

Original Research Article

Explaining and Analyzing the Factors Influencing the Branding of Riverfront Cities with an Environmental–Ecological Approach (Case Study: Ahvaz City)

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Received: 26/07/2025

Accepted: 02/09/2025

Available online: 22/12/2025

Abstract | Rivers play a central role in shaping ecological, social, and symbolic connections between citizens and the urban living environment in riverfront cities. The present study aims to analyze the mechanisms influencing citizens' place attachment to the Karun River by employing Structural Equation Modeling (SEM) using SmartPLS software. The conceptual framework consisted of eight latent constructs: ecological quality, natural landscape, aesthetic perception, social participation, place attachment, city brand image, economic tourism, and river-based sports and recreational activities. Data were collected through a structured questionnaire, and the relationships among the variables were examined within both the inner and outer models. The results of the outer model analysis indicated acceptable validity and reliability; factor loadings were mostly above 0.7, composite reliability exceeded 0.7, and the average variance extracted (AVE) for most constructs was above 0.5, confirming satisfactory convergent validity. Findings revealed that ecological quality had a positive and significant effect on the development of economic tourism ($\beta = 0.267, p < 0.05$), and tourism, in turn, significantly enhanced place attachment to the river ($\beta = 0.695, p < 0.01$). Furthermore, sports and recreational activities around the river acted as an effective mediator in strengthening the sense of attachment ($\beta = 0.581, p < 0.01$), whereas the direct effect of ecological quality on place attachment was not significant. Overall, the model explained 52.4% of the variance in place attachment, and the goodness-of-fit index (GoF = 0.42) confirmed the adequacy of the model. The results suggest that citizens' positive experiences with the river are not solely achieved through environmental improvements, but rather require the activation of tourism potentials, the enhancement of social participation, and the reinforcement of recreational functions along the river. These findings highlight the necessity of an integrated approach in the management of urban riverfront spaces, whereby environmental planning is coupled with improving experiential engagement and strengthening citizens' emotional bonds.

Keywords | *Branding, Riverfront Cities, Environmental–Ecological Approach, Ahvaz City.*

Introduction | Riverfront cities have historically benefited from natural and cultural advantages in their formation and development. However, in many such cities, the potential opportunities for enhancing urban image and branding have been overlooked. Today, with increasing competition among cities to attract investment, tourism, and human capital, city

branding has emerged as a strategic tool. In this context, identifying the factors influencing the branding of riverfront cities, such as geographical, cultural, environmental, land-use, social participation, and media representation features, can contribute to sustainable development and the strengthening of urban identity. Over the past decades, city branding has been recognized as a modern instrument in urban

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management and development, attracting the attention of policymakers and planners worldwide. The primary goal of this process is to create a positive, distinctive, and competitive image of the city in the minds of residents, tourists, investors, and other stakeholders (Bonakdar & Audirac, 2020). Riverfront cities, due to their natural resources and unique aquatic landscapes, possess significant potential to reinforce their urban brand (Falahatkar & Aminzadeh, 2018). In this regard, rivers are not only considered as natural elements but also as shapers of place identity, spatial experience, and social bonds. Despite these capacities, many riverfront cities, particularly in developing countries, have failed to incorporate rivers as integral components of their urban identity and brand. In numerous cases, rivers are confronted with environmental crises such as pollution, degradation of natural riverbanks, and ecological imbalance, turning them from natural assets into environmental threats. This condition not only affects the quality of urban life but also weakens the city's image and reputation among stakeholders (Yang et al., 2019). An environmental–ecological approach to city branding seeks to conceptualize the brand not merely as a marketing product but as a reflection of ecological health, environmental sustainability, and the symbiotic relationship between humans and nature. Within this framework, river ecological quality, protection of natural corridors, riverfront landscape regeneration, and the application of green design strategies can serve as key components in shaping the brand of riverfront cities (Sun et al., 2022). Ahvaz, as one of the few Iranian metropolises crossed by a permanent, historical, and voluminous river, the Karun, presents a unique case. The Karun River, as both a natural and cultural symbol of Ahvaz, has historically played a fundamental role in shaping the city's urban fabric, social identity, natural landscape, economic activities, and even its collective memory. However, the current condition of the river and its surrounding spaces does not reflect this historical and natural potential. Instead, it faces serious challenges related to ecological degradation, urban landscape deterioration, water pollution, and inconsistent land-use practices (Pouryarmohammadi et al., 2022). While many global cities, such as Budapest, Lyon, and Portland, have successfully utilized rivers as central elements in sustainable city branding processes, Ahvaz has yet to effectively capitalize on this capacity to strengthen its image and enhance its urban brand position. The degradation of riverbanks, uncoordinated development of peripheral areas, weaknesses in aquatic tourism infrastructure, and the absence of a coherent environmental strategy are among the main barriers preventing the formation of a meaningful urban brand along the Karun River. This study, adopting an environmental–ecological perspective, seeks to identify and analyze the factors influencing the branding of Ahvaz as a riverfront city. The aim is to propose a comprehensive framework for reinforcing Ahvaz's urban identity by

leveraging the ecological capacities of the Karun River and to provide practical solutions for sustainable development and effective city branding. The central research questions are: Which environmental and ecological factors play the most significant role in the branding process of Ahvaz as a riverfront city? And how can city branding in Ahvaz be improved through an environmental–ecological approach?

