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Article

Expert Assessment of The Economic and Ecological Situation of The Khoresm Region Based on Questionnaires

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Abstract: In the article In order to study the Khorezm region regionally and assess the economic and environmental development of the region, questionnaires were conducted, and studies were conducted to assess the situation expertly. Also, the questionnaires were analyzed by online survey in the regions. As a result of the studies, proposals and recommendations were made for the economic, environmental and social development of the region.

Keywords: : region, questionnaires, expert assessment method, expert groups, degree (color) matrix, modified degree (color) matrix, Concordance coefficient, quantitative limits

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1. Introduction

Sustainable development of the regions of our country has become a modern requirement. In particular, along with the development of sectors and industries in the region, it is also important to study the impact of regionally individual industrial enterprises, agriculture, and service activities on the economy and the environmental situation, as well as to constantly assess the situation.

Goal 91 of the Decree of the President of the Republic of Uzbekistan No. PF-158 dated September 11, 2023 on the "Uzbekistan - 2030" strategy specifically emphasizes the implementation of tasks such as "Strengthening cooperation in various priority areas in the region, in particular, ecology and nature protection, rational use of water resources, and further development of transport and communication infrastructure" [1].

Based on the tasks set out in the "Uzbekistan - 2030" strategy, it is necessary to set priorities for the development of the regions of our country, develop measures for the rational use of economic and environmental resources in the regions, in particular, international cooperation in the areas of nature protection, efficient use of water resources, and further development of transport and communication infrastructure in the regions.

According to Resolution No. 154 of the Cabinet of Ministers of the Republic of Uzbekistan dated April 4, 2022 “On additional measures for the comprehensive socio-economic development of the territories of the Khorezm region and further improvement of the living standards of the population in 2022-2026”, the tasks of ensuring economic growth of the Khorezm region, reducing poverty, creating new jobs, developing entrepreneurship, and paying special attention to construction and ecology and greening issues in the region were set [2].

2. Materials and Methods

In this research work, questionnaires were conducted to study the Khorezm region regionally and assess the state of economic and ecological development of the region, and

conclusions were drawn as a result of expert assessment of the situation. As a result of the conducted questionnaires, proposals and recommendations were made on the introduction of the Khorezm region into regional state programs for economic and ecological development.

Literature review.

The questionnaire method first appeared in psychology. The questionnaire method was first introduced in psychology by the English scientist F. Galton in his research to study the sources of mental traits. Also, researchers such as psychologists S. Hall, A. Binet, GM Andreeva, E. Noel used the practical technology of questionnaires [3].

According to the ideas presented in U. Khudaiberdiev's research, "In observation through questionnaires, special questionnaires (questionnaires) are given to a certain circle of individuals or are published in the press. Answering these questionnaire questions is voluntary and is often used to determine public opinion on certain events" [4].

SRYuldashev also highlighted in his research the need to pay special attention to the following when conducting questionnaires, taking into account the number of respondents:

a. Individual questionnaire survey (conducting a questionnaire survey with one respondent, that is, each citizen separately);
b. Group questionnaire survey (conducting a survey with several (up to 100) respondents at the same time);
c. Mass questionnaire survey (involving more than one hundred respondents in a questionnaire survey) [5].

3. Result

It is important to ensure the effective implementation of the tasks set out in strategic programs and regionally developed regulatory and legal documents for the development of regions. Therefore, in order to study the economic and environmental situation of the Khorezm region, surveys based on questionnaires and expert assessments of the state of economic and environmental development were carried out based on monographic observations.

The main goal of studying the economic and ecological development of regions through questionnaires and assessing the situation is to identify economic and environmental problems in the region, to provide proposals and recommendations aimed at solving problems in the development of regional programs, and to improve the economic and ecological situation of the region.

In order to assess the economic and environmental situation of the Khorezm region, the object of our study, online and offline questionnaires were conducted among the population using digital programs. As of December 1, 2024, as a result of the questionnaires conducted by the region, the largest number of respondents was 52 from the city of Urgench, 28 from the city of Khiva, and 22 from the Khiva district, while the smallest number of respondents was from the Tuproqqala district (Figure 1).

