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CENTRALITY OF WATER IN FOOD SYSTEM SUSTAINABLE TRANSFORMATION

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Abstract

Water is used in every stage and task within the entire food system chain, from production to consumption, through food storage and processing. However, despite its centrality in food systems, water has not yet received sufficient policy and academic attention. This has practical and policy implications for the food system's transformational agenda. With worsening climate change and food insecurity, the study of water within the food system is indispensable. Drawing on secondary literature in both grey and academic formats and underpinned by qualitative latent content analysis, this article (i) examines the uses of water across the food system chain, (ii) identifies the challenges of water sustainability, and (iii) explores how food system actors can shield food system water 'breaks'. The article shows water is among the key ingredients within the food system, being used to water crops and livestock during production, and is used for various purposes in storage, processing, and consumption. Without water, the food system is dysfunctional. To shield food systems from water 'breaks', the article argues that food system actors should focus on (i) Improving agricultural water management, (ii) Reducing water and food losses beyond the farm-gate, (iii) Increasing the environmental sustainability of food systems; (iv) Explicitly address social inequities; and (v) Improve data quality and monitoring for water-food system linkages.

Keywords: Food security, food systems, sustainability, transformation, water

1. Introduction

Water is an essential resource that plays a critical role across all stages of food systems, from crop irrigation to food processing and consumption. Agriculture accounts for over 70% of global freshwater use, making it indispensable for meeting global food demands (FAO, 2023). Beyond irrigation, water is needed for maintaining livestock, processing food, and ensuring safe food preparation, which collectively underscores water's multifaceted importance. For instance, 15,000 litres of water are required to produce just one kilogram of beef, highlighting its water-intensive nature, while crops like rice require considerably less, approximately 3,000 litres per kilogram (Armstrong, 2021). The environmental impact of such differences in water use becomes more pronounced in regions already experiencing water scarcity, making efficient water management crucial to ensuring food security (Ringler et al., 2023).

The recognition that water scarcity constitutes an agricultural production challenge and a fundamental issue in the broader food system is critical to transforming the food system (Ndhlovu, 2024a). Water integrates all levels of the food system, from crop irrigation to food processing and consumption (Ringler et al., 2023). In most cases, though, its significant role is typically overlooked by strategies concerning the food systems; water is the main input for agricultural and food system activities. The gap becomes even more alarming with the increasing impacts of climate change that aggravate water stress, along with disturbance in terms of food security. A holistic approach to treating water as a key factor for resilience in the food system would be necessary for long-term sustainability (UNDP, 2024). Good water management practices like efficient irrigation, food and water wastage mitigation, and overall governance help systems articulate best practices amidst climatic changes and increased demand for good supplies.

Despite the essential role of water, it remains grossly underrepresented in the studies and policies of food systems. Current policies on food security highlight crop yields and the nutritional outcome, but fail to adequately address the water needed for these processes. As climate change accelerates in its impacts on increasing water stress, poor management practices, and over-extraction, such vulnerabilities in food systems are being exacerbated; however, water is rarely mainstreamed into any food security strategy (UNDP, 2024). High water availability means higher food production of more than 80%, thus calling for an integrated approach to inculcate water scarcity as one of the major components in building resilience within the food system (Ringler et al., 2023). Where such investments have not been made, food insecurity will prevail, more so in regions with acute vulnerability to water shortages (FAO, 2023).

The major challenge for addressing water scarcity in food systems lies in the uneven distribution and management of the available water resources. As long as erratic rainfall and prolonged droughts continue, rain-fed agriculture will make most sub-Saharan African countries vulnerable (Mugagga & Nabaasa, 2016; Ndhlovu & Dube, 2024). On the other hand, even though some parts of North America and Asia benefit from large-scale irrigation systems, they still face challenges related to inefficient usage and pollution caused by many factors, like old infrastructure and poor water resource governance (Strauss & Mahalingam, 2024). The over-extraction of groundwater alongside mismanaged irrigation systems further compounds issues regarding strained water supplies that should ideally support an adaptive climate for food systems against climatic changes (Ringler et al., 2023). These disparities demand better governance, investment in infrastructure capable of using water efficiently, and policies embracing both security of water and food.

