



Reviving the walls of times: Stepwell conservation and Adaptive reuse of Stepwell

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Abstract : This study has been undertaken to investigate the determinants of stock returns in Karachi Stock Exchange (KSE) Stepwells, which were traditionally important for water conservation, groundwater recharge, and cultural heritage, have long been overlooked owing to industrialization. However, with growing worries about water scarcity and climate resilience, these structures are being reassessed for adaptive reuse and preservation. This study investigates stepwell conservation initiatives and their transition into sustainable water management systems, heritage tourism destinations, and urban community spaces. The study emphasizes the role of stepwells in modern urban design and sustainable water management by examining regional conservation techniques, case studies, and decision-making frameworks. The findings call for policy integration, community involvement, and adaptive reuse measures to guarantee that stepwells are functional and relevant for future generations.

Keywords - Stepwell Conservation, Adaptive Reuse, Water Sustainability, Heritage Preservation, Groundwater Recharge

I. INTRODUCTION

India is the world's largest extractor of groundwater. The groundwater level in India is estimated to have declined by 61% between 2007 and 2017. Stepwells are being revitalized as a sustainable solution for water conservation. (UNESCO)

1.1 Background of water scarcity

Water symbolizes life beyond its material form. Covering 71% of Earth's surface, only 3% is freshwater, with just 0.5% accessible for human use (USGS, USBR). India is the world's largest extractor of groundwater, withdrawing more than the U.S. and China combined, with groundwater levels declining by 61% between 2007 and 2017 (World Bank, Indian Express). With groundwater depletion reaching critical levels, stepwells are being revitalized as a sustainable water conservation solution (Fair Planet).

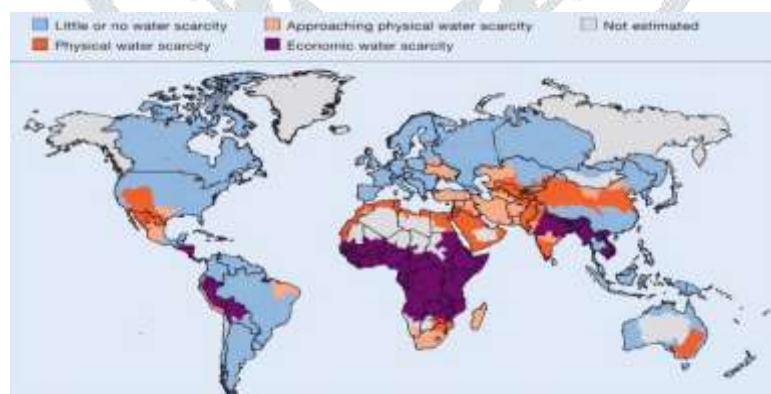


Fig no. 1 World-map of water scarcity

Source: IWMI Comprehensive Assessment of Water Management in Agriculture using the Watersim model; chapter 2.

Solutions to water scarcity include identifying new water sources, improving efficiency in urban systems, and planning for future needs. They also focus on climate-resilient technologies, promoting water conservation through community education, collaborating for national water planning, and supporting the WASH sector with guidance and training.(UNICEF)

Global water consumption is doubling every 20 years, surpassing population growth. In India, mismanagement and excessive use have led to severe groundwater depletion. Traditional water harvesting systems have supported local populations for centuries, serving as efficient methods for collecting, storing, and conserving surface runoff for future use. These systems remain one of the oldest and most widely used water management techniques in India. (World Bank).

Water conservation has been a long-standing practice in India, with stepwells historically serving as crucial structures for water storage and groundwater management, especially in Western India and arid regions. These architectural marvels were designed to handle seasonal water fluctuations. However, by the 21st century, most stepwells had deteriorated due to British-era concerns over hygiene and the rise of modern plumbing systems, leading to their neglect, re-purposing, or destruction. (Living

Waters Museum) In recent years, growing water conservation needs have spurred restoration efforts in states like Delhi and Gujarat. (INTACH)

