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What Is a Qanat? Rethinking the Role and Interpretation of Qanats in Tehran's Urban Infrastructure Network

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Abstract

The decline of Tehran›s qanat system cannot be explained solely by environmental change or the pressures of urbanization. Rather, it reflects a fundamental misreading of the qanat within contemporary urban planning, where it has increasingly been treated as a technical utility rather than as an integral component of the city›s landscape infrastructure. This technocratic perspective has reduced the qanat to a network of underground hydraulic facilities, contributing to its gradual exclusion from Tehran›s urban infrastructure and to restoration strategies focused primarily on physical rehabilitation.

This study argues that the dominant planning paradigm has stripped the qanat of its broader historical, cultural, and social significance, reducing it to little more than a conduit for water conveyance. As a result, meaningful conservation cannot rely on engineering interventions alone; it requires a fundamental shift in how the qanat is conceptualized within urban planning and governance.

Drawing on the concept of landscape infrastructure, the paper reconceptualizes the qanat as a multi-layered socio-ecological system that embodies the long-standing relationship between Tehran›s inhabitants and their environment. Beyond its physical elements including access shafts, public water shrines, and surface channels the qanat also sustains collective memory, local cultural practices, a sense of place, and urban identity.

The study concludes that the future conservation and revitalization of Tehran›s qanats depends on moving beyond reductionist interpretations and embracing a landscape-based understanding that recognizes their ecological, cultural, and infrastructural significance as an integrated urban system.

Keywords: Tehran qanats, Landscape infrastructure, Technocratic approach, Landscape approach, Qanat ontology.

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How should the qanat be conceptualized within Tehran's urban water infrastructure? What is the underlying cause of the decline of Tehran's qanats?

Extended Abstract

Introduction and Problem Statement: The decline of Tehran's qanats is often attributed to environmental change or the pressures of urbanization. This paper argues, however, that its underlying cause lies in the way qanats have been conceptualized within contemporary urban planning and governance. The prevailing technocratic paradigm has reduced the qanat from a complex urban system to a technical utility or underground hydraulic facility, valued primarily in terms of engineering performance and perceived risks such as land subsidence. This reductionist view has progressively marginalized qanats within Tehran's urban infrastructure and shaped restoration strategies focused almost exclusively on physical interventions.

Historical Context: For centuries, qanats constituted Tehran's primary water infrastructure and played a central role in shaping the city's spatial structure, landscape, and identity. Their significance extended well beyond water supply, influencing patterns of settlement, public space, and everyday urban life. With the introduction of modern water distribution systems, however, qanats gradually lost their functional and institutional status. Infrastructure expansion, groundwater pollution, fragmented governance, and the absence of an integrated conservation strategy have since accelerated their deterioration and abandonment.

Theoretical Framework: Drawing on the concept of landscape infrastructure, this study challenges the conventional understanding of qanats as purely hydraulic systems. Instead, it conceptualizes the qanat as a multi-layered socio-ecological infrastructure in which physical, ecological, cultural, and symbolic dimensions are inseparably intertwined. From this perspective, the qanat comprises not only tangible elements including access shafts, saqqakhanes, and surface water channels but also intangible values such as collective memory, local cultural practices, sense of place, and urban identity.

Conclusion: The findings suggest that current conservation initiatives remain constrained by a technocratic understanding of infrastructure, limiting restoration to engineering solutions while overlooking the broader urban and cultural functions of qanats. Meaningful conservation requires a fundamental shift in perspective: the qanat must be recognized not simply as a hydraulic facility, but as an integrated landscape infrastructure that connects water, landscape, culture, and urban life. Reframing the qanat in this way provides a more comprehensive foundation for its conservation, governance, and long-term revitalization within contemporary Tehran.

The decline of qanats is rooted less in environmental processes than in a fundamentally flawed understanding of what a qanat is.

A fragmented, one-dimensional understanding of qanats has shaped planning decisions, leading to inadequate conservation measures and, in some cases, their complete removal.

Reconceptualizing the qanat as landscape infrastructure may serve as a viable foundation for its revitalization.

Due to its tangible and intangible cultural, social, economic, and environmental values, as well as its functional, identity-forming, and aesthetic roles, the qanat operates as a landscape infrastructure with an objective–subjective nature.