

## RESEARCH ARTICLE



# Socio-Economic Gender Inequality in Kazakhstan: Analysis based on the Cluster Approach

Akbota  
G. Anessova<sup>1\*</sup>

Abzal  
S. Bekbossinov<sup>2</sup>

Bizhamal A.  
Abdullayeva<sup>3</sup>

<sup>1</sup> Eurasian Technological  
University

<sup>2</sup> Inter Service LLP, Almaty,  
Kazakhstan

<sup>3</sup> Narxoz University, Almaty,  
Kazakhstan

**Corresponding author:**

\* Akbota G. Anessova – PhD  
candidate, Eurasian  
Technological University,  
Almaty, Kazakhstan.  
Email: [a\\_bota@mail.ru](mailto:a_bota@mail.ru)

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**Abstract**

Gender-based public policy is crucial for ensuring equal opportunities for men and women across all spheres of life. The objective of this study is to analyze gender inequality trends in Kazakhstan from 2013 to 2023 by focusing on key social and economic indicators, such as political representation, educational attainment, labor force participation, and wage disparities. The study employs K-means clustering to group Kazakhstan's regions into clusters based on gender inequality indicators, such as the Gender Inequality Index (GII), wage gap, maternal mortality, and political representation. The data used in this study come from official statistics provided by the Bureau National of Statistics of the Republic of Kazakhstan and international organizations such as the United Nations from 2013 to 2023. The analysis revealed that Cluster 0 had the lowest gender inequality, with a Gender Inequality Index (GII) of 0.34 and a 27% wage gap. Cluster 1, with a GII of 0.37, exhibited higher disparities, particularly in adolescent birth rates and wage gaps (33%). Cluster 2, with the highest inequality (GII of 0.41), also showed a 32.73 maternal mortality rate and a 24% wage gap. These findings underscore the persistent challenges in gender equality, especially in the areas of economic and political participation, despite improvements in educational access. The study's implications are significant, highlighting the need for targeted policies to reduce wage disparities, improve political representation for women, and address maternal health. These insights can guide policymakers in prioritizing gender-focused interventions for sustainable development, thereby contributing to the broader goal of achieving long-term gender equality in Kazakhstan.

**Keywords:** Gender, Gender Inequality, Wage Gap, Labor Force Participation, Political Representation, Clustering, Kazakhstan

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## 1. INTRODUCTION

Gender-based public policy plays a key role in ensuring justice and equal opportunities for men and women in all spheres of life. It aims to eliminate discrimination, improve working conditions, increase employment, access to resources, political participation and social security. In recent decades, gender equality has become an essential component of sustainable development, as it contributes not only to social harmony, but also to economic growth, innovation and stability in society. Within the framework of international commitments, such as the UN Sustainable Development Goals, gender equality has become a global priority, and Kazakhstan, following these principles, is taking significant steps to promote it (UN, 2022).

The state gender policy of Kazakhstan, aimed at achieving equality, is based on international obligations and the country's legal acts. Essential steps in this area have been the «Strategy for Gender Equality of the Republic of Kazakhstan for 2006-2016», the law «On State guarantees of equal rights and opportunities for men and women» as well as the «Concept of family and Gender Policy in the Republic of Kazakhstan until 2030». These documents provide a legal framework for the promotion of gender equality and the development of tolerance in society.

Indicators such as the gender gap and the global Gender Development Index are used to assess success in this area. These allow us to identify differences in access to resources and opportunities for self-realization in the economy, politics, education, and health. Kazakhstan, as a developing country with high economic potential, recognizes the importance of gender policy in strengthening social justice and sustainable development, taking active steps to improve women's positions in the labor market and in political life.

Research on gender policy in Kazakhstan highlights significant advances in education, health, and women's participation in the labor market. However, despite the achievements in improving women's access to education and

health care, there remains a significant gender gap in pay, political participation, and economic opportunities. For example, according to the Agency for Strategic Planning and Reforms of Kazakhstan (NBS, 2024), women earn 26.5% less than men, even with comparable qualifications and experience.

Despite the progress made, gender inequality remains a problem in Kazakhstan. Women face discrimination in the workplace, limited access to high-level positions and political activities, and difficulties in the social sphere, including limited access to health services. The wage gap between men and women remains significant, negatively affecting socio-economic stability and poverty reduction efforts (OECD, 2020).

