CHAPTER 7

The Difficult Reappropriation of an Ancient Technical Knowledge

Rainwater Harvesting in Ahmedabad, India

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Introduction

Intergovernmental cooperation plays a role in disseminating the concept of heritage. The rehabilitation of the old city of Ahmedabad, which forms the background of this chapter, is the result of an agreement between the French state and the municipality of the state of Gujarat. It occurred thanks to 'an ambient ideology favourable to heritage intervention',[1] following an initiative undertaken by individual and collective actors.

The rehabilitation of old urban centres in developing countries raises the question of the heritagization[2] of technical knowledge and practices related to the use of restored objects or structures. Heritagization relates to the process of turning cultural features into heritage. This notion based on a linear and open conception of time, is part of European modernity, 'a path towards a better world',[3] unlike non-Western civilizations that are often built on a cyclical relationship to time. The transfer of this notion of heritage to non-Western societies is rather problematic: it requires an implicit and institutionalized social agreement on collectively accepted values across a territory. This heritagization sometimes proves to be paradoxical in the Indian context, where material (especially built) heritage is

not so important. The significance lies in the place and the attributed stories/data, but not in its materiality. That makes a big distinction with 'heritage' as it is understood in the modern West.

But the perception of this heritage can be positive when it is part of a tradition: 'insofar as the past is transmitted as a tradition, it is authoritative' to quote Hannah Arendt.[4] This grafting of the notion of heritage is due in part to a quest for recognition by elected officials, supported by local elites who seize upon it to consolidate their status in the eyes of the world:[5] heritage, an eminently political construction, reinforces power. The classification of a remarkable site by UNESCO confers on emerging countries a symbolic status that allows them to compete with powerful countries, as illustrated by the classification in 2017 of the old city of Ahmedabad in the list of world heritage sites.

This propagation of the principle of heritagization, which is materialized by operations centred on the architectural dimension of the habitat, gives a marginal role to the rehabilitation of infrastructures and old water supply systems. However, in situations of water shortage, these systems could constitute a complementary source of supply. The present chapter questions both the utility of their rehabilitation and the state of knowledge associated with their use.

In the 2000s, several projects to rehabilitate 'traditional' housing to improve the living conditions of inhabitants in some of the old cities in Gujarat took place. These operations, initiated by individuals and then supported by local public authorities, highlighted the preservation of a limited number of underground cisterns for harvesting rainwater, a system that was partially abandoned under colonial rule; their continued existence sheds light on the fragility of the knowledge associated with their use.

Using the example of Ahmedabad (Map 7.1), this chapter aims to describe the state of this ancient technique that

fell into disuse under British rule, most probably in the second half of the nineteenth century, and was highlighted by the shortcomings of the municipal water service. This research assesses its potential for reintegration in the light of continued water storage practices and of the knowledge associated with its use. I argue that the *tanka*, a traditional urban water system, is at odds with a modernity epitomized by the individual tap despite the unreliability of the municipal water supply service. If these cisterns would allow its user to benefit from an additional water supply, the knowledge associated with its use remains confined to certain castes and communities that followed the practice of using and maintaining them. Beyond them, a reappropriation of these underground structures by weaker sections of the society remains a challenge given their rehabilitation cost.

Two series of questions illustrate the point: the first concerns the place of cisterns in the city's overall supply systems. To what extent do they constitute a complementary source of supply? How does the user incorporate them into a socio-technical context characterized by a multitude of supply systems? The second set of questions relates to the local knowledge associated with the construction and use of cisterns: what is its nature? How is this knowledge maintained, transmitted or integrated into existing social balances? Which social groups participate in its revival?

To understand the marginal role of this supply system, it is important to place it in its socio-political context and in a historical perspective. This step back in time, dealt with in the first part, allows us to understand the influence of political power on an autonomous technical system, managed by the inhabitants. The second part questions the possibility of reusing cisterns in the old city of Ahmedabad. It outlines the methodology of the survey conducted in 2001–2 among sixty households. The third part presents the results of this survey focused on water storage and cistern