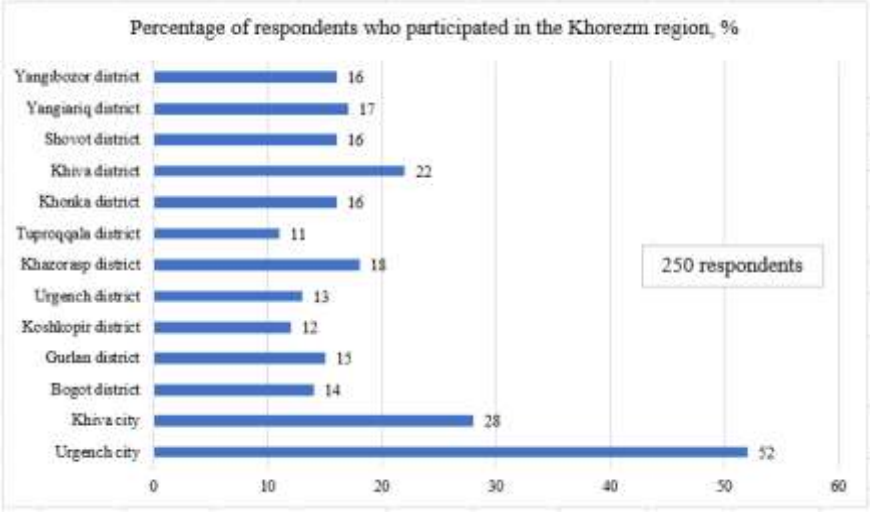
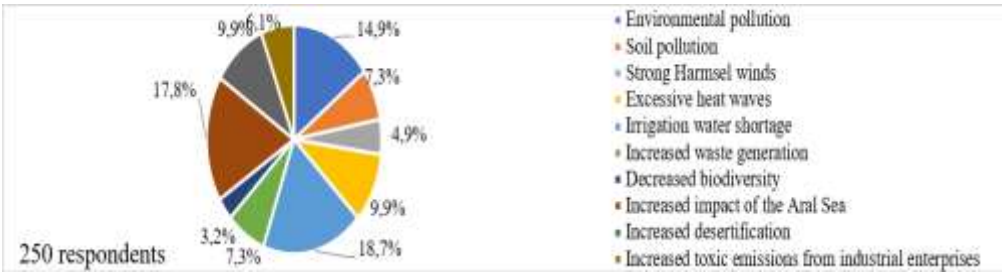


Figure 1. Share of respondents who participated in questionnaires in the Khorezm region by district, %

The respondents' opinions were studied based on 18 questionnaires on the study of factors affecting the economic and ecological state of sustainable development of the Khorezm region. In particular, when respondents were asked what environmental problems are bothering you in your region? - the most frequently asked questions were: 18.7% of respondents expressed their opinions on the shortage of irrigation water in the region, 17.8% on the increasing impact of the Aral Sea from year to year, 14.9% on the increasing level of environmental pollution, 9.9% on the increasing problems associated with excessive heat and desertification. 3.2% of respondents also noted that they were concerned about the loss of biodiversity in the region (Figure 2).



2. Level and share of environmental problems occurring in the Khorezm region (in %)

As a result of a survey conducted in the study area, respondents were asked how they would like to receive information about environmental hazards in the region. 80.1% of respondents expressed their opinion that the information should be simple and understandable, 12.1% that it should be sent to personal contact numbers via SMS, and 12.1% that the information should be delivered to the addressee via communication services. However, 0.3% of respondents concluded that it would be appropriate to deliver information through various electronic platforms (Figure 3).

Along with the economic development of the region, it is also important to protect the ecosystem. However, the increase in the volume of various emissions into the atmosphere by industrial enterprises in the region and the annual increase in the volume of waste discharged into the environment by the population are causing the ecological situation in the region to deteriorate.

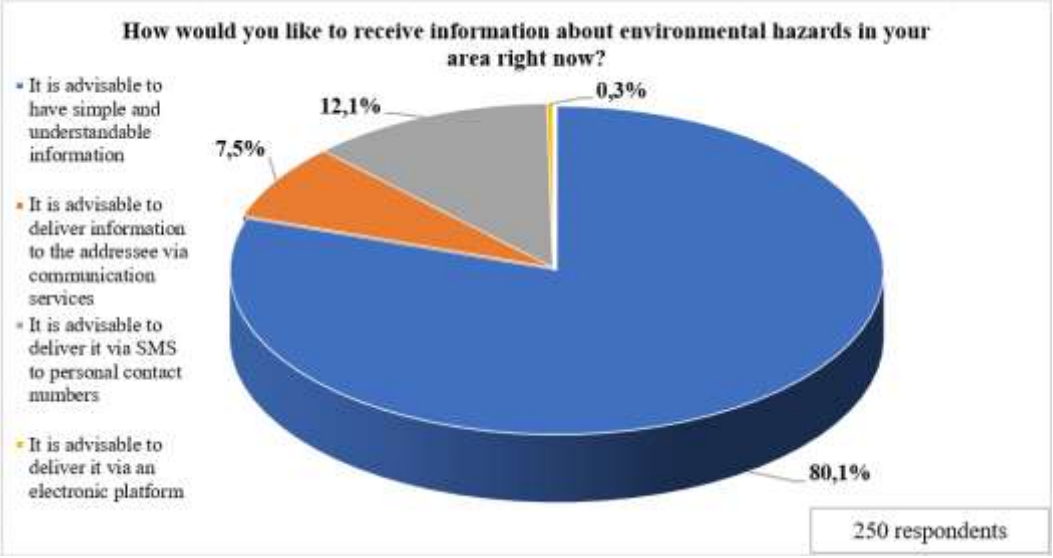


Figure 3. Share of convenience in providing information about environmental hazards to the population in the Khorezm region (in %)