The objective of this study is to analyze gender inequality trends in Kazakhstan from 2013 to 2023, focusing on key social and economic indicators such as political representation, educational attainment, labor force participation, and wage disparities. The study aims to identify patterns of gender inequality across various dimensions using K-means clustering, allowing for the classification of groups based on gender disparities.

## 2. LITERATURE REVIEW

The existing literature on gender inequality spans various dimensions of social, economic, and political life, focusing on disparities in education, political participation, labor market outcomes, and the effects of major disruptions such as the COVID-19 pandemic. While significant progress has been made in education and through legal frameworks promoting gender equality, research consistently reveals persistent gaps in economic and political spheres.

These inequalities are often rooted in structural factors, cultural norms, and the slow pace of institutional change, which continue to disadvantage women globally, including in Kazakhstan. Education has long been recognized as a crucial factor in reducing

gender inequality. The relationship between higher educational attainment and improved economic outcomes for women is well-documented. For instance, Kabeer (2016) found that increased access to education is linked to lower fertility rates, improved health outcomes, and greater labor market participation. Despite these advances, however, women's educational gains do not always translate into economic or political empowerment due to entrenched patriarchal norms and limited access to leadership positions (ILO, 2020). In Kazakhstan, as in many other countries, educational parity has improved over recent decades, but its impact on reducing broader social and economic inequalities has been limited (Kredina et al., 2023). While women may have achieved higher educational qualifications, they still face significant barriers to career advancement and political leadership.

The underrepresentation of women in political decision-making remains a significant form of gender inequality. Despite legislative efforts in countries like Kazakhstan to increase women's political participation, barriers persist. Rashkova and Erzeel (2023) argue that without systematic reforms, such as gender quotas, women are unlikely to achieve substantial representation in political leadership. This trend is mirrored globally, where women's political representation has stagnated in many countries despite progress in education. Phillips (2020) points out that the exclusion of women from political roles undermines both gender equality and democratic legitimacy, as half of the population remains underrepresented in key decision-making processes. In Kazakhstan, women's representation in Parliament remains low, particularly after a sharp decline in 2023, reflecting global trends and the difficulty of translating legal frameworks into substantive political outcomes.

Economic inequality, especially in labor markets, remains one of the most persistent challenges in achieving gender equality. Although women's participation in the labor force has increased, wage disparities between

men and women continue to be significant. Goldin (2014) explains that the "motherhood penalty" exacerbates wage inequality, as women who take time off for childbearing and caregiving responsibilities face long-term economic disadvantages, including slower career progression and lower lifetime earnings. Blau and Kahn (2017) found that in developed economies such as the U.S., women earned only about 82% of what men earned for comparable work. This wage gap is largely due to occupational segregation, where women are more likely to work in lower-paying sectors such as education and healthcare.

In Kazakhstan, the gender wage gap has remained substantial, with women earning on average 25-34% less than men over the past decade. This disparity can be attributed to several factors, including occupational segregation, the undervaluation of women's labor, and limited opportunities for advancement in higher-paying industries such as technology and finance (Kireyeva & Olzhebayeva, 2023). While some policies have been introduced to address wage discrimination, their practical effects remain limited, highlighting the need for more robust interventions that target the root causes of inequality in the labor market.

The COVID-19 pandemic has further exacerbated existing gender inequalities, particularly in the labor market. Alon et al. (2020) note that women were disproportionately affected by the economic fallout of the pandemic, especially in sectors like retail, hospitality, and healthcare, where they are overrepresented. With the closure of schools and childcare centers, women also assumed a greater share of caregiving responsibilities, limiting their ability to participate in paid work. This resulted in what Fairlie et al. (2021) describe as the "COVID motherhood penalty," where women with young children faced greater job losses and reduced working hours, reversing decades of progress in gender equality in the labor market.

Studies by Collins et al. (2021) and Couch et al. (2021) documented a widening gender gap in labor force participation, as women were

more likely than men to reduce their working hours or leave the workforce entirely due to increased caregiving demands. This burden disproportionately affected women with young children, further entrenching economic disadvantages. Additionally, Güney-Frahm (2020) found that women were spending an average of 5.2 more hours per week on unpaid caregiving during the pandemic, compared to 3.5 additional hours for men, contributing to increased mental health strain for women. Etheridge and Spantig (2020) also reported that women experienced higher levels of stress, anxiety, and emotional strain, exacerbating gendered vulnerabilities in both the private and public spheres.