Research Background

In any scientific study, reviewing the background of related research is essential for understanding previous findings and ultimately comparing the results of the present study with those of earlier works. Accordingly, in what follows, the background of international studies is presented first, followed by the background of domestic research related to the subject of this study, as summarized in Table 1.

The main distinction of the present study lies in presenting a comprehensive conceptual framework that simultaneously considers eight key constructs: ecological quality, natural landscape, aesthetic perception, social participation, place attachment, city brand image, economic tourism, and river-based sports and recreational activities, and analyzes their relationships using Structural Equation Modeling (SEM). This approach not only reveals the mediating role of tourism and recreational activities in enhancing the sense of place attachment but also demonstrates that effective riverfront city branding requires an integrated management strategy that concurrently improves environmental quality, activates tourism potentials, and strengthens citizens' social bonds.

Thus, the present research clearly differentiates itself from previous studies and can serve as a novel contribution to theoretical knowledge while providing practical solutions for the branding of riverfront cities, particularly in the context of the Karun River.

Theoretical Foundations

In recent decades, urban branding has emerged as a novel approach in city management and planning, aiming to create a distinct, positive, and sustainable image of cities in the minds of both domestic and international audiences. Urban branding is a strategic and multidimensional process that leverages identity, cultural, historical, and environmental elements to transform a city's relative advantages into competitive values (Kavaratzis & Ashworth, 2005). Cities with prominent natural features, such as rivers, possess high potential for urban brand development. Rivers, in addition to their ecological and environmental services, also perform social, cultural, and symbolic functions, serving as focal points for identity formation and urban brand representation (Gospodini, 2004). In the context of riverfront cities, attention to the ecological quality of rivers is of particular importance. River ecosystem health, biodiversity, water quality, vegetation cover, and riverbank management are considered key

Table 1. Research background. Source: Authors.

Researcher(s) / Year	Title / Focus	Findings / Results
Gold & Ward (1994)	Place promotion: The use of publicity and marketing to sell towns and regions	Place promotion through marketing is a key tool in creating a positive mental image of cities and regions.
Fabos (1995)	Introduction and overview: The greenway movement, uses and potentials of greenways	Urban greenways play a significant role in improving living quality, connecting natural spaces, and enhancing environmental brand image.
Kavaratzis (2004)	From city marketing to city branding: Towards a theoretical framework for developing city brands	Urban branding requires a multi-level approach, including identity, image, and stakeholder participation; the proposed model facilitates the formation of a credible urban brand.
Zenker & Braun (2010)	The place brand centre—a conceptual approach for the brand management of places	Residents' and tourists' perceptions of ecological features are key to city branding; protecting natural resources helps create a positive urban image.
Medic et al. (2010)	Branding impact on the economic development of cities and counties: Example branding city of Ilok	Studied city branding was based on nature, river, and local lifestyle, implicitly emphasizing ecological advantages.
Bonakdar & Audirac (2020)	City branding and the link to urban planning: Theories, practices, and challenges	Successful city branding requires alignment with policies and spatial planning; spatial planning can provide an effective framework for place branding.
Chen et al. (2020)	Evaluation of ecological city and analysis of obstacle factors under the background of high-quality development: Taking cities in the Yellow River Basin as examples.	Barriers to ecological development in cities were identified; strengthening infrastructure and innovation capacity is necessary to improve urban ecological branding.
Falahatkar & Aminzadeh (2018)	Sense of place and its impact on place branding: Case study of natural landscapes in Sanandaj, Iran	Sense of place, especially in natural contexts, can form a basis for effective city branding; emphasis on enhancing natural landscape identity.
Pouryarmohammadi et al. (2022)	Developing physical resilience strategies in passive defense according to identification of endangered areas of urban environments (Case study: Ahvaz city)	Identifying high-risk urban areas against natural and human threats and proposing resilient design strategies with an emphasis on landscape and open spaces can play an effective role in improving the safety, resilience, and sustainability of the urban environment.
Anh et al. (2023)	Influences of key factors on river water quality in urban and rural areas: A review	Human (urban and rural) factors play a major role in water pollution; integrated policies are needed for river management in urban areas.
Vorob'yova (2024)	RETRACTED: Techniques for the formation of the natural and ecological framework of riverine cities (on the example of Rostov-on-Don)	Urban landscape redesign can be proposed as an effective tool for ecological restoration and enhancing the sustainability of riverine cities.
Azari (2012)	Principles of architectural design and regeneration of urban riverfronts with emphasis on sustainable development for attracting tourists	Emphasizes the importance of the physical design of riverbanks to attract tourists and strengthen urban branding.
Salehi & Yavari (2013)	Application of ecological approach in the design of riverfront parks (Case study: Zayandehrood riverfront parks)	Ecological approach contributes to the creation of sustainable and attractive landscapes.
Eslami Parikhani et al. (2015)	Tourism development and the global water management crisis in tourist areas with emphasis on rivers	Emphasizes the potential of rivers for sustainable tourism development and related environmental challenges.
Motalebi et al. (2023)	Regeneration of urban riverside's worn-out textures: The case study of urban worn-out textures of the Abshuran Riverside in Kermanshah	Citizen participation in regenerating worn riverbank areas is essential to strengthening urban identity.