This article explores how water is used at various stages of the food system chain and examines the challenges related to water sustainability in food production. Understanding these stages, from irrigation to food processing, is critical for identifying where interventions are most needed to prevent disruptions in the food system. Additionally, the article explores how better management practices and innovations in water use can help mitigate some of the disruptions caused by water scarcity and quality issues. A key goal is to offer practical strategies for mitigating water-related disruptions in food systems, with an emphasis on improving water efficiency and sustainability (Walton, 2021). The article is structured as follows: After the introduction, the literature review, methodology, findings, and discussion, and lastly, the conclusion follows.

2. Literature Review

2.1. The role of water in the food systems

Water is an essential resource in the global food system, critical for agricultural production, food processing, storage, and consumption. In agriculture, water plays a vital role in crop irrigation, livestock watering, and aquaculture, with irrigation being one of the largest water consumers globally. Efficient irrigation practices, such as drip irrigation and automated sprinkler systems, help conserve water while ensuring adequate moisture for crops, especially in insufficient rainfall (Frimpong et al., 2023). Additionally, livestock farming requires significant water for animal hydration and feed crop cultivation. On average, producing one kilogram of beef requires up to 15,000 litres of water, underscoring the extensive water use involved in animal agriculture (Chaire Bien-être animal, 2023; Mekonnen & Hoekstra, 2011). Aquaculture, which provides a substantial portion of the world's seafood, also heavily depends on water quality and quantity to maintain healthy ecosystems for fish farming. As climate change exacerbates water scarcity, efficient water management strategies such as saline irrigation and recycled water are becoming increasingly crucial to sustaining food production in water-limited regions (Ndhlovu, 2024b; Qadir et al., 2021).

Beyond the production stage, water usage in food processing, storage, and consumption is also significant. The food processing industry accounts for approximately 25% of global water consumption, using water for cleaning, cooking, cooling, and product formulation (Kouadio & Koffi, 2023). Given the large-scale operations involved, food processors increasingly adopt water conservation strategies, including recycling water within closed-loop systems and optimising cleaning processes to reduce waste. Managing product water activity in food storage is essential for controlling spoilage and microbial growth, directly impacting food quality and shelf life (Sathguru, 2023). The consumption phase also demands water, especially in food preparation and cooking, where large amounts are used to wash ingredients and cook meals. With rising concerns over water availability and environmental sustainability, the food industry must continue to invest in water-efficient technologies and practices to reduce water consumption, minimise waste, and ensure a sustainable food system for the future (Rockström et al., 2024).

In addition to production and processing, water plays a vital role in food storage and consumption. Managing product water activity levels in food storage is essential to prevent spoilage and microbial growth, particularly in perishable goods like fruits, vegetables, and dairy products (Sadovskiy et al., 2024). Water activity can be regulated by controlling temperature and humidity to extend shelf life and reduce food waste (Alkhafaji, 2024). Water also plays a significant role in food preparation, contributing to the overall water footprint of food through washing, cooking, and processing (Panigrahy & Rout, 2025). As global water scarcity intensifies, the food system must adopt water-efficient practices, from precision irrigation and water recycling in food processing to innovations in packaging that reduce water usage (Alaka & Ogunlade, 2024; Panigrahy & Rout, 2025). Ongoing technological advancements are essential to ensure a sustainable, water-efficient food system capable of addressing the challenges of climate change and water scarcity (Odeyemi et al., 2025).

2.2. Challenges to Water Sustainability in Food Systems

2.2.1 Climate Change and Water Scarcity

The impacts of climate change on water availability for agriculture manifest primarily in the arid and semi-arid regions, which are most prone to the adverse effects of such changes. Over 40% of these incredibly vast areas on the Earth's surface suffer from highly erratic droughts and dry spells that have worsened under increasing global temperatures (Samimi et al., 2022). In the worst case, this directly impacts freshwater resources. Food production, which relies heavily on a stable water supply, makes the situation worse. These extreme climatic events, such as waves, low rainfall, and dire floods, diminish water availability and agricultural productivity since they lead to the fast deterioration of soil quality and crop yields (Lesk et al., 2016). The greater need for resilient agriculture, such as dealing with irrigation by precision means, diversifying crops, and developing heat-tolerant varieties of crops, comes about as strategies for mitigating climate-induced water stress (Asseng et al., 2019). These solutions must be implemented at scale, especially in vulnerable regions, if sustainable food production is to be sustained under the changing climate conditions (Ryu & Seo, 2025).

