend in agricultural sciences; the total number of scientists has decreased by 2%. It should be noted that in this sector, the number of female researchers exceeds the number of male scientists. Training potential researchers in the field of agricultural sciences is essential for developing the agricultural sector, as it promotes innovation, productivity, and sustainable agricultural development [4-7]. Based on this, Table 2 presents data on doctoral students in Kazakhstan. In the 2022/2023 academic year, 6,156 people were enrolled in doctoral studies, while 180 doctoral students were employed in the agricultural sector, or 2.9%. Compared to the 2020/2021 academic year, the dynamics show a negative trend; during the analyzed period, the number of doctoral students decreased by 53 doctoral students. In addition, by gender, female doctoral students prefer to study in the agricultural sector more than men. This trend can be explained by the fact that women may be more interested in sustainable development, ecology, and environmental management, which is essential for agriculture.

Table 2. Dynamics of the training of researchers for agricultural sciences.

By year/by gender	2020/2021		2021/2022		2022/2023		Growth from 2020/2021 to 2022/2023	
	man	woman	man	woman	man	woman	man	woman
Total number of doctoral students	2452	4462	2168	3756	2278	3878	-7%	-13%
Number of doctoral students in agricultural science	102	131	65	88	74	106	-27%	-19%
% of the total number of doctoral students	4.2	2.9	3.0	2.3	3.2	2.7	-0.9	-0.2

Table 3 presents data on the average nominal wage in the agricultural sector, broken down by gender. In 2024, the average monthly salary of men in this sector was \$487, women's waves were fixed at \$461, and men's waves were 5% higher. The situation in 2022 differed from 2024; men's waves were \$629, and women's were \$522. However, the dynamics of ages show a negative trend, both in tenge and in dollars. Based on this, the competitiveness of this sector is low.

Table 3. Gender gap in nominal wages of workers in the agricultural sector.

By year/by gender	2022		2023		2024	
	woman	man	woman	man	woman	man
The average monthly nominal wage in the agricultural sector in tenge	245 436	295 542	285744	361481	225985	238539
The average monthly nominal wage in the agricultural sector in dollars	522	629	621	786	461	487
Gender wage gap	17%		20%		5%	
2022 – 1 dollar = 470 tenge; in 2023 1 dollar – 460 tenge, in 2024 1 dollar – 490 tenge.						

Figure 2 shows information on the average monthly salary of critical positions in the agricultural sector, including employees of research organizations. High salaries are observed among researchers and specialists engaged in commercialization, ranging from \$ 1,000 to \$6,324 monthly. However, ordinary lab workers or researchers have salaries of \$694 for men and \$381 for women. There is a gender wage gap in the leading positions.

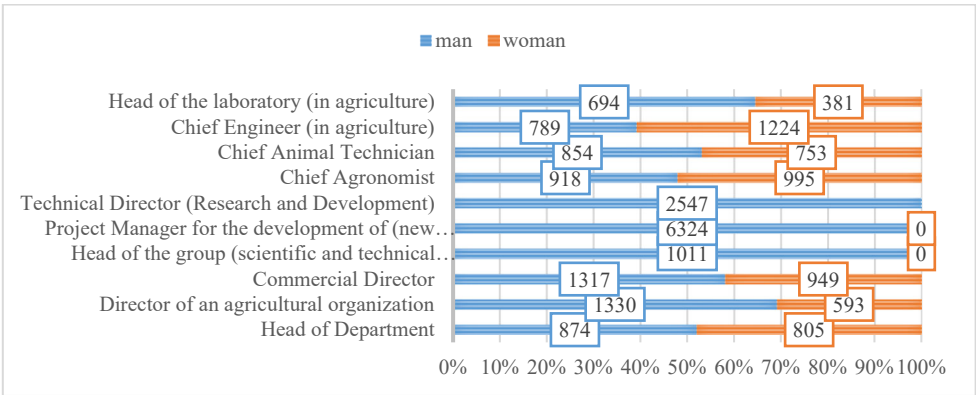


Fig. 2. The structure of the average monthly nominal salary of employees by primary professions and positions, 2024.