1.2 Different Traditional water harvesting system

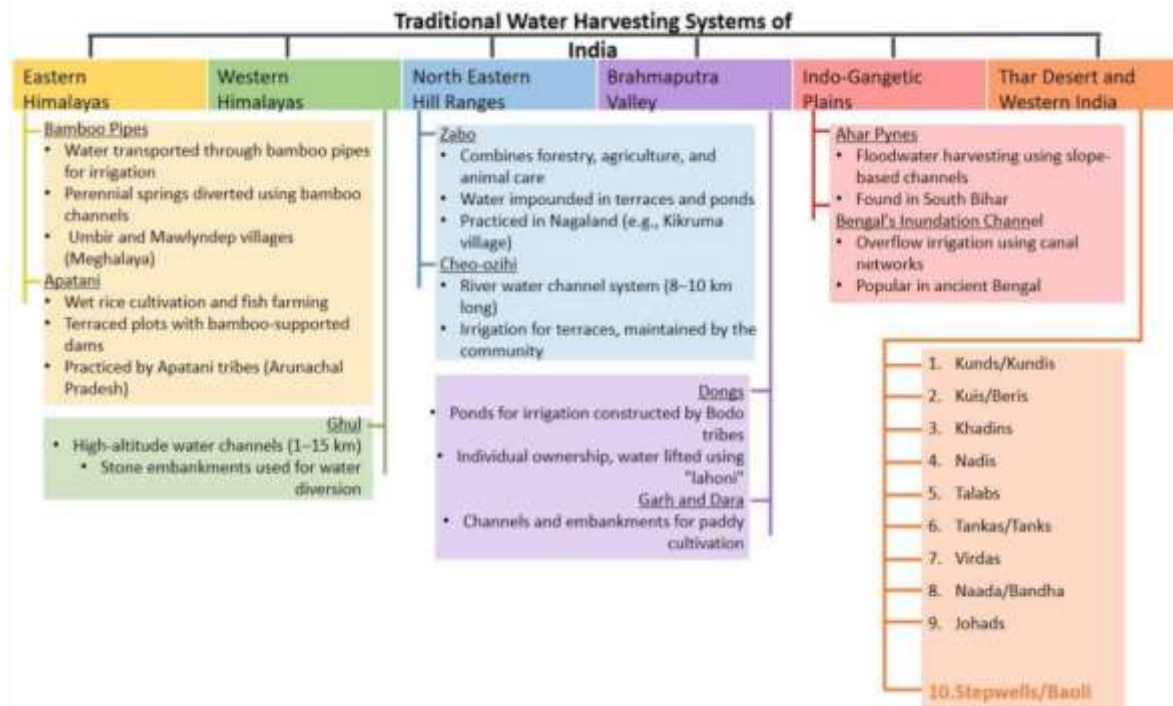


Fig no. 2 Tree diagram showing traditional water harvesting systems in India

Source: Traditional water harvesting systems for drought mitigation in India by Sreeja S.

1.4 Significance of Ancient Water Systems

India's ancient water management systems were adapted to the local geology, environment, climate and requirements. They were effective in the sense that except in cases of severe and prolonged drought, they generally managed to solve local problems with local solutions. These systems, which included stepwells, tanks, baolis, johads, and canals, were intended to efficiently capture, store, and distribute water, assuring sustainability in both desert and semi-arid locations. They were community-driven, with maintenance and upkeep frequently performed collaboratively, instilling a sense of shared responsibility. (Water Management in Ancient India)

Except for severe and extended droughts, these traditional systems were highly effective in meeting local water needs. Unlike current large-scale infrastructure, they used natural water cycles to prevent resource depletion. Many of these techniques, including rainwater harvesting and stepwell conservation, are being reviewed as feasible solutions to water scarcity and climate resilience. These solutions, by combining ancient wisdom with modern technologies, can help to ensure sustainable water management in contemporary India. (Rainwater as a renewable resource to achieve net zero urban water in water stressed cities, 2021)

1.3 Background of stepwell

Stepwells in India are unique and complex architectural structures designed for water management in arid and semi-arid regions, particularly in Western India. Built to collect and store monsoon rains for the dry months, they served as sites for drinking, bathing, washing, festivals, and sacred rituals. They also provided cool sanctuaries for travelers, caravans, and pilgrims. The discovery of 700 wells in Mohenjo-daro and estimates of thousands of stepwells by the 19th century highlight their prevalence. (stepwells of india (jal mandir))

These structures varied in scale, layout, materials, and shape, including rectangular, circular, and L-shaped designs made of masonry, rubble, or brick. Besides their functional role, stepwells were social and religious hubs, often adorned with carvings of deities and used for ritual bathing and offerings. Some still function as active temples today, despite the reduced availability of groundwater. (History of Stepwells of Rajasthan and Gujarat)



Fig no. 3 & 4 Ancient Stepwell in Dholavira and Mohenjo-Daro

[Source: ancientorigins.com & harappa.com]

1.5 Aim: To evaluate the conservation and adaptive reuse of stepwells in India, focusing on their historical, architectural, and sustainable water management significance.