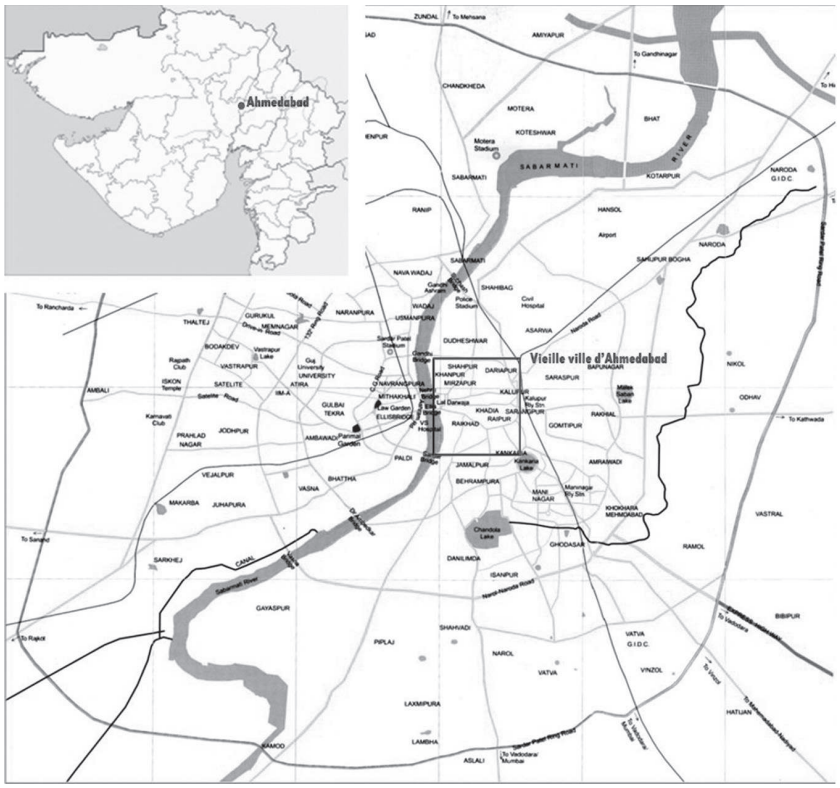
use practices. It examines the reasons for their insufficient use despite the discontinuity of the municipal water service. The fourth part concludes with the state of knowledge associated with the use of cisterns. The 2001–2 survey[6] was updated in November 2016–17. This update highlights the abandonment of operational cisterns identified fifteen years earlier. It indicates a retention of the technical knowledge of craftsmen in the building trade on the design of cisterns.

Origins and Discontinuation of Cisterns in Gujarat

The Cistern: An Ancient System Resulting from the Circulation of Knowledge

The cisterns of the old city centres in Gujarat[7] take the form of chambers located under the inner courtyards of private houses or collective buildings. Historical underground cisterns exist over a vast area stretching from Central Asia to the western side of the Mediterranean basin: their existence is attested in the sixteenth century in Herat in Afghanistan,[8] in Constantinople, and in Resafa in Syria.[9] In the western Mediterranean basin, a few cisterns can still be found in arid regions.[10] The likeliness of a knowledge diffusion of the *tanka* system reaching India from elsewhere is high, due to its similarity with Persian and Mediterranean models, and knowing that 'Western India was alien to cloistering water in underground storing systems'.[11]

Little information exists on the origin of cisterns in Gujarat, especially on the external contributions and influences in their architecture. The origin of the term '*tanka*' used to designate them is not known. Certain characteristics of their internal structure allow us to hypothesize the use of Persian-inspired construction techniques: the vaulted and arched roofs (Map 7.1), and the use of lime mortar or



Map 7.1: Location of the old city of Ahmedabad.

brick-*chuna* in the masonry. These features suggest that they refer to the Mughal period in Gujarat (from 1573 onwards) and *tankas* must have been built from the early seventeenth century onwards.[12] These elements are examples of knowledge acquired and mastered in Persia by Persian hydraulic engineers who adapted them for the construction of hydraulic structures in India, as it is seen in Bijapur (present-day Karnataka) in the sixteenth–seventeenth centuries,[13] i.e. a period prior to that of the construction of wealthy traditional wooden houses or *havelis* in Ahmedabad in the eighteenth–nineteenth centuries.[14]

The characteristics of the Ahmedabad cisterns are similar to those of Bijapur, according to Rötzer's description, and

they might be of a same period. In addition to the Persian influence, other architectural styles and techniques were added, starting with the input of local knowledge resulting from exchanges with the outside world over a long period. We must refer here to the historical perspective proposed by Habib and taken up by Mahias[15] on the process of aggregation of foreign techniques with local technical knowledge: 'The pre-colonial assembly of techniques in India was built up by accretions and substitutions that took place at different times'.[16] This reading challenges the simplistic approach of a purely endogenous technology. It would be risky to attribute to these cisterns a precise geographical origin or a given period. Tracing the distribution of these systems remains difficult.[17]

Historian Kenneth Gillion details the development of water supplies. During the Mughal period in Ahmedabad (1573–1753), aqueducts, wells and step wells were the main sources of supply. While the aqueducts fell into disuse well before the arrival of the British, the wells, the Sabarmati River that runs alongside the city, and the rainwater cisterns remained.[18] The dating of this last system converges quite significantly according to the few sources that mention it: it is positioned in the Muslim period (1411–1707).[19] Shaukat Ullah Khan's work indicates the presence of cisterns in the fifteenth–sixteenth centuries: the Portuguese traveller-writer Duarte Barbosa (1480–1521) notes the existence of freshwater wells in the houses of the city's merchants, and the emperor Jahangir (1569–1627) mentions that these were cisterns that kept rainwater from one year to the next.[20] The first cistern constructions in Ahmedabad happened in mosques during the 1590s: these underground structures were supplied by rainwater from levelled courtyards. These later evolved in the seventeenth century into covered structures supplied by pipes and with catchments on terrasses.[21] Keller notes that when Gujarat ceased to be a sultanate, and became a province, the deterioration of water structures and the commons brought