Thus, scientific human resources in the agricultural sector need a stronger development trend. There is a need for more scientific personnel in Kazakhstan, which would create breakthrough projects for implementing and improving the sector's competitiveness. In addition, the gender aspect shows that woman researchers have a vast potential for increasing scientific activity, diversifying research, and developing innovations. In order to improve the potential of scientific personnel in the agricultural sector, it is necessary to implement measures aimed at developing education, supporting research activities, and creating favorable conditions for young scientists. Education is one factor that determines the country's future development. Therefore, educational programs must meet the requirements of modernity in order to achieve a positive effect. In addition, theory and practice should keep pace when more attention is paid to theoretical knowledge in the CIS countries. As the practice of foreign countries shows, the theory should be applied in practice and tested by students. To train scientific personnel, it is necessary to integrate modern technologies such as artificial intelligence, the Internet of Things, big data, and the robotization of agriculture into educational and research programs. The organization receives a specialist who has basic research knowledge and is ready for new inventions in the agricultural sector [8]. Also, the opportunity to train in domestic agricultural enterprises, research institutes, and experimental farms would significantly improve students' research qualities. Further, creating a transparent career development system in scientific organizations, including professional development and promotion programs, will help retain talented young researchers in the sector [9]. According to the results of the analysis, we can observe the low popularity of the agricultural sector in Kazakhstan; to increase the prestige of scientific work in the agricultural sector, information campaigns can be conducted that demonstrate the importance of scientific achievements for the country's development. Examples of successful scientists and their contribution to agriculture can be a good motivation for young people. After such measures, the sector's profitability will increase, consequently increasing wages. These measures will help create a favorable environment for the development of scientific potential in the agricultural sector, which will ensure the introduction of innovative technologies and sustainable development of the agricultural sector in Kazakhstan.

4 Conclusion

To increase the scientific potential in the agricultural sector of Kazakhstan, an integrated approach is needed, including the modernization of educational programs, support for scientific research, and the creation of favorable conditions for the professional growth of

young scientists. Integrating modern technologies such as artificial intelligence, the Internet of Things, big data, and robotics into educational and research processes will be a key step towards the development of the industry. The organization of internships at domestic enterprises, the introduction of practice-oriented training, and the creation of a transparent career development system will help attract talented young people and keep them in the scientific field. Increasing the prestige of the agricultural sector through information campaigns demonstrating the contribution of science to the country's development is also an important measure. Implementing these steps will ensure the sustainable development of Kazakhstan's agricultural sector, the growth of its profitability, the introduction of innovative technologies, and, ultimately, an increase in the standard of living of specialists in this industry.

The study was conducted within the framework of grant funding of young scientists of the Committee of Science of the MSHE Republic of Kazakhstan (AP19579256 «Mechanisms for empowering women in scientific activity in the interests of the development of the innovative economy of Kazakhstan»).

References

1. D. Kangalakova, Z. Satpayeva, M. Nurkenova, A. Suleimenova, *Problems and Perspectives in Management* **22(3)**, 593-605 (2024).
2. T. Marinchenko, *IOP Conference Series: Earth and Environmental Science* **699**, 012039 (2021).
3. F. Hermans, M. Stuiver, P. Beers, K.Kok, *Agricultural Systems* **115**, 117-128 (2013).
4. N. Selwyn, *J. Comput. Assist. Learn.* **23** 83-94 (2007).
5. V. Leksin, *Scientific Works of the Free Economic Society of Russia* **5** 3-25 (2022).
6. S. Datta, M. Saad, D. Sarpong, *Technological Forecasting and Social Change* **143** 27-36 (2019).
7. D. Sarpong, D. Boakye, G. Ofosu, D. Botchie, *Technovation* **122(C)** 90-101 (2023).
8. T. Ahmad, S. Ahmad, M. Jamshed, *2015 International Conference on Green Computing and Internet of Things*, **2015**, 333-340 (2015)
9. E. Kydyrbaeva, S. Baidybekova, B. Shomsheikova, *Problems of AgriMarket* **4** 190-196 (2022).