indicators of ecological quality. When effectively managed, these factors can enhance urban liveability and sustainability, while simultaneously fostering a positive mental image of the city (Beatley, 2000; Mostafavi & Doherty, 2016). In the eco-environmental approach to urban branding, these natural elements are not only resources for sustainable development but also instruments for city identity and differentiation. Natural landscape and the design of public spaces along rivers play a crucial role in urban branding. Landscape quality, spatial legibility, human-centered design, presence of walkways, and resting spaces all influence aesthetic perception and the lived experience of citizens in the urban environment (Kaplan & Kaplan, 1989; Lynch, 2023). Such experiences, particularly when associated with pleasure, tranquility, or collective memory, strengthen emotional attachment to place. Place attachment, recognized as a key component of urban identity, emerges from these experiences. When individuals feel a sense of belonging, security, pride, and memory associated with a place, it acquires meaning and value in their minds (Tuan, 1977; Relph, 1976). Rivers that are embedded in citizens' lived memory over time have high potential to create and reinforce these identity-based bonds. Furthermore, social participation in the planning, maintenance, and use of riverfront spaces is another critical factor in enhancing social capital and urban branding. Active citizen involvement in events, cultural programs, and volunteer activities related to the river increases feelings of attachment and collective ownership of the space, generating a vibrant and participatory image of the city (Healey, 2020; Innes & Booher, 2004). This participation is particularly important in riverfront contexts, where natural beauty, social interactions, and shared memories converge. Ultimately, all these factors—from ecological quality and natural landscape to aesthetic perception, social participation, and place attachment—contribute to the formation of the city's brand image. Brand image reflects the cognitive, emotional, and perceptual impressions of citizens and audiences about a place, shaped by lived experiences, social interactions, natural environments, and historical identity (Anholt, 2007). The eco-environmental approach emphasizes the preservation and restoration of natural resources, particularly river ecosystems, and has been recognized as a sustainable strategy for urban development and branding (Salehi & Yavari, 2013). Rivers, as vital urban networks, provide multiple ecosystem services, including water supply, climate regulation, recreational spaces, and quality-of-life improvements (Boostani & Esmaili, 2015). This approach focuses on sustainable use of natural resources, pollution reduction, and ecological restoration so that cities can be presented as green and sustainable destinations (Fabos, 1995). Factors such as water quality, waste management, biodiversity conservation, and the design of riverfront parks are influential in urban branding (Salehi & Yavari, 2013). Based on previous

studies, the factors influencing riverfront city branding can be classified into several main categories:

- Environmental–Ecological Factors: River water quality, protection of riparian ecosystems, sustainable management of water resources, and reduction of environmental pollution (Eslami Parikhani et al., 2015).
- Physical–Spatial Factors: Urban landscape design, organization of riverbanks, and creation of attractive and sustainable public spaces (Azari, 2012).
- Socio-Cultural Factors: Citizen Participation, river-related cultural identity, and enhancement of place attachment (Salehi & Yavari, 2013).
- Economic Factors: Development of sustainable tourism, attraction of investment, and creation of river-related employment opportunities (Eslami Parikhani et al., 2015).
- Managerial Factors: Integrated policy-making, coordination among executive agencies, and strategic planning for river restoration (Bonakdar & Audirac, 2020).

Riverfront cities face unique challenges in branding and development, requiring a balance between urban growth and environmental conservation. Factors influencing riverfront city branding include urban landscape organization, ecological frameworks, and the integration of natural elements into urban spaces (Anh et al., 2023). City branding strategies should align with developmental pathways and consider industrial characteristics and regional contexts to maintain credibility (Gold & Ward, 1994). Effective branding can enhance a city's attractiveness, distinctiveness, and economic development by highlighting unique features such as location, cultural heritage, and lifestyle (Medic et al., 2010). Environmental safety and ecological conditions are vital components of urban branding, particularly for tourism development. Cities must address environmental concerns while emphasizing their natural and cultural assets to create an appealing brand that supports socio-economic growth, business development, and international collaboration (Terlestka et al., 2023). This comprehensive approach to riverfront city branding can lead to sustainable urban development and improved quality of life for residents and visitors. Numerous studies have explored urban branding and the role of environmental–ecological approaches in riverfront cities.

In riverfront cities such as Ahvaz, where the Karun River serves as a central natural, cultural, and historical element, urban branding cannot be separated from the riverine and environmental identity. Therefore, effective branding in this context requires an interdisciplinary and integrative approach that simultaneously addresses environmental sustainability, urban quality of life, and identity representation (Liu, 2021). Rivers, as natural elements with diverse capabilities, play a significant role in the structure and development of cities. They not only provide suitable settings for economic tourism but also serve as active spaces for sports and recreational

activities. In line with sustainable tourism development, riverfront areas can attract investment in services and recreational activities, contributing to local economic growth. Activities such as boating, riverside markets, local festivals, and the establishment of cafes and restaurants along the water not only enhance the visual and functional appeal of the space but also generate employment and strengthen social interactions. Moreover, the river landscape, as an open and flexible space, provides ideal conditions for sports activities such as walking, cycling, and water sports (Peters, 2011). These activities contribute not only to the revitalization of urban spaces but also positively affect residents' quality of life and physical health (Torabi Farsani, 2012). In cities like Ahvaz, where the Karun River embodies both cultural and natural identity, optimizing the economic and recreational potential of this natural asset can serve as an effective strategy for urban branding, creating a positive image of the city in the minds of residents and tourists. Overall, integrating tourism development and recreational activities along rivers can significantly advance the economic and social objectives of cities. Fig. 1 illustrates the development cycle of riverine city branding.