Map 7.2: Map of Ahmedabad and its environs (1866).
Source: Hope et al., 2011

the wealthy inhabitants to search for individual solutions to gain water autonomy.[22] Replacing open tanks, *tankas* spread into wealthy houses, independent of the regime, from the early seventeenth century onwards.[23] The author underlines that this water technology shift happened through the wide overseas connections that Gujarat developed over centuries, to start with Persia, through maritime roads during the Sultanate and land roads during the Mughals.[24] Archaeological remains with similarities with the Gujarati *tankas* in cities of the Persian Gulf and the Red Sea show a strong proximity with the cisterns of the Mediterranean basin. Multiple features (underground rectangular structure, arches and vaults, use of bricks) testify to the circulation of ideas and technologies between these territories.[25] During their presence in Ahmedabad (1817–1947), the British noticed that the majority of houses of wealthy inhabitants had wells and cisterns. This system already existed at the time of the first *pols*, or neighbourhoods constituted about 280 years ago,[26] a period contemporary with the construction of the houses that structure these same *pols*.

Pols consist of rows of houses built along an inner street, and closed by a gate that protects the inhabitants in case of riots. The grouping of houses into *pols* is a characteristic of Gujarat, especially Ahmedabad. Usually, each *pol* had a population of the same caste, with a few exceptions.[27] This situation no longer reflects the norm, given the high geographical mobility of traditional castes from the old centre to the new parts of the city.[28] If caste constitutes a binding element, profession, religious affiliation, or ethnic background also play a role in the feeling of belongingness inside neighbourhoods such as *pols*.

Multiple Causes for Discontinuing Cisterns

The beginnings of the municipal water network in Ahmedabad go back to the middle of the nineteenth century, following

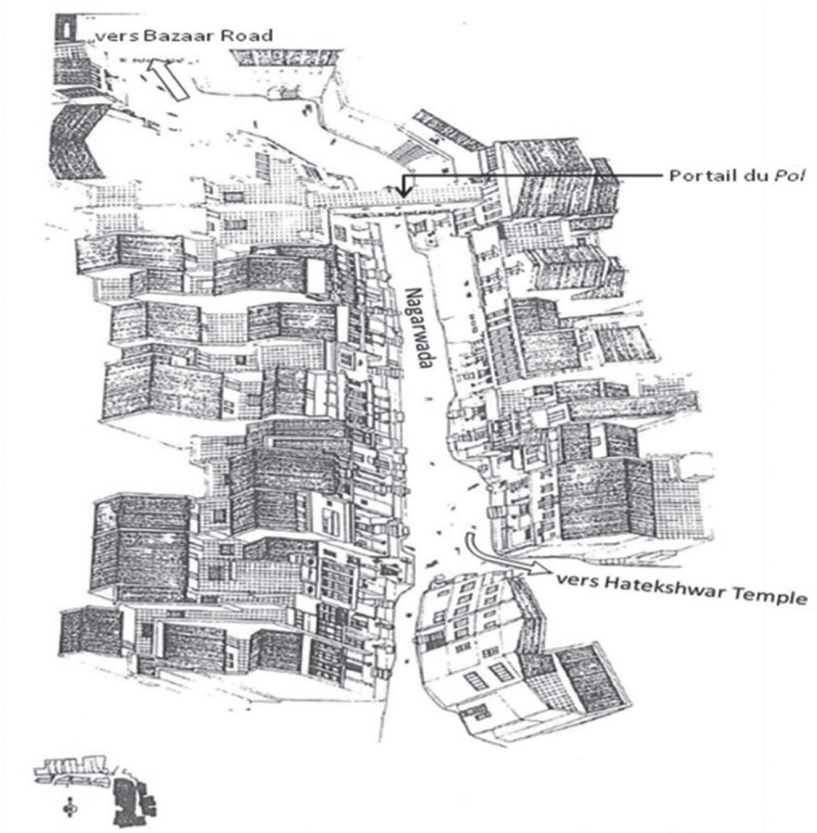


Figure 7.1: Aerial view of a *pol* in Ahmedabad.
Source: Vaastu Shilpa Foundation, Ahmedabad

initiatives taken by the city's notables. Water from the Sabarmati was pumped, filtered and then conveyed through an embryonic network to a few individual connections from 1849 onwards. Gillion notes that at the outset, the water of the municipal network was not drinkable; that of the wells was hardly better, because of the infiltrations of the sewerage network; and the river water was polluted by artisanal and domestic activities. Rainwater would therefore have been the safest source, due to precautions that continue to be taken today: water from the first rains, and from the surface of the flat rooftops where occupants walk, are not channelled into the cistern; the entrance to the cistern is raised by a circular

structure located above the ground, and closed by a lid that protects against involuntary water splashes.[29] The British noted that in wealthy houses, well water was used for bathing and other domestic purposes, while cistern water was used for drinking and cooking.[30] They understood that rainwater was the 'least unfit for consumption' source for the 8,000 to 9,000 well-to-do households in the city.[31] At the end of the nineteenth century, it seems that a few cisterns still remained, although the majority of them were too old, cracked and unfit for use. But the water collected constituted 'the best source of water' in the city.[32]

While access to this water was confined to the household, water sharing seemed to exist within the *pols* and traditionally within the caste; this situation perpetuated the principle of social stratification: when merchant castes (Jain, Vania) complained that their tank located near their *pol* was being used by other castes, the municipality ended up prohibiting the use of the tank by groups outside the *pol*. In 1877, the municipality also prohibited the construction of individual deep wells and sealed off the existing ones as a health precaution.

