Urban Profile: An Integrated Analysis of Mehriz with an Emphasis on Water Governance and Spatial Justice in Arid Climates

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City Profiles

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Abstract

The garden city of Mehriz faces simultaneous challenges of water crisis, spatial inequality, and weak urban governance, which threaten its ecological sustainability and historical identity. Using a case study approach, this research utilized national population and housing census data, statutory documents, and field observations, analyzing data by integrating six analytical frameworks: SWOT, DPSIR, PESTEL, Porter, VRIO, and Fishbone. Results showed the Mehriz plain aquifer declines by 0.5 to 1 meter annually, and approximately 30 percent of water is wasted in the distribution network. Also, the city's per capita green space (6.6 square meters) is lower than the national standard, and a significant gap exists between the population density of the historic fabric (over 120 persons per hectare) and peripheral developments (under 50 persons per hectare). The DPSIR analysis demonstrated that aquifer depletion intensifies spatial inequality through orchard degradation, land-use conversion, and reduced environmental quality. The VRIO analysis indicated that qanats and the garden-city structure, despite their value, rarity, and inimitability, have not become a developmental advantage due to weak institutional organization. Furthermore, the Fishbone analysis identified the root of problems in institutional fragmentation, poor coordination among responsible agencies, and the dominance of static physical planning. Accordingly, the main challenge of Mehriz is not absolute water scarcity, but the weakness of integrated water and spatial governance. Establishing integrated aquifer and garden-city management, reducing network water loss, continuously monitoring water resources, and utilizing qanat capacities in urban planning can enhance the resilience of this garden city in arid climate conditions.

Keywords: Arid Climate, Integrated Analytical Frameworks, Mehriz, Resource Scarcity, Spatial Inequality, Urban Profile, Urban Planning.

1. Introduction

Cities located in arid climates face simultaneous challenges of water scarcity, environmental fragility, unsustainable physical development, and spatial inequality. In these cities, water is not merely a natural resource; rather, it plays a decisive role in shaping the spatial structure, settlement sustainability, environmental quality, and the distribution of urban services. The literature on water crises emphasizes the importance of resource scarcity and the necessity of rethinking water management (Gleick, 2003), while the urban resilience approach analyzes the city as a socio-ecological system (Meerow et al., 2016). On the other hand, the theory of spatial justice indicates that urban inequality is reflected in spatial organization, service distribution, and environmental quality (Soja, 2010), whereas the concept of the hydrosocial cycle examines water in connection with power, institutions, and the production of space (Swyngedouw, 2004). Mehriz, as one of the mid-sized cities in Yazd province, serves as a clear example of the nexus between water crisis and spatial inequality. With its garden-city background and historical network of qanats, this city has been founded on a historical relationship among water, orchards, settlement, and livelihoods (Riahi Moghaddam, 2015). In such a context, a qanat is not solely a water conveyance structure but is considered an integral part of the local governance system and the spatial organization of arid settlements (Banihabib & Ghafouri Kharanek, 2019; Hassani Fakhrabadi & Hassani Fakhrabadi, 2024). However, the declining sustainability of water resources, the functional degradation of qanats, horizontal urban sprawl, pressures for orchard land-use conversion, and weak institutional coordination have undermined the historical bond between water, orchards, and settlement in Mehriz. Simultaneously, studies concerning the distribution of urban services in Mehriz indicate the existence of spatial inequality and disparities in access to services and land values (Gha'ed Rahmati & Hazeri, 2013).

The core problem of this research is that in Mehriz, the water crisis and spatial inequality are not independent issues; rather, they operate as a mutually reinforcing cycle. The diminished sustainability of water resources and the weakened functionality of qanats pave the way for orchard degradation, environmental quality decline, and increased pressure for land-use conversion; a situation that exacerbates the center-periphery divide and inequality in access to services and green spaces. Conversely, uncoordinated physical development, weak control over land-use conversion, and institutional disharmony exert further pressure on water resources and orchard lands. From this perspective, Mehriz can be understood as a hydrosocial-spatial system in which water, orchards, urban physical structure, and spatial justice mutually influence one another.

A literature review shows that studies of arid cities have often focused either on water resource management and environmental resilience or on spatial justice and the distribution of urban services (Gleick, 2003; Meerow et al., 2016; Soja, 2010). In domestic literature, research has also emphasized the role of institutional and managerial dimensions in urban resilience against water crises (Hosseini et al., 2024), and some studies have examined the qanat as a traditional system in water governance and the structuring of arid settlements (Banihabib & Ghafouri Kharanek, 2019; Hassani Fakhrabadi & Hassani Fakhrabadi, 2024). However, few studies have investigated the relationship between water governance, the degradation of the garden-city structure, and the reproduction of spatial inequality within an integrated framework.

Accordingly, the current research aims to compile an analytical urban profile for Mehriz; a profile that, instead of providing a comprehensive master plan or a detailed executive program, elucidates the city's status from the perspective of the nexus between the water crisis and spatial justice. In this study, the concept of a hydro-spatial profile is employed as an analytical framework to examine the relationship between water resources, physical structure, orchards, service patterns, institutional capacities, and spatial inequality.

In terms of objective, the research is applied, and methodologically, it adopts a descriptive-analytical approach conducted through a case study strategy (Yin, 2018). Data were gathered from official statistics, statutory and master planning documents, organizational reports, previous studies, and field observations. To analyze the data, the complementary frameworks of PESTEL, DPSIR, SWOT, VRIO, Porter's Five Forces model, and the Fishbone diagram were utilized.

The main research questions are as follows:

1. How does the water crisis in Mehriz interlink with orchard degradation, land-use conversion, and the exacerbation of spatial inequality?
2. Which institutional, physical, and managerial factors play a primary role in reproducing the city's hydro-spatial instability cycle?
3. How can an urban profile be compiled through the integration of analytical frameworks to understand the relationship between water governance and spatial justice in Mehriz?

The significance of this research lies in examining Mehriz not merely as a city with a water shortage, nor simply as a city with service inequalities, but as a holistic hydrosocial and spatial system. However, the research findings are primarily limited to the Mehriz case study, and their application to other arid cities will require comparative studies and adaptation to the local conditions of each respective city.

2. Theoretical Background of the Research

2.1. Urban Planning in Arid Climates: Resource Scarcity and the Resilience Paradigm

Cities in arid and semi-arid regions worldwide face simultaneous challenges of water scarcity, land degradation, extreme climatic fluctuations, and the fragility of surrounding ecosystems (Reynolds et al., 2007). In this context, the traditional concept of comprehensive-rational planning, which relies on linear forecasting and land allocation, has demonstrated its inefficiency. In contrast, the urban resilience paradigm, emphasizing the capacity of urban systems to absorb disturbances, adapt, and reorganize, has become the dominant framework in the literature on arid climate planning (Folke, 2006; Meerow et al., 2016). From the resilience perspective, the city is not a static entity, but rather a socio-ecological system in which the flows of water, energy, and materials shape spatial structure and social justice (Pickett et al., 2011). This tension introduces the concept of the thirsty city, wherein continuous physical and demographic development has pushed the pressure on groundwater resources beyond renewable thresholds, thereby jeopardizing the city's hydrological security (Gleick, 2003; Ahmadi et al., 2020). Therefore, the first theoretical foundation of this research is the urban resilience paradigm in arid climates, which justifies the necessity of transitioning from planning based on an unlimited supply of land and water to water-sensitive planning constrained by ecological limits.

2.2. Spatial Justice and Urban Inequalities: From Resource Distribution to the Concept of Hydrological Justice

The concept of spatial justice, prominently theorized by Edward Soja (2010), is based on the principle that space and geography are both products and producers of unequal social relations. Spatial inequalities are not merely reflections of economic or class divides; rather, through the uneven distribution of public services, infrastructure, environmental quality, and access to resources, they exacerbate and reproduce social inequalities (Marcuse, 2009). In arid region cities, this inequality takes on a specific dimension: the unequal distribution of access to water, fertile lands, and green spaces creates a structural gap between central and peripheral neighborhoods, which can be termed the hydrological center-periphery divide (Lankford, 2013). In such a context, spatial justice transcends distributional frameworks and becomes intertwined with procedural justice and recognitional justice; meaning that marginalized groups are not only deprived of resources but are also ignored in decision-making processes and identity representation (Fraser, 2009). In this research, the concept of hydrological spatial

justice is employed not as a general and independent theory, but as an analytical framework for understanding the relationship between water, space, and inequality in the Mehriz case study. This concept entails examining the distribution patterns of benefits and deprivations resulting from access to water, orchards, green spaces, land value, and urban services across the city area. This framework also considers the role of local participation, the historical rights of qanat-dependent communities, and the impact of institutional decisions on the reproduction of inequality. From this perspective, the decline in qanat discharge and aquifer depletion in Mehriz is not merely a technical or environmental issue; rather, it has spatial and social consequences observable in orchard degradation, land-use conversion pressures, and the exacerbation of the center-periphery divide.

2.3. Urban Profile as a Multi-layered and Integrated Cognitive Tool

Addressing intertwined issues such as the water crisis and spatial inequality requires an analytical tool capable of simultaneously revealing the physical, social, economic, environmental, and institutional layers of the city. The urban profile, promoted by the United Nations Human Settlements Programme (UN-Habitat, 2016), provides such a framework. Going beyond a descriptive report, an urban profile is a structured analysis of the current situation, trends, gaps, and intervention priorities, compiled through stakeholder participation and multi-source data collection. Theoretically, this concept aligns with the evidence-based planning approach, but by adding a layer of institutional and power analysis, it also leans toward critical planning (Davoudi, 2015). In mid-sized Iranian cities, which typically suffer from weak information systems and data fragmentation, the urban profile is not a static product but a dynamic process for constructing the big picture of urban problems. Specifically for arid climates, this framework has the capacity to unveil the hidden links among groundwater flows, orchard distribution patterns, qanat networks, and the spatial structure of poverty. Thus, the urban profile can act as a methodological bridge between ecological analysis and institutional analysis (Pickett et al., 2011), thereby mitigating the reductionism common in Iranian urban planning.

2.4. Water Governance, Common Resources, and Historical Institutions: The Qanat as a Socio-Ecological System

In the central plateau of Iran, qanats have not been merely hydraulic structures, but socio-ecological institutions that, over centuries, simultaneously ensured equitable water distribution, participatory management, and ecological sustainability (Ahmadi et al., 2020). From the perspective of common-pool resources theory formulated by Elinor Ostrom (1990), qanat exploitation systems are considered a successful example of spontaneous local community governance over water resources that prevented the tragedy of the commons without state or market intervention. However, the introduction of modern pumping technologies, centralized water management policies, and the weakening of traditional institutions (such as *mirabs* and water distribution committees) have disrupted the feedback loop of sustainability (Folke et al., 2005). This situation exemplifies a multi-level governance failure in water resource management; a scenario where the state has failed to provide an effective alternative to local institutions, the market has not led to optimal allocation, and the local community lacks sufficient power to revive the traditional system (Pahl-Wostl, 2009). In Mehriz, the globally registered qanats are today viewed more as cultural and tourism heritage than as active elements in water supply and garden-city sustainability; this institutional disconnect is the core of the dormant advantages problem. The adaptive governance theory suggests that the way out is to create hybrid structures that integrate indigenous and formal knowledge, local and state institutions, and supply and demand management within a learning and flexible framework (Chaffin et al., 2014).

2.5. Planning Failure and the Necessity of Transitioning from Static to Adaptive Implementation

A major portion of urban issues in Iran is not the product of a lack of plans, but rather stems from implementation failure and the dominance of static planning (Rafieian et al., 2017). Critical urban planning literature shows that comprehensive and detailed plans in contexts with high uncertainty and limited resources quickly become obsolete, turning into ceremonial documents instead of guiding development (Albrechts, 2004). In contrast, the adaptive planning approach is founded on the principles of continuous learning, environmental feedback, flexibility in goals, and small-scale interventions (Rauws, 2017). In the context of arid climates, adaptive planning is more necessary than anywhere else, as climate change, aquifer level fluctuations, and land market dynamics create fundamental uncertainties. The integrated garden-city and water management model proposed in this research aligns with the theory of integrated spatial planning, with the distinction that its scale is a city intertwined with a historical hydrological network (qanats) and vegetation cover (orchards) (Stead & Meijers, 2009). Such an approach cannot be realized without the theoretical framework of co-production and network governance, and it requires a shift in planning culture from issue-avoidance and financial centralization toward accountability, transparency, and institutionalized participation (Watson, 2014).

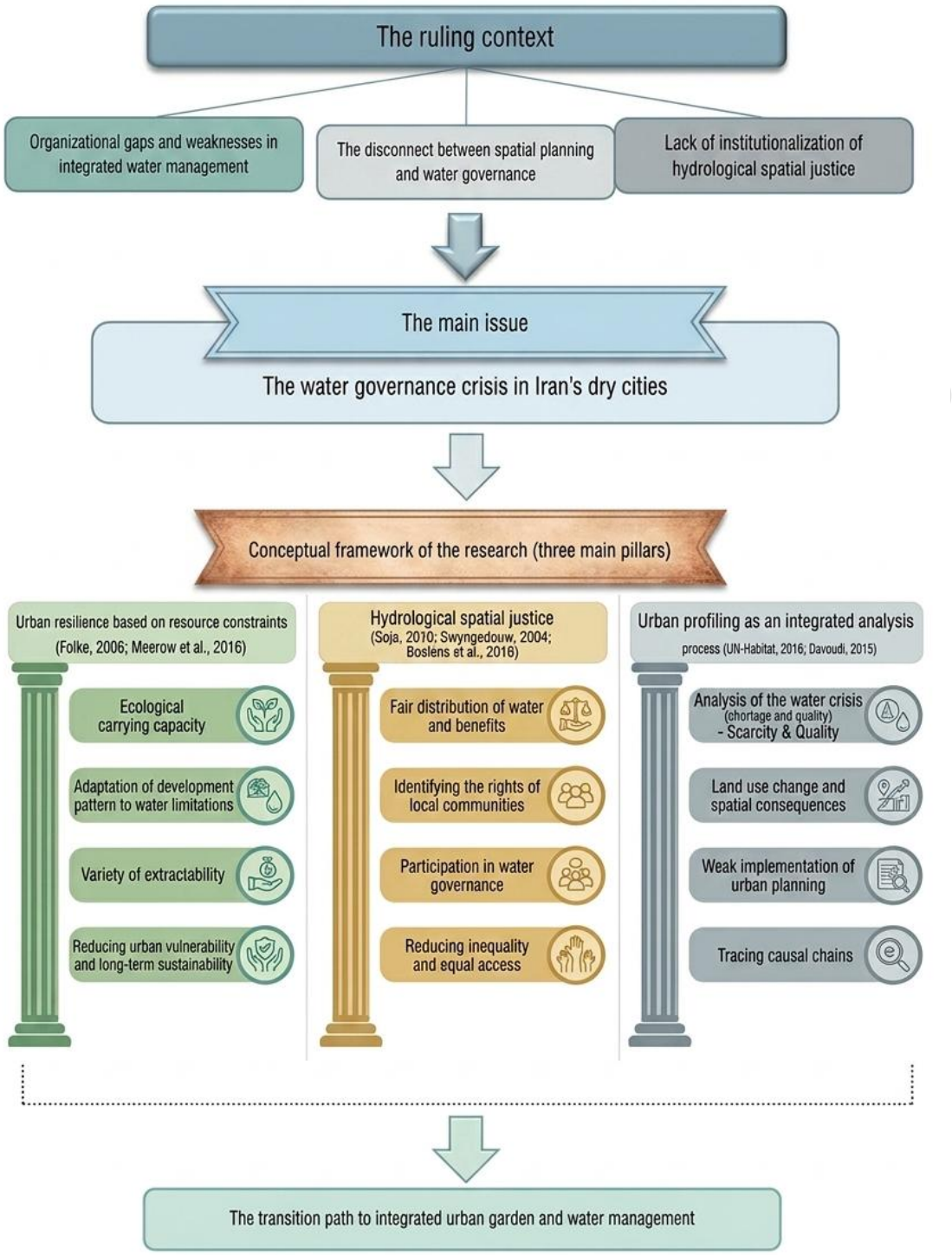


Figure 1: The theoretical framework of the transition to integrated garden-city and water governance

3. Research Background

The following table provides a summary of the research literature at both international and domestic levels, organized around four key themes: the urban profile, water resource management in arid climates, hydrological resilience, and spatial justice. The objective of this systematic review is to elucidate the existing theoretical context and evaluate how researchers address the challenges of space reproduction and ecological crises in mid-sized cities. This theoretical framework first explores the global dimensions of concepts such as water-sensitive cities and the hydrosocial cycle, and then assesses the tangible manifestation of these concepts

in the context of Iran—with an emphasis on the garden-city structure and the socio-ecological system of the qanat. Ultimately, this categorization leads to the extraction of four fundamental gaps in the research literature, which form the primary basis for the necessity and originality of the current research.