The mental health toll of the pandemic on women has also been significant. Etheridge and Spantig (2020) found that women reported higher levels of stress, anxiety, and emotional strain compared to men during the pandemic, mainly due to the increased burden of unpaid care work. The World Economic Forum (2021) also highlighted those women were more likely than men to report feelings of loneliness, frustration, and fear during the pandemic, further intensifying gendered vulnerabilities in both the private and public spheres.

In sum, the literature underscores the persistence of gender inequality across multiple domains despite improvements in women’s educational attainment. The COVID-

19 pandemic has deepened these disparities, particularly in the labor market, where women have faced greater job losses, reduced working hours, and increased caregiving responsibilities. To achieve long-term gender equality, policymakers must address occupational segregation, promote equal pay, and provide greater support for women in leadership and caregiving roles. Implementing these policies is essential for reducing the gender gap and ensuring sustainable development in Kazakhstan and globally.

### 3. METHODOLOGY

The methodology of this study involves several key steps, beginning with data preparation, analysis of key gender inequality indicators, application of clustering methods, and evaluation of the resulting clusters. The study spans data collected over the period from 2013 to 2023, sourced from official statistics provided by national statistical bureaus and international organizations such as the United Nations Development Programme (UNDP). The data include social and economic indicators related to gender inequality, such as political representation, educational attainment, labor force participation, wage disparities, and other relevant metrics (see Table 1 for details).

**Table 1.** Indicators used in the study

Indicator	Code	Unit
Social indicators		
Gender Inequality Index	GII	%
Maternal Mortality Rate (per 100,000 live births)	MMR	%
Adolescent Birth Rate (per 1,000 women aged 15-19)	ABR	%
Seats in Parliament (men)	SPM	%
Seats in Parliament (women)	SPW	%
Population (men, 15+ years, at least secondary education)	PSEM	%
Population (women, 15+ years, at least secondary education)	PSEW	%
Economic indicators		
Labor Force Participation (men)	LFP_M	%
Labor Force Participation (women)	LFP_W	%
Gender Wage Gap	GWG	%

*Note:* compiled by authors

The K-means clustering method was selected to categorize the data based on similarities between these indicators. K-means was chosen for its simplicity and efficiency in partitioning data into distinct groups or clusters with minimal computational complexity. The optimal number of clusters was determined using the Elbow Method, which indicated that three clusters would provide the most meaningful segmentation of the data.

Once the number of clusters was established, the data were divided into three groups, each characterized by different levels of gender inequality, maternal mortality, educational attainment, and wage gaps. Centroid calculations were performed for each cluster to define the average values of the indicators within each group, allowing for a clear comparison of cluster characteristics.

To assess the quality of clustering, statistical metrics such as the R-squared ( $R^2$ ) and Adjusted  $R^2$  were used to measure the variance explained by each cluster model. These metrics provided insight into how well the clusters represented the data. Additionally, the profiles of each cluster were analyzed and compared to understand their unique characteristics and disparities.

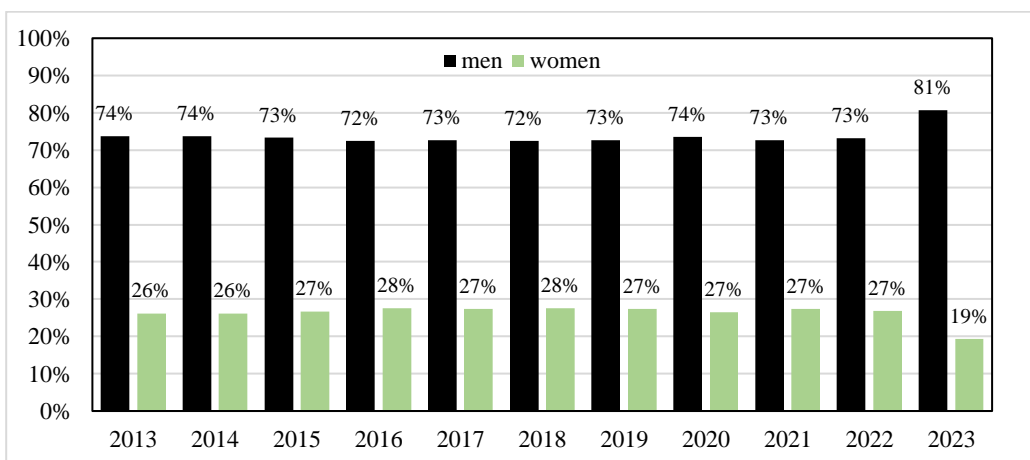
Visualization techniques such as radar charts (spider charts) were employed to display each cluster's average values of key indicators graphically. This helped to identify trends and