2.2.2. Water Pollution in Food Systems

Food systems face significant threats to safety and risks to the ecosystem from a water pollution phenomenon caused by agricultural runoff and industrial waste. Agricultural runoff consists of fertilisers, pesticides, and herbicides that contaminate adjacent water sources, decreasing water quality and biodiversity. In dry areas, such contamination speeds up the fresh water available, causing total depletion, which directly affects agricultural productivity and food security (Schyns et al., 2022). Pollutants also accumulate in water bodies, making it impossible for them to act as credible sources for irrigation, and drinking water returns scarcity back into the system. Untreated wastewater from food industries further complicates matters by dumping industrial waste into water bodies, which introduces harmful microorganisms and many toxic chemicals that are dangerous to food safety and ecosystem health. Contaminated crops irrigated with polluted waters accumulate toxins, posing a threat to consumer health and further compromising the integrity of the food systems (WWAP, 2017). The systemic challenge is water pollution, which threatens environmental health and jeopardises public health and food security. It requires the integration of pollution control strategies with sustainable farming practices. Indeed, chemical runoff can be reduced through industrial wastewater treatment, while chemical runoff from agriculture must be treated through agriculture. Nature-based solutions for pollutant filtration before reaching the water body would improve wetland water quality. These integrated approaches would benefit water resource management, increase food safety, and provide sustainability in food systems (Khetan et al., 2024).

2.2.3. Water Inefficiency and Waste in Food Systems

Water inefficiency and waste are primarily attributed to food systems, such as agriculture and food processing, which significantly deplete resources and degrade the environment. In most countries, outdated irrigation practices, such as flood irrigation, account for massive water losses through evaporation and runoff (Bangi et al., 2025). While modern methodologies, like drip irrigation and precision farming, can be made more efficient in using water, their adoption is lagging, particularly in areas where there is less accessibility to technology (Schyns et al., 2022). A significant amount of water is lost along the food supply chain by food wastage; almost 24% of total crop production water is wasted due to post-harvest and storage waste (WWAP, 2017). Inadequate processing facilities also contribute to water loss; excessive amounts are used to clean and process food (Odeyemi et al., 2025). Adopting water-saving technologies, upgrading systems, and using green practices to deliver food help reduce these problems. This complete plan will best use water and cut waste, guaranteeing a better and safer food system (Khan et al., 2024).

2.2.4 Social Inequities in Water Access

Inadequate access to water greatly influences food security, primarily in water-stressed marginalised communities. More than 2 billion people live in high water stress, and 2.2 billion do not have safely managed drinking water (UNESCO, 2019). Such inequalities result from poor water governance, political games, and social stratification; rural Sub-Saharan Africa suffers most from water scarcity because their agriculture is predominantly rainfed and sensitive to climate conditions (UNESCO, 2019). In such regions, women tasked with collecting water face additional burdens, which restrict their time for education and advancement in economic activities. Access to water is among the significant requirements for food systems like irrigation farming and livestock watering; inequities in water availability constrain food production (Nkiaka et al., 2021). Water supply insecurity affects several socially marginalised women and low-income households, exacerbating vulnerability to food insecurity (Mokone & Gumede, 2025). In rural areas, poor water management limits both drinking water and water for farming, which restricts food security. Water's seasonal availability also affects food access and results in nutritional gaps (Shamah-Levy et al., 2024). Adequate irrigation can fill these gaps and bring better food security. Any effort that does not take into account the social, political, and economic barriers to accessing water will be futile in achieving improved food security for the majority (UNESCO, 2019).

2.3 Strategies for Shielding Food Systems from Water 'Breaks'

2.3.1 Improving Agricultural Water Management

Water management is critical to deal with the scarcity of water in agriculture. Drip irrigation reduces water waste compared to traditional methods and has been implemented successfully in water-scarce regions like Afghanistan, boosting crop production (Rahmani & Azizi, 2024). Precision agriculture optimises water use by adjusting irrigation based on real-time data application, reducing consumption and enhancing productivity (Farig et al., 2025). These are meant to sustain agricultural output with minimal environmental impact, hence their importance in a water-scarce region. Sustainable sources of supply could be obtained from rainwater harvesting and recycled wastewater. In places such as the Eastern Cape of South Africa, this would be an alternative source of water, but it is much less reliable now since rains have become erratic due to climate change (Mokone & Gumede, 2025). Techniques like conservation tillage, crop rotation, and wastewater reuse improve soil moisture retention, leave the field under rainfed conditions, and reduce irrigation needs (Rahmani & Azizi, 2024). As such, these practices reduce dependence on conventional water sources, build resilience, and sustain food security in the long run.