Table 1: Summary of research background and elucidation of research originality

Section	Topic/Theme	Findings and Key Concepts	Sources
International Studies	**Urban Profile**	The urban profile is more than a descriptive report; it is an analytical framework for identifying gaps, prioritizing interventions, and creating a common language among stakeholders. Participatory profiles in the context of urban poverty and informal housing have contributed to evidence-based policies. Critique: If the analysis of power structures and political economy is ignored, they turn into neutral and ineffective documents.	UN-Habitat, 2016; Beall & Fox, 2009; Patel et al., 2015; Roy, 2011
	Planning in Arid Climates and the Thirsty City	The concept of the thirsty city (Gleick, 2003): Cities where their water demand has exceeded the capacity of local resources. This phenomenon is not limited to metropolitan areas, as mid-sized and small cities also face depleted groundwater reserves, land subsidence, and declining water quality.	Gleick, 2003; McDonald et al., 2014
	Urban Resilience and Water-Sensitive Cities	The urban resilience framework (Meerow et al., 2016) emphasizes adaptive capacity, resource diversity, and network governance. The transition to water-sensitive cities requires simultaneous changes in technology, citizen behavior, and institutional frameworks.	Meerow et al., 2016; Brown et al., 2009
	Spatial Justice and the Hydrosocial Cycle	Soja (2010): Seemingly technical spatial decisions have profound distributional consequences. Swyngedouw (2004): The flow of water in the city is a reflection of class and ethnic power relations. Boelens et al. (2016): The concept of hydrosocial territories as arenas of negotiation and conflict over water, identity, and power.	Soja, 2010; Heynen et al., 2006; Swyngedouw, 2004; Boelens et al., 2016
Domestic Studies	**Urban Resilience and Water Resource Management**	Sadeghloo and Sajasi Gheidari (2014): Prioritizing factors affecting the resilience of farmers against drought. Hosseini et al. (2024): The socio-institutional dimensions of resilience are more decisive than physical or climatic factors. Yadgarifar et al. (2023): Weak organizational awareness has undermined the resilience capacity of Tehran.	Sadeghloo & Sajasi Gheidari, 2014; Hosseini et al., 2024; Yadgarifar et al., 2023
	The Qanat as a Socio-Ecological System	Banihabib and Ghafouri Kharanek (2019): The qanat is a spontaneous governance system based on local participation. Hassani Fakhrabadi and Hassani Fakhrabadi (2024): The spatial structure of the cities of Naein, Yazd, and Gonabad is deeply intertwined with qanat networks. Labbaf Khaniki et al. (2019): The Hasanabad Qanat of Mehriz is a model of territorial cooperation and participatory water management.	Banihabib & Ghafouri Kharanek, 2019; Hasani Fakhrābādi & Hasani Fakhrābādi, 2024; Labbaf Khaniki et al., 2019
	Spatial Justice and Inequality in	Dadashpour and Alvandipour (2017): The dominance of the distributional approach and the neglect of structural justice in Iranian	Dadashpour & Alvandipour, 2017; Parizadi et al., 2016

Section	Topic/Theme	Findings and Key Concepts	Sources
	the Distribution of Urban Services	research. Parizadi et al. (2016): The unequal distribution of urban services in Marivan and the concentration of spatial injustice in peripheral neighborhoods.	
	Specific Studies on Mehriz	Gha'ed Rahmati and Hazeri (2013): Inappropriate distribution of urban services in the twelve neighborhoods of Mehriz and its impact on land value. Riahi Moghaddam (2015): The garden city of Mehriz is the achievement of a prolonged process of urban morphological transformation.	Gha'ed Rahmati & Hazeri, 2013; Riahi Moghaddam, 2015

The analysis and synthesis of the research literature at both domestic and international levels reveal that despite the existence of rich literature in the fields of water management, physical resilience, and distributional justice, the research approach in addressing mid-sized cities in arid climates has faced two fundamental limitations and gaps. Studies in the field of water and ecological resilience have primarily viewed water resources through a hydrological and technical lens, neglecting the spatial, class-based, and distributional consequences of the water crisis on the city's structure. Conversely, research in the realm of spatial justice and urban inequality has focused solely on conventional physical indicators (such as access to parks, service land uses, and land prices), ignoring the vital element of water and hydrological dynamics as one of the primary drivers generating inequality in desert cities.

Urban planning documents in Iran lack an integrated methodological framework to link macro-environmental structural factors with local causal roots. None of the previous studies have attempted to compile an integrated hydro-spatial profile by combining tools for causal chain analysis, internal resource assessment, and root cause analysis, which could simultaneously dissect the hydrological cycle and the structure of spatial inequalities. The present research is defined precisely at the intersection of these scientific gaps in order to address this theoretical and methodological void in the planning of arid region cities in Iran as an urban profile study, utilizing the concept of hydrological spatial justice and integrating the six analytical tools.

4. Research Methodology

In terms of objective, the present research is applied, and in terms of nature, it is descriptive-analytical, conducted using a case study strategy. The selection of Mehriz as a case study was made because this city, as one of the mid-sized cities in the arid climate of Iran, possesses a historical bond among the qanat, orchard, settlement, and spatial organization, and in recent decades, it has faced the simultaneous challenges of groundwater resource depletion, orchard degradation, land-use conversion, and spatial inequality. Hence, Mehriz can serve as an appropriate case for examining the relationship between water governance and spatial justice in the context of arid cities. The spatial scope of the research is the city of Mehriz and the zones influencing its garden-city structure and water resources. The temporal scope of the analysis, in accordance with available data and the horizon of statutory documents, primarily encompasses the period from 2011 to 2026 (1390 to 1405 SH). However, in cases where the analysis of historical trends of qanats, orchards, and the physical transformations of the city was necessary, previous studies and data have also been utilized.

The research data were collected from four main sources: first, official and registered statistics, including national population and housing census data, demographic indicators, and information on urban services, land use, green space, and the water network; second, statutory and master planning documents, including the Mehriz City Master Plan, the Detailed Plan, the Yazd Regional Development Plan, and documents related to water resource management; third, organizational reports, previous studies, and official news related to the status of water, orchards, infrastructure, and urban transformations; and fourth, field observations to complete the understanding of the physical condition, orchards, urban services, and spatial signs of

inequality. In this research, data from the Statistical Center of Iran have been used as official and registered data, and the primary data of the research are limited to field observations and the descriptive recordings of the researcher. Given the multidimensional nature of the problem, data analysis was conducted using six complementary frameworks: PESTEL, DPSIR, SWOT, VRIO, Porter's Five Competitive Forces model, and the Fishbone diagram. The rationale for using these frameworks is that the water crisis and spatial inequality in Mehriz are not merely physical or morphological phenomena, but are formed through the interaction of environmental, institutional, economic, social, managerial, and regional factors. Therefore, each framework was employed to analyze a specific level of the problem, and its results were integrated with other findings in the final stage.

The PESTEL framework was used to identify the macro-level political, economic, social, technological, environmental, and legal drivers affecting the city's development. Porter's Five Competitive Forces model was applied to analyze Mehriz's regional position in relation to attracting population, capital, and tourism, as well as its competition with peripheral cities. The VRIO framework was used to evaluate the city's internal capacities, particularly qanats, orchards, historical identity, and tourism potential, in terms of value, rarity, inimitability, and the level of institutional organization. The DPSIR model was also employed to elucidate the causal chain among driving forces, pressures, states, impacts, and managerial responses regarding the water crisis and spatial inequality. Subsequently, the findings derived from these analyses were synthesized within a SWOT matrix to determine the city's main strengths, weaknesses, opportunities, and threats. Finally, the Fishbone diagram was utilized to identify the root causes of the problem across dimensions such as governance, infrastructure, environment, land economy, local community, and the urban planning system.

The analysis process was conducted in stages. In the first stage, official, documentary, and field data were collected and classified. In the second stage, the external drivers and internal capacities of the city were identified through PESTEL, Porter, and VRIO. In the third stage, the causal relationship among the water crisis, orchard degradation, land-use conversion, and spatial inequality was analyzed using DPSIR. In the fourth stage, the findings from the previous stages were integrated into the SWOT matrix. In the final stage, the root causes of the identified issues were explained using the Fishbone diagram. In this way, the analytical frameworks were not used in a scattered and independent manner; rather, each completed a part of the process of understanding and explaining the problem. To increase the analytical validity of the findings, a data source triangulation strategy was used. Based on this, factors that were simultaneously confirmed in official statistics, statutory documents, organizational reports, or field observations were included in the analysis with a higher level of reliance. Factors observed in only one source or in news and media reports were used with caution and at the level of analytical corroboration. Therefore, the research findings have an analytical-interpretive nature, and their objective is not the statistical testing of causal relationships, but rather the presentation of a coherent picture of the nexus among the water crisis, garden-city structure, spatial inequality, and urban governance in Mehriz. The main limitation of the research is the restricted access to up-to-date and disaggregated data regarding the quality of distributed water, the amount of extraction from wells, the operational status of the wastewater network, and neighborhood-level indicators of urban services. Furthermore, stakeholder-related data in this research are based on the content analysis of official stances, media reports, and published documents, and do not include direct interviews or large-scale surveys of citizens, managers, and urban activists. Hence, the results of this section possess a supplementary and exploratory nature and can be strengthened in future research with field and participatory data.

Table 2: Methodological Anatomy Integration: Necessity, Function, and Interactive Flow of the Six Tools in the Research

Analytical Framework	Level and Dimension of Analysis	Unique Role and Function in the Research	Transitional Data or Finding (Tool Output)	Destination Tool and Communication Mechanism (Complementarity)
PESTEL	Macro-External	Identifying macro-environmental drivers and trends on the unsustainable development of the city (political, economic, social, technological, environmental, and legal dimensions).	Macro-external trends and pressures (such as climate change, high evaporation, and national housing laws).	**SWOT (Opportunities and Threats):** Continuous monitoring of the external environment to extract instability codes as threats (T) and development platforms as opportunities (O).
Porter's Five Competitive Forces	Regional Competitive	Assessing the attractiveness of Mehriz city in attracting capital, ecotourism, and retaining the active population compared to neighboring competitor cities (Yazd, Taft, and Ardakan).	Market dynamics of regional competition and potential for attracting capital in the fields of historical and natural tourism.	**SWOT (Opportunities and Threats):** Direct feeder of market-oriented and economic opportunity (O) and threat (T) codes in strategic analysis.
VRIO	Internal Assets	Qualitative evaluation of indigenous assets (qanats and garden-city) in terms of value, rarity, inimitability, and particularly their level of institutional organization.	1. Codes of value and historical accumulation of indigenous resources. 2. Codes of severe weakness in local resource organization.	**SWOT (Strengths) and Fishbone:** Value codes are recorded as fundamental strengths (S) in SWOT, and the organizational weakness code is sent to Fishbone for root-cause analysis.
DPSIR	Hydro-Spatial Causal	Modeling the physical cause-and-effect chain among driving forces, pressures, state, impacts, and environmental responses (the relationship of aquifer depletion with spatial inequality).	The hydro-spatial degradation chain (aquifer depletion _ orchard degradation _ neighborhood inequality) and ineffective urban planning responses.	**Fishbone and SWOT (Weaknesses):** Ineffective planning responses are transferred to Fishbone for root-cause identification, and the final state of degradation enters SWOT as physical weakness codes (W).
Fishbone	Institutional Root Cause	Penetrating the underlying layers of administrative, financial, legal structures, and planning culture to discover the reasons for the failure of static physical planning.	Deep systemic and governance roots (such as financial centralization, institutional fragmentation, and issue-avoidant planning culture).	**SWOT (Weaknesses):** These structural factors are embedded as fundamental internal weaknesses (W) in the final SWOT matrix to avoid superficial analyses.
SWOT	Strategic Synthesis	Simultaneous integration and synergy of internal strengths/weaknesses with external opportunities/threats obtained from the five preceding tools.	The four intersecting strategies (SO, WO, ST, WT) and baseline codes for scenario development.	**Final research output:** Cross-combination of internal and external dimensions to present the final solution (establishing an integrated institution and functional monitoring system for the garden-city).