Research Methodology

In this study, aiming to explain the factors influencing riverfront city branding with an environmental approach, Ahvaz was selected as the case study. The research method is descriptive-analytical with a quantitative approach, and structural equation modeling (SEM) using SmartPLS software was employed to analyze the relationships among variables. The statistical population consisted of citizens residing in the vicinity of the Karun River, from which a stratified random sampling method was applied to select a sample of 384 participants. Data were collected through a researcher-developed questionnaire, designed based on theoretical and empirical foundations, measuring six main indicators: ecological quality, natural landscape, aesthetic perception, social participation, sense of place, and urban brand image. Content validity of the instrument was confirmed by expert



Fig. 1. Urban branding development cycle in riverfront cities. Source: Anh et al., 2023.

judgment, while construct validity was verified through confirmatory factor analysis (CFA). Reliability of the items was also confirmed using Cronbach's alpha and composite reliability, with the latter reaching 0.82. Subsequently, the conceptual model of the study, which includes causal relationships among latent variables, was tested, and model fit indices were employed to validate the structural model. In this model, ecological quality and natural landscape act as predictor variables that, through their influence on aesthetic perception and social participation, enhance the sense of place and ultimately contribute to improving the urban brand image of Ahvaz as a riverfront city.

Research Scope

Ahvaz, as the capital city of Khuzestan Province in southwestern Iran, is considered one of the major metropolitan centers of the region. With a population exceeding one million, the city plays a pivotal role in the province's economy and culture, and it is recognized as an industrial, commercial, and agricultural hub. Ahvaz is situated within the Karun River basin, which, as the longest river in Iran, holds a vital function in supplying drinking water, supporting agriculture, sustaining industries, and maintaining surrounding ecosystems. Originating from the Zagros mountain range and flowing approximately 950 kilometers before discharging into the Persian Gulf, the Karun River is of particular environmental and economic significance to Ahvaz. The study area of this research encompasses the city of Ahvaz and those sections of the Karun River that flow through and around the city. Geographically, this domain extends from the central districts of Ahvaz to its peripheral zones and the green areas along the riverbanks, serving as a focal point for environmental, urban, and social analyses. Considering the city's rapid population growth and urban expansion, along with the challenges posed by industrial pollution and land-use changes, investigating the interaction between Ahvaz and the Karun River is of great importance for sustainable regional management. A comprehensive study of this area can contribute to a deeper understanding of the reciprocal impacts of urban development and river conditions, while also offering strategies to improve environmental quality and promote sustainable utilization of water resources.

Research Findings

In this study, the statistical population consisted of 384 residents of Ahvaz living in the areas surrounding the Karun River. Among them, 53.4% of the respondents were male and 46.4% were female. Furthermore, 64.3% were married and 35.7% were single, reflecting diversity in family experiences with respect to urban spaces. Regarding educational level, more than 60% held university degrees at the bachelor's level or higher, which indicates the active participation of educated individuals in assessing the urban environment. Employment distribution

revealed the presence of various groups, including government employees (25.5%), private sector workers, students, retirees, and homemakers. In addition, 57.3% of the respondents stated that they visit the areas around the river on a daily or weekly basis. Such a high frequency of regular presence reinforces the potential for behavioral and experiential analyses in relation to the mental image and sense of place attachment to the Karun River. Table 2 shows the demographic characteristics of the respondents.

Analysis of Environmental and Ecological Factors Affecting the Branding Process of Ahvaz's Riverfront City
The descriptive analysis of the conceptual dimensions of the

Table 2. Demographic characteristics of the questionnaire respondents. Source: Authors.

Variable	Category	Frequency (n)	Percentage
Occupation	Government employee	98	25.5
	Private sector	83	21.6
	Student	61	15.9
	Retired	33	8.6
	Homemaker	52	13.5
	Unemployed	37	9.6
	Self-employed/ Other	20	5.2
Frequency of visits to the river	Daily	89	23.2
	Several times a week	131	34.1
	Weekends only	101	26.3
	Less than once a month	49	12.8
	Almost never	13	3.3
Gender	Male	205	53.4
	Female	179	46.6
Marital status	Married	247	64.3
	Single	137	35.7
Education	High school or lower	54	14.1
	Associate degree	68	17.7
	Bachelor's degree	157	40.9
	Master's degree	80	20.8
	Doctoral degree or above	25	6.5
Total		384	100

study reveals that citizens' experiences of the Karun River are primarily meaningful at perceptual, social, and emotional levels, while their environmental perception appears relatively weaker. The lowest mean score was recorded for the dimension of "ecological quality of the river" (M = 2.25, SD = 0.25), indicating that respondents, with a relatively high level of consensus, evaluated the ecological status of the river as unfavorable. This reflects a shared negative perception regarding visual, olfactory, and biological pollution surrounding the river.