disparities in gender inequality across the different groups. The SPSS statistical software was used for all calculations, data analysis, and visualization, ensuring rigorous and accurate handling of the data throughout the study. This methodology enables a systematic analysis of gender inequality trends, offering insights into the specific areas where interventions and policy reforms are most needed to promote gender equality in Kazakhstan.

#### 4. ANALYSIS AND RESULTS

An analysis of the dynamics of gender equality in Kazakhstan based on indicators of the representation of men and women in the Mazhilis of Parliament and the proportion of the population with at least secondary education for the period from 2013 to 2023 reveals complex trends indicating ambiguous successes of the country's gender policy.

First, look at the indicators of women's representation in Parliament. The proportion of women remained at a consistently low level from 2013 to 2021, ranging from 26% to 28%. This slight increase, at most 2%, indicates the absence of significant changes to the rise in women's participation in the country's political life. It is important to note that in 2022 there was a slight decline in female representation to 27%, and in 2023 there is a sharp decrease in this figure to 19% (see Figure 1).



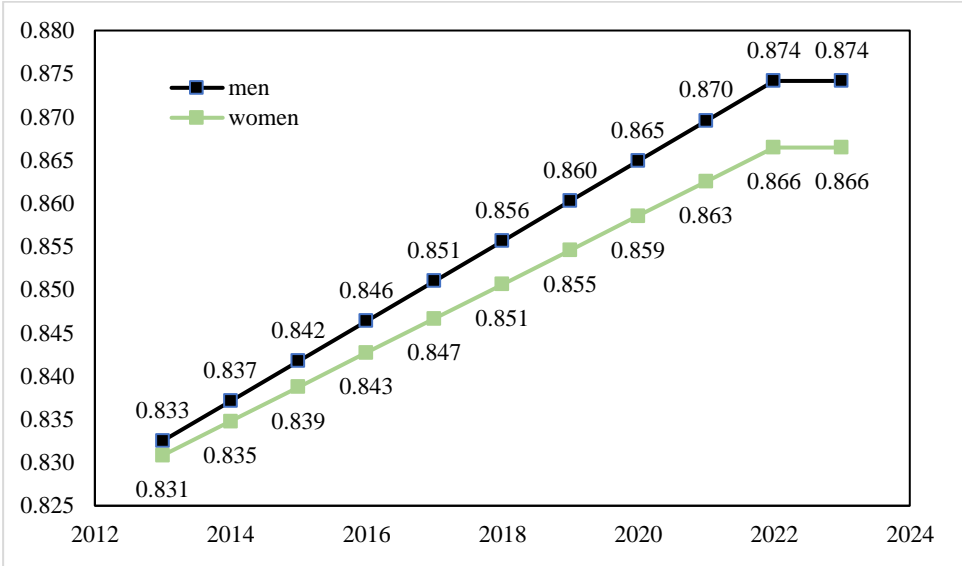
**Figure 1.** Seats in the majilis of the parliament for 2013-2023, %

*Note:* compiled by authors based on data from the Bureau of National Statistics (2023)

Such a decline requires special attention, as it indicates a possible reduction in interest or opportunities for women to actively participate in political processes against the background of political changes in the country. This negative trend contrasts with the increase in male representation, which reached 81% in 2023, indicating an increasing gender imbalance in the legislature.

Secondly, the data show a positive trend regarding education access. In 2013, the % of men with at least secondary education were 83.3%, and women - 83.1%.

This figure has gradually increased throughout the period, and by 2023, it reached 87.4% for men and 86.6% for women (Figure 2).