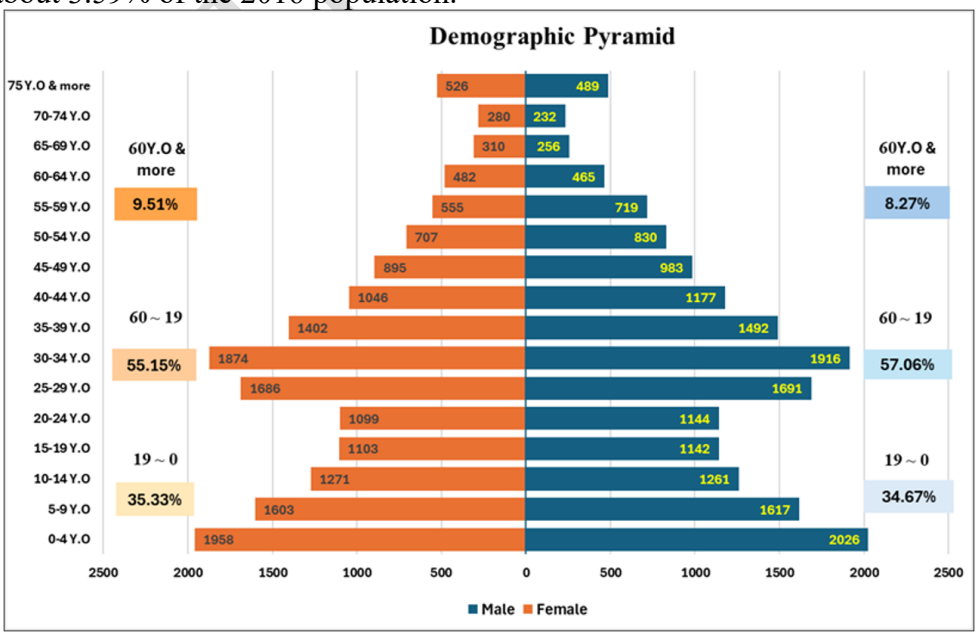
5. Introduction to the Study Area

5.1. Geographic Location and Natural Characteristics

The city of Mehriz, as one of the mid-sized cities of Yazd province, is situated within the arid and semi-arid climate of central Iran and is a prominent example of desert settlements with a rich historical background, garden-city structure, and vital dependence on groundwater resources and qanat networks. The city of Mehriz is the center of Mehriz County and is located approximately 35 kilometers south of the city of Yazd (the provincial capital). This city is situated on the main Yazd-Kerman-Bandar Abbas communication route and is connected to the national transportation network via a transit road. Mehriz is primarily established on a gently sloping alluvial plain (Dasht-e Sar) on the southern slopes of Shirkooh. Geologically, Mehriz is located in the Central Iran tectonic zone, and the presence of active faults, particularly the Taft-Aliabad fault, has exposed the city to earthquake risks. Based on the Köppen climate classification, Mehriz has a hot desert climate (BWh). Analysis of data from the Mehriz meteorological station (statistical period 1986-2011) indicates an average annual temperature of about 19 degrees Celsius, average annual precipitation of only 71.9 millimeters, low average annual relative humidity (about 30%), and abundant sunshine hours (an average of 3,222 hours per year). Water resources are the most vital element of Mehriz's natural environment. Groundwater is the primary source for supplying drinking, agricultural, and industrial water, which is extracted through two means: qanats (including the Mehrpadin, Baghdadabad, and Hasanabad qanats) and 11 deep wells.

5.2. Demographic and Social Characteristics

A review of national population and housing census data shows that the population of Mehriz increased from 10,542 people in 1966 to 34,237 people in 2016. The annual growth rate reached 4.5 percent during the 2011-2016 period. Based on 2018 statistics, Mehriz's gross population density is calculated at 15.96 persons per hectare, and the net residential density at 95.44 persons per hectare. The stark difference between these two figures indicates the significant extent of non-residential lands (especially orchards and barren lands) within the city limits. An important point is the significant spatial diversity in density: Zone 1 (the older core) has a much higher net density compared to Zone 2 (newer developments). Household size shows a declining trend and has stabilized at approximately 3.8 persons. The age structure of Mehriz is young, and a youth demographic bulge is observed in the 15-19 and 20-24 age cohorts. The literacy rate in Mehriz has reached about 92%. Migration is a key component; based on 2009 data, only 90.1% of the city's population were natives, and Afghan immigrants constituted about 3.59% of the 2016 population.



year	the crowd	Growth rate 75 to 65	Growth rate 85 to 75	Growth rate 95 to 85
Year 65	20,830	21.17%		
Year 75	25,239		4.46%	
Year 85	26,364			29.86%
Year 1995	34,237			

Growth rate 75 to 65	21.17%
Growth rate 85 to 75	4.46%
Growth rate 95 to 85	29.86%

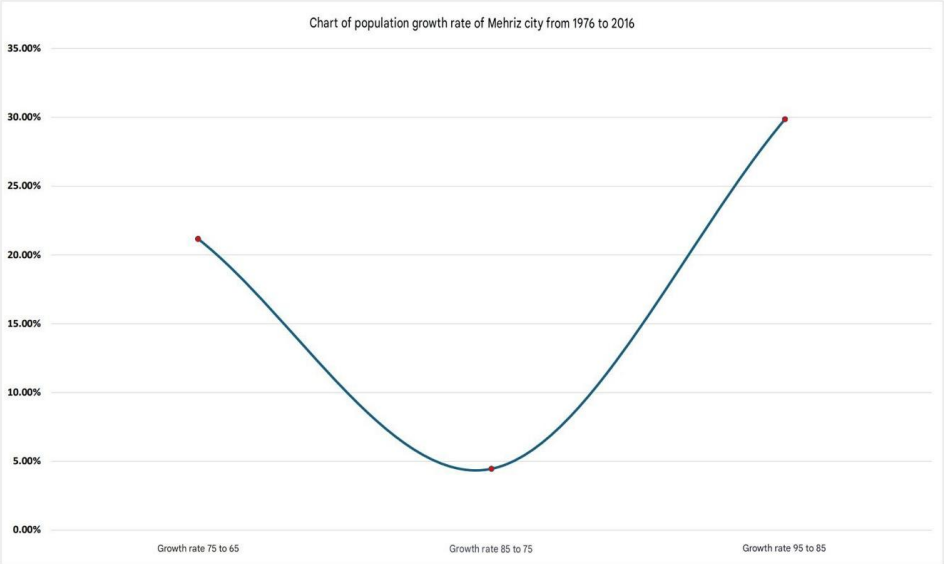
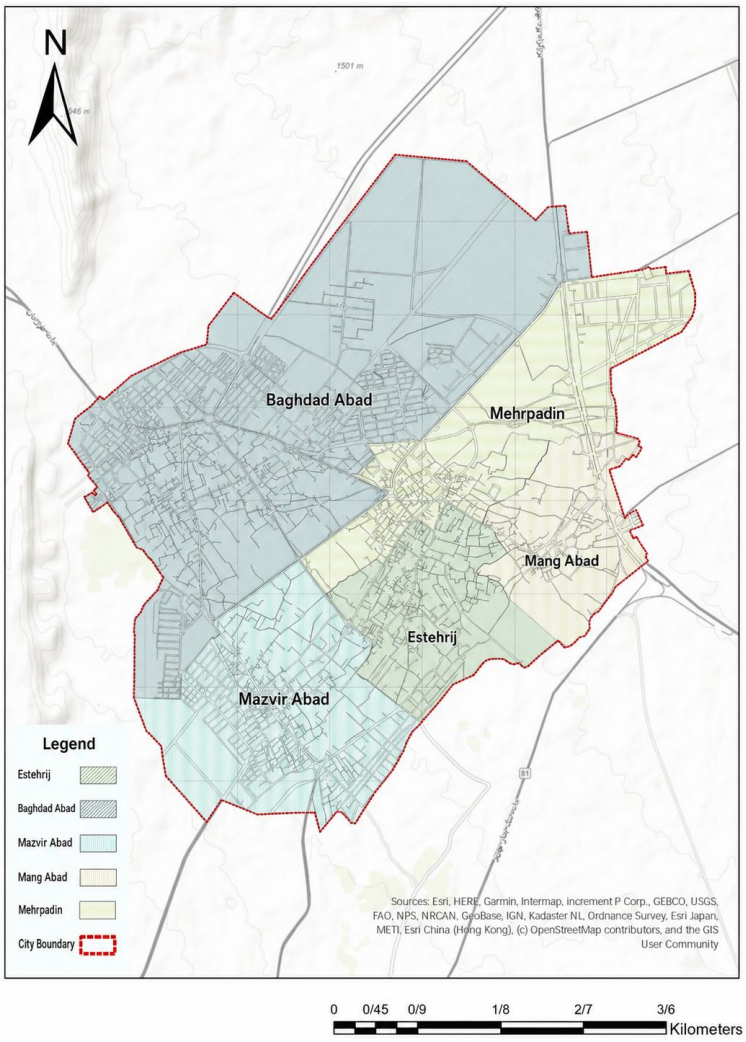


Figure 2: Population age pyramid of Mehriz city and population growth chart (Source: Statistical Center of Iran, 2016)

5.3. Physical-Spatial Structure and Urban Organization

Historical Development and Neighborhood System

The physical structure of Mehriz is deeply intertwined with its qanat network. The initial core of the city, Mehrpadin, formed along the main qanat, and subsequent developments (Baghdadabad, Estahrij, Mazvirabad) each settled around a qanat. This linear-string pattern influenced by qanats is a specific characteristic of desert cities in central Iran. Today, Mehriz consists of seven main neighborhoods: Mehrpadin (the oldest core with a dense historical fabric), Baghdadabad, Estahrij, Mazvirabad, Mangabad, Shahid Rajaei Town (a newly planned development), and parts of peripheral annexed fabrics. These neighborhoods often possess distinct physical and social identities, and historical mosques or Hussainiyas constitute their social centers of gravity. For comparative analysis, the city has been divided into Zone 1 (including older neighborhoods) and Zone 2 (including newer developments).



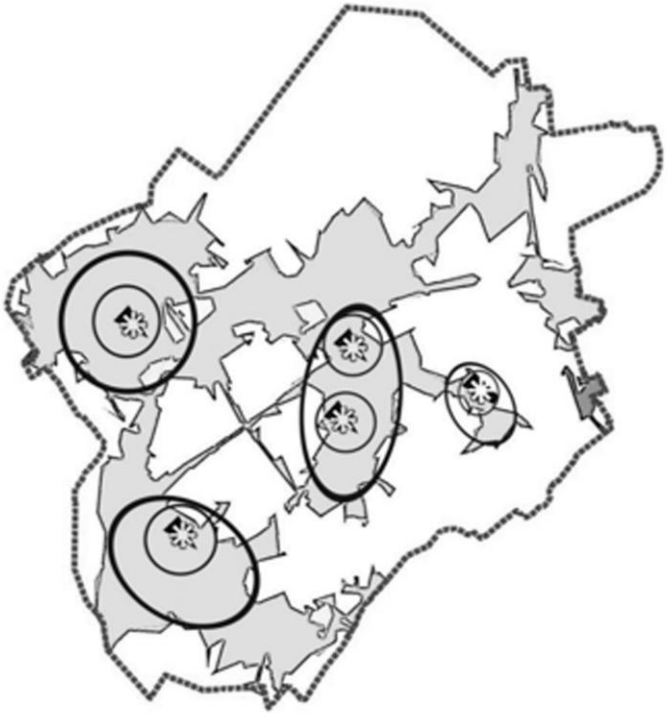


Figure 3: Analysis of the urban structure and neighborhood cores of Mehriz

Land Use and Density

Residential land use is the most dominant, but a specific characteristic of Mehriz is the integration of orchards and agricultural lands with the residential fabric (the garden-city concept). The total public green space of the city is 22.5 hectares (16 parks), which yields a per capita area of about 6.6 square meters per person (based on the 2016 population); a figure significantly lower than the national standard of 10-15 square meters. Industrial land use is primarily concentrated in the industrial estate on the eastern edge of the city. Barren and abandoned lands also constitute a considerable portion (about 15%) of the area's surface, which are considered both a challenge (sites for illegal waste dumping) and an opportunity (potential for endogenous development). Land prices are strongly correlated with centrality and accessibility: the highest prices are observed in the city center and along the Imam Khomeini Boulevard axis, while the lowest prices are found in the peripheries and underprivileged neighborhoods.

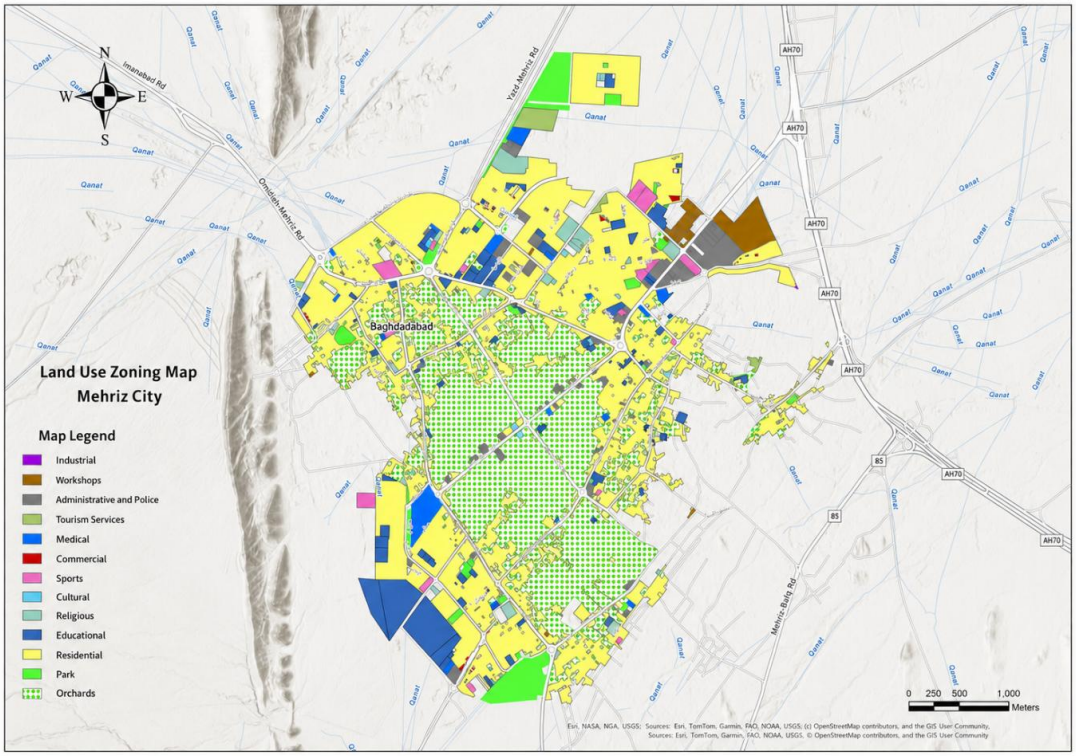


Figure 4: Zoning map of Mehriz city

Road Network and Accessibility

Mehriz's urban road network is hierarchical: the main artery is formed by Imam Khomeini Boulevard (the Yazd-Mehriz communication axis), which passes through the city center. Collector roads and local streets complete the network. However, analyses indicate weaknesses in east-west connections (due to the city's north-south elongation), traffic bottlenecks at central intersections, and poor pavement and sidewalk quality in many neighborhoods. These shortcomings negatively impact not only traffic flow but also equitable access to services at the neighborhood level.

5.4. Urban Services and Infrastructure

The state of urban services in Mehriz presents a picture of infrastructural duality. On the one hand, gas, electricity, telecommunications networks, and main urban access routes are developed to a relatively acceptable level; on the other hand, infrastructure related to water, wastewater, and green spaces still faces serious challenges. The city's drinking water supply relies on a combination of local wells and transferred resources, and the distribution network faces significant leakage due to the dilapidation of some lines. Regarding wastewater, the main issue is not an absolute lack of facilities, but rather the incompletion of the collection network, limited connection of branches, and underutilization of the treatment and effluent recycling capacity. This situation has meant that the possibility of effectively using effluent to reduce pressure on groundwater resources and irrigate urban green spaces has not yet been fully realized. Furthermore, low per capita public green space, weak distribution of services in some neighborhoods, and incomplete coverage of safety services are among the challenges affecting the city's spatial justice and environmental quality.