2.3.2 Reducing Water and Food Losses Beyond the Farm-Gate

Adopting efficient irrigation systems is essential in modern agriculture and key to solving water and food waste problems. Drip irrigation is one technique that conserves and feeds water directly to the roots, minimising evaporation and runoff. It has been reported that this technique could reduce water usage by up to 50% compared to conventional irrigation methods, ensuring more efficient use of water accompanied by increased crop productivity (Shlash et al., 2025). In addition, conservation measures such as rainwater harvesting and planting crops with low water consumption can help maximise available resources and lower external source dependence, preventing the depletion of local water supplies (Sengupta et al., 2024). Beyond the farm, the food processing, packaging, and distribution stages also present opportunities for reducing water and food losses. Using a closed-loop water system in food processing enables the recycling and reusing of water within a single operation, thereby significantly reducing consumption (Sengupta et al., 2024). Additionally, innovative and more efficient packaging techniques, like modified atmosphere packaging (MAP), will reduce spoilage during storage and transport by extending product shelf life (Caner et al., 2024). In this way, the water consumed can be saved and unnecessary food waste eliminated, making the sustenance of appropriate food systems achievable (Shlash et al., 2025).

2.3.2 Increasing Environmental Sustainability of Food Systems

Raising the environmental sustainability of food systems hinges on the double juxtapositions of efficient food production and consumption practices. Sustainable agricultural practices that involve crop breeding for water efficiency and precision irrigation can significantly reduce water use. Drip irrigation has proved very efficient in reducing wastage under challenging, arid conditions while increasing yields (Yadav et al., 2024). Developing such crops does not show further vulnerability to droughts but also enhances climate change adaptation, improving productivity in the dry spells regarding water scarcity on an agricultural site. These strategies concern water use and enhance food security by constantly producing food in challenging environments (Babu et al., 2023). The complete natural-technical integrated systems would support much more sustainable agricultural water usage, such as using wetlands and other conservation measures (Yu et al., 2021). Policies regarding food systems that include water conservation can be beneficial so that the impacts of water scarcity are mitigated while carrying out more sustainable practices in the food value chain. Policymakers must emphasise water management at every stage of food production, from irrigation to post-harvest processing and distribution. Improved storage and handling, especially for perishables, could reduce the wastage of food and thus reduce water-intensive cultivation methods. Adopting eco-friendly packaging would further reduce waste and enhance environmental sustainability within the agri-food system (Rufí-Salís et al., 2024). Integrating water conservation into broader food system policies will enable better management of these systems by countries, reducing wastage of food and providing a much stronger, more assured resilience in systems concerned with food against the relentless march of adverse impacts from climate change.

2.3.3 Explicitly Addressing Social Inequities

Equitable water access is the first step in ensuring food security through improved public health, particularly for marginalised groups. Water needs for personal consumption and agricultural production, which sustain communities and economies, are critical. In developing countries, most low-income and rural families face challenges in accessing water; this applies even more to informal settlements. For example, South African households have socioeconomic disparities concerning piped water on-premises compared to households of a certain wealth status; the poorer households obtain their water from less safe sources and farther away (Oskam et al., 2021). Such inequities lead to inadequate food production since such communities would require adequate supplies of irrigation water for crops and animals so that they can be secure and well-nourished with food. In any consideration for equity in water access, there should be primacy for the needs of vulnerable groups, low-income households, and rural communities. Gomez et al. (2019) indicate that water availability is strongly linked to socioeconomic variables, such as income, education, and governance. For instance, the quality of education for women and the governance system correlate significantly with water access, bringing out the socio-political factors' role in hydro distribution (Gomez et al., 2019). Food production systems will not operate efficiently if sufficient water is unavailable, especially in rural areas where agriculture-based livelihoods rely on it. Policies that improve food system infrastructures and promote fair water access could aid in reducing stress for marginalised populations and improve food security.