**Figure 2.** Percentage of the population aged 15 and over with at least secondary education for 2013-2023

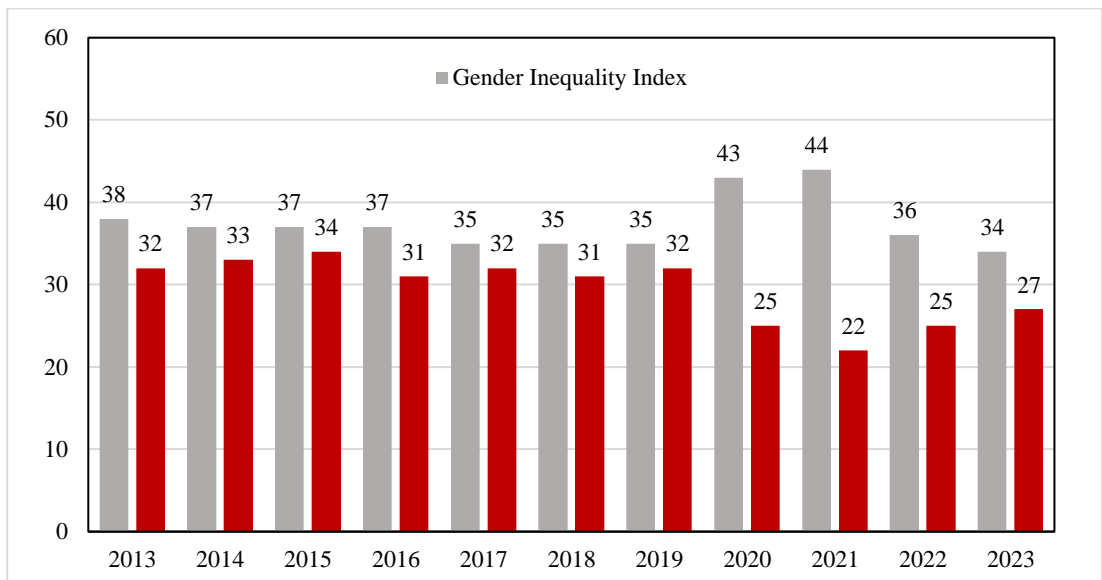
*Note:* compiled by authors based on data from the Bureau of National Statistics (2023)

This trend indicates that Kazakhstan is progressing in educational policy to ensure equal access for men and women to primary and secondary education. It is important to note that the difference in the level of education between men and women remains minimal, which underlines the relative equality in this area.

Despite this, inequalities in other areas, such as politics and economics, remain significant, indicating a lack of integration of women's educational achievements into different public and political life aspects.

Summarizing the above, it can be concluded that, despite progress in improving education among men and women, gender equality

indicators in the political sphere show regressive trends. This indicates the need for a more active and targeted public policy to eliminate gender imbalances in the political and economic spheres. In particular, attention should be paid to introducing mechanisms to encourage women's participation in politics, such as quotas for seats in legislative bodies and expanding vocational training and support programs for women, especially in rural regions. The successful implementation of such measures will not only increase the level of gender equality but also contribute to sustainable economic growth and social harmony in the country. Furthermore, Figure for GII and gender wage gap dynamics.



**Figure 3.** Dynamics of the gender inequality index and the gender wage gap for 2013-2023, %

*Note:* compiled by authors based on data from the Bureau of National Statistics (2023)

The analysis of the dynamics of the Gender Inequality Index and the Gender pay gap in Kazakhstan from 2013 to 2023 reveals complex and ambiguous trends indicating existing problems and challenges in the field of gender policy. First, it is necessary to note the stability of the Gender Inequality Index at the level of 35-38% during 2013-2019. These values indicate no significant changes in gender equality indicators during this period, suggesting no substantial progress in combating gender inequality. It is important to emphasize that such stability, in the absence of positive dynamics, reflects the inertia of the existing system and the need for more active government intervention to eliminate structural imbalances.

The sharp increase in the Gender Inequality Index in 2020 and 2021 to 43% and 44%, respectively, indicates a significant deterioration in the gender situation. This increase may be related to the impact of the COVID-19 pandemic, which is known to have disproportionately affected the position of women in society, especially in areas such as

employment, access to resources, and participation in public life. The pandemic has exacerbated existing inequalities and has left women in a more vulnerable position in conditions of economic and social instability. In this context, the observed increase in the Gender Inequality Index requires an analysis of the causes and the development of targeted measures to offset these negative consequences.