5.5. Economic Characteristics

The economy of Mehriz is based on three pillars: agriculture (orchard farming), industry (an industrial estate including tiles, ceramics, and steel), and services. Water scarcity and the decreased discharge of qanats have put the agricultural sector under severe pressure. The tourism potential is significant given the global registration of qanats and the historical fabric, but underdeveloped infrastructure has hindered its flourishing (Ghafourzadeh et al., 2017).

These hydraulic challenges and the decline of groundwater levels (Barati et al., 2019), in addition to reducing the yield of strategic orchards, have increased the tendency to convert agricultural lands into residential and industrial uses, thereby undermining the resilience of local communities. In contrast, the development of heavy and water-intensive industries in the Mehriz industrial estate, although creating short-term employment, is in clear contradiction with the environmental carrying capacity of this semi-arid region; it exacerbates the risk of land subsidence and water resource pollution, while the profits generated from these industries effectively exit the city's financial cycle due to a lack of organic links with the local economy. This is while global attractions such as Pahlavanpur Garden and Hasanabad Qanat have provided a unique opportunity to transition to a green economy. However, structural gaps such as the shortage of accommodation infrastructure, weaknesses in the transportation system, and a lack of urban branding have prevented the realization of this goal. As a result, the spillover of the province's tourism benefits is less injected into the local economy, and Mehriz has effectively become a transient and low-yield destination for day-trip tourism (Taqvaei et al., 2023).

5.6. Socio-Cultural Characteristics and Heritage

Mehriz possesses rich cultural layers. Traditional rituals are especially prominent during religious occasions: Nakhl-Bardari (palm-carrying), Joush-Zani, the Bani Asad mourning group, and Kotal-Bastan are among the most distinctive. Tangible heritage also includes historical qanats (globally registered), the Jameh Mosque, the Qadamgah shrine, traditional water reservoirs, and the ancient cypress tree of Mehriz. This cultural capital, if properly planned and invested in, can be transformed into a sustainable competitive advantage for the city. Mehriz is a city with strategic opportunities (communicational location, rich cultural heritage, demographic window) and fundamental challenges (water crisis, spatial inequality in services, vital infrastructure weaknesses, and threats to garden cities). This duality highlights the necessity for a meticulous planning anatomy.

5.7. Statutory Documents

Analyzing the physical-spatial landscape and development planning of a city is impossible without considering the legal context, macro-regional policies, and upper-level statutory frameworks. Statutory documents, as practical guides for local planning, bear the responsibility of determining macro-development directions, allocating regional resources, and outlining the legal vision of cities. Regarding the garden city of Mehriz, the intersection of ecological pressures (such as drought and aquifer level decline) with its logistical and transit location doubles the necessity of aligning urban plans with the approved zonings and policies in provincial and national statutory documents. Therefore, in this section, to analyze the overarching frameworks governing the city, three key documents are analyzed: the New Yazd Transformation Plan (at the provincial strategic planning level), the Mehriz Master Development and Construction Plan (at the macro-physical planning level), and the City Detailed Plan (at the local executive regulations level), in order to explain the legal basis for development, Mehriz's role in the province's spatial organization, and the physical requirements governing the legal boundaries of the city (Table 3).

Table 3: Statutory documents, development plans, and executive implications related to Mehriz city

Statutory Document Name	Preparation, Approval, and Timeframe	Provisions related to water, space, and environmental governance	Relationship to the issue of water, garden-city, and spatial justice
New Yazd Transformation Plan (1401-1404 / 2022-2025) (Based on the	**Prepared by:** Management and Planning	• Sustainable management of the province's water supply and consumption.	• Ensuring sustainable water supply by pursuing desalination and water transfer projects.

Statutory Document Name	Preparation, Approval, and Timeframe	Provisions related to water, space, and environmental governance	Relationship to the issue of water, garden-city, and spatial justice
Spatial Planning Document)	Organization of Yazd Province **Timeframe:** 2022 to 2025	• Enhancing energy security through solar network development. • Strengthening the province's role as a modern transit, logistics, and trade hub. • Safeguarding cultural heritage and developing sustainable tourism in the province.	• Constructing solar power plants (provincial share of 2000 MW). • Boosting parts manufacturing, machining, and knowledge-based economy industries. • Implementing tourism infrastructure projects based on the rich historical identity of the Mehriz plain.
Mehriz City Master Plan	**Prepared by:** Amin Consulting Engineers **Approval Authority:** Supreme Council of Urban Planning and Architecture of Iran (January 13, 2014) **Plan Horizon:** 2026 **Horizon Population:** 36,112 people	• Guiding economic development prioritizing industry, compatible agriculture, and tourism. • Revitalizing dilapidated fabrics and urban physical renewal. • Improving communication networks and developing basic water, electricity, and telecommunication infrastructure. • Conserving natural resources, developing green space, and controlling soil erosion.	• Strengthening and expanding workshop industries by creating a new industrial zone. • Modernizing traditional agriculture and promoting drought-resistant plant species. • Improving roads, securing urban thoroughfares, and safeguarding qanats as the city's lifelines. • Widening and upgrading communication axes and constructing special tourist routes.
Mehriz City Detailed Plan	**Prepared by:** Amin Consulting Engineers **Preparation Date:** March 2019 **Approval Date:** 2021 **Plan Horizon:** 2026	1. Guiding physical development with the aim of equitable distribution of urban services and controlling population density. 2. Balanced infrastructure development across different neighborhoods. 3. Preserving green spaces and ecological orchards of the city. 4. Securing sustainable financial resources for civil projects.	• Creating and expanding parks, recreational areas, and local green spaces in underprivileged areas. • Constructing local day markets, public parking lots, and commercial centers to distribute services. • Improving pedestrian walkways, redesigning transportation stops, and enhancing public access. • Designing and implementing recreational, sports, and cultural projects by engaging local civic participation.
Yazd Regional Development and Construction Plan	**Prepared by:** Arseh Architecture and Urban Planning Consulting Engineers **Client:** Ministry of Housing and Urban Development (Yazd Province Housing and Urban Development Organization)	• Zoning of land environmental capability and land-use zoning at the regional level. • Organizing the settlement and service hierarchy of urban and rural points (dividing the province into 5 functional regions).	• Directing the physical development of Mehriz city strictly toward the southwest (up to the highlands) due to having suitable lands and no interference with orchards. • Strictly preventing the horizontal spread of the city toward high-quality

Statutory Document Name	Preparation, Approval, and Timeframe	Provisions related to water, space, and environmental governance	Relationship to the issue of water, garden-city, and spatial justice
	Timeframe: Approved Winter 2011	• Designating environmentally sensitive zones and the buffer zones for built infrastructure (power and gas transmission).	orchards in the north, east, and south. • Focusing on Tang-e Chenar and Bahadoran rural districts as rural points capable of converting into cities. • Ecological protection of the Kalmand-Bahadoran protected area and fault buffer zones.

5.8. Water Situation in Mehriz

In the past, Mehriz relied on qanats and springs such as Gharbalbiz, Damgahan, Hasanabad, Mehrpadin, Khormiz, and Baghdadabad. The historical Hasanabad qanat, as one of the most prominent traditional resources of the region, holds cultural and historical significance (Sadnews, 2025). However, this historical background does not play a decisive role in the city's current drinking water supply. Official statistics show that the annual extraction at the Mehriz county level exceeds 119 million cubic meters, but only a small share of it is allocated for urban drinking purposes (Table 4).

Table 4: Composition of water extraction and consumption in Mehriz County

Variable	Amount	Share of Total (%)	Source
Annual Extraction (Total)	119 million cubic meters	100	Yazd Regional Water Company (1404); Mehr News Agency (1404a)
Extraction from Wells	44.37 million cubic meters	37.3	
Extraction from Springs	28.91 million cubic meters	24.3	
Extraction from Qanats	46.7 million cubic meters	39.2	
Agricultural Consumption		96.8	
Industrial and Services Consumption		1.4	
Drinking and Sanitation Consumption		1.8	

Table 5: Status of Mehriz city drinking water supply and consumption

Indicator	Amount (liters per second)	Source
Supply Capacity (Well + Transferred)	200	Yazd Province Water and Wastewater Company (1404)
City Consumption	260	
Deficit	60	

The main dependence for the city's drinking water supply is on local wells and transferred water. The operation report of the Bidak reservoir highlights the gap between supply and demand (Table 5). To compensate for this deficit, 19 wells are in the county's supply circuit, and one new well was added last year. Out of about 37,000 subscribers in the county, nearly 23,000 are concentrated in the city of Mehriz itself (Seda va Sima News Agency, 2025).

Table 6: Nitrate and Nitrite concentrations in 11 wells supplying drinking water to Mehriz (Survey from the second half of 2006)

Parameter	Minimum	Maximum	Unit	Source
Nitrate	22	76	mg/L	Mahmoudi Sadr et al. (1387)
Nitrite	Zero	0.67	mg/L	

Disaggregated and up-to-date parametric data for the network's distributed water is limited. The latest available study on the raw water of the wells was conducted in 2006, the results of which are presented in (Table 6). These data do not represent the final quality of the drinking water. An official from the Yazd Province Water and Wastewater Company emphasizes that distributed water is continuously monitored and evaluated in accordance with Ministry of Health standards, and to improve quality, resource blending and, in some locations, desalination plants are used (Alamdar, 2025). Therefore, the quality of water delivered to subscribers differs from the raw material condition in the table above. The Bahadoran plain (related to the Mehriz territory) is categorized as critically forbidden (Aftab News, 2021; ISNA/Yazd, 2024; Saghi-Jadid et al., 2023). The reservoir deficit of Yazd province's plains is estimated at approximately 233 million cubic meters annually (Yazd Regional Water Company, 2017). On the other hand, the vulnerability of the Yazd-Ardakan aquifer to natural and industrial pollutants has also been documented (Mehrnahad & Pourdara, 2015). These conditions expose any expansion of extraction to the risk of further water level drops, quality degradation, and land subsidence.

Table 7: Summary of Mehriz storage and wastewater infrastructure status

Infrastructure	Indicator/Action	Details	Source
Storage Reservoirs	Operation of Bidak reservoir	5000 cubic meters capacity; increases total county capacity to about 30,000 cubic meters	Yazd Province Water and Wastewater Company (1404); Mehr News Agency (1403a)
Distribution Network	Network development	Over 26,000 meters in the county	Yazd Province Water and Wastewater Company (1403)
Wastewater Treatment Plant	Operational status	Completed and ready for operation	Seda va Sima News Agency (1405); ISNA (1405)
Wastewater Network	Progress percentage	About 30% executed and connected to the treatment plant	
Wastewater Branches	Number of connected subscribers	Over 300 branches	

Infrastructural actions have been focused on increasing storage capacity and completing the wastewater network (Table 7). Treated effluent offers options for irrigating green spaces, agriculture, groundwater recharge, and industrial consumption (Maherani & Hosseini, 2010), and completing the network is considered a key tool for reducing pressure on fresh water resources. The gap between produced water and registered consumption (non-revenue water) is one of the main bottlenecks.

Estimation of water loss in the Mehriz network

Indicator	Amount (Percent)	Main Factors	Source
Difference between production and consumption	30 to 35	Network leakage, meter wear and tear, unauthorized branches, reading errors, and accidents	ISNA (1405)

Current programs include installing smart meters, pressure management, and cracking down on unauthorized branches (Seda va Sima News Agency, 2026; ISNA, 2026). Mehriz, like other parts of the province, is engaged with prolonged drought (Yazd Meteorological Administration, 2025). Urban water management under the Water Scarcity Adaptation Document is focused on resource reallocation, water markets, and extraction control (Yazd Regional Water Company, 2026, 2019), and local actions including filling unauthorized wells and conserving groundwater resources have also been reported (ISNA, 2024). The water situation in Mehriz is fragile and multidimensional. Quantitative dependence on wells and transmission lines, a 60 liters per second deficit, a 30 to 35 percent water loss, the plain being a forbidden zone, and the incomplete wastewater network are the most important challenges. A sustainable approach involves the integrated management of urban water resources prioritizing the reduction of water loss, aquifer protection, wastewater completion, effluent

recycling, and continuous quality monitoring. Disaggregating city statistics from county statistics is also essential for precise planning.

6. Research Findings

6.1. SWOT Analysis Findings

The SWOT analysis was conducted with the objective of systematically identifying the internal strengths and weaknesses, as well as the external opportunities and threats concerning the development of Mehriz. Factors extracted from the master and detailed plan reports, census data, and municipal documents have been categorized in a matrix format (Table 8). This matrix provides a general overview of the city's strategic position.

Table 8: SWOT Matrix for Mehriz Urban Development

Internal Factors	**Strengths (S)**	**Weaknesses (W)**
	S1. Rich historical background and distinct cultural identity (rituals such as Nakhl-Bardari, Joush-Zani, Kotal-Bastan)	W1. Crisis of water scarcity and declining groundwater levels
	S2. Globally registered historical qanat network	W2. Lack of an urban wastewater collection and treatment network
	S3. Unique garden-city structure	W3. Significant spatial inequality in service distribution and population density (the gap between Zone 1 and 2)
	S4. Special communicational location (southern gateway of Yazd province on the Yazd-Kerman transit route)	W4. Very low per capita public green space (about 6.6 square meters)
	S5. Experiencing a milder climate compared to the city of Yazd	W5. Dilapidation of the water distribution network and its high leakage
	S6. Young demographic structure and demographic window of opportunity S7. Strategic location on the north-south transit corridor of the country (Tehran-Bandar Abbas transit highway). S8. Establishment of the country's first cooperative dry port (Pishgaman Dry Port) in the city's suburbs as the province's logistics hub. S9. Quick access and proximity to the provincial capital (Yazd) while possessing flat and barren lands suitable for hinterland development and warehousing. S10. Existence of an unparalleled transportation network connected to the country's southern ports and neighboring provinces. S11. Deep connection between the garden-city identity and globally registered heritage sites with the capacity of corridor transit passengers.	W6. Poor quality of road pavements and sidewalks in many neighborhoods W7. Inefficiency in solid waste management W8. Unreadiness of physical infrastructure and local city services to support heavy traffic and labor demand arising from the dry port. W9. Disconnection and weak linkage between the modern logistics economy (dry port) and the local agricultural economy and Mehriz's garden-city identity. W10. Concentration of heavy transit traffic and scattered freight terminals in the middle core of the city due to the failure to complete the western bypass on time. W11. Absence of land-use regulatory tools within the municipality to prevent the encroachment of unauthorized warehousing patches into the margins of historical orchards.
External Factors	**Opportunities (O)**	**Threats (T)**
	O1. Global registration of qanats and increased international attention to heritage tourism	T1. Intensification of drought and climate change
	O2. Growing national trend in demand for ecotourism and desert tourism	T2. Continuous decline of groundwater levels and the threat of water bankruptcy
	O3. Location on the transit route and the north-south corridor of the country	T3. High seismic risk (proximity to the active Taft-Aliabad fault)
	O4. High potential for utilizing solar energy	T4. Intensified competition from neighboring cities (Yazd, Taft, Ardakan) in attracting tourists and capital
	O5. National policies for regeneration and conservation of historical fabrics	T5. Increase in uncontrolled migration (especially from Afghanistan) and pressure on urban services
	O6. Possibility of attracting massive national and international investments in supplementary	T6. Potential environmental pollution caused by the development of water-intensive and

	industries, re-export, and mechanized warehousing at the dry port. O7. Structural potential to transition from an unsustainable flood-irrigation agricultural economy to a less water-intensive economy of transit, packaging, and logistics services. O8. Development of the value chain for handicrafts and local agricultural products (pomegranates and pistachios) through the dry port's direct access to export markets. O9. Paving the way for the development of commercial and transit tourism by establishing standard roadside service complexes and introducing the garden-city brand to corridor passengers.	energy-intensive industries in the industrial estate T7. Intensification of environmental pollution (noise, air, heavy metals) and aquifer pollution due to runoff and wastewater from dry port logistics activities. T8. Physical and creeping encroachment of workshop zones and transit garages into the boundaries of historical orchards and national lands of the Yazd-Mehriz Dasht-e Sar. T9. Severe loading of non-native migrant population resulting from the transit hub and double pressure on the city's dilapidated healthcare, housing, and drinking water infrastructure. T10. Heavy competition and duplication of efforts in logistics and freight terminals with ports and special economic zones of neighboring cities such as Taft and Ardakan.

