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Analysis of the Driving Forces Influencing Urban Water Crisis Management from a Sustainability Perspective (Case Study: Ilam City)

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Abstract

Background and Objective: Water crisis management in arid and semi-arid cities, including Ilam, is considered one of the critical and complex challenges due to resource limitations, increasing urban population, and climate change. This study uses an exploratory-analytical approach based on the Mactor model to identify and analyze the role and impact of actors, convergence of goals, and key drivers of water crisis management.

Methodology: In this study, a combination of qualitative and quantitative methods was used; semi-structured interviews with experts in the fields of water, environment, urban management, and local governance led to the identification of actors and macro- and micro-goals of water crisis management, and quantitative data was supplemented through impact-dependency matrices and convergence of goals.

Results and Findings: The findings showed that the Ilam water crisis management network has a clear hierarchy and specific roles of subordinate, intermediary, and strategic actors. Urban consumers have a subordinate and limited role, executive companies are mediators and coordinators, and Ilam Governorate and Water Resources Management have a strategic and determining role. The net distance map between goals indicates high convergence between legal, executive, and participatory goals, and the net distance map between actors allows for the identification of potential coalitions and points of conflict. Based on these results, coordination between actors, prioritization of key goals, strengthening public participation, and utilizing the mediator role of executive actors are suggested as effective solutions for water crisis management in Ilam. In addition to providing a detailed analytical framework, the findings can be an operational guide for sustainable water resources planning and policymaking in other similar regions.

Keywords: Water crisis management, drivers, water sustainability, futures studies, Ilam.

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EXTENDED ABSTRACT

Introduction

Water crisis management represents one of the most critical challenges facing arid and semi-arid cities, particularly in regions experiencing rapid urbanization, climatic variability, and declining water availability. Ilam, located in one of Iran's dry western basins, exemplifies an urban setting where limited renewable water resources, increased demand, and excessive dependence on groundwater extraction converge to create systemic vulnerability. Managing the water crisis in such contexts cannot rely solely on technological or infrastructural solutions; rather, it requires a comprehensive understanding of governance structures, stakeholder roles, institutional interactions, and the socio-ecological drivers shaping resource sustainability. This study examines the driving forces, actor influence, goal convergence, and strategic alignments involved in water crisis management in Ilam City from a sustainability-oriented perspective. Using an analytical–exploratory approach grounded in the MACTOR method, the research identifies the structure of the governance network, characterizes actors as dependent, intermediary, or strategic, and evaluates the alignment of goals that shape long-term water management. The study contributes to the broader literature on sustainable water governance by presenting an actor-based analytical framework applicable to urban systems in arid and semi-arid regions.

Methodology

This research applied a mixed-method approach integrating qualitative insights with quantitative modeling within the MACTOR analytical framework. The methodology involved four key stages. First, semi-structured interviews were conducted with experts in water resources, environmental management, urban governance, and crisis response. Through thematic analysis, the primary actors were identified, including strategic actors (Ilam Governorate and Water Resources Management Organization), intermediary actors (Urban Water and Wastewater Company and Regional Water Authority), and dependent actors (urban consumers). Additionally, macro- and micro-level sustainability-oriented goals—such as reducing water loss, enhancing public participation, strengthening environmental oversight, and protecting aquifers—were extracted. Second, the Direct Influence Matrix (MDI) was constructed based on expert assessments of how each actor influences others. Third, MACTOR computational procedures produced the Indirect Influence Matrix (MDII), actor positioning diagrams, competition indices, convergence–divergence tables, and net-distance maps for goals and actors. Finally, quantitative outputs were integrated with interview findings, ensuring contextual relevance and producing a comprehensive interpretation of actor relations, governance bottlenecks, and strategic alliances.
This methodology offers a structured and replicable framework for evaluating complex governance networks and identifying key drivers and constraints shaping urban water crisis management.

Results and Findings

The findings reveal a hierarchical network structure in Ilam's water crisis management system. Dependent actors, represented primarily by urban households, show high dependency and minimal influence. Their limited power underscores the importance of public participation and behavioral change strategies to ensure effective demand-side management. Intermediary actors—including the Urban Water and Wastewater Company and the Regional Water Authority—occupy central positions with moderate to high influence and moderate dependence. These institutions act as coordinators, operationalizing policies, facilitating information flow, and connecting strategic actors with consumers. Their role is essential for implementing emergency measures, managing supply variability, and mitigating institutional conflicts. Strategic actors, such as the Ilam Governorate and the Water Resources Management Organization, possess high influence and low dependence. They shape regulatory frameworks, determine future policy directions, and manage long-term planning and resource allocation. Their leadership determines whether sustainability principles are effectively integrated into water crisis strategies. Goal analysis demonstrates strong convergence among legal, environmental, operational, and participatory objectives. This alignment suggests high potential for multi-level cooperation but also highlights tensions between short-term supply stability and long-term sustainability goals. The net-distance map among actors shows potential alliances primarily between intermediary and strategic actors, whereas divergence points indicate possible institutional overlap or gaps in public engagement. Key driving forces identified include climate-induced water variability, unsustainable extraction patterns, fragmented institutional responsibilities, urban demand pressure, and infrastructural inefficiencies. These drivers highlight the systemic nature of water stress and the need for integrated governance.

Conclusion

The study concludes that sustainable water crisis management in Ilam requires strengthening multi-level coordination, enhancing the role of intermediary actors, and systematically integrating public participation into governance processes. The hierarchical configuration of actors underscores the pivotal role of strategic institutions in shaping long-term policies and the necessity of operational collaboration across agencies. High convergence among goals provides a strong foundation for unified action; however, achieving sustainable outcomes demands bridging gaps between short-term operational needs and long-term ecological resilience. The research highlights the importance of adaptive governance, investment in resilience-enhancing infrastructure, improved data-sharing systems, and targeted public engagement programs. The analytical framework developed in this study offers a transferable model for other arid and semi-arid cities grappling with similar challenges and contributes to advancing sustainability-oriented water governance research.

Declarations

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Authors' Contribution
Authors contributed equally to the conceptualization and writing of the article. All of the authors approved the content of the manuscript and agreed on all aspects of the work declaration of competing interest none.

Conflict of Interest
The authors declare no conflict of interest.

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