



MANAGEMENT MODEL FOR EFFICIENT USE OF NATURAL-ECONOMIC RESOURCES IN KASHKADARYA REGION

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ABSTRACT

This study develops and validates a comprehensive management model for efficient utilization of natural-economic resources in the Kashkadarya region of Uzbekistan. The research analyzes resource management practices across five key districts of the region over the 2020–2023 period, examining agricultural land, mineral resources, and water resource management systems. Using a multi-criteria evaluation framework combining GIS spatial analysis, stakeholder surveys (n=180), and institutional performance assessment, the study identifies significant variation in management effectiveness across districts and resource categories. The proposed Regional Resource Management Model integrates strategic planning, operational monitoring, stakeholder coordination, and performance evaluation components, demonstrating effectiveness improvements of 68–84% in pilot implementation sites. The research contributes region-specific management tools adaptable to comparable resource-rich regions of Central Asia.

Introduction

Kashkadarya region, located in south-central Uzbekistan, represents one of the country's most resource-rich territories, encompassing significant agricultural land (approximately 1.8 million hectares), major mineral deposits including natural gas, sulfur, and construction materials, and complex water management systems fed by the Kashkadarya River and its tributaries [1]. The effective management of these natural-economic resources is critical not only for regional economic development but also for national food and energy security.

Despite its resource endowment, Kashkadarya faces significant management challenges including agricultural land degradation affecting approximately 23% of cultivated area, water use efficiency rates below 65% in irrigation systems, and sub-optimal extraction practices in the mineral sector [2]. The regional administration's 2021–2025 Development Program establishes resource efficiency improvement as a central priority, targeting 30% efficiency gains across major resource categories by 2025.

This study aims to develop and validate a comprehensive management model for natural-economic resource efficiency in Kashkadarya. The research objectives are: (1) to assess current resource utilization levels and trends across key districts; (2) to evaluate the effectiveness of existing management mechanisms; (3) to identify best practices from high-performing districts; and (4) to propose an integrated regional resource management model.

Literature review

Regional natural resource management is a well-developed field drawing from environmental governance, regional economics, and public administration theory. Ostrom's (1990) groundbreaking work on governing the commons established that local communities can develop effective self-governance institutions for common-pool resources, challenging both market and centralized state management paradigms [3]. Her polycentric governance framework has since been extensively applied in water, forest, and rangeland management contexts globally.

In Central Asian contexts, resource management challenges are particularly acute given the legacy of Soviet-era extensive resource use patterns. Wegerich (2020) analyzed water governance transformation in Central Asia and identified institutional fragmentation, misaligned incentives, and information asymmetries as the primary barriers to efficient water management [4]. His research recommends integrated basin management approaches that align administrative, hydrological, and economic boundaries.

Regarding Uzbek regional resource management specifically, Karimov and Umarov (2022) examined agricultural land management reforms in Surkhandarya and Kashkadarya regions and found that market-oriented land use reforms improved land productivity by 28% over five years, while poorly designed deregulation led to land degradation in some districts [5]. Their finding underscores the importance of context-specific management models rather than universal frameworks.

Research methodology

This study employs an integrated multi-method approach combining GIS spatial analysis of resource distributions, quantitative assessment of management performance indicators, and qualitative stakeholder analysis. Research was conducted across five key districts of Kashkadarya — Shahrizabz, Kitob, G'uzor, Muborak, and Dehqonobod — over 2020–2023.

Primary data were collected through structured surveys of 180 resource managers, enterprise directors, and local government officials, supplemented by 24 in-depth interviews with key informants. Secondary data sources included the Regional Statistics Department databases, satellite imagery analysis for land use mapping, and water management agency records. The Multi-Criteria Decision Analysis (MCDA) framework was used to develop composite resource management effectiveness scores for each district and resource category.

Analysis and results

Table 1 presents key natural resource utilization indicators for Kashkadarya region over the study period, demonstrating measurable efficiency improvements.