The proposal of an enlightened municipal official to increase taxes in order to provide the city with a water system worthy of its rank was met with hostility from the inhabitants, relayed by the press, petitions and elected officials. The endogamy associated with the principle of purity made it difficult to adopt this measure: certain castes, unwilling to share the water of the municipal network, were opposed to this extension for fear that the lower castes would pollute it.[33] However, from 1891 onwards, the city improved its water network and the demand for individual connections increased tenfold: it was recognized for the quality of its urban management beyond the subcontinent. This short-lived improvement (*op. cit.*, p. 140) can be explained in part by the investment choices of Ranchhodlal,

an enlightened municipal administrator. His death in 1898 ended this period of development and good management of urban services. The following decade was characterized by inaction, clientelism and acts of corruption by a series of municipal administrators.[34] This status quo undermined the municipality's plan to build a sustainable water and sanitation infrastructure to meet the growing needs of an expanding population, in a context where there was a risk of epidemics.[35]

In the tense political climate of the struggle for independence, a municipal ordinance required the discontinuation of the cisterns in 1943.[36] Several households and architects interviewed in the survey affirm that they served as a refuge for individuals wanted by the authorities, such as independence militants or bandits.[37] In Bharuch, some cisterns have an annex room called *chor-khana* (the thieves' chamber). Historians seem to be rather vague on this question, with the exception of Gillion. The desire of the colonists to prohibit this decentralized method of supply in order to make way for a centralized water network contributed to the gradual discontinuation of the cisterns. In 1945, the city committee extended the municipal water system from the old city centre to the entire city.[38] This extension precipitated the discontinuation of the cisterns despite their usefulness in a semi-arid context punctuated by the monsoon season.[39] After Independence, local decision-makers who had studied in the West, known as 'Brown Sahibs' because of their mimetic attitude towards their predecessors, continued the development of the British municipal water system.

The administrators' desire to introduce public hygiene measures by developing centralized water networks came up against the persistence of decentralized water supply systems managed by the inhabitants. When cholera epidemics broke out, the users of the public water system were the first to

be affected.[40] To remedy this situation, the State introduced filtration, ozonation or disinfection of water from the end of the nineteenth century, following the example of technical developments in Europe.[41]

The Possibility of Reviving Cisterns in Ahmedabad

Idealization of Ancient Water Supply Techniques by the Elite

Ancient water supply systems in Indian cities have been the subject of renewed interest since the mid-1990s, spurred on by local movements that are campaigning for their rehabilitation in a rather scattered manner. These movements propose that the inhabitants manage the techniques and knowledge associated with these systems, which are sometimes presented as a panacea for the deficiencies of the municipal water service. The latter is characterized by a discontinuous distribution, with low pressure and random frequency: in some cities, water reaches the user's tap every three days for a supply period of about two hours.

The Centre for Science and Environment, an Indian NGO focused on environmental awareness initiatives, is playing a key role in raising awareness of the usefulness of alternative water supply systems. Its outreach magazine, *Down to Earth*, has found a favourable echo among young urban elites: it conveys a committed discourse on the need to rehabilitate these ancient techniques. Its reference work, *Dying Wisdom*,[42] devoted to the emergence and decline of traditional water supply systems, promotes decentralized technologies in the face of the centralized infrastructure of the British and now the Indian state.

This nostalgia for a golden age that characterizes the discourse of these militant organizations reflects an ideological

representation of the world centred on the endogenous character of knowledge and techniques.[43] Mahias clarifies this dichotomy:

> The criticism is based on a rhetoric which opposes (even if some defend it) on the one hand, a modernity indissociable from sciences and techniques imported from the West, i.e. related to foreign domination, and on the other hand, 'traditional', endogenous knowledge, which one seeks to date back as far as possible in the past and to link to prestigious fields of knowledge, if possible textual'.[44]

This idealization of ancient objects and knowledge echoes the Western vision of heritage.

The Reuse of Cisterns as Part of a Larger Architectural Project

The reuse of cisterns in Ahmedabad is part of a larger architectural project, namely the rehabilitation of traditional housing and its adaptation to the demands of modern life. The progression of the nuclear family model at the expense of the joint family is leading to a fragmentation and a reconfiguration of housing with implications for the modes of access to water. This renovation is a response to a necessity in the old city: the amplified effects of demographic pressure in a confined space, and the aspiration to better living conditions lead the inhabitants to migrate to new residential areas. The reuse of cisterns is a marginal aspect of this housing-centred rehabilitation. However, its importance deserves to be underlined: it helps improve the comfort of houses in the old city centre which lost its attractiveness at the beginning of the twentieth century when new districts were built on the other bank of the Sabarmati. In contrast with the limited functions of the traditional habitat (e.g.

rudimentary water and sanitation services), city dwellers prefer the modern facilities of new buildings which meet their aspirations in terms of comfort and space.