1.6 Objective

Analyze the historical and architectural importance of stepwells.

- i. Assess stepwell conservation efforts and their regional impact.
- ii. Evaluate adaptive reuse case studies for tourism and sustainability.
- iii. Propose policy recommendations for integrating stepwells into modern use.

1.7 scope and limitations

- i. Covers stepwell conservation and adaptive reuse across only on India.
- ii. Examines architectural, cultural, and water sustainability aspects.
- iii. Relies on historical records, which may lack precise data.
- iv. No scientific water quality analysis included.

II. HISTORICAL AND CULTURAL-RELIGIOUS IMPORTANCE OF STEPWELL

Stepwells, also known as Baolis or Vavs, are one of India's most important ancient water conservation methods, dating back to the fourth century CE. These structures, which were frequently built in Rajasthan, Gujarat, Madhya Pradesh, and Karnataka, were intended to store water in semi-arid regions.(Rathore et al., 2024).

2.1 Historical Background

Stepwells, also known as baolis or vavs, are ancient water conservation structures that emerged in the Indus Valley Civilization (about 3000 BCE), with early examples discovered in Dholavira and Mohenjo-Daro. They developed substantially during the Gupta period (4th-6th century CE) and flourished under Rajput and Solanki monarchs (10th-13th century CE), especially in Rajasthan and Gujarat, when magnificent stepwells such as Rani ki Vav and Chand Baori were built, (Potential of Stepwells). These wells were not just water sources, but also social, cultural, and religious hubs, frequently linked to temples and community gatherings. During the Mughal era (16th-18th centuries CE), stepwells were adapted for public use, with Persian-inspired patterns. (stepwell: a human-made marvel)

However, under British administration, stepwells fell into disuse due to the development of piped water supplies, resulting in their abandonment. In recent years, stepwells have been recognized for their architectural and environmental value, with conservation efforts focused on restoring them as sustainable water management solutions and heritage sites.(Stepwells as Living Heritage of India).



Fig no. 12 & 13 Temple-Adjacent Stepwells: Surya Kund, Gujrat Modhera Stepwell

[Source: Popular Stepwells in India by travelyogiindia]

2.2. Religious Significance.

- i. Many stepwells were created near temples and pilgrimage destinations to represent purity and sacredness in Hinduism. Ritual bathing (snan) was popular before to temple visits.
- ii. Some stepwells, such as Rani ki Vav (Gujarat), are dedicated to deities like Vishnu and include intricate carvings illustrating mythological stories.
- iii. Jain and Buddhist societies also constructed stepwells and incorporated them into monasteries for meditation and ceremonies.
- iv. During Islamic control, stepwells provided public and charity services to tourists and religious communities (for example, Agrasen ki Baoli in Delhi).

2.3 Cultural and Social Roles

- i. Stepwells were essential to village life, giving a common location for women to get water, interact, and carry out daily rituals.
- ii. Weddings and religious gatherings were commonly held around stepwells. Some stepwells served as rest stops for travelers, showing India's history of hospitality and compassion.



Fig no. 14 Women Collecting Water at Stepwells

[Source: Popular Stepwells in India by travelyogiindia]

III. DESIGN OF STEPWELL

Stepwells, also known as Baolis or Vavs, are one of India's most important ancient water conservation methods, dating back to the fourth century CE. These structures, which were frequently built in Rajasthan, Gujarat, Madhya Pradesh, and Karnataka, were intended to store water in semi-arid regions.



Fig no. 5 & 6 Indus Valley Civilization Stepwell

[Source: This Mysterious 5,000 Year Old Stepwell Hidden In The Indus Valley Baffled Archaeologists]

3.1 Evolution of Stepwell

Step-wells (baolis or vavs) emerged as a sophisticated water conservation technique in arid and semi-arid countries, particularly in India, where they acted as reservoirs, social places, and architectural marvels. Their evolution may be tracked through several historical periods, with each contributing to their design and functionality.