In 2022 and 2023, there is a decrease in the Gender Inequality Index to 36% and 34%, respectively, which may indicate the beginning of the process of recovery and partial stabilization of gender indicators in the country. However, despite this progress, it is worth noting that the level of gender inequality in 2023 remains higher than in previous years (until 2019), which underlines the need to continue working in this direction to achieve long-term improvement in gender equality indicators.

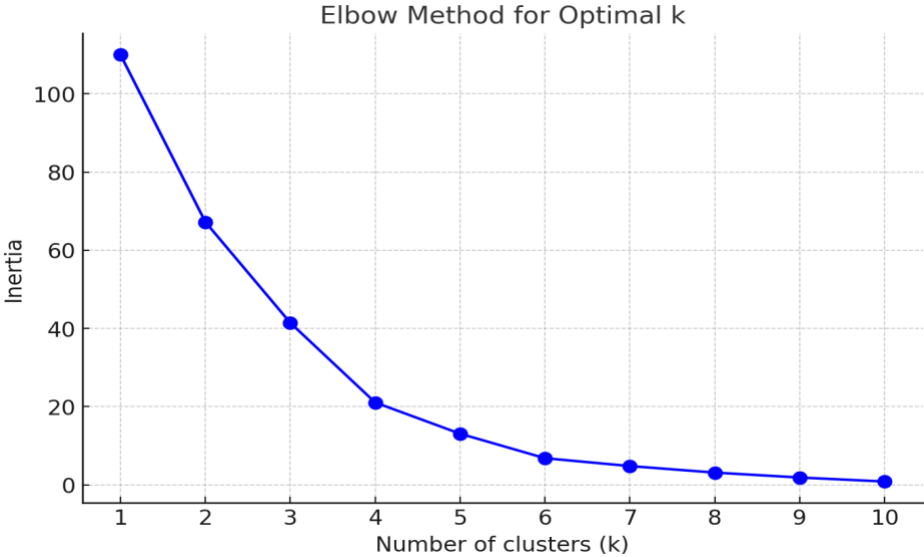
The gender pay gap, which is also an important indicator of gender inequality, shows similar dynamics. Between 2013 and

2019, the pay gap between men and women ranged from 31% to 34%, indicating stable but high wage inequality. This suggests that, despite the declared measures to eliminate wage discrimination, the practical implementation of these initiatives still needs to be improved to ensure equal earnings. Notably, a significant wage gap was observed in 2020, when this indicator decreased to 25%, and in 2021 reached a minimum value of 22%. This decrease may be due to economic measures taken in response to the pandemic and temporary changes in the labor market, which may have contributed to the decline in wage discrimination. However, starting in 2022, the wage gap begins to widen again, reaching 27% in 2023. This trend indicates that the earlier progress was temporary, and

structural problems of gender pay inequality exist.

Summarizing the analysis's results, it can be concluded that, despite some positive developments, Kazakhstan faces severe challenges in gender policy, especially in terms of eliminating inequality in the political and economic spheres. The observed increase in the Gender Inequality Index, combined with the renewed growth of the wage gap, underscores the need to develop new and more effective public policy mechanisms aimed at overcoming gender barriers and creating conditions for equal participation of women in public life and the country's economy.

Next, cluster analysis was considered, and to determine the number of clusters, the Elbow Method Optimal K was used (Figure 4).



**Figure 4.** Elbow Method Optimal K

*Note:* compiled by authors based on calculations

The Elbow method assumes that the optimal number of clusters is 3 or 4, at which the decrease in inertia (the sum of squares within the cluster) begins to slow down significantly. Based on this, 3 clusters were used for the K-means algorithm. The cluster analysis divided the data into three groups (clusters) based on indicators related to gender inequality and related social factors:

Cluster 0: This group includes facilities with the lowest level of gender inequality, the lowest rates of maternal mortality, and the lowest rates of teenage fertility. The wage gap is moderate here.

Cluster 1: In this group, we see higher teen birth rates and a more significant wage gap between men and women. Although gender inequality is slightly higher here, this group



requires special attention in the context of equal pay.