3. Method

The paper applied a qualitative latent content analysis approach, which is ideal for a literature review to analyse and synthesise secondary data. The work used both academic and gray literature on water use at different stages of the food system—production, processing, storage, and consumption.

3.1. Literature Collection

The paper commences by systematically identifying the relevant literature through a comprehensive search in academic databases (e.g., Google Scholar, Scopus) and gray literature sources - reports from international organisations (e.g., FAO, UNESCO) and government agencies. Only the studies that pertained directly to water management in the food system were included, focusing on food security, water sustainability, and water scarcity. Such ensured that both peer-reviewed journal articles and policy reports from well-regarded institutions were included to maintain an equilibrated and wide comprehension of the theme.

3.2. Data Coding and Categorisation

After identifying the literature, each source was coded through key themes and concepts about water use in food systems. The themes noted in the literature-e.g., water management practices, challenges of water sustainability, and impact of climate change on water resources- were used to classify the content. Under this procedure, all articles were read and analysed to extract relevant information, including case studies, applied strategies for managing water, and statistics on agricultural and food processing water usage.

3.3. Synthesis and Thematic Analysis

After coding the data, the next step involved synthesising the findings by grouping similar themes. This thematic analysis highlighted recurring issues, challenges, and strategies related to water use in food systems. Particular attention was given to the social, economic, and environmental factors influencing water access and sustainability. The analysis also explored the disparities in water availability across different sectors and regions, particularly in developing countries and low-income communities. A comparative approach was used to identify common strategies that have effectively improved water management in diverse contexts.

This article's methodology relied on available literature, which may introduce bias based on the geographical and temporal scope of the included studies. Additionally, the study is limited to secondary data analysis, which may not capture the latest developments in water management practices or emerging technologies in the food system.

4. Findings and discussion

The results below are based on a qualitative latent content analysis of literature on water's role in food systems. Through systematic review and categorisation of academic and gray literature, five key themes and two additional sub-themes were identified. These critical themes are discussed below:

4.1. Water's Role Across the Food System

Water is integral to each stage of the food system, from agricultural production to food processing, storage, and consumption. This theme was consistently reinforced across the literature, emphasising that most global freshwater is used in agriculture, especially for irrigation (Ringler et al., 2023). Water is needed for crop irrigation, livestock hydration, aquaculture, and food processing. For instance, producing one kilogram of beef requires approximately 15,000 litres of water, much higher than water-intensive crops like rice (World Economic Forum, 2021). The need for water at all stages highlights its pivotal role, yet it also presents a vulnerability when considering the increasing scarcity of water resources, exacerbated by climate change. The imbalance in water use across different food types and the fact that most water-intensive industries (like livestock farming) are unsustainable in water-scarce regions make the need for more efficient water use imperative. Furthermore, food processing, which uses up to 25% of global water resources, adds another layer of water demand often overlooked in food security discussions (Kouadio & Koffi, 2023). The theme of water usage across the entire food system calls for an integrated approach to water management that spans agricultural and food industry practices.

4.2. Climate Change and Its Impact on Water Resources

The effects of climate change are likely to be most profound on water availability, particularly in regions already stressed by a lack of sufficient water. Therefore, this poses the greatest threat to food security since it is about how highly variable and intense droughts stress water availability for production crops. Climate change continues to alter precipitation, increase temperature, decrease freshwater supplies, and worsen food insecurity within vulnerable regions (Lesk et al., 2016). Unreliable rainfall makes rainfed agriculture less reliable in dry and semi-arid lands, and high temperatures deplete water sources meant for further irrigation. Sub-Saharan Africa is one region where economic activities are susceptible to climate variations due to agricultural activities (Mugagga & Nabaasa, 2016). Adapting to these transformations requires constructing climate-smart food systems that integrate adaptive practices such as dry-resistant farming and water-saving irrigation technologies. Water management should be the main strategy of policymakers and actors in the food system to address the erratic impacts of climate change on food production.