3.1.1 Early Origins (about 3000 BCE - 600 CE)

The first water storage devices resembling stepwells date back to the Indus Valley Civilization (c. 3000 BCE - 1500 BCE). Sites such as Dholavira in Gujarat have innovative water management systems with stepped reservoirs. The Great Bath of Mohenjo-Daro (c. 2600 BCE) is another early example of a big man-made water facility with descending stairs. These early prototypes paved the way for later stepwell designs, which got increasingly ornate throughout time.

During the Maurya (322-185 BCE) and Gupta periods (4th-6th century CE), stepwells became more common as public water sources. Early versions included basic rectangular or circular wells with steps leading down to the water.

3.2.2 Medieval Advancement (7th-13th Century CE)

- i. The 7th to 13th centuries CE were the golden years of stepwell construction, especially in Rajasthan, Gujarat, and Madhya Pradesh under Rajput and Solanki monarchs.
- ii. Regional Specialization: Different locations evolved distinct stepwell designs influenced by climate, materials, and cultural factors.
- iii. Deep, multi-tiered stepwells with exquisite carvings, pillared pavilions, and galleries can be found in Rajasthan and Gujarat respectively.
For example, Rani ki Vav in Gujarat is a seven-story stepwell with over 500 sculptures of Hindu deities that is UNESCO-listed.
- iv. Chand Baori in Rajasthan is one of the deepest stepwells, with 3,500 symmetrically constructed steps.
- v. Stepwells in Central India (Madhya Pradesh, Maharashtra) are simpler, utility-focused, and utilized for irrigation and drinking water.



Fig no. 7 & 8 Rani ki vav and Stepwell in Indore

[Source: Tripadvisor and Can Traditional Stepwells Help Curb the Water Crisis in MP]

3.2.3 Mughal Influence (16th–18th Century CE)

During the Mughal Empire, Persian-style water gardens and fountains replaced many stepwells. Some stepwells were still constructed, particularly near caravanserais (traveler inns), for public use. Agrasen ki Baoli (Delhi) is an example of a stepwell from this period.



Fig no. 9 & 10 Rajaon ki Baoli and Agrasen ki Baoli

[Source: Top 7 Famous Stepwells in Delhi]

3.2.4 Colonial Decline (19th to 20th Century CE)

During British administration, stepwells were deemed unsanitary and gradually became obsolete as piped water systems were introduced. Many stepwells were neglected or reused, resulting in degradation.

3.2.5 Modern Revival (21st Century)

Stepwells are currently being revitalized for tourism, heritage conservation, and sustainable water management. Several stepwells, such as Rani ki Vav, have been renovated and designated as UNESCO World Heritage sites.

3.2 Architectural and structural Features of stepwell

A stepwell is a deep masonry well with steps leading down to the water level, designed to provide access to groundwater in arid and semi-arid regions of India. Stepwells are known by different names based on their geographical locations, such as Vav in western India and Baoli in northern India.

Some stepwells were constructed by kings and nobility and featured rich ornamentation and elaborate carvings, while others were built for public utility, allowing unrestricted access to water.

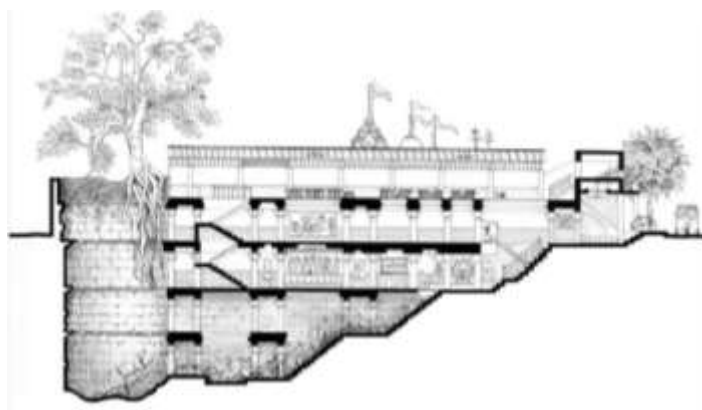


Fig no. 11 Stepwell in Ahmedabad

[Source: Top 7 Exhibition at Yale Architecture]

3.2.1 Structural Features of Stepwells:

Stepwells generally consist of two main components:

A vertical shaft – The main well from which water is drawn.