Table 1. Natural Resource Utilization Indicators in Kashkadarya Region (2020–2023)

Resource Indicator	2020	2021	2022	2023
Agricultural land productivity (mln UZS/ha)	28.4	31.6	35.8	41.2
Mineral extraction efficiency (%)	61.2	63.8	67.4	71.6
Water use efficiency (irrigation, %)	52.4	55.7	59.3	64.8
Renewable energy share (%)	8.2	11.4	15.6	21.3

Source: Kashkadarya Regional Statistics Department; Authors' calculations

The data demonstrate substantial progress across all resource categories. Agricultural land productivity increased by 45.1% over four years, mineral extraction efficiency improved by 10.4 percentage points, water use efficiency grew from 52.4% to 64.8%, and the share of renewable energy nearly tripled from 8.2% to 21.3%. These improvements, while significant, still fall short of regional development targets, indicating continued need for management system strengthening.

Table 2 presents the structural components of the proposed Regional Resource Management Model and their assessed effectiveness in pilot implementation sites.

Table 2. Components of Regional Natural Resource Management Model

Management Component	Responsibility Level	Key Tools	Monitoring Freq.	Effectiveness (%)
Strategic Planning	Regional Gov.	GIS, Forecasting	Annual	72%
Operational Monitoring	District Level	IoT Sensors	Daily/Weekly	84%
Stakeholder Coordination	Multi-Level	Digital Platforms	Quarterly	68%
Performance Evaluation	Regional Gov.	KPI Dashboards	Monthly	79%

Source: Authors' design based on research findings; pilot effectiveness data from 2023–2024

Operational monitoring demonstrates the highest effectiveness (84%) among management model components, reflecting the high value of real-time data for resource managers. Strategic planning effectiveness (72%) reflects the challenges of long-term planning in volatile environmental and market conditions. The relatively lower effectiveness of stakeholder coordination (68%) highlights the persistent challenge of aligning diverse interests across government agencies, enterprises, and local communities.

Table 3 presents comparative resource management performance scores for the five studied districts.

Table 3. Resource Management Performance Scores by District (Scale 1–10, 2023)

District	Agricultural Score	Mineral Score	Water Score	Overall Score
Shahrisabz	7.4	6.8	7.1	7.1
Kitob	7.1	7.4	6.8	7.1
G'uzor	6.4	7.8	6.2	6.8
Muborak	5.8	8.4	5.9	6.7
Dehqonobod	7.8	5.6	7.4	6.9

Source: Authors' MCDA calculations based on survey and secondary data

Shahrisabz and Kitob districts demonstrate the strongest overall resource management performance (both scoring 7.1), while Muborak shows the highest mineral resource management score (8.4) reflecting the district's mature natural gas management infrastructure. Dehqonobod leads in agricultural resource management (7.8), consistent with its strong agricultural extension service tradition. These district variations provide valuable learning opportunities for knowledge transfer within the region.

Conclusions And Recommendations

The research demonstrates that Kashkadarya region has achieved significant natural resource management improvements over 2020–2023, but substantial efficiency gaps remain compared to regional development targets. The proposed Regional Resource Management Model, integrating four core components of strategic planning, operational monitoring, stakeholder coordination, and performance evaluation, demonstrates strong effectiveness potential (68–84% effectiveness in pilot sites) and provides a practical framework for systematic resource management improvement.

The study recommends: (1) scaling the pilot management model to all 14 districts of Kashkadarya, with the G'uzor and Muborak districts prioritized for agricultural and water management improvement respectively. (2) Establishing a regional Resource Management Information System integrating real-time IoT data from monitoring networks across all resource categories. (3) Creating a dedicated Regional Resource Efficiency Fund using a portion of mineral extraction revenues to finance agricultural land improvement and water infrastructure investments. (4) Implementing annual inter-district resource management performance ratings to stimulate healthy competition and knowledge sharing.

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