6.2. DPSIR Analysis Findings

The DPSIR framework (Driving forces, Pressures, State, Impacts, Responses) was applied to analyze the causal chain of the two core issues of Mehriz city: water resource scarcity and spatial inequality. Required data were extracted from the master plan report, meteorological statistics, and municipal documents, and the five components for each of the two issues were categorized in (Table 9). This framework enables the identification of connecting loops between the water crisis and spatial inequality.

Table 9: DPSIR Analysis for Mehriz's Core Issues

DPSIR Component	Water Resource Scarcity	Spatial Inequality
Driving Forces (D)	- Urban population growth (4.5% annual rate) - Horizontal urban expansion - Relative boom in agriculture and water-intensive industries - Increasingly potential tourism	- Unbalanced historical development (multi-core formation) - Land and housing policies (concentration of investments in the center) - Migration and settlement in underprivileged peripheral fabrics - Land market mechanisms
Pressures (P)	- Increase in the number and depth of deep wells (11 wells) - Decreased discharge and gradual drying up of qanats - Traditional irrigation of orchards - High leakage in the urban water distribution network	- Concentration of civil and service investments in Zone 1 - Lack of funds for providing services in new neighborhoods - Disproportionate distribution of per capita allocations - Poor road quality in peripheral neighborhoods
State (S)	- Annual drop of 0.5 to 1 meter in groundwater levels - Insufficient drinking water storage capacity - Increase in minerals and nitrates in some wells	- High net density over 120 persons/ha in Zone 1 versus less than 50 in Zone 2 - Public green space per capita around 6.6 sq meters with unbalanced distribution - Stark disparity in land value between the center and the periphery
Impacts (I)	- Threat to sustainable drinking water supply in the master plan horizon - Reduced orchard productivity and their conversion to residential use (loss of garden-city identity) - Increased risk of land subsidence - Potential social tensions over water allocation	- Decrease in quality of life and citizen satisfaction in deprived neighborhoods - Exacerbation of spatial segregation and the formation of rich and poor neighborhoods - Decrease in sense of belonging and social capital in underprivileged neighborhoods - Weakening of overall urban cohesion

DPSIR Component	Water Resource Scarcity	Spatial Inequality
Responses (R)	- Approval of a master plan aiming to increase density and prevent horizontal expansion - Implementation of some projects for qanat conservation and restoration - Lacking a comprehensive integrated urban water management plan	- Targeting increased net density in the master plan - Some new service distribution programs in the detailed plan - Limited efforts to improve roads - Major weaknesses in execution, budget allocation, and supervision

6.3. PESTEL Analysis Findings

The PESTEL analysis was conducted to identify the macro-environmental factors affecting Mehriz's development across six dimensions: political, economic, social, technological, environmental, and legal. Required data were extracted from the master plan report, municipal documents, and national statistics, and categorized in (Table 10). This framework facilitates the recognition of the most significant external forces driving or hindering development.

Table 10: PESTEL Analysis for Mehriz City

Dimension	Key Factors
Political	- Mehriz's position as the county center and benefiting from asset acquisition budgets - Centralization in Iran's urban planning system and limited authority for local management - Influence of provincial policies (Yazd-centric view in resource allocation) - Relative political stability in the region
Economic	- Local economy's dependence on three sectors: agriculture, industry, and services - High inflation and its impact on construction costs and civil projects - Fluctuation in agricultural product prices - Presence of Afghan immigrants in the informal labor market - Municipal budget limitations
Social	- Young age structure and demographic window - Declining trend in household size - Gender gap in literacy among older generations - Increased migration and ethno-cultural diversity (3.59% Afghan presence) - High social capital at the neighborhood level
Technological	- Acceptable coverage of mobile phone and internet networks - Technological obsolescence in the water sector - Failure to utilize modern water treatment and recycling technologies - Potential for using solar energy but lacking sufficient investment - Weakness in employing smart technologies for urban management
Environmental	- Hot and dry desert climate (71.9 mm precipitation, high evaporation) - Crisis of water resource scarcity and declining groundwater - Decreased discharge and gradual drying of qanat networks - Risk of desertification and dust storms - Soil and groundwater pollution resulting from unsanitary wastewater disposal
Legal	- The master and detailed plan framework as upper-level urban development documents - Incomplete binding force of urban service per capita standards - Laws for the protection of historical fabrics and cultural heritage - Weak laws and regulations regarding the supervision of unauthorized well drilling - Complexity of land ownership laws and orchard land-use conversion

6.4. Porter's Five Competitive Forces Analysis Findings

Porter's five competitive forces analysis was conducted to evaluate the attractiveness and competitive position of Mehriz in attracting investment, tourists, and population. This framework includes five forces: competition among existing rivals, threat of new entrants, threat of substitute products or services, bargaining power of suppliers, and bargaining power of buyers (citizens and investors). Findings are categorized in (Table 11) based on data from the master plan and municipal documents.

Table 11: Porter's Five Competitive Forces Analysis for Mehriz

Competitive Force	Analysis in the Context of Mehriz	Consequence for City Attractiveness

Competition among existing rivals	Yazd, Taft, Ardakan, and Meybod are main competitors in attracting tourists, investors, and skilled migrants.	**Threat:** Attractiveness decreases. Mehriz must focus on its differentiating advantages (milder climate, tranquility, historical garden-city).
Threat of new entrants	New cities and developing desert tourism regions can capture market share from Mehriz.	**Neutral to Threat:** Requires faster branding and development of differentiating infrastructure.
Threat of substitute products/services	Substitute tourism destinations (North, Kish, abroad) for tourists; use of substitute water and energy resources by industries.	**Neutral:** Desert and heritage tourism is a specialized market with relative loyalty.
Bargaining power of suppliers	Water resources: Very high power (due to absolute scarcity). Electrical energy: High power. Labor force: Low power. Land: Power of owners in the city center is high.	**Serious Threat:** The power of vital resource suppliers (water and electricity) reduces long-term investment attractiveness.
Bargaining power of buyers (citizens/investors)	Citizens exacerbate spatial inequality by choosing privileged neighborhoods. Investors have high bargaining power due to multiple options.	**Threat:** The city must facilitate retaining population and attracting investors by offering incentives and improving services.

6.5. VRIO Analysis Findings

The VRIO analysis (Value, Rarity, Inimitability, Organization) has been utilized to evaluate the most critical strategic resources and capabilities of Mehriz. Its goal is to discern which of the city's assets can be a source of sustainable competitive advantage and which are in a dormant state. Required data were extracted from master plan documents, cultural heritage reports, and the current managerial status, summarized in (Table 12).

Table 12: VRIO Analysis of Mehriz's Strategic Resources

Resource / Capability	Valuable (V)	Rare (R)	Inimitable (I)	Organized (O)	Competitive Consequence
Historical qanat network and garden-city	Yes (Water supply, urban identity, tourism)	Yes (Rare on a global scale)	Yes (Historical accumulation, indigenous technology)	Weak (Lack of integrated management, insufficient protection)	Potential competitive advantage → Requires organizational strengthening
Intangible cultural heritage (Ashura rituals, Nowruz)	Yes (Tourism attraction, social cohesion)	Yes (Regionally unique)	Yes (Social complexity and historical depth)	Medium (Sporadic registration and introduction programs, but weak in branding)	Potential competitive advantage → Requires commercial-cultural packaging
Geographical location and milder climate	Yes (Residential attractiveness compared to Yazd)	Yes (Unique in the province)	No (Can be altered with road development)	Medium	Temporary competitive advantage
Young demographic structure (window of opportunity)	Yes (Potential labor force)	No (In many Iranian cities)		Weak (Lack of a comprehensive employment and skills training program)	Competitive parity (Currently)
Barren lands and endogenous development capacity	Yes (Developable land without horizontal expansion)	No (In many cities)	No	Medium (Master plan has targeted this but implementation tools are limited)	Competitive parity

6.6. Fishbone Diagram Analysis Findings

The Fishbone diagram, or cause-and-effect diagram, was applied with the aim of fundamentally identifying the root causes of the issues and problems in Mehriz. Based on the content analysis of upper-level documents, potential causes were categorized into six main groups: climate, management, technology, economy, culture, and laws. The main problem at the head of the fish was defined as the inefficiency of planning and unsustainable urban development, and the roots of each category were illustrated in Figure (7).

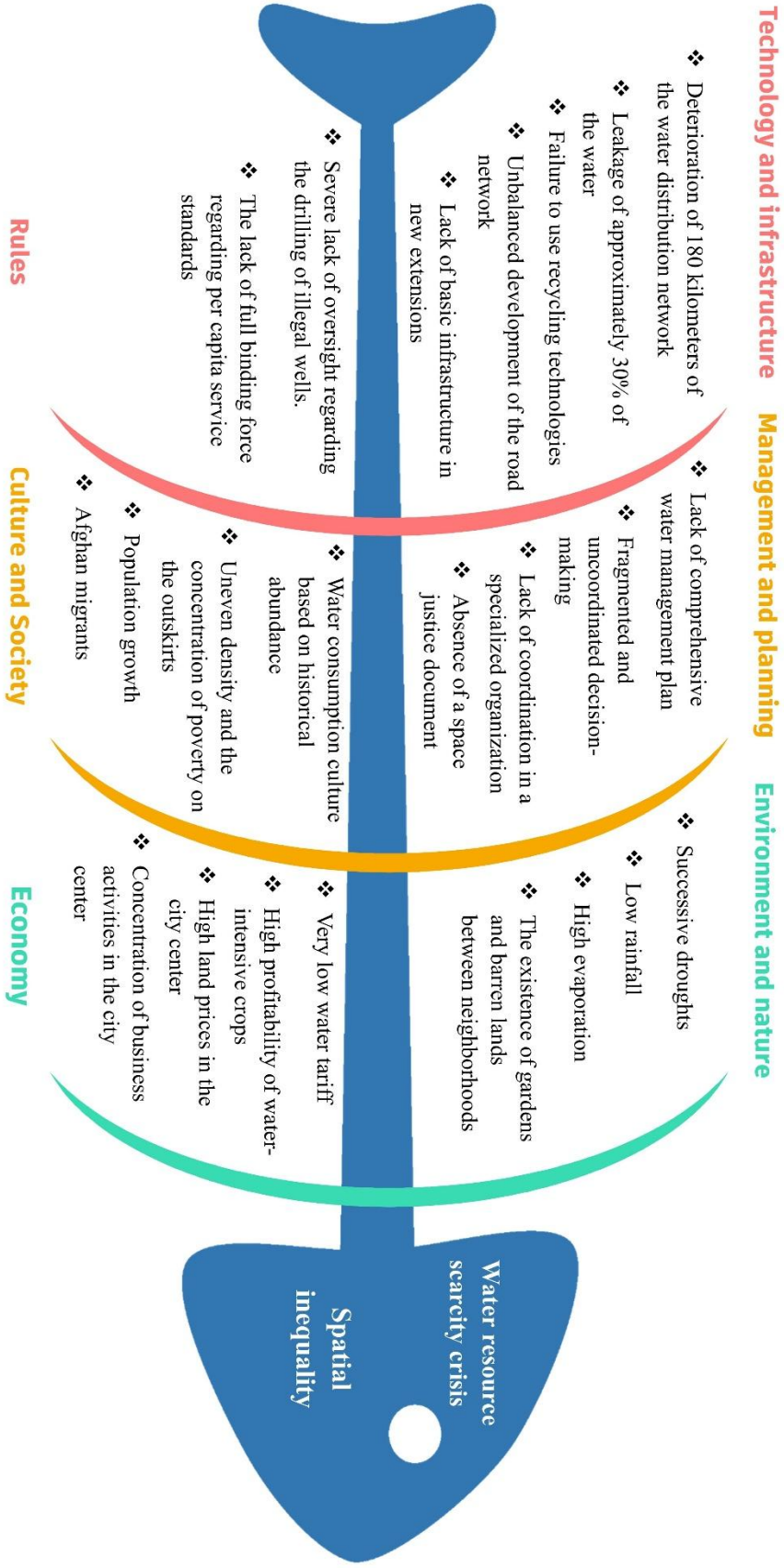


Figure 5: Fishbone Diagram Analysis

6.7. Positions and Demands of Local Actors and Stakeholders in Mehriz City

Analyzing the water crisis and spatial inequality in Mehriz is not complete using only physical and statistical data, as these issues are shaped within the context of the interests, conflicts, and decisions of various urban actors. Therefore, in this section, the positions and demands of stakeholders concerning water, orchards, land-use conversion, and urban management have been examined. Data in this section are not based on direct interviews or field surveys, but were gathered through qualitative content analysis of official stances, media reports, published statements, and accessible documents. Thus, the results of this section reflect an indirect perspective of stakeholders and should be interpreted as supplementary and exploratory data.