Cluster 2: This group has the highest maternal mortality rates and a higher level of

gender inequality. However, the wage gap is lower here than in cluster 1.

The visualization of the 3 clusters can be seen in Figure 5.

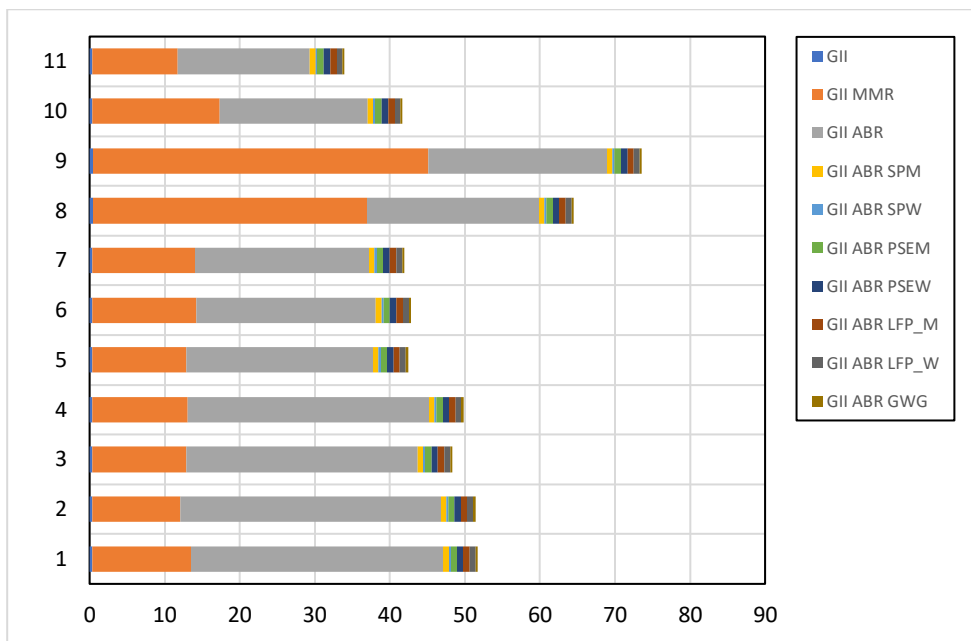


Figure 5. Cluster characteristics radar chart

Note: compiled by authors based on calculations

The cluster analysis reveals important insights into the various dimensions of gender inequality by grouping indicators based on socio-economic factors. Main conclusions:

1. Cluster 0 is the least problematic group from the point of view of gender equality, and it demonstrates the most positive indicators on critical indicators. This cluster is characterized by positive performance across several key indicators. Specifically, it exhibits a lower gender wage gap, high levels of female participation in education and employment, and significant representation of women in political and decision-making roles.

2. Cluster 1 is characterized by a significant wage gap and a high teenage birth rate, which indicates the need to improve women's rights in the workplace and reproductive health. The wage gap in Cluster 1 is substantial, underscoring persistent issues of economic inequality. Women in these regions

face considerable barriers to equal pay and career advancement. Despite some improvement in gender equality relative to other groups, Cluster 1 requires special attention in the context of closing the wage gap and improving reproductive health services.

3. Cluster 2 shows that high maternal mortality and gender inequality remain a serious problem, although the wage gap is smaller than in Cluster 1. High maternal mortality rates often reflect systemic deficiencies in healthcare infrastructure, which disproportionately impact women. Interestingly, despite the severe social and health disparities, Cluster 2 exhibits a somewhat smaller wage gap than Cluster 1. This suggests that while economic inequality remains an issue, it is not as pronounced in this cluster as in others.

The analysis provided an opportunity to understand better how different factors of

gender inequality are interrelated and showed which groups need priority measures to improve women's status.

Cluster analysis grouped indicators based on social and economic factors, which made it possible to trace which groups (clusters) experience more pronounced gender inequality. Thus, clusters with high MR and ABR scores and high representation of women in political life tend to show significant social disparities.

Clusters with significant employment gaps and low levels of women's participation in the workforce indicate more profound economic inequality.