The rehabilitation of the old city combined the promotion of local technical know-how (e.g. repair of wooden structures) and French know-how in architectural project management (e.g. inventory techniques). The project, initiated in 2000 in the framework of a bilateral cooperation, represents a donation from the French government for the fiftieth anniversary of India's independence (1947–97). This sharing of know-how on urban renewal between French architects and their Indian counterparts followed similar experiments conducted by the former in other developing cities (e.g. Quito). Ahmedabad was chosen for the urban quality of the old city centre, which is characterized by the structuring of neighbourhoods by *pols* and the high density of houses with carved wooden facades[45] and Gujarati ornamentation.[46]

The initial project to rehabilitate the old city was inspired by the vision of an architect, Ravindra Vasavada, a teacher at the CEPT University,[47] recognized for his expertise in built heritage in Gujarat. The heritage department created within the municipality took over the initiative with the support of an Indian foundation, CRUTA,[48] dedicated to the rehabilitation of urban heritage, in tandem with the team of French architects and Indian students trained in inventory techniques by the French. This rehabilitation, carried out by a group of individuals with expertise in their field of intervention, subsequently benefited from the technical and financial support of the French Embassy in India and the institutional support of the municipality of Ahmedabad.

However, the inhabitants for whom the rehabilitation is intended were not involved in the design of the project. This situation underlines the ambiguity of a project carried by 'civil society' which is in reality limited to a handful of qualified and committed individuals, without any real popular participation.[49]

The Place of Cisterns in a Context of Discontinuity of Water Supply

The reuse of rainwater cisterns is part of a general context of discontinuity in the public water supply service. Such a discontinuity embodies the notion of 'inconstancy', used by Zérah in his study of Delhi, as 'the set of characteristics that affect the quantitative supply of water';[50] these also apply to Ahmedabad:

- the discontinuity of the service (two hours of water per day in the old centre);
- insufficient, irregular flow (low pressure in the entire city);
- the unpredictability of the service (frequent water cuts throughout the network).

In addition, the quantity of water distributed fluctuated (and still fluctuates) from one neighbourhood to another, and even from one connection to another in the same street. This fluctuation in water service and supply was the result of financial, administrative and technical deficiencies in the management of the network infrastructure by the municipality. The municipality supplied the city with water,[51] both from surface water (the Mahi River, via the Raska Canal) and from groundwater through deep boreholes at various points.

The scarcity of water, characterized by insufficient quantity and discontinuous distribution, which prevailed in Ahmedabad[52] would justify the use of rainwater. This was manifested in the decrease in the volume of individually distributed public water from 191 to 140 litres per day from 1972 to 2012. However, in the same period, the network increased in capacity, delivering not 317 but 950 million litres per day. This discrepancy between the two trends over the same period is linked in particular to several concomitant factors: the increase in population, the expansion of the

municipal water network's service area and the possibility of leaks. In this context of insufficient municipal service, cisterns occupy a marginal place among all sources of water supply.

Location and Study Population

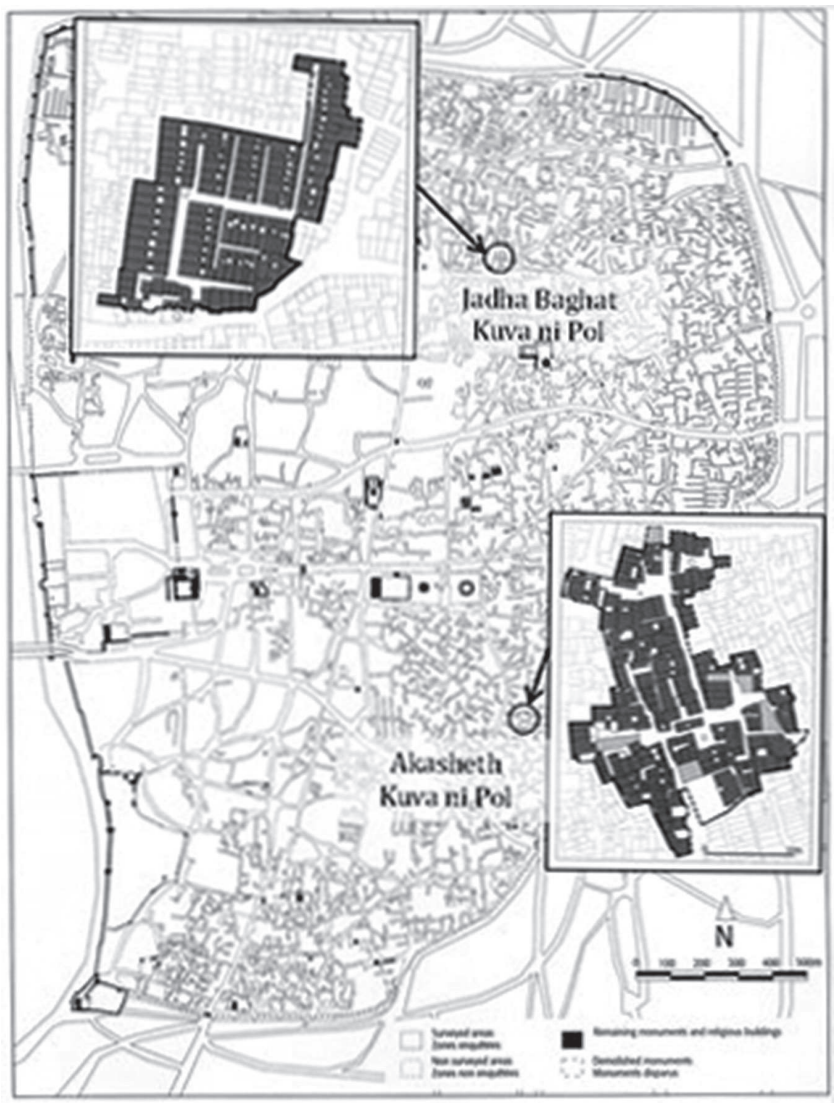
The data collected allows us to understand the place of rainwater harvesting cisterns among all water supply systems, as well as to identify and question the knowledge associated with their construction and use.