Table 13: Qualitative analysis of the positions, statements, and demands of local actors and stakeholders in Mehriz

Category of Actors and Stakeholders	Actor Name / Legal Position	Extracted Objective Position, Statements, and Demands
Judiciary (Legislative Branch)	A. Dehghan (Public and Revolutionary Prosecutor of Mehriz)	Necessity of decisive judicial action against land subdivision, villa construction, and unauthorized fencing in orchard lands, and restoring lands to their original state based on the Law on Preservation of Agricultural Lands (Dehghan, 2025).
Municipality and Urban Management	Hamidreza Zare Bidoki (Mayor of Mehriz)	Emphasis on the national registration of the Mehriz garden-city as a 900-hectare historical and ecological zone, and an absolute ban on fencing without municipal regulations (Zare Bidoki, 2026).
Local Management and Council	Mehdi Zare Bidoki (Former Head of Mehriz City Council)	Clarifying the inherent illegality of converting orchard land use and the legal duty of the municipality and council in preventing unauthorized subdivision of orchard and agricultural lands.
Municipality (Former)	Hamzeh Zare Zadeh (Former Mayor of Mehriz)	Announcing the immediate and uncompromising demolition of fenced agricultural plots within the historical fabric based on the legal rulings of the Article 100 Commission (Zare Zadeh, 2020).
Experts and Urban Planning Profession	Seyed Reza Mohsen-Al-Hosseini (Head of Construction Engineering Organization)	Severe criticism of the process of gradual drying of orchards by profiteers, the inefficiency of Article 100 Commission fines as a non-deterrent factor, and the necessity of firm resolve among officials against the destruction of the garden-city (Mohsen-Al-Hosseini, 2020).
Agriculture and Natural Resources Sector	Kamyar Rasouli (Former Head of Agriculture Jihad)	Opposition to cutting down trees under the pretext of desiccation and the necessity of restoring and replacing orchards with new fruitful trees instead of attempting to physically change land use (Rasouli, 2015).
Natives, Trustees, and *Mirabs*	*Mirabs* and local farmers	Severe complaints and protests regarding the inequality in equitable water distribution at the peak of the drought, and the irrigation of private orchards belonging to influential individuals with drinking water, while neighborhoods face water shortages (Mehr News Agency, 2015).
Citizens and Local Community	Residents of historical neighborhoods and summer resort areas	Protests against the influx of brokers, villa construction by non-natives in summer resort orchards, the entry of bulldozers, and the destruction of traditional agricultural water rights (Mehr News Agency, 2015).

6.8. Integrating Findings: The Unified Analytical Matrix

In order to reveal the linkages among the findings of the six analytical frameworks (SWOT, DPSIR, PESTEL, Porter, VRIO, Fishbone) and to achieve an integrated picture of the issues in Mehriz, key findings from each framework were consolidated into a unified analytical matrix (Table 14). In this matrix, five core issues or factors—comprising the water crisis, spatial inequality, heritage tourism opportunity, demographic window, and qanat decline—are juxtaposed against the perspectives of all six frameworks.

Table 14: Integration Matrix of Analytical Frameworks

Core Issue / Factor	SWOT	DPSIR	PESTEL	Porter	VRIO	Fishbone (Root Cause)
Water Crisis	Threat T1, T2 / Weakness W1	Main pressure, critical state	Environmental (Dominant factor)	High supplier power (Water)	Qanat: V, R, I but weak O	Inefficient governance + Outdated technology
Spatial Inequality	Weakness W3 / Threat T5	Undesirable state, weak responses	Socio-economic	Buyer power (Investor)	Weak organization (Unequal distribution)	Administrative-financial centralization
Heritage Tourism Opportunity	Opportunity O1, O2 / Strength S1, S2	Potential response but requires organization	Socio-cultural	Threat of new entrants	High V, R, I; O requires work	Weak branding / Infrastructure
Demographic Window	Strength S6	Driving force (D) (for both growth and pressure)	Social (Opportunity and threat)	Low supplier power (Labor)	Yes V; No R; Weak O	Lack of employment program
Qanat Decline	Compound weakness (Environmental-Heritage)	Pressure (P) and State (S)	Environmental and legal	Increased supplier power (Nature)	Advantage at risk of erosion	Weak laws monitoring unauthorized wells

6.9. Strategic Statements and Urban Development Scenarios for Mehriz

Based on the integrated findings of the six analytical frameworks (SWOT, DPSIR, PESTEL, Porter, VRIO, and Fishbone), strategic statements including the vision, mission, capacities, and limitations of Mehriz were formulated. Additionally, considering the two critical uncertainties—the state of water resources and the quality of urban governance—three probable scenarios for the 2041 horizon were drawn, and a strategic alternative was proposed for each scenario. (Table 15) summarizes these statements and scenarios.

Table 15: Strategic Statements and Urban Development Scenarios for Mehriz

Title	Content
Vision Statement (in the style of Oregon)	By the 2041 horizon, Mehriz is the sustainable and resilient garden-city of central Iran's desert; a city where the limitations of the arid climate have been transformed into opportunities for innovation in resource management, and the historical qanat network flows not only as global heritage but as the living pulse of urban identity and economy. In this vision, water resources have regained their sustainability through integrated governance and recycling technologies; spatial inequality has given way to equitable service distribution; intangible cultural heritage has become the axis of creative tourism; the garden-city economy has transformed by relying on low-water-demand species and solar energy; and a compact, pedestrian-oriented, and connected physical structure is formed upon the foundation of qanats.
Mission Statement	The mission of urban planning and management in Mehriz is to preserve the life of the garden-city by halting and reversing the depletion of water resources, establishing spatial justice in access to services and infrastructure, and activating heritage-cultural capital for endogenous and resilient economic development. This mission is pursued through executing a comprehensive water security plan, redistributing service per capitas based on a spatial justice map, packaging and marketing intangible heritage, and institutional capacity building.
Capacity Statement (Strategic Assets)	Mehriz possesses the capacities of unparalleled heritage capital (qanats and rituals), a demographic window (young workforce), a garden-city origin, a geostrategic location, a distinct climate and solar energy potential, strong social capital, and intra-urban barren lands.
Limitation Statement (Fundamental	In contrast, limitations include imminent water bankruptcy, a deep gap in organizational cohesion, institutionalized spatial inequality, competitive pressure

Title	Content
Challenges and Obstacles)	and weak differentiation, natural and climatic threats, a fragile economy, and an issue-avoidant planning culture.
Strategic Options (Alternatives)	• **Alternative A: Stabilization and Flourishing** (Regeneration of the garden-city based on water security and spatial justice), including forming an integrated institution, investing in a wastewater treatment plant, drafting a spatial justice document, and tourism branding. • **Alternative B: Selective Resilience** (Threat management and mitigating critical gaps), including prioritizing drinking water supply, seismic retrofitting, and providing minimum basic services. • **Alternative C: Survival under Emergency** (Adaptation to absolute scarcity), including water rationing, resettlement, and emergency heritage conservation.

6.10. Objectives, Strategies, and Policies

After formulating strategic statements and selecting the desired scenario (Green Flourishing), the next step is translating broad directions into quantitative, time-bound objectives, macro-strategies, and specific executive policies. In this section, four priority areas have been defined: water resource security and sustainability; spatial justice and urban integration; economic flourishing based on heritage and garden-city identity; and institutional and participatory capacity building. For each area, specific objectives, strategies derived from SWOT analysis (matching internal and external factors), and corresponding executive policies are presented in (Table 16).

Table 16: Objectives, Strategies, and Policies

Strategic Objective	Relevant Macro-Strategy	Relevant Executive Policies	Supporting and Aligned Statutory Documents	Supporting Views, Statements, and Demands of Stakeholders
Water Resource Security and Sustainability (Reducing leakage, storage, wastewater, aquifer stabilization, qanat restoration)	**Garden-City Regeneration Based on Water Security** (WO and WT combination: Addressing water weaknesses with technological opportunities and mitigating drought threats)	• Prioritizing the repair and renovation of the water distribution network in areas with the highest leakage, based on technical and financial feasibility • Strengthening control, monitoring, and limiting new well drilling according to legal regulations and aquifer capacity • Gradual development of recycling systems and greywater reuse in new construction, particularly in public and large-scale projects • Phased planning to complete the wastewater network and utilize treated effluent for irrigating urban green spaces and orchards • Proposing the creation of a special fund or financial line for urban water security, involving the	• New Yazd Transformation Plan (Sustainable water transfer projects for the province) • Yazd Regional Development Plan (Necessity of recycling consumed water and constructing urban wastewater collection networks) • Mehriz Master Development and Construction Plan (Improving water resources and reforming the distribution network)	• Protests by *mirabs* and local farmers against unequal distribution of aquifer quotas during droughts. • Statements by Mehriz's prosecutor (Dehghan) regarding judicial protection of lands and confronting unauthorized wells. • Media reports highlighting the challenge of one-third water production loss in Mehriz's distribution network (ISNA).

Strategic Objective	Relevant Macro-Strategy	Relevant Executive Policies	Supporting and Aligned Statutory Documents	Supporting Views, Statements, and Demands of Stakeholders
		municipality, water supply agencies, and other relevant institutions • Investigating the possibility of allocating a specific portion of municipal revenues to projects reducing water leakage, restoring qanats, and protecting orchards, following legal and financial evaluation • Implementing incentive and deterrent policies for water consumption management, emphasizing high-volume and non-essential uses • Protecting the buffer zones of qanats and orchards as ecological and heritage infrastructure of the city in the process of issuing building permits and land-use changes.		
Spatial Justice and Urban Integration (Balanced per capita green space, reducing density gaps, road improvement, service distribution)	**Spatial Balancing and Endogenous Compact Development** (WO Strategy: Using legal opportunities to address inequality weaknesses)	• Drafting and approving the Mehriz spatial justice document • Halting the issuance of permits converting orchards to residential use and applying TDR • Mandating the municipality to equitably provide land for public services in deprived neighborhoods • Developing a five-year road improvement plan • Offering density incentives for development in barren lands within city limits	• Mehriz Detailed Plan (Guiding physical development with the aim of equitable distribution of services and controlling population density) • Yazd Regional Development Plan (Strict prohibition of the city's physical development toward northern, eastern, and southern orchards)	• Technical critique by the head of Mehriz's Construction Engineering Organization (Mohsen-Al-Hosseini) regarding the municipality's expediency on orchard subdivision and the inefficiency of Article 100 Commission fines. • Public grievances and protest petitions by residents of summer resort neighborhoods concerning unchecked villa construction by brokers in orchard

Strategic Objective	Relevant Macro-Strategy	Relevant Executive Policies	Supporting and Aligned Statutory Documents	Supporting Views, Statements, and Demands of Stakeholders
				alleys (Mehr News Agency).
Economic Flourishing Based on Heritage and Garden-City Identity (Increasing tourism share, attracting tourists, 25% employment, solar power plant)	**Cultural Branding and Creative Tourism** (SO Strategy: Linking heritage and garden-city strengths with ecotourism and global registration opportunities)	• Creating a Mehriz Garden-City Heritage and Tourism Base • Compiling an annual calendar for ritual tourism • Granting low-interest loans and tax exemptions to ecotourism investors • Requiring the industrial estate to supply 15% of its electricity from solar energy • Supporting the formation of local youth cooperatives for sustainable orchard management	• New Yazd Transformation Plan (Safeguarding cultural heritage, developing sustainable tourism, and building solar power plants in the province) • Mehriz Master Development and Construction Plan (Introducing historical/natural attractions and building hotels and tourist routes)	• Emphasis by the Mayor of Mehriz (Zare Bidoki) on the national registration of the historical orchard zone of Mehriz and the necessity of its preservation. • Stances by the head of Agriculture Jihad (Rasouli) on the necessity of reviving and restoring historical orchard alleys as ecotourism attractions instead of physically destroying lands.
Institutional and Participatory Capacity Building (Integrated institution, GIS, participatory budgeting, realizing service land uses)	**Institutional Integration and Responsible Execution** (Foundation WT Strategy: Targeting the organizational gap and issue-avoidant culture)	• Forming a Mehriz Sustainable Development Steering Committee • Establishing neighborhood facilitation and development offices in main Hussainiyas • Designing and implementing a specific responsible migration management program • Mandating passive defense and seismic retrofitting annexes • Creating a Mehriz Urban Development Fund	• Yazd Regional Development Plan (Proposing an organizational structure for regional development management and activating specialized working groups with public participation) • Mehriz Detailed Plan (Proposing neighborhood-based recreational, cultural, and sports projects with municipal participation)	• Emphasis by the former Mayor of Mehriz (Zare Zadeh) on the necessity of public oversight and reporting orchard fencing violations to municipal judicial authorities. • Emphasis by the head of the Construction Engineering Organization of Mehriz on the necessity of firm resolve and synergistic coordination among all supervisory bodies (Roads and Urban Development, Jihad, and Municipality).

6.11. Analytical and Policy Implications of the Research

The research findings demonstrate that the main problem in Mehriz is not merely a shortage of water resources or weak distribution of urban services, but rather the disconnect among water resource management, orchard conservation, land-use conversion control, and spatial planning. Therefore, the main implication of the research is that urban policymaking in Mehriz must consider the relationship between the aquifer, qanats, orchards, physical development, and spatial justice in an integrated manner.

First, decisions related to the city's physical development must be aligned with water resource capacity and aquifer status. The drop in groundwater levels, decreased qanat discharge, and water loss in the distribution network indicate that water must be considered as one of the main spatial organizing variables in urban planning. Second, protecting valuable orchards should not be limited to merely prohibiting land-use changes; it must be accompanied by economic incentives, alternative water supply, controlled use of treated effluent, and support for owners. Third, qanats must be removed from a purely heritage status and redefined in urban documents and decisions as part of the historical system of water governance, garden-city identity, and participatory resource management. Fourth, institutional coordination among the municipality, water resource management, agriculture, cultural heritage, and environment must be strengthened, as institutional fragmentation is one of the main drivers perpetuating hydro-spatial instability in Mehriz. Finally, spatial justice in Mehriz must be understood beyond the distribution of public services, encompassing access to environmental quality, green space, water security, orchards, and the benefits of urban development. These implications are presented as policy directions derived from the analysis and do not substitute a master plan or detailed executive program. Their objective is to highlight that without reforming the relationship among water, space, and decision-making institutions, isolated actions in urban services, orchard conservation, or physical development cannot lead to long-term resilience for Mehriz.

The present research has a fundamentally distinct nature and structure compared to common physical development plans (such as approved master and detailed plans). Traditional physical development plans are static documents that focus on linear population projections (such as Mehriz's 36,000 population horizon) and rigid color-coded zoning on maps. In contrast, the current research is a diagnostic and causal model based on feedback loops; this study does not seek to draw rigid land-use maps, but rather, by combining interpretive tools (such as content analysis of official and media statements of local stakeholders like the mayor, prosecutor, and *mirabs*), it aims to discover the causal cycle of decline, assess the organizational level of strategic assets (VRIO), and provide dynamic governance and institutional solutions. Based on the theoretical foundations, the garden city of Mehriz is an integrated socio-ecological system; therefore, aquifer management cannot be separated from the dynamics of population growth, local livelihoods, transit logistics, or building quality. Analyzing economic variables (such as the employment share in industry and services) and physical variables (such as the 41% share of residential land use and the presence of marginal sand dunes) helps to better understand the systemic interactions between water and space. An alteration in any of these sub-systems (such as new industrial loading or physical development in the southwest) directly changes the aquifer's consumption balance; hence, the analysis of these non-hydrological variables was an indispensable diagnostic prerequisite for evaluating the garden-city's resilience.