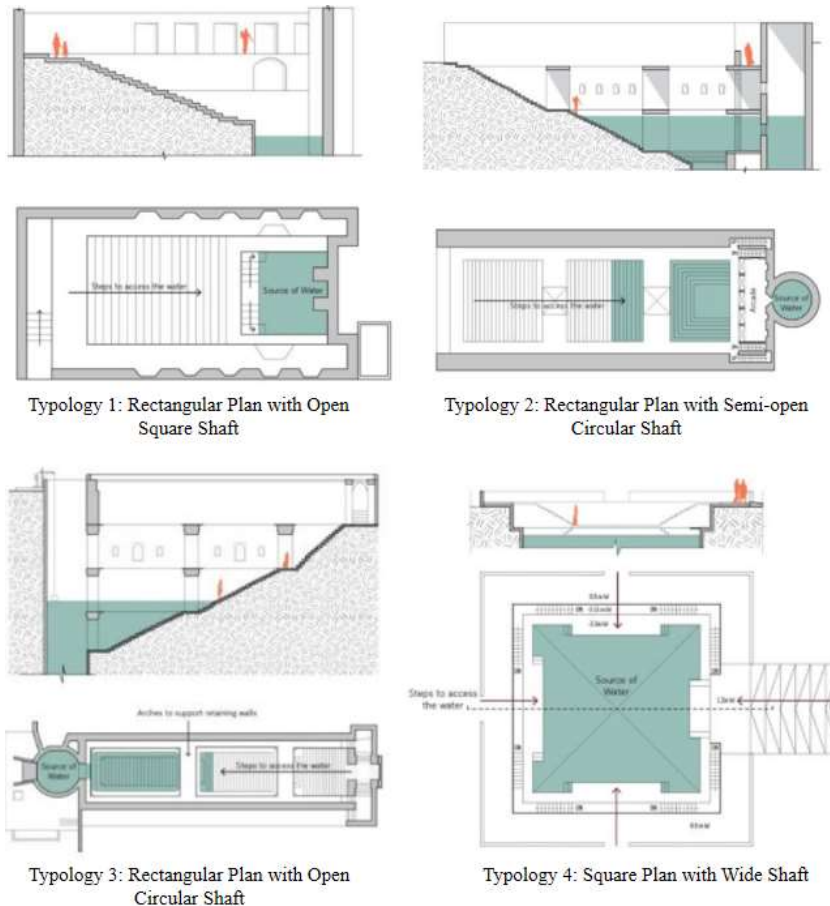
Inclined subterranean passageways, chambers, and steps – These structures provide access to the well and often include galleries and resting areas.

The galleries and chambers surrounding stepwells were intricately carved and designed to offer a cool retreat from the heat, making them important social and cultural spaces in addition to being water sources.

3.3 Typology of stepwell

By Structural Design:

- Linear Stepwells: Single flight of stairs leading to water (e.g., Chand Baori, Rajasthan).
- Rectangular Stepwells: Multi-sided steps with courtyards (e.g., Rani ki Vav, Gujarat).
- Circular Stepwells: Spiral steps descending into a well (common in South India).
- Multi-Axis Stepwells: Steps in different directions (e.g., Adalaj Stepwell, Gujarat).



Sources: The need & necessity for adaptive re-use of stepwells & temple tanks in india by aishwarya sreekanth

By Function:

- Temple Stepwells (Pushkarini): Used for religious rituals (e.g., Hampi Pushkarini).
- Community Stepwells: Built for public water access (e.g., Agrasen ki Baoli, Delhi).
- Royal Stepwells: Ornate structures built by rulers (e.g., Rani ki Vav).
- Travelers' Stepwells: Located along trade routes for drinking water.

IV. STEPWELL CONSERVATION

Stepwells, which were historically used for water storage, community gatherings, and religious rites, have been neglected and deteriorated as a result of urbanization, modernization, and changed water management systems. However, rising recognition of their architectural, cultural, and environmental significance has resulted in conservation efforts aimed at restoring, maintaining, and reintegrating stepwells into modern water management.

4.1 Case studies for stepwell conservation

Efforts to rehabilitate and conserve stepwells have gained traction in recent years, both in India and elsewhere. Several successful restoration projects demonstrate how stepwells may be revived to conserve water, promote tourism, and preserve cultural heritage.



Fig no. 15, 16 & 17 Rani ki Vav, Agrasen ki Baoli, Adalaj Stepwell

[Source: Popular Stepwells in India by travelyogiindia]

i. Rani Ki Vav, Gujarat (UNESCO World Heritage Site)

This stepwell, built in the eleventh century, was submerged under silt for centuries.