Analyzing these social and economic factors reveals the relationship between the social and economic aspects of gender inequality. It shows how differences in one area (for example, health care) may reflect broader systemic problems that manifest in the economy (for example, differences in wages and labor force participation). The results of the analysis allow policymakers to plan activities more effectively.

## 5. CONCLUSIONS

The purpose of this study was to analyze gender inequality in Kazakhstan in the period from 2013 to 2023 using a cluster approach to identify regional differences in socio-economic development indicators. A literature review has shown that, despite advances in education and health, significant gender gaps persist in women's political participation and economic opportunities. Structural barriers, such as patriarchal norms and restrictions on access to high-level positions, which continue to hinder the full integration of women into economic and political life, were discussed.

The study results showed that although there is an increase in access to education in Kazakhstan, significant differences remain in wages and political representation. The cluster analysis identified three regions: the most prosperous cluster regarding gender equality (Cluster 0) and areas with high levels of wage

inequality and maternal mortality (Clusters 1 and 2). The most significant problems were identified in the economic sphere and women's participation in political decision-making. The results show that while Kazakhstan has made strides in improving women's access to education and reducing some forms of inequality, key areas such as wage parity and political participation still require substantial improvements. The clustering analysis identified groups with varying levels of gender inequality, helping to pinpoint where targeted interventions are most necessary.

In conclusion, the analysis of gender inequality in Kazakhstan from 2013 to 2023 reveals persistent disparities despite specific progress in education and access to healthcare. The study highlights significant gaps in political representation and wage equality, with women consistently underrepresented in decision-making positions and earning considerably less than men. The results show that while Kazakhstan has made strides in improving women's access to education and reducing some forms of inequality, key areas such as wage parity and political participation still require substantial improvements. The clustering analysis identified groups with varying levels of gender inequality, helping to pinpoint where targeted interventions are most necessary.

Addressing these inequalities requires the development of more effective public policy mechanisms to remove structural barriers to women's political and economic participation. Existing measures, such as vocational training programs and social support, should be strengthened and adapted to the specific needs of various social and demographic groups, especially in rural areas.

Based on the analysis, the following recommendations on public policy are given:

First, one key measure to increase women's political participation is the introduction of mandatory gender quotas in representative government bodies. Countries with successful gender equality policies have shown that quotas are an effective tool for increasing the number of women in politics and decision-

making. Kazakhstan should consider setting quotas at both the national and regional levels.

Second, the gender pay gap remains a significant problem, and comprehensive measures are needed to overcome it. The State should develop and implement mechanisms for monitoring the implementation of equal pay standards. This may include regular audits of companies on compliance with wage equality standards, the publication of reports on compliance with gender standards, and the creation of financial incentives for enterprises actively promoting gender equality policies.

Third, the development of women's entrepreneurship can become an essential factor in the fight against gender inequality. The state should set up programs to support women entrepreneurs by offering financial assistance, preferential loans, and advisory

services. Particular attention should be paid to women in rural areas where opportunities for entrepreneurship and access to economic resources are limited.

Furthermore, to address these inequalities, developing more effective public policy mechanisms that focus on eliminating structural barriers to women's political and economic participation is crucial. Policy interventions such as introducing gender quotas in legislative bodies, promoting equal pay initiatives, and expanding vocational training for women, particularly in rural areas, will bring these gaps. Continued efforts to reduce gender inequality will foster greater social justice and promote sustainable economic growth and social cohesion in Kazakhstan.

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## AUTHOR BIOGRAPHIES

\***Akbota G. Anessova** – PhD candidate, Eurasian Technological University, Almaty, Kazakhstan. Email: [a\\_bota@mail.ru](mailto:a_bota@mail.ru), ORCID ID: <https://orcid.org/0000-0003-1102-1803>

**Abzal S. Bekbossinov** – Master of Technical Sciences, Inter Service LLP. Email: [abzal\\_kerei@mail.ru](mailto:abzal_kerei@mail.ru), ORCID ID: <https://orcid.org/0009-0003-1271-2339>

**Bizhamal A. Abdullayeva** – Cand. Sc. (Econ.), Associate Professor, Narxoz University, Almaty, Kazakhstan. Email: [bizhamal.abdullaeva@narxoz.kz](mailto:bizhamal.abdullaeva@narxoz.kz), ORCID ID: <https://orcid.org/0000-0002-5392-0594>