Conversely, the components of "social participation" and "place attachment" ranked highest, both with mean scores of 3.88, suggesting that for many citizens, the Karun is not only a space for presence and social interaction but also an integral part of their individual and collective identity. The component of "aesthetic perception" (M = 3.86) also ranked high, reflecting that the experience of being by the river is often associated with feelings of tranquility, nostalgia, and visual attractiveness.

The "city brand image" dimension (M = 3.43, SD = 0.79) indicates diverse and sometimes contradictory perceptions regarding the role of the river in defining Ahvaz's urban brand. Similarly, functional components such as "economic tourism" (M = 3.18) and "river-based sports and recreation" (M = 3.70) show that although significant potential exists for the development of these spaces, much of their capacity has not yet been fully realized in practice. Overall, the findings suggest that the Karun River, rather than being firmly established in the minds of citizens as an environmental element, carries substantial social, emotional, and identity-related significance, making it a potentially central factor in urban branding policies. Table 3 shows the mean and standard deviation of the research conceptual dimensions.

In Structural Equation Modeling (SEM), the type of construct indicates the nature of the relationship between latent constructs and their observable indicators. Specifically, the construct type determines whether the indicators form the construct or the construct manifests through the indicators. Accordingly, in this study, all conceptual constructs, including "ecological quality," "natural landscape," "aesthetic perception," "place attachment," and "city brand image," were considered as reflective constructs. In reflective constructs, the indicators function as direct reflections or manifestations of the latent construct, with the underlying assumption that a change in the latent variable leads to simultaneous changes in all associated indicators. In other words, if the level of place attachment increases, it is expected that feelings of belonging, pride, nostalgia, and identity with respect to the river will also increase correspondingly. This approach aligns with the nature of the concepts measured in this study, as constructs such as citizens' perceptions, emotions, and attitudes toward riverfront spaces are generally measurable through positively correlated and directionally consistent

indicators. Therefore, employing a reflective measurement model provides a theoretically and empirically sound basis for analyzing structural relationships in this research. Table 4 shows the definitions of the constructs and items (research measurement model).

Integrated Analysis of Indicators

The integrated analysis of the indicators indicates that the Karun River, as the most significant natural and landscape element within the urban fabric of Ahvaz, plays a key role in shaping the city's livability, urban identity, and tourism potential. Results from the structural equation modeling (SEM) suggest that citizens' perceptions of the Karun River are complex across aesthetic, ecological, social, and tourism-related dimensions. Natural landscape, tourism, and river-based recreational activities are two constructs that exhibit satisfactory reliability and validity indicators. This suggests that residents have a relatively positive relationship with the natural features of the Karun River and its potential for recreational and sports activities, which may be attributed to the presence of walking paths, open spaces along the river, and relatively good access to the riverbanks. In contrast, while ecological quality demonstrates acceptable composite reliability, its negative Cronbach's alpha and low AVE indicate citizens' negative or heterogeneous perceptions regarding the river's environmental condition. This finding aligns with field observations of environmental pollution, wastewater inflows, reduced water flow, and decreased biodiversity in

the Karun River, suggesting a discrete relationship between natural landscape and actual environmental quality. The aesthetic perception construct, although exhibiting a relatively acceptable AVE, shows composite reliability below the standard threshold. This indicates a duality in visual perception among the public; some recognize beauty in the river's structure, whereas others perceive pollution and heterogeneous constructions along the riverbanks as detracting from its visual appeal. Social participation and place attachment, particularly the latter, display a very favorable status. This finding highlights that the river remains a significant identity and place-making element for Ahvaz residents, with considerable potential for social revitalization, especially if integrated into participatory and management-focused policymaking. For the city brand image, reliability is relatively high, but AVE is somewhat low, indicating that while the Karun River is part of Ahvaz's natural brand, a coherent and positive image has not yet fully formed in the citizens' minds. This perception may be linked to the contrast between visual beauty and environmental degradation. Finally, the economic tourism indicator demonstrates good reliability and validity, reflecting that citizens recognize the potential of the Karun River as a tourism hub with economic benefits for the city. This capacity is particularly significant for the development of local businesses, restaurants, marketplaces, and aquatic ecotourism. Table 5 shows the reliability and validity of the research indicators. The conceptual model of this study was designed to examine the

Table 3. Mean and standard deviation of conceptual dimensions. Source: Authors.

Conceptual Dimension	Mean (M)	Standard Deviation (SD)
Ecological quality of the river	2.25	0.25
Natural landscape and environmental quality	3.30	0.50
Aesthetic perception	3.86	0.55
Social participation	3.88	0.69
Place attachment	3.88	0.53
City brand image	3.43	0.79
Economic tourism	3.18	0.56
River-based sports and recreation	3.70	0.78

Table 4. Definition of constructs and indicators (Measurement model). Source: Authors.