The Archaeological Survey of India (ASI) restored the site in the early 2000s.

In 2014, it was designated a UNESCO World Heritage Site, gaining international prominence.

ii. Agrasen Ki Baoli, Delhi.

A previously forgotten 14th-century stepwell is being exploited as a dumping place.

The Indian National Trust for Art and Cultural Heritage, or INTACH, restored it in the 2000s. Now a popular history and tourism destination, it retains its historical integrity.

iii. Adalaj Stepwell, Gujarat.

A five-story Indo-Islamic stepwell was restored via government and community efforts. The site is now a cultural and tourist attraction, with conservation efforts for its stonework and water management.

4.2 Need of Conservation of Stepwell

Stepwells were historically vital for water conservation, groundwater recharge, and year-round water supply in arid regions. Their preservation is crucial for modern water management and environmental sustainability.

i. Revival of a Traditional Water Management System

Stepwells provided self-sustaining water storage, ensuring groundwater recharge and long-term sustainability.

ii. Addressing Groundwater Depletion

Restoring stepwells can replenish aquifers naturally, reducing dependence on borewells and combating India's groundwater crisis.

iii. Cost-Effective & Eco-Friendly Solution

Stepwell conservation is low-cost compared to dams, offers natural water filtration, and supports potable and irrigation use.

iv. Enhancing Urban & Rural Water Security

Restored stepwells can supplement city water supplies and provide local water sources for rural communities.

4.3 Strategies for Stepwell Conservation as a Traditional Water Conservation

The conservation of Hazrat Nizamuddin Baoli, a 14th-century stepwell, offers a model for restoring stepwells as functional water conservation structures. The approach focused on structural stability, water restoration, heritage preservation, and community involvement.

i. Structural Conservation and Stability

Rebuilding Collapsed Sections: Traditional masonry techniques were used to restore walls.

Use of Authentic Materials: Modern cement was replaced with lime mortar and sandstone for durability.

Structural Monitoring: Digital systems were installed to track stability and prevent risks.

ii. Water Restoration and Quality Improvement

De-silting and Cleaning: Removed centuries of silt and debris to restore water depth.

Contaminant Diversion: Redirected sewage drainage to improve water quality.

Groundwater Recharge: Preserved the natural spring system for continuous water inflow.

iii. Heritage Conservation and Maintenance

Removal of Modern Additions: Eliminated epoxy and cement layers that caused structural damage.

Architectural Restoration: Replaced metal grilles with sandstone lattice screens (jaali).

Facade Repairs: Restored surrounding arcades and corridors for structural safety.

Community Engagement and Sustainable Management

Public Awareness Programs: Engaged locals in conservation efforts.



Fig no. 18, 19 & 20 Ongoing projects of AConservation of stepwell of Hazrat Nizamuddin Baoli

[Source: Need and necessity of adaptive reuse of stepwell and temple tanks in india]

V. ADAPTIVE REUSE OF STEPWELL

Adaptive reuse of stepwells is the act of adapting these old water facilities for modern functional, cultural, and environmental purposes while conserving their architectural integrity. As many stepwells have fallen into disrepair, restoration efforts seek to incorporate them into modern urban design, tourism, and sustainable water management.

5.1 Case studies for adaptive reuse of stepwell

- i. **Neemrana Baoli, Rajasthan – Integrated Heritage & Tourism Project**
Restoration Focus: Revived by the Neemrana Group, which also restored the adjacent palace as a hotel. Adaptive Reuse: Transformed into a heritage tourism destination, promoting local economy. Sustainability Impact: Supports rainwater harvesting and local water conservation efforts.
- ii. **Chand Baori, Rajasthan – Film & Cultural Promotion**
Restoration: Periodic maintenance keeps the stepwell structurally intact.
Adaptive Reuse: Used as a film shooting location (*The Dark Knight Rises*), boosting global awareness. Impact: Promotes cultural tourism and stepwell preservation.
- iii. **Rajon ki Baoli, Mehrauli (Delhi) – Heritage Conservation Model**



Restoration Focus: A 16th-century stepwell, restored under the Mehrauli Archaeological Park project. Adaptive Reuse: Integrated into eco-tourism and heritage walks, attracting cultural tourism. Sustainability Impact: Maintained as a historical site, though water restoration efforts are ongoing.