4.3. Water Pollution and Its Impact on Food Systems

A significant theme that emerged from this review was water pollution, primarily through agricultural runoff and industrial waste. Contamination of freshwater sources occurs with the application of fertilisers, pesticides, and herbicides in agriculture; this contamination undermines water quality and biodiversity (Schyns et al., 2022). In addition, the discharge of untreated industrial wastewater from food processing plants enters the mainstream water supply with toxic chemicals and microorganisms that cause food safety hazards (WWAP, 2017). The effects of water contamination are not limited to its quality but also extend to food safety because contaminated water used for irrigating crops may lead to the uptake of harmful substances by plants, eventually getting into the human food chain. Polluted water also decreases the dependability of freshwater sources for irrigation and drinking purposes; thus, it adds to the existing problem of water scarcity. Efforts toward controlling water pollution in the food systems should be oriented toward a mixture of strategies: controlling the pollution through better wastewater management and curtailing runoffs of chemicals, and sustainable agriculture, reducing the need for chemical inputs.

4.4. Water Inefficiency and Waste in Food Systems

Water inefficiency and waste are featured prominently in the literature. Many world water resources used in agriculture and food processing come back as waste because of old irrigation systems, inefficient water use, and wastage of food through the supply chain (Bangi et al., 2025). For example, conventional flood irrigation wastes water by evaporation and runoff. On the other hand, new technologies like drip irrigation would be life-saving but are hardly applied in most parts of the world (Schyns et al., 2022). Apart from agriculture, inefficiencies in water use in food processing result in the waste of water resources; excessive use of water for washing, cooling, and cleaning adds to process requirements (Odeyemi et al., 2025). The food supply chain adds to water inefficiency; nearly 24% of the water used in crop production is lost due to food waste at harvesting, storage, and distribution (WWAP, 2017). To address water inefficiencies, technological innovation should be embraced, which should include saving irrigation water systems and processing technologies added to more efficient food distribution systems aimed at reducing waste and optimising water use.

4.5. Social Inequities in Water Access

Social inequalities in access to water prove one of the most paramount impediments to food security within low-income and marginalised communities. Evidence showed disparities in the provision of water, more so within rural-urban informal settlements across developing nations. For instance, households belonging to low-income earners in South Africa often obtain their water from unsafe and considerable distances, whereas wealthier households have piped water at home (Oskam et al., 2021). Such inequalities deny the less privileged access to water for agricultural production and food consumption, thus worsening food insecurity. In most developing countries, women are tasked with fetching water; safe water is not easily accessible, which thus restricts them from engaging in any productive work, including farming (Mokone & Gumede, 2025). To tackle these challenges, the review accentuates the need for policies that enhance infrastructure in poor and rural areas, where water is shared fairly, and address the socio-political factors that affect water access.

4.6. Additional Insights

In addition to the themes above, the review identified emerging technological innovations that could significantly enhance water management within food systems. Artificial intelligence (AI) and remote sensing are increasingly used to monitor water use in agriculture and food processing, allowing for more precise and efficient water management (Farig et al., 2025). These technologies enable real-time data collection on water availability, irrigation needs, and water use efficiency, offering significant potential for improving sustainability in food systems.

The review also revealed a need for integrated policy approaches where water management is a core component in the sustenance of the food system. In developing countries, policies mainly emphasise food security or water management and ignore their interdependence. Incorporating synergies into water conservation within food systems policies can lead to sustainable agricultural practices, resulting in less waste of both water and food (Rufí-Salís et al., 2024). In building more resilient and sustainable food systems, policymakers need to highlight the conservation of water in agriculture as well as in the whole chain of food supply.

Conclusions

The literature review highlights key challenges at the interface of water and food systems, which are drawn out in the following narrative, emphasising water's central role throughout the entire spectrum of food production, processing, storage, and consumption. Findings reveal that inadequate use of water resources, water pollution, climate change impacts, and social inequities in accessibility all contribute to food insecurity and environmental degradation. The review calls for integrated technical input into both water and food policies that would prioritise efficient irrigation practices as well as economical processing of food. These should also include equitable access to water for marginalised households. Improvement in agricultural water management practice, investment in sustainable technologies, tackling wastage of both food and water along the supply chain, and equitable access to water are some specific, actionable recommendations that can be distilled from the review. Findings from this paper accentuate the need for urgent integration of good practices in conservation agriculture as part of the resilience-building process for rainy-day climate changes within farming systems. However, since there is little secondary data and insufficient local research, it urges more empirical studies and case studies to look into actual implementations and assess the effect of governance on water distribution. Future research should focus on the long-term impacts of climate change on water resources, new technologies for managing water, and regional case studies that can help formulate specific, effective policies.

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