The study studied the economic and ecological situation in the Khorezm region, identified existing problems and developed a number of scientific proposals for their solutions, that is, for the sustainable economic and ecological development of the region. In particular, for the sustainable economic and ecological development of the region, the proposal "To hold enterprises that contribute to the deterioration of the ecological situation in the region financially responsible in proportion to their impact and to establish an effective mechanism for encouraging them in the opposite case" is one of them.

To scientifically substantiate this proposal, the opinions of industry experts were studied, and the conclusions were evaluated based on the "Expert Evaluation" method.

responsible in proportion to their impact and to establish an effective mechanism for encouraging them in the opposite case" developed for the economically and environmentally sustainable development of the region:

1. To provide incentives to private enterprises over state-owned enterprises in increasing regional economic stability and achieving regional economic growth;
2. Monitoring the environmental damage caused by enterprises operating in the region and economically assessing the impact of the identified damage;
3. Establish an effective mechanism for holding enterprises that contribute to the deterioration of the environmental situation in the region financially responsible in proportion to their impact and, conversely, for encouraging them to do otherwise;
4. Specialization of agricultural crops in the production of agricultural products in the region, based on the climatic conditions of the region.

Table 1. Points given by experts to the proposals developed for the economically and environmentally sustainable development of the Khorezm region

No.	Proposals under evaluation	Experts				
		1	2	3	4	5
1.	To provide incentives to private enterprises over state-owned enterprises in increasing regional economic stability and achieving regional economic growth	2	2	1	2	4
2.	Monitoring the environmental damage caused by enterprises operating in the region and assessing the economic impact of the identified damage	3	3	4	3	2
3.	Establish an effective mechanism for holding enterprises that contribute to the deterioration of the environmental	5	4	5	5	5

	situation in the region financially responsible in proportion to their impact and, conversely, for encouraging them to do otherwise.					
4.	Specialization of agricultural crops in the cultivation of agricultural products in the region, based on the climatic conditions of the region	4	5	3	4	3

The above proposals were presented to a group of experts consisting of leading specialists in the field to select the best option (i.e., to scientifically substantiate the main proposal option (the third proposal)).

The experts were asked the main question: "Which of the following measures is considered effective for the economically and environmentally sustainable development of the Khorezm region?"

To evaluate the experts' answers to this question, a "5"-point evaluation criterion was adopted, and four proposals developed by the experts for the economically and environmentally sustainable development of the Khorezm region were evaluated (Table 1).

As is known, in the process of applying the expert assessment method, the main attention is paid to issues such as quantitative selection of experts and formation of expert groups, assessment of their level of competence, determination of the level of consensus of experts' decisions, processing of information by experts and making specific decisions based on the results obtained.

Based on the survey data, a general rank (color) matrix and a summary rank (color) matrix are constructed (Table 2).

Table 2 . Level (color) matrix

Expert/ Offer	1st exp.	2nd exp.	3rd exp.	4th exp.	5th exp.	Total levels (colors)	d	d^2
1	1	1	1	1	3	7	-5 , 5	30 , 25
2	2	2	3	2	1	10	-2 , 5	6 , 25
3	4	3	4	4	4	19	6 , 5	42 , 25
4	3	4	2	3	2	14	1 , 5	2 , 25
Σ	10	10	10	10	10	50		81 .0

In expert evaluation, the "consensus of expert opinion" is of great importance. To assess the degree of consensus of expert opinion, Kendall's "Concordance Coefficient" is used:

$$W = \frac{12S}{m^2\left(n^3 - n\right)} \quad (1)$$

where, *W* is the concordance coefficient , *m* is the number of experts, *n* is the number of objects, and *S* is the quantitative value of the concordance coefficient.

$$S = \sum_{i=1}^{m}\left(\sum_{j=1}^{n} r_{ij} - \bar{r}\right)^2 \quad (2)$$

where, r_{is} the rating or color given to the *i*- object by *the j -expert.*

To assess the quality of the level of agreement of expert opinions, it is recommended to use the following Harrington verbal-numerical scale (Table 3).