7. Discussion

The anatomy of Mehriz's urban planning structure, through the integration of analytical frameworks, provided a multi-layered and intersecting picture. The SWOT analysis indicated that Mehriz is trapped in a conservative position where environmental threats, such as the annual 0.5 to 1 meter drop in the aquifer level, outweigh the strengths; although the establishment of the Pishgaman Dry Port is considered a prominent transit opportunity. The DPSIR causal chain revealed that aquifer depletion and a 30% leakage in the drinking water distribution network have led to a decrease in orchard productivity, land subdivision, and unauthorized land-use conversion, deepening the center-periphery gap (the historical fabric with a density of over 120 persons per hectare versus peripheral fabrics with a density of less than 50 persons). The VRIO analysis also specified that Mehriz's globally registered qanats possess value, rarity, and inimitability, but due to the extreme weakness of local organization,

they have remained a dormant advantage. Ultimately, the Fishbone diagram identified the roots of this crisis in fragmented governance, financial centralization, and static physical planning.

The fundamental argument of this research demonstrates that the cycle of decline in the garden city of Mehriz is rooted in a change in structural approach and the political economy of space. Aquifer depletion and water loss in the distribution network are not merely deterministic and hydrological phenomena, but rather the direct consequence of the transition from participatory and local management of qanats to centralized yet fragmented and sectoral management. In this causal cycle, the decreased discharge of qanats such as Hasanabad and Mehrpadin has severely reduced the consumptive and ecological value of water for the life of orchards, and conversely, has increased the exchange value of land for land-use conversion. The high profitability of residential and commercial construction versus the low returns of the agricultural economy has encouraged owners to subdivide their lands in the absence of a deterrent and supportive system. In this space, water, which in the past was a factor of spatial connection and neighborhood cohesion, has now become the driving engine for reproducing inequality; such that central neighborhoods have attracted capital by exploiting locational rent and the remaining freshness of orchards, while peripheral neighborhoods have faced a severe decline in environmental quality and very low per capita green space. This anatomy proves that the crisis in Mehriz is the result of the intersection of land economy, governance fragmentation, and weak institutional regulation, not merely an absolute lack of precipitation.

The results of this research can be interpreted under the core concept of the organizational gap. The main bottleneck in Mehriz is not an absolute shortage of material resources, but a structural inability to mobilize and guide existing assets toward sustainability. Traditional water distribution systems (*mirabs*) have been weakened without being replaced by a modern and coordinated institution. Qualitative explanation of official statements also indicates that despite officials' emphasis on preserving orchards, no deterrent system exists, and official responses have stalled at the level of paper zoning and lack a monitoring cycle. This phenomenon reflects the very implementation failure in the country's physical planning; as the municipality's revenue-generating approach from Article 100 construction violations has deepened the gap between having regulations and being able to enforce them.

The root causes of hydro-spatial decline in Mehriz can be explained at three levels: First, at the structural level, administrative-financial centralization in budget allocation has tied the hands of Mehriz's local management and created a scalar gap between the scale of the problem (local) and decision-making (national-provincial). Second, at the institutional level, the dispersion of responsibilities among authorities (Municipality, Agriculture Jihad, Water Affairs, and Cultural Heritage) without a central coordinator has led to conflicting decisions; such that the municipality generates revenue from Article 100 fines, the Jihad emphasizes the physical preservation of orchards, and the prosecutor's office is forced to demolish villas. Third, at the cognitive level, the dominance of an issue-avoidant planning culture and administrative routine has focused actions merely on managing symptoms. The combination of these levels has formed a vicious cycle that has rendered Mehriz's potential advantages dormant.

At the applied and concrete policymaking level, the research results outline the transition path from static physical planning to adaptive implementation in Mehriz through four specific strategies: (1) establishing an integrated Mehriz aquifer and garden-city management institution to eliminate institutional fragmentation, (2) implementing a spatial justice document based on Transfer of Development Rights (TDR) tools for orchard conservation, (3) deploying a functional monitoring system based on Key Performance Indicators (KPIs) to curb distribution network leakage and seal unauthorized wells, and (4) launching neighborhood-based facilitation offices to increase the participation of locals. The experience of anatomizing Mehriz shows that without rethinking the governance structure and dynamically linking

hydrological resources to physical space, even the most precise technical plans will remain abortive in the implementation phase.

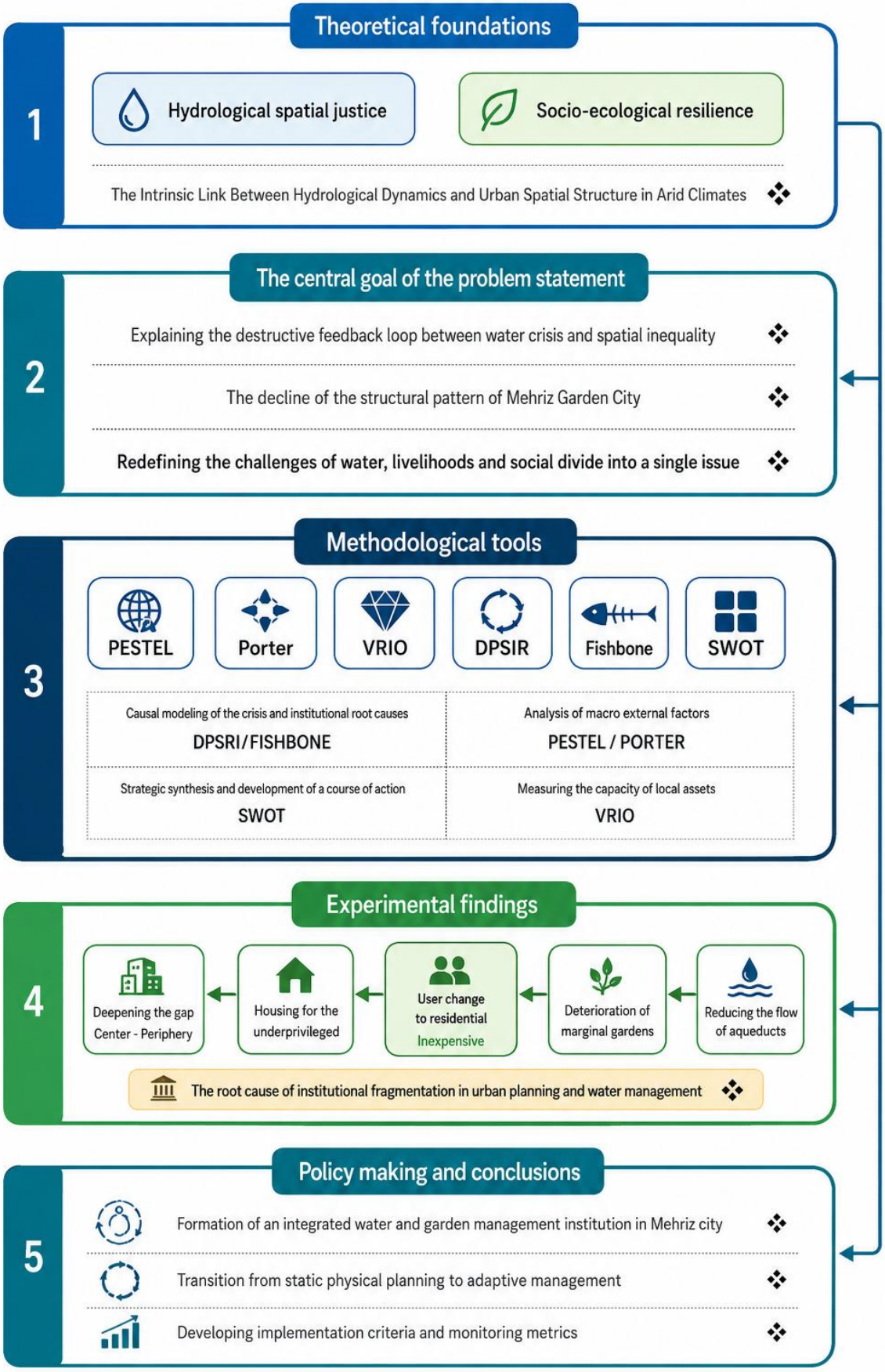


Figure 6: Linking theoretical foundations and the research problem through methodological tools with findings and conclusions

8. Conclusion

The present research was conducted with the aim of compiling an analytical urban profile for the garden city of Mehriz and demonstrated that the issue of this city goes beyond a physical shortage of water resources or a weakness in the equitable distribution of services. The key deduction of this study is that Mehriz's main crisis is the consequence of a destructive feedback loop among water resource depletion, the degradation of the garden-city structure, land-use conversion, and the land economy system. From this perspective, Mehriz faces a form of hydro-spatial instability in which environmental crisis and physical inequality exacerbate one another in a causal cycle.

In response to the first research question, the causal chain showed that the water crisis is directly the driving engine for reproducing spatial inequality. The annual drop in the aquifer level and the decreased discharge of qanats have destroyed the ecological value of orchards and raised the exchange value of land for speculation. These findings, in a comparative analysis, corroborate Swyngedouw's (2004) hydrosocial cycle framework and Soja's (2010) spatial justice theory within the context of a desert city; where the flow of water is not merely a natural phenomenon, but rather the unequal distribution of its benefits (concentration of capital and freshness in the center versus a decline in quality in the periphery) has reproduced physical inequality. Furthermore, these results indicate that to understand spatial justice in arid Iranian cities, one must, as Dadashpour and Alvandipour (2017) emphasized, move beyond a merely distributional approach to services and pay attention to the structural and hydrological roots of injustice.

In response to the second question, rooting out this destructive cycle proved that Mehriz's inefficiency is not caused by climatic determinism, but is rooted in an organizational gap and fragmented governance. This result, in line with studies by Hosseini et al. (2024) and Sadeghloo and Sajasi Gheidari (2014), proves that in confronting environmental crises, institutional and managerial dimensions take precedence over physical limitations. The dominance of static physical planning and fragmented decision-making among responsible institutions have caused strategic assets like qanats to be abandoned without organization. This finding perfectly aligns with the views of Banihabib and Ghafouri Kharanek (2019), who consider the qanat not merely a physical or heritage structure, but a socio-ecological system whose weakening in Mehriz is a clear manifestation of multi-level governance failure (Pahl-Wostl, 2009).

In response to the third question, the integration of the six frameworks (PESTEL, Porter, VRIO, DPSIR, SWOT, and Fishbone) proved that the concept of a hydro-spatial profile is an effective tool for overcoming reductionism in urban planning. These tools made it possible to trace the root of the crisis from the level of physical symptoms to the level of macro-drivers and institutional structures.

Ultimately, the analytical achievement of this urban profile shows that the solution to break out of this cycle of decline, prior to requiring budget injections or the formulation of new physical development plans, hinges on reforming the political economy of space and redesigning the governance structure. Enhancing Mehriz's resilience will only be realized when, by establishing an integrated institution for the joint management of the aquifer and the garden city, the missing link among ecological conservation, controlling land speculation, and the equitable distribution of spatial benefits is restored. Since this research is based on the specific context of Mehriz, it is recommended that future studies test this causal framework in other arid cities of Iran using disaggregated neighborhood-level data.

Despite the aforementioned analytical achievements, this research has also faced limitations. First, limited access to disaggregated and up-to-date data regarding the exact quality of

distributed water at the neighborhood level, as well as a lack of transparent statistics on the volume of extraction from unauthorized wells, caused quantitative analyses of water flow to face challenges. Second, the research relied on official data, document content analysis, and field observations, and due to the lack of extensive surveys or in-depth interviews with local stakeholders, it was not possible to accurately represent all hidden social conflicts. Given these limitations, it is recommended that future studies employ disaggregated neighborhood-level data and spatial analysis techniques (GIS) to conduct a precise spatial assessment of access to services and environmental quality in Mehriz's neighborhoods. Furthermore, conducting qualitative studies based on interviews with *mirabs*, orchard owners, and local activists to better understand the political economy of space and power relations in land-use conversion, as well as executing comparative studies between Mehriz and other qanat-based cities in Iran, can significantly contribute to developing and generalizing the hydro-spatial profile framework in arid city planning.

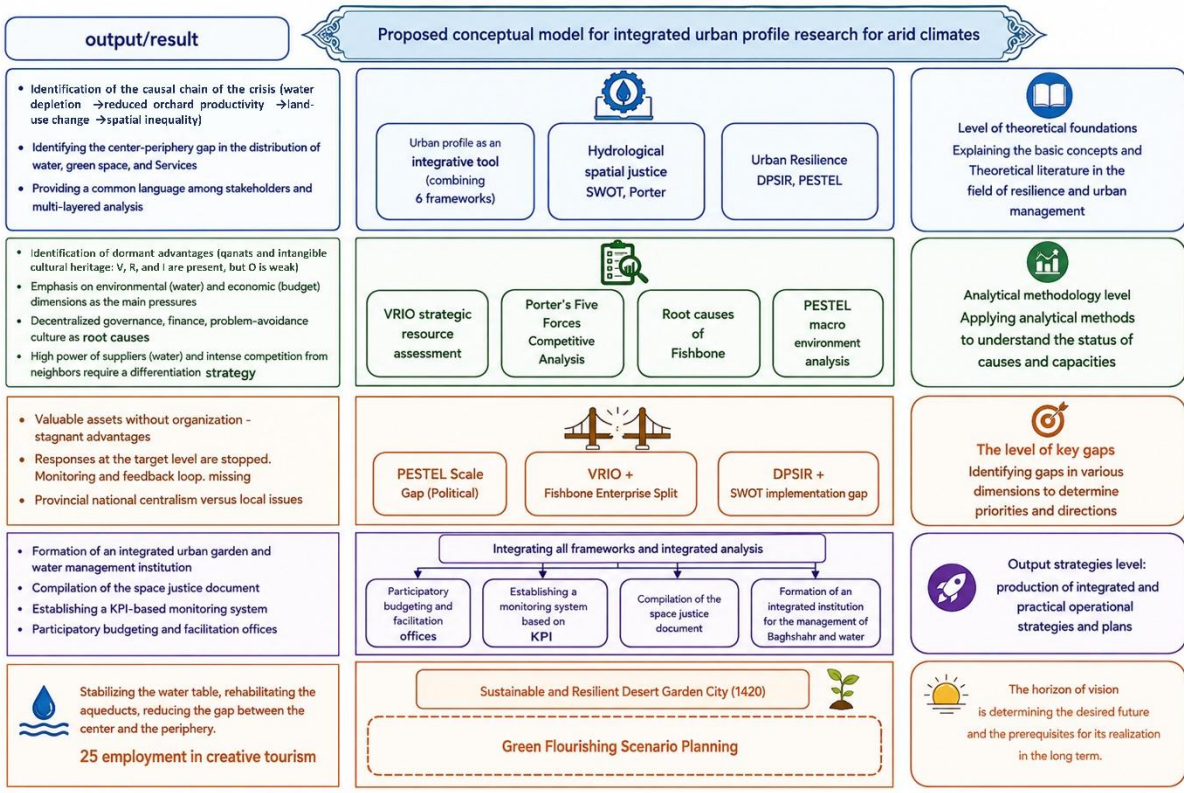


Figure 7: The proposed conceptual model of the research

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Conflict of Interest

The authors declare that there is no financial or personal conflict of interest that could influence the results presented in this research. The data and information used in this research will be made available to researchers and interested parties upon reasonable request.