Fig no. 21, 22 & 23 Neemrana Baoli, Chand Baori, Rajon ki Baoli

[Source: Stepwells of India]

5.2 Need of Adaptive Reuse of Stepwell

Stepwells, once vital for water conservation and community sustenance, have lost their functional value due to modern water supply systems. However, reviving and repurposing them can serve both cultural heritage preservation and sustainable water management.

- i. **Water Conservation & Sustainability**
Stepwells were designed to trap rainwater and replenish groundwater. Integrating them with modern water management techniques (e.g., rainwater harvesting, wastewater recycling) can enhance urban water sustainability.
- ii. **Climate Resilience & Microclimate Creation**
These underground structures create a cool microclimate, offering potential solutions to urban heat islands and climate adaptation.
- iii. **Cultural & Historical Preservation**
Stepwells represent India's architectural and engineering heritage. Conservation supports Sustainable Development Goals (SDGs) by promoting a circular economy and preserving traditional knowledge.
- iv. **Urban Revitalization & Community Engagement**
Many stepwells have turned into waste disposal sites, leading to hygienic and aesthetic concerns. Revitalizing them as public spaces (e.g., parks, cultural hubs, haat bazaars, walking plazas) can restore their social and economic value.



Fig no. 24 Stepwell in Jaipur under Re-use strategy for communal activities

[Source: Need and necessity of adaptive reuse of stepwell and temple tanks in india]

5.3 Strategies for Adaptive Reuse of stepwell

The adaptive reuse of stepwells preserves their historical and cultural value while integrating them into modern urban and rural settings. These strategies focus on heritage conservation, economic benefits, sustainability, and public engagement.

- i. **Heritage Conservation & Educational Use**

- Prserve stepwells as living historical sites showcasing traditional water management.
- Convert them into museums and educational centers to promote history and sustainability awareness.
- ii. **Economic Revitalization & Employment Generation**
Create jobs for local artisans in restoration and cultural conservation. Promote eco-tourism and cultural events to support local economies.
- iii. **Sustainable Urban-Rural Integration**
Integrate stepwells into modern water management for suburban development. Utilize existing structures for cost-effective revitalization.
- iv. **Environmental Sustainability & Climate Adaptation**
Use stepwells for natural cooling, ventilation, and climate-resilient urban planning. Restore them as rainwater harvesting systems to recharge groundwater.
- v. **Functional Repurposing for Public Use**
Transform stepwells into community gathering spaces, event venues, and markets. Develop them as meditation areas, parks, and cultural hubs.



Fig no. 25 Ongoing projects of Adaptive re-use of Northern step-well
[Source: Need and necessity of adaptive reuse of stepwell and temple tanks in india]

VI. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The protection and adaptive reuse of stepwells is critical for water sustainability, cultural heritage preservation, and urban growth. Stepwells, which were previously essential for water storage and community life, have either fallen into disrepair or lost their original function as a result of modern water systems. However, their architectural, historical, and environmental significance make them excellent candidates for restoration and repurposing.

5.1.1 Stepwells Suitable for Adaptive reuse:

- i. Urban stepwells that are no longer utilized for water storage but nevertheless have cultural or economic value (for example, Agrasen ki Baoli and Neemrana Baoli).
- ii. Stepwells with sturdy architectural structures can be used as tourist attractions, public areas, and event locations.
- iii. Stepwells in high-traffic locations are good for heritage tourism, markets, and performance spaces (for example, Chand Baori in Rajasthan).

5.1.2 Stepwells Suitable for Conservation:

- i. Historically significant stepwells with strong cultural and religious associations that must be preserved in their original shape (for example, Rani ki Vav in Gujarat).
- ii. Stepwells with great water management potential, such as the Adalaj Stepwell, can be revived for rainfall gathering and groundwater recharging.
- iii. Stepwells in rural or semi-arid areas continue to serve as water supplies for local people.