Conceptual Construct	Indicators	Construct Type
Ecological quality	EQ1–EQ6	Reflective
Natural landscape and environmental quality	LV1–LV6	Reflective
Aesthetic perception	AE1–AE5	Reflective
Social participation	PS1–PS5	Reflective
Place attachment	PA1–PA5	Reflective
City brand image	BI1–BI5	Reflective
Economic tourism	RET1–RET4	Reflective
River-based sports and recreation	RSR1–RSR4	Reflective

Table 5. Reliability and validity of the research indicators. Source: Authors.

Construct (Abbreviation)	Cronbach's Alpha	rho_A	rho_C (CR)	AVE	Assessment / Notes
Aesthetic Perception (AE)	0.631	0.741	0.449	0.527	AVE acceptable; CR slightly below 0.7
City Brand Image (BI)	0.530	0.860	0.683	0.475	CR excellent; AVE slightly low but acceptable with caution
Place Attachment (PA)	-0.625	0.739	0.676	0.624	Negative alpha and reversed parameters
Social Participation (PS)	0.640	0.739	0.766	0.547	Reliability and validity acceptable
Natural Landscape (LV)	0.707	0.741	0.511	0.541	Reliability and validity acceptable
Ecological Quality (EQ)	-0.578	0.698	0.712	0.414	Composite reliability adequate; low AVE and negative alpha are concerning
Economic Tourism (RET)	0.603	0.765	0.659	0.584	Reliability and validity acceptable
River-based Recreation & Sports (RSR)	0.731	0.725	0.698	0.691	Reliability and validity acceptable

role of environmental, social, and tourism-related factors in shaping place attachment to the Karun River and was tested using Structural Equation Modeling (SEM) in SmartPLS. The model comprised eight latent constructs: Ecological Quality (EQ), Natural Landscape (LV), Aesthetic Perception (AE), Social Participation (PS), Place Attachment (PA), City Brand Image (BI), Economic Tourism (RET), and River-based Recreational and Sports Activities (RSR). For each construct, a set of observable indicators was developed to comprehensively assess citizens' perceptions of the various dimensions influencing the human–river relationship. The inner model results indicated that Ecological Quality (EQ) has a positive and significant relationship with Economic Tourism (RET) (path coefficient = 0.267, $p < 0.05$), suggesting that a positive perception of the river's environmental condition enhances its capacity to attract tourists and generate economic activities. Furthermore, Economic Tourism exerts a highly significant effect on Place Attachment (PA) (path coefficient = 0.695, $p < 0.01$), highlighting the crucial role of tourism experiences in fostering emotional and spatial bonds between citizens and the river. Additionally, River-based Recreational and Sports Activities (RSR) also significantly influence Place Attachment (path coefficient = 0.581, $p < 0.01$), confirming the positive contribution of leisure and social use of the river to strengthening place-based connections. Conversely, the direct path between Ecological Quality and Place Attachment (EQ → PA) was not significant (path coefficient = -0.086), indicating that the effect of environmental quality on place attachment occurs primarily through mediating variables such as tourism and social activities. This underscores the importance of mediators in the model. Overall, the model explained 52.4% of the variance in Place Attachment ($R^2 = 0.524$), demonstrating a substantial explanatory power. The overall Goodness-of-Fit (GoF) index was calculated at 0.42, reflecting an adequate model fit. Additionally, t -values obtained from bootstrap testing exceeded the 1.96 threshold for most paths, confirming the statistical significance of the relationships. In summary, these findings suggest that

enhancing the ecological quality of the river is effective only when accompanied by tourism infrastructure, leisure opportunities, and participatory programs for river use. Place Attachment, as a socio-spatial outcome, depends not only on the physical condition of the river but also on its experiential accessibility within the context of social interactions and tourism activities. Accordingly, urban policies should move beyond purely environmental approaches toward the development of social, cultural, and recreational functions of the Karun River. Fig. 2 shows the analysis of environmental and ecological factors affecting the branding process of Ahvaz riverine cities based on the structural equation model.

Discussion

The findings of this study indicate that urban branding in the context of riverfront cities goes beyond a mere marketing activity and requires a holistic consideration of environmental, social, and cultural dimensions. Nevertheless, critical analysis reveals that this approach still faces multiple challenges and questions that may affect the validity and generalizability of the results. First, the results highlight the prominent role of the river's ecological quality in enhancing the urban brand. While this finding aligns with previous studies (Beatley, 2000; Mostafavi & Doherty, 2016), it should be noted that ecological quality is a multi-dimensional concept. In this study, only certain aspects—including water quality, biodiversity, and vegetation cover—were assessed. Other factors, such as noise pollution, climate change, equitable access to green spaces, and industrial waste management, could also influence the city's perceived image but were less explored here. Therefore, the findings may be somewhat simplified, indicating potential for more detailed analysis of this variable. Second, aesthetic perception and natural landscape were introduced as mediating variables. This aligns with classical theories by Ralf (1976) and Kaplan & Kaplan (1989). However, aesthetics is inherently relative and culturally dependent. What constitutes a “pleasant landscape” for one group of citizens

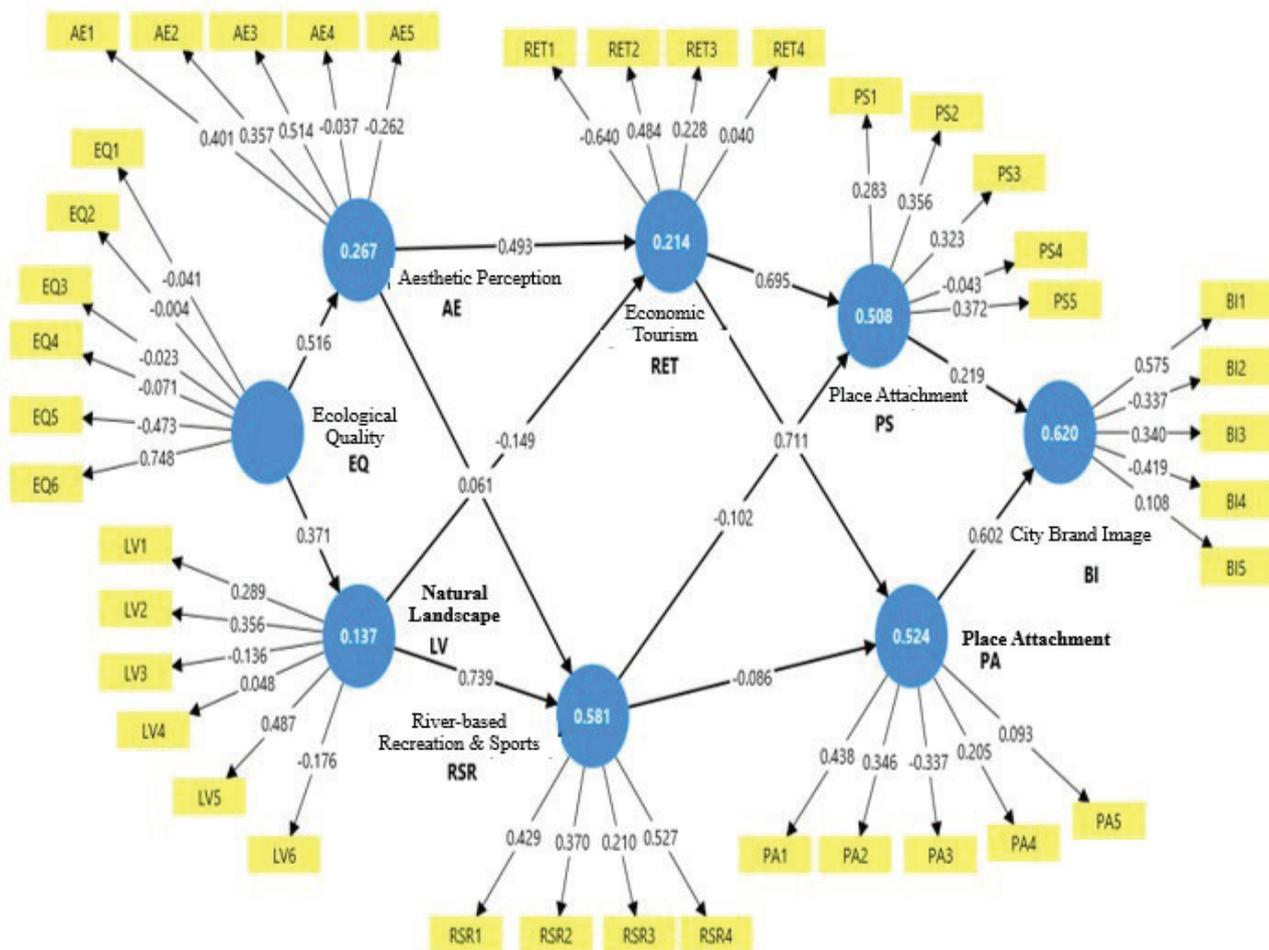


Fig. 2. Analysis of environmental and ecological factors influencing the branding process of Ahvaz’s Riverfront City based on the structural equation modeling (SEM). Source: Authors.

may not be appealing to others. This is particularly relevant in multicultural cities like Ahvaz. In the current analysis, cultural and social differences in aesthetic perception were minimally considered, which may limit the generalizability of the results. Third, social participation emerged as an important factor in strengthening the urban brand, consistent with participatory planning literature (Innes & Booher, 2004; Healey, 2020). However, social participation is itself influenced by political, economic, and institutional factors. In contexts where urban institutions lack transparency or efficiency, or citizens are distrustful of governmental mechanisms, opportunities for participatory branding may be limited. This institutional and structural dimension was not sufficiently addressed in the current study, representing a notable limitation. Fourth, the model demonstrated that ecological quality does not directly influence place attachment but exerts an effect through mediating variables such as tourism and recreational activities. On one hand, this underscores the importance of citizens’ lived experiences; on the other hand, it raises the critical question of whether urban policymakers can increase place attachment solely through tourism and recreational development or whether deeper interventions in social equity,

employment opportunities, and overall quality of life are required. In other words, there is a risk that urban branding could be reduced to mere beautification and leisure projects, neglecting fundamental environmental and social issues. Fifth, theoretically, this study focused on integrating ecological, social, and branding concepts. This integration is a strength; however, critical questions remain regarding the relative weight of these domains. For example, some branding theorists (Kavaratzis & Ashworth, 2005; Anholt, 2007) emphasize the role of economic policies and marketing in creating a brand, linking it primarily to image management processes. In contrast, the current study shows that environmental and social dimensions can form the foundational basis of a brand. This theoretical discrepancy indicates the need for broader interdisciplinary dialogue to develop a more cohesive framework for riverfront city branding. Despite these contributions, the study has several limitations: Geographical limitation: The study focused exclusively on the city of Ahvaz and the Karun River, limiting the generalizability of findings to other riverfront cities with different characteristics (e.g., Isfahan with the Zayandeh River or Tabriz with the Mehraneh River).

Methodological limitation: Data were primarily collected through self-reported questionnaires, which are prone to response bias and social desirability effects.

Temporal limitation: The study was conducted at a single point in time, while place attachment and brand perception may dynamically change due to environmental changes (e.g., droughts, floods, or urban development projects).

Conceptual limitation: Some important dimensions, such as environmental justice, institutional river management, and broader economic policies, were not included in the model.

Given these limitations, the following recommendations are proposed for future research:

Comparative Intercity Studies: Conducting comparative analyses across multiple riverfront cities in Iran and other countries can help identify which factors have the greatest impact in diverse cultural and environmental contexts.

Mixed Methods Approaches: Simultaneous use of qualitative methods, such as in-depth interviews and field observations, alongside quantitative surveys, can provide a more comprehensive understanding of citizens' lived experiences.

Longitudinal Studies: Research examining changes in place attachment and urban branding over time can better capture the dynamics of these phenomena.

Attention to Policies and Institutions: Future studies should focus more on the role of urban policy, institutional transparency, and environmental governance in the branding process of riverfront cities.

Social and Environmental Justice Dimensions: Investigating whether urban branding can lead to a more equitable distribution of opportunities and resources, or conversely, result in the marginalization of vulnerable groups, is crucial.

In summary, the present study represents an important step toward elucidating the relationship between ecological quality, social participation, and urban branding in riverfront cities. However, it requires further development through interdisciplinary approaches, more diverse data sources, and attention to institutional and justice-related dimensions.

Only through such comprehensive approaches can urban branding serve as a tool for sustainability and enhancing the quality of urban life, rather than merely a promotional strategy.

Conclusion

The integrated analysis of the indicators demonstrates that the Karun River simultaneously holds potential for tourism, natural landscape appreciation, and place attachment in the minds of Ahvaz citizens. However, from the perspective of ecological quality and urban brand image, it faces significant challenges. Reliability and validity indices indicate that people recognize the river's role in social and recreational activities and continue to value its landscape. Nonetheless, perceptions of pollution,

environmental degradation, and aesthetic incoherence have hindered the formation of a cohesive and positive mental image. This gap between perceived value and actual environmental condition highlights the necessity for revisiting environmental policies, urban brand regeneration, and enhancing citizen participation in river management.

Consequently, riverfront city branding in Ahvaz, centered on the Karun River, offers a valuable opportunity to integrate environmental sustainability with socio-economic development, which, if properly leveraged, could serve as a successful model for other riverfront cities in Iran. Based on the results obtained, the following recommendations are proposed to achieve effective riverfront urban branding in Ahvaz, with an emphasis on an ecological-environmental approach:

- Developing a comprehensive ecological restoration plan for the Karun River, focusing on pollution reduction and biodiversity enhancement.
- Integrating the river's ecological identity into the city's vision and branding documents.
- Redesigning riverside spaces with an emphasis on urban landscape, furniture, and appropriate lighting.
- Expanding green pedestrian and cycling pathways connecting the urban fabric to the river corridor.
- Regenerating residential areas along the river following ecological and vernacular architectural principles.
- Organizing cultural and social events along the river to promote social interactions.
- Launching urban campaigns to strengthen citizens' sense of attachment to the Karun River.
- Increasing safe and equitable access to public spaces around the river.
- Implementing educational programs in schools and media to raise awareness about the river's role in urban identity and sustainability.
- Utilizing the Karun River as a central axis for nature-based tourism development in Ahvaz.
- Continuously monitoring water quality and vegetation cover by local authorities.
- Enhancing the role of non-governmental organizations in the protection, design, and oversight of the river corridor.
- Creating a unified identity brand centered on the Karun River for urban marketing purposes.
- Developing construction and urban landscape regulations specific to the river corridor, in collaboration with environmental experts.
- Designing educational, recreational, and artistic spaces along the river to increase attractiveness and usability.

Declaration of No Conflict of Interest

The authors declare that they have no conflict of interest in conducting this research.

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HOW TO CITE THIS ARTICLE

Goodarzi, M., Soltani, Z., & Rahdar, A. (2026). Explaining and analyzing the factors influencing the branding of riverfront cities with an environmental–ecological approach (Case study: Ahvaz City). *MANZAR, The Scientific Journal of Landscape*, 17(73), 38-49.

DOI: [10.22034/manzar.2025.536910.2368](https://doi.org/10.22034/manzar.2025.536910.2368)

URL: https://www.manzar-sj.com/article_230853.html?lang=en