Authors' Contributions

All authors participated in the research design, data collection, results analysis, and writing of the article, and their level of contribution was equal across all stages of the research. Additionally, all authors have read and approved the final version of the manuscript.

Refrences

Aftab News. (2022, March 30). Subsidence threat looms over Yazd / Ancient monuments at risk of destruction. https://aftabnews.ir/fa/news/766634/ [In Persian]

Ahmadi, M., et al. (2020). Qanat systems and urban spatial structure in central Iran. Springer.

Albrechts, L. (2004). Strategic (spatial) planning reexamined. Environment and Planning B: Planning and Design, 31(5), 743–758. https://doi.org/10.1068/b3065

Banihabib, M., & Ghafouri Kharanek, S. (2019). Evaluation of traditional aquifer governance characteristics using effective groundwater governance principles. Iranian Indigenous Knowledge, 6(12), 235–265. https://qjik.atu.ac.ir/article_8101.html [In Persian]

Barati, M., et al. (2019). Assessment of groundwater pollution in the Mehriz plain with emphasis on nitrate concentration. National Conference on Water and Environmental Engineering. Link: Groundwater Pollution Study in Mehriz Plain

Beall, J., & Fox, S. (2009). Cities and development. Routledge. https://doi.org/10.4324/9780203086452

Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., & Wester, P. (2016). Hydrosocial territories: A political ecology perspective. Water International, 41(1), 1–14. https://doi.org/10.1080/02508060.2016.1134898

Brown, R. R., Keath, N., & Wong, T. H. F. (2009). Urban water management in cities: Historical, current and future regimes. Water Science and Technology, 59(5), 847–855. https://doi.org/10.2166/wst.2009.029

Chaffin, B. C., Gosnell, H., & Cosens, B. A. (2014). A decade of adaptive governance scholarship: Synthesis and future directions. Ecology and Society, 19(3), Article 56. https://doi.org/10.5751/es-06824-190356

Dadashpour, H., & Alvandipour, N. (2017). Spatial justice at the urban scale in Iran: A meta-study of the theoretical framework of existing scientific articles. Fine Arts Journal: Architecture and Urban Planning, 21(3), 67–80. https://doi.org/10.22059/jfaup.2016.61103 [In Persian]

Davoudi, S. (2015). Planning as practice of knowing. Planning Theory, 14(3), 316–331. https://doi.org/10.1177/1473095215575919

Dehghan, A. (2025, April 25). Judicial action against unauthorized villa construction in Mehriz orchards. Mizan News Agency. [In Persian]

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. Global Environmental Change, 16(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. Annual Review of Environment and Resources, 30(1), 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Fraser, N. (2009). Scales of justice: Reimagining political space in a globalizing world. Columbia University Press.

Gha'ed Rahmati, S., & Hazeri, M. (2013). Spatial analysis of urban service distribution and its effect on urban land prices: Case study of Mehriz city neighborhoods. Geographical Explorations of Desert Regions, 1(2), 89–112. http://grd.yazd.ac.ir/article_457.html [In Persian]

Gleick, P. H. (2003). Water use. Annual Review of Environment and Resources, 28(1), 275–314. https://doi.org/10.1146/annurev.energy.28.040202.122849

Hasani Fakhrābādi, N., & Hasani Fakhrābādi, M. (2024). Water heritage and urban structuring: Analysis of the role of qanats in the formation of Naein, Yazd, and Gonabad. Architectural Research. https://www.noormags.ir/view/fa/articlepage/2197346 [In Persian]

Heynen, N., Perkins, H. A., & Roy, P. (2006). The political ecology of uneven urban green space: The impact of political economy on race and ethnicity in producing environmental inequality in Milwaukee. Urban Affairs Review, 42(1), 3–25. https://doi.org/10.1177/1078087406290729

Hosseini, A., Javāharjoud, M., & Heidari, A. (2024). Analysis of factors affecting urban resilience in the face of water crisis in small cities: Case study of Kabudarahang. Urban Planning Geography Research, 12(2). https://ensani.ir/fa/article/591525 [In Persian]

IRIB News Agency. (2026, May 5). Completion of water supply projects, wastewater development, and network smartening in Mehriz. https://www.iribnews.ir/fa/news/5831077/ [In Persian]

Islamic Republic News Agency (IRNA). (2026, May 6). Film | Criticism of Mehriz mayor regarding unauthorized constructions in orchards [In Persian]. https://www.irna.ir/news/86140334/

ISNA. (2015, April 15). Destruction of Kooh-e Rig orchard alley of Mehriz on the pretext of development project [In Persian]. https://www.isna.ir/news

ISNA. (2024). Preventing the over-extraction of 260,000 cubic meters of water in the cities of Yazd and Mehriz. https://www.isna.ir/news/1403101208681/ [In Persian]

ISNA. (2025). 16 plains of Yazd province are prohibited. https://www.isna.ir/news/1404021007225/ [In Persian]
ISNA. (2026). Wastage of one-third of the produced water in Mehriz / Intensifying the crackdown on unauthorized connections. https://www.isna.ir/news/1405033018164/ [In Persian]

Jamaran News. (2019, January 6). Conversion of Mehriz city land use is subject to legal prosecution [In Persian]. https://www.jamaran.news/%D8%

Labbaf Khaniki, M., Rezvani, M., & Badri, A. (2019). Explaining the process of territorial cooperation in qanat exploitation (case study: Hasanabad qanat, Yazd Province). Rural Research, 10(1), 44–59. https://www.sid.ir/fa/VEWSSID/J_pdf/23013980302.pdf [In Persian]
Lankford, B. (2013). Resource efficiency complexity and the commons. Earthscan. https://doi.org/10.4324/9780203520888
Maherani, M., & Hosseini Nazhvani, M. (2011). Technical, economic and environmental evaluation of the use of effluent from Mehriz wastewater treatment plant in Yazd. International Water and Wastewater Conference with Privatization Approach and Best Practices in Design, Construction and Operation. Civilica. https://civilica.com/doc/110597/ [In Persian]
Mahmoudi-Sadr, M. R., Mortazavi, M. S., Marandi, R., & Zamani, N. (2008). Investigating the nitrite and nitrate levels of water sources supplying Mehriz city. 11th National Conference on Environmental Health of Iran. Civilica. https://civilica.com/doc/144693/ [In Persian]
Marcuse, P. (2009). From critical urban theory to the right to the city. City, 13(2-3), 185–197. https://doi.org/10.1080/13604810902982177
McDonald, R. I., Weber, K., Padowski, J., Flörke, M., Schneider, C., Green, P. A., Gleeson, T., Eckman, S., Lehner, B., Balk, D., Boucher, T., Grill, G., & Montgomery, M. (2014). Water on an urban planet: Urbanization and the reach of urban water infrastructure. Global Environmental Change, 27, 96–105. https://doi.org/10.1016/j.gloenvcha.2014.04.022
Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. Landscape and Urban Planning, 147, 38–49. https://doi.org/10.1016/j.landurbplan.2015.11.011
Mehr News Agency. (2015, April 22). Shirkuh gardens under the blade of bulldozers / Luxury villas replacing ancient trees of Mehriz [In Persian]. https://www.mehrnews.com/news/2539246/

Mehr News Agency. (2026, February 24). Demolition of 40 unauthorized villas and restoration of agricultural lands in Mehriz [In Persian]. https://www.mehrnews.com/news/6758823/

Mehr News Agency. (2025, April 11). Alamdar: The quality of drinking water in Yazd province complies with Ministry of Health standards. https://www.mehrnews.com/news/6730862/ [In Persian]
Mehr News Agency. (2024a, October 16). Mahjoubi: 94% of the wells in Mehriz county are equipped with smart meters. https://www.mehrnews.com/news/6612156/ [In Persian]
Mehr News Agency. (2024b, October 19). Sustainable water supply for Mehriz city by constructing a 30,000 cubic meter reservoir. https://www.mehrnews.com/news/6266224/ [In Persian]
Mehriz Municipality. (2025). Hasanabad qanat of Mehriz. https://mehriz.ir/%D8%AC [In Persian]
Mehrnahad, H., & Pourdara, H. (2016). Study of environmental risks of pollutants in the Mehriz region on creating pollution on groundwater resources of Yazd aquifer. Journal of Iranian Association of Engineering Geology. https://civilica.com/doc/1865700/ [In Persian]
Mohsen-Al-Hosseini, S. R. (2021, February 23). There is no serious determination to prevent the destruction of Mehriz gardens. News Archive [In Persian]. https://newsarchive.ir/%D8%B9%D
Ostrom, E. (1990). Governing the commons: The evolution of institutions for collective action. Cambridge University Press. https://doi.org/10.1017/CBO9780511807763
Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Global Environmental Change, 19(3), 354–365. https://doi.org/10.1016/j.gloenvcha.2009.06.001
Parizadi, T., Hosseini, F., & Behboudi Moghaddam, H. (2016). Analysis of spatial inequalities in the distribution of urban services from the perspective of spatial justice (case study: Marivan city). Geographical Planning of Space, 6(20), 89–104. https://gps.gu.ac.ir/article_41675.html [In Persian]
Patel, S., et al. (2015). The 21st century challenges for cities in the Global South. International Journal of Urban and Regional Research, 39(3), 439–454.
Pickett, S. T. A., Cadenasso, M. L., Grove, J. M., Nilon, C. H., Pouyat, R. V., Zipperer, W. C., & Costanza, R. (2001). Urban ecological systems: Linking terrestrial ecological, physical, and socioeconomic

components of metropolitan areas. Annual Review of Ecology and Systematics, 32, 127–157. https://doi.org/10.1146/annurev.ecolsys.32.081501.114012

Quds Online. (2022, May 10). Modification and development of over 3,000 meters of water piping in Mehriz. https://qudsonline.ir/news/463563/%D8%A7 [In Persian]

Rasouli, K. (2015, April 15). Destruction of Kooh Rig orchard alley of Mehriz on the pretext of development project. Iranian Students' News Agency (ISNA). https://www.isna.ir/news/9402150 [In Persian]

Rauws, W. (2017). Embracing uncertainty without abandoning planning. disP - The Planning Review, 53(1), 32–45. https://doi.org/10.1080/02513625.2017.1316539

Reynolds, J. F., Smith, D. M. S., Lambin, E. F., Turner, B. L., Mortimore, M., Batterbury, S. P. J., Downing, T. E., Dowlatabadi, H., Fernández, R. J., Herrick, J. E., Huber-Sannwald, E., Jiang, H., Leemans, R., Lynam, T., Maestre, F. T., Ayarza, M., & Walker, B. (2007). Global desertification: Building a science for dryland development. Science, 316(5826), 847–851. https://doi.org/10.1126/science.1131634

Riahi Moghaddam, S. (2015). Mehriz: The township of yesterday, the garden city of today. Housing and Rural Environment, 34(151), 55–66. http://jhre.ir/browse.php?a_id=219 [In Persian]

Roy, A. (2011). Slumdog cities: Rethinking subaltern urbanism. International Journal of Urban and Regional Research, 35(2), 223–238. https://doi.org/10.1111/j.1468-2427.2011.01051.x

Sadeghloo, T., & Sajasi Gheidari, H. (2014). Prioritization of factors affecting the enhancement of farmers' resilience against natural hazards with emphasis on drought (case study: Farmers of Ijrud County villages). Geography and Environmental Hazards, 3(10), 129–154. https://ensani.ir/fa/article/337510 [In Persian]

Saed News. (2026). Introduction of 11 long and mysterious qanats in Iran; registered in UNESCO. https://saednews.com/cn/10158/362248 [In Persian]

Saghi-Jadid, M., Naderi, M., & Nadiri, A. (2024). Evaluation of groundwater resources exploitation and identifying forbidden plains (Case study: Yazd province). Civilica. https://civilica.com/doc/2197573/ [In Persian]

Soja, E. W. (2010). Seeking spatial justice. University of Minnesota Press.

Stead, D., & Meijers, E. (2009). Spatial planning and policy integration. Policy Studies, 30(3), 273–290. https://doi.org/10.1080/14649350903229752

Swyngedouw, E. (2004). Social power and the urbanization of water: Flows of power. Oxford University Press. https://doi.org/10.1093/oso/9780198233916.001.0001

Taqvaei, M., et al. (2023). Sustainable tourism in historical cities of arid regions through qanat revitalization: The case of Yazd. Journal of Geotourism Studies. Link: Sustainable Tourism and Qanat Revitalization in Yazd

UN-Habitat. (2016). Urban profiling for better urban policy. UN-Habitat.

Watson, V. (2014). Co-production and collaboration in planning – The difference. Planning Theory & Practice, 15(1), 62–76. https://doi.org/10.1080/14649357.2013.866266

Yadgarifar, F., Poudineh, M., & Esmailnejad, M. (2023). Analysis of urban resilience against water crisis: Case study of Tehran. Safe City, 2(5), 1–14. https://www.ispdrc.ir/article_705486.html [In Persian]

Yazd IRIB News Agency. (2026, May 6). Demolition of 60,000 square meters of unauthorized construction in Mehriz orchards [In Persian]. https://www.iribnews.ir/fa/news/5785584/

Yazd Province Meteorological Administration. (2025). Yazd besieged by heat and drought; Water is the most important issue of the century for the province. https://www.yazdmet.ir/cs/News/112/9603/ [In Persian]

Yazd Province Water and Wastewater Company. (2025). Bidak Mehriz storage reservoir; A strategic step in sustainable water supply for 11,000 people. https://news.abfayazd.ir/cs/News/18/2656 [In Persian]

Yazd Province Water and Wastewater Company. (2024). Development of more than 26,000 meters of water distribution network in Mehriz county. https://news.abfayazd.ir/cs/News/18/2142 [In Persian]

Yazd Province Water and Wastewater Company. (2025). The 5,000 cubic meter Bidak Mehriz water reservoir was inaugurated / Emphasis on sustainable water supply in the province. https://news.abfayazd.ir/cs/News/18/2658 [In Persian]

Yazd Regional Water Company. (2025). Collecting compensation for damages caused to aquifers is seriously on the agenda of Yazd Regional Water Company. https://www.yzrw.ir/cs/News/118/1683 [In Persian]

Yazd Regional Water Company. (2025). Extraction of 119 million cubic meters of water from the resources of Mehriz county. https://news.yzrw.ir/cs/News/118/4002/ [In Persian]

Yazd Regional Water Company. (2021). The water scarcity adaptation program in the urban area of Yazd province was communicated. https://news.yzrw.ir/cs/News/118/2506/ [In Persian]

Yazd Regional Water Company. (2025). Urgent review of drinking water supply challenges in Mehriz at the 8th meeting of Yazd province water resources quality management. https://news.yzrw.ir/cs/News/118/4058/ [In Persian]

Yazd Regional Water Company. (2026). Yazd's three strategic plans for water consumption management / 73% achievement of the goals of the water scarcity adaptation document. https://news.yzrw.ir/cs/News/118/ [In Persian]