The collection method is a qualitative survey (semi-directive questionnaire). The interviews were restricted to the population of the old city centre: the cisterns are concentrated in the *pols* of this 550-hectare area, which was populated by 450,000 inhabitants in the 2001–2 survey[53] and 350,000 inhabitants in the 2016–17 survey, i.e. 6 per cent of the population of Ahmedabad.

Before Independence, the city had about 360 *pols*.[54] Today, there are between 500[55] and 600[56] and not all of them have water tanks. The survey focuses on two *pols* studied in 2000 by an Indo-French revitalization project (Map 7.3): the Akasheth Kuva *ni pol* and the Jadha Baghat *ni pol*. The plans drawn by the team of architects which locate a significant number of tanks in these *pols* justify this choice.

This survey of households and building craftsmen provides an overview of the state of knowledge about the cisterns, which for the former are witnesses and for the latter actors in the rehabilitation project. This contribution constitutes a counterpoint to the discourse of militant urban elites and NGOs on the need to preserve knowledge and techniques, an echo of Western-style heritagization.

The population studied comprises sixty households equally distributed in the two selected *pols* (30+30). A



Map 7.3: Location of the two pols surveyed in the old city.
Source: Directorate of Architecture and Heritage (2001)

map produced by the Indo-French project localizing the situation of the *tanka* in each *pol* (operational systems, non-operational systems, non-existing systems) served to select the houses to be surveyed.

The questionnaire was administered in priority to households who may use the rainwater harvesting system, followed then by the non-operational systems and the non-existing systems. The sampling method is therefore non probabilistic. Therefore, a combination of snowball and convenience sampling was used to reached the relevant respondents. There were respectively seven and three operational systems in the *pols* of Akasheth Kuva and Jadha Baghat (see Table 7.1).

The populations in each *pol* have distinct socio-economic characteristics, but overall income and education levels are low: half of the households in each *pol* receive between Rs.2,000–6,000 and only half of the respondents have a secondary education. The presence of brahmins in the *pol* of Akasheth Kuva is reflected in the high share of tertiary graduates: they represent almost half of the respondents in this *pol* and double that in the *pol* of Jadha Baghat. The *pol* of Akasheth Kuva also has a concentration of better-off households: more than a third of the households surveyed have an income of over 6,000–8,000 rupees, almost a third of the heads of households are professionals, and only one household surveyed has an income of less than 2,000 rupees, compared to ten households in the *pol* of Jadha Baghat. In this later *pol*, two-thirds of the households surveyed have a wage-earning head of household, which is twice as many as in the *pol* of Akasheth Kuva.

These *pols* differ in their caste distribution: brahmins (Nagar brahman) make up more than half of the respondents in the *pol* of Akasheth Kuva, with the rest of theses respondents spread across different castes; Vaishya (Patel) make up two-thirds of the surveyed population in the *pol* of Jadha Baghat. This composition reflects the social structure of the *pols*, which traditionally comprise a predominant caste. The survey validates the low mobility in these two areas:[57] while four houses were occupied by non-indigenous (Marwari)

communities in the *pol* of Jadha Baghat in 2001–2, the Patels were henceforth a minority in 2016–17.

Storage as a Response to the Deficiency of the Municipal Water Supply Service

In order to understand the role of cisterns for households, and the state of their knowledge about their use, it is necessary to situate this system among all the sources of water supply in the old city.

A majority of households have no knowledge on cisterns: they do not have one, or no longer use it. For those who do use it, their use is confined to storage and constitutes a compensatory strategy to compensate for the deficiencies of the public water supply service. This comparison of the two systems allows us to examine the reasons behind the insufficient appropriation of cisterns.