Table 3. Evaluation criteria for the concordance coefficient

No.	**Quantitative limits**	**Levels of consensus of expert opinion**
1	$0 \le W < 0{,}2$	Compatibility is very low
2	$0{,}2 \le W < 0{,}3$	Low compatibility
3	$0{,}3 \le W < 0{,}6$	Compatibility is medium.

No.	Quantitative limits	Levels of consensus of expert opinion
4	$0,6 \le W < 0,8$	Compatibility is high.
5	$0,8 \le W \le 1,0$	Compatibility is very high.

To assess the significance of the concordance coefficient, Pearson's goodness-of-fit χ^2 - criterion is adopted. *The* χ^2 - distribution takes the following value with *j = n -1 degrees of freedom:*

$$\chi^2 = \frac{12S}{mn(n+1)} = n(m-1)W \quad (3)$$

If $\chi^2_{his} > \chi^2_{jad}$ so, the level of consensus of expert opinion is reasonable, otherwise such consensus is considered insignificant.

Using the above formula, the degree of agreement of experts' opinions, that is, the concordance coefficient (W), is calculated. In this process, the number of experts selected $m = 5$ is ta and the number of objects being evaluated $n = 4$ is ta.

$$W = \frac{12 \cdot 81}{5^2(4^3 - 4)} = 0,648$$

The results of the analysis showed that the level of agreement (W), that is, the concordance coefficient, of the experts' opinions on the directions was 0.648, which corresponds to the fourth-order quantitative limit of Harrington's verbal-numerical scale , and the experts' decision was assessed by the criterion "High level of agreement".

is assessed by Pearson's correlation coefficient (χ^2).

$$\chi^2 = 5 \cdot (4-1) \cdot 0,648 = 9,72$$

According to the results of the Pearson correlation coefficient evaluation, $\chi^2_{his} = 9,72$ ($\chi^2_{jad} = 7,82$) is equal to , $\chi^2_{his} > \chi^2_{jad}$ which satisfies the condition. Therefore, the level of agreement of the experts' opinions is reasonable.

the expert ratings or color $S_{ij} = X_{\max} - X_{ij}$ formula, a modified level matrix is constructed (here, $X_{\max} = 5$). That is, the decision of the expert group is prepared (Table 4).

Table 4. Modified level (color) matrix

No.	Proposals under evaluation	Experts					Σ	Decisio n weight
		1	2	3	4	5		
1.	To provide incentives to private enterprises over state-owned enterprises in increasing regional economic stability and achieving regional economic growth	3	3	4	3	1	14	0.4516
2.	Monitoring the environmental damage caused by enterprises operating in the region and assessing the economic impact of the identified damage	2	2	1	2	3	10	0 , 3226
3.	Establish an effective mechanism for holding enterprises that contribute to the deterioration of the environmental situation in the region financially responsible in proportion to their impact and, conversely, for encouraging them to do otherwise.	0	1	0	0	0	1	0 , 03226
4.	Specialization of agricultural crops in the production of agricultural products in the region, based on the climatic conditions of the region	1	0	2	1	2	6	0 , 1935
Total:							**31**	**1**

Above, the weighting indicators of the parameters considered are calculated based on the sum of the levels (colors), whereby the evaluation object with the smallest weight is accepted as the proposal with the highest rating.

4. Discussion

The findings of this study indicate a pressing need to balance economic growth and environmental sustainability in the Khorezm region. The analysis of questionnaire responses revealed that water scarcity, pollution, and desertification are perceived as the most critical ecological challenges by local respondents. This aligns with global trends in arid regions, where climate change and unsustainable land use practices exacerbate environmental degradation. Moreover, the low biodiversity concern among respondents (3.2%) suggests a potential gap in ecological awareness, highlighting the importance of public education campaigns alongside environmental policy reforms. The expert evaluation method further underscored the necessity of holding polluting enterprises accountable, as this measure received the highest rating for its potential to address ecological decline while promoting responsible industrial practices. The high level of expert agreement, confirmed by a Kendall's W coefficient of 0.648 and validated through Pearson's chi-square test, strengthens the reliability of this conclusion. Additionally, the preference for receiving ecological information via simple and accessible means (e.g., SMS and public communication channels) suggests that any policy intervention should be complemented with targeted information dissemination strategies. Collectively, the integration of community insights and expert assessments provides a robust foundation for formulating regional development strategies that are both inclusive and evidence-based.

5. Conclusion

In conclusion, the points given by experts to the proposal "To hold enterprises that contribute to the deterioration of the ecological situation in the region financially responsible in proportion to their impact and to establish an effective mechanism for encouraging them in the opposite case" among the measures proposed for the sustainable economic and ecological development of the Khorezm region confirm the high level of consensus among experts. Therefore, this proposal is considered scientifically sound.

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