Aspect	Stepwells for Adaptive Reuse	Stepwells for Conservation
Historical Significance	Integrated into tourism and public spaces while maintaining cultural essence	Preserved in original form for heritage conservation
Architectural Value	Maintained for aesthetic appeal, adapted for new uses like museums, cultural centers	Structural restoration using traditional methods to retain authenticity
Sustainable Water Management	Used as public spaces but can include rainwater harvesting elements	Active water conservation sites for groundwater recharge and rural water supply

Table 1 Comparing Conservation and Adaptive Reuse of St

5.2 Recommendations

Stepwell conservation and adaptive reuse must work together to ensure historical preservation and practical functionality. A hybrid strategy can strike a compromise between history protection and modern use, keeping stepwells relevant and sustainable. How Adaptive Reuse Can Save Water

- Rainwater Harvesting and Groundwater Recharge: Even stepwells that have been renovated for tourism can feature rainwater collection systems to help with urban water management.
- Climate Adaptation and Cooling Effects: Stepwells naturally cool the surrounding surroundings, decreasing urban heat and promoting sustainable city development.
- Public Awareness and Education: Adaptive reuse projects may feature interactive learning spaces that teach communities about water conservation and history.
- Integration into Urban Infrastructure: Revitalized stepwells can be incorporated into smart city programs, helping to ensure sustainable urban water consumption

REFERENCES

- [1] Steps to Water: Stepwells in India Sharad Chandra Chitrolekha International Magazine on Art and Design, (ISSN 2231-4822), Vol. 5, No. 2, 2015 URL of the Issue: www.chitrolekha.com/v5n2.php
- [2] Adalaj Stepwell: A Magical Resonance of Architectural Ingenuity By Unni Sriparvathy □ & T.N. Salahsha± Athens Journal of Architecture - Volume 7, Issue 2, April 2021 – Pages 275-304
- [3] Future is Urban n Urban Resilience, Capacity Building, Nature Based Solutions Utpal Sharma, Swati Kothary, Vibha Gajjar First published 2024
- [4] Review of the Potential of Stepwells as Sustainable Water Management Structures. Water 2022, 14, 2665. Thirumalini Selvaraj 1, Prathiba Devadas 2, Jayashree Lakshmi Perumal 1, Anastasia Zabaniotou 3 and MaheshGanesapillai 4
- [5] STEPWELLS OF INDIA (JAL MANDIR) Preserving the traditional water-harvesting systems of India Jal Mandir Scheme for revival of Step Wells in Gujarat (Ministry of Jal Shakti) June 22, 2022
- [6] STEPWELL: A HUMAN-MADE MARVEL (Exploring the History of Stepwells of Rajasthan and Gujarat:-With a Special Focus on The Relationship Between Stepwells and Women) MANYA JAIN, DIVYA ASWANI & SARA CHAUDHARY Neerja Modi School, Jaipur, Rajasthan, India (IJCSEIERD)
- [7] The Historical Sustainable Cities In India: A Survey Of Sustainable Practices Followed In Cities Of India In Ancient And Medieval Times Kartikeya BhardwajOSR Journal Of Humanities And Social Science (IOSR-JHSS) Volume 29, Issue 9, Series 7 (September, 2024)
- [8] Revitalizing Heritage: Exploring the Cultural and Historical Significance of Maner Tank in Patna, Bihar, India 1Ar. Anushri Barman, 2Dr. Anjali Sharma, 3Ar. Ashutosh Kumar Volume 36 | Issue 3
- [9] Bhatt, P. M. Her Space, Her Story: Exploring the Stepwells of Gujarat. New Delhi: Zubaan, 2014. Chandra,
- [10] Steps to Water: Stepwells in India. Chitrolekha International Magazine on Art and Design 5, no. 2 (2015): 40-46.
- [11] Hogeboom, R.J. The water footprint concept and Water's grand environmental challenges. One Earth 2020, 2, 218–222.
- [12] IWMI Comprehensive Assessment of Water Management in Agriculture using the Watersim model; chapter 2
- [13] Looking down to plan ahead, In india, cities are restoring ancient stepwells to build climate resilience. Shruti ganesh March 29, 2023
- [14] Need and necessity of adaptive reuse of stepwell and temple tanks in india Architecture dissertation '23 by aishwarya Published on sep 20, 2023
- [15] Traditional water harvesting systems for drought mitigation in India by Sreeja S.
- [16] Down To Earth on water by Anil Agarwal August 15, 1997
- [17] Traditional Methods of Water Conservation TERRE YuCon Vol 3 Issue 2 | June 2016 Kazi Erum, Mehraj Shaikh
- [18] Stepwells as Heritage Sites: Exploring Their Roles for Sustainable Communities Kirti Nishant Nikam Department of Sustainable Design, Manipal School of Architecture & Planning, Vol. 15, 2024
- [19] StepwellKhandani khazana for liquid assets of India