The Functioning of the Rainwater Harvesting System

The number of cisterns in the *pols* fluctuates according to sources: between 5,000,[58], 8,000–9,000,[59] and 10,000.[60] Although 1,500 cisterns are said to be in good condition,[61] only ten or so have been restored, on the fringes of the Indo-French project which does not include their rehabilitation. This rehabilitation, carried out on the initiative of the municipality and a neighbourhood association (Khadia Itihas Samiti),[62] is part of a process of revitalizing the material and immaterial heritage.

The storage capacities of the underground chambers (Map 7.2) vary between 20,000[63] and 50,000 litres. Rainwater is collected from the roof, only after the first rains clean its surface. It is then diverted through a gutter to the underground

cistern. Water can be filtered by a cloth or a metal grid located at the entrance of it. For maintenance, a single opening from where water is drawn allows a person to access the chamber (Plate 7.1), for maintenance purpose, generally once in a year. And before the first summer rainfalls, water must be evacuated from the cistern which mobilizes family members for half a day.

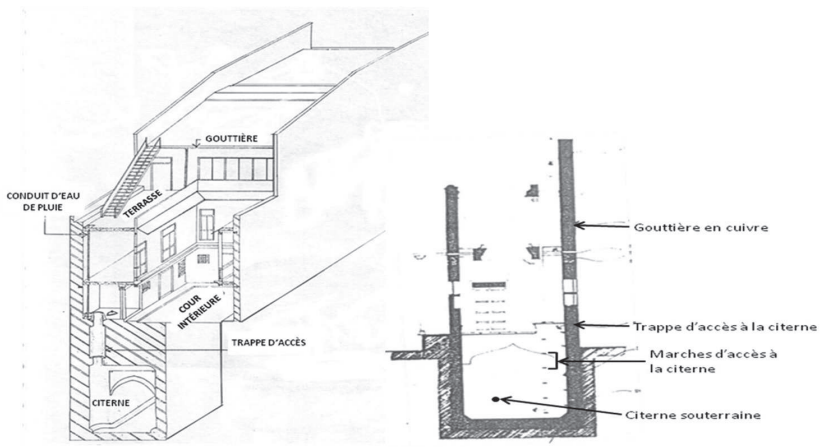


Figure 7.2: Cross-section of a *pol* house and rainwater harvesting system.
Source: Vaastu Shilpa Foundation, Ahmedabad.

Their functioning is based on the principle of storing water that is channelled through a gutter after it has run off the roof.

Plate 7.1: Rainwater storage in an individual house.
Credit: Author, Ahmedabad, 2002.

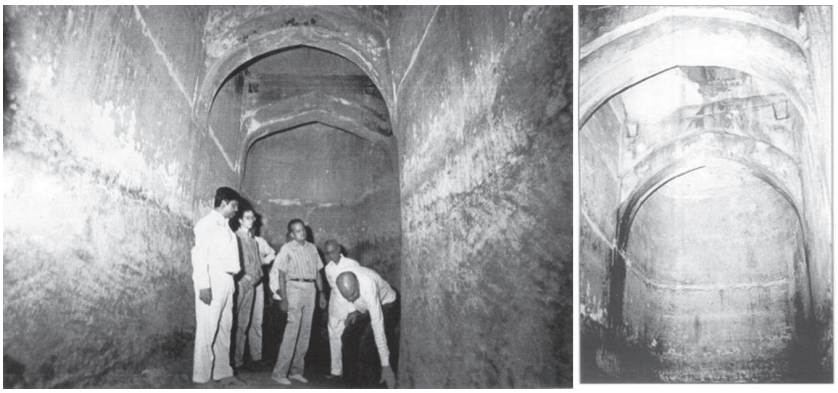


Plate 7.2: Interior of a cistern. *Source:* Author, Ahmedabad, 2002

The circular cistern is supported by arches that rise from the upper part of the structure. These arches, three or four in number, support the inner courtyard, often located above the cistern.

The brick walls, built from an earthen mortar composed of river sand and clay, are coated with plaster and covered with lime (a material known for its antiseptic properties). These materials come from the soil and subsoil around the city.

Some temples and mosques have cisterns with a storage capacity of about 100,000 litres for worship and maintenance, with a maximum capacity of 200,000 litres in Ahmedabad.[64]

Water Storage, a Daily Practice Linked to a Discontinuous Public Service

The desire to store water results from the discontinuity of the municipal water service. Households receive on average two hours of water per day, early in the morning. This duration has decreased by thirty minutes between the 2001–2 survey (5:45–8:15 a.m.) and the one conducted at the end of 2016 (6:00–8:00 a.m.).

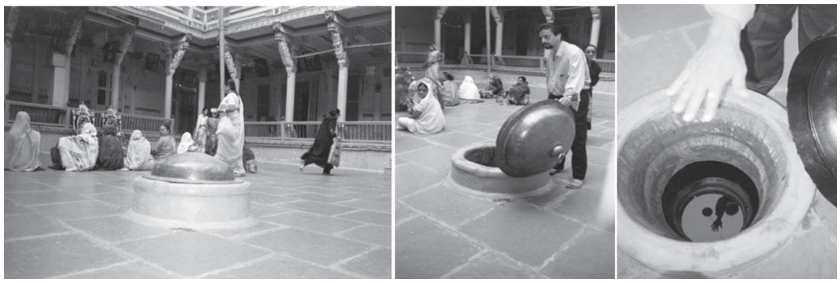


Plate 7.3: Storage of water in a temple. *Source:* Author, Ahmedabad, 2002

While the municipal water network is the main source of supply, its intermittent nature leads users to collect water in buckets from which it is transferred into jerry cans, *tankis*, from dawn until dusk. *Tankis* are recipients in plastic or in cement generally placed near the connection of the municipal water supply system to store water from this source. This practice, identified among fifty households in the survey, is carried out by children and women who also work to earn a daily income.

Plate 7.4: Storage of water from the municipal water system in external 'tanki' containers. *Source:* Author, Ahmedabad, 2002

Another common practice in Indian cities is to store water in a rooftop tank. This tank collects water from the bore well with the help of an electric pump, which is to the tank what the bucket is to the canister: it allows the user to transport the water from the bore well to the rooftop tank. This device is becoming increasingly popular on flat roofs, as sloping roofs and now sheet metal roofs[65] do not facilitate the installation of the tank on the roof. It is difficult to determine how many of the surveyed population use this system.

Water Sharing, a Constant in the Pol

While two-thirds of households claim to have sufficient water, the remaining third use water from their neighbour's individual municipal connection (Figure 7.2). Half of the households use this sharing on a daily basis, the other half use it during the dry season; this practice requires several journeys, but the low level of motorized traffic makes it easier to come and go in the confined space of the *pols*. Social or geographical proximity and neighbourly relations encourage exchanges that go beyond the link of reciprocity, as the demand for water cannot be refused even if it means restricting one's own consumption,[66] given its essential nature beyond traditions and religions.[67]

Of note is the size of the average amount of water taken by households using water sharing in the *pol* of Jadha Baghat and the number of trips: an average of 206 litres per day for five people per household and seventeen daily trips. This sharing is double in terms of volume and trips compared to the *pol* of Akasheth Kuva where incomes are higher and bore wells are used intensively. These observations confirm that the time spent on water transport and storage decreases as income increases, similar to the results of Zérah's survey in Delhi.[68]

Plate 7.5: Water sharing inside a *pol*. *Source:* Author, Ahmedabad, 2002

Despite the deficiencies of the water supply service, the majority of households surveyed do not want to benefit from an improvement in the service in return of an increase of the price of water based on consumption.[69] This reluctance is explained by the fear of a switch to a new billing system that would make water more expensive and sharing water less obvious.[70] This opinion is explained by the strength of social ties in the *pols* and mutual aid behaviours due to the discontinuity of the municipal water service.

If water storage and sharing practices are anchored in the daily life of the inhabitants, few questions remain: why is the cistern little used? What are the practices of use and the technical knowledge associated with its use?

Weak Appropriation of Cisterns and Limited Knowledge on its Use

Understanding the perception of households about historical underground cisterns implies questioning water consumption practices in general, the nature and state of knowledge associated with its use, and the perception of water quality.

The Use of Cisterns, a Marginal Compensatory Strategy

Rainwater harvesting systems are not widely used in the two *pols* surveyed (see Table 7.1).

- Only 1 household in 10 has an operational system;
- More than half of households have a non-operational system;
- Less than a third of households do not have a system.

Of the two *pols*, the Akasheth Kuva *ni pol* makes more use of cisterns.

Table 7.1: Status of Rainwater Harvesting Systems in the *Pols* under Study

Status of systems	*Akasheth Kuva*	*Jadha Baghat*	*2 pols*
Operational systems	7	3	10
Non-operational systems	13	19	32
Non-existent systems	10	8	18
Total	30	30	60

Source: Survey conducted by the author in Ahmedabad, 2002.

The ten operational systems identified have not undergone recent renovation: their users utilized them before the rehabilitation of the old city. The majority of households with an operational system[71] in the Akasheth Kuva *ni pol* are Nagar brahman (5/7). During the interviews, they express their interest in preserving the tanks. The 2016 survey notes that none of the thirty-two non-operational systems identified in 2001–2 have been significantly renovated in the past fifteen years.

Knowledge Associated with Rainwater Cisterns

The age of the cisterns is suggested by all households having one, whether the system is operational or not: they estimate

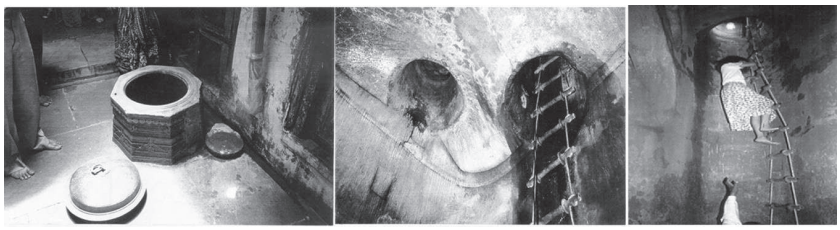


Plate 7.6: Access hatch to the tank. *Source:* A. Bhatt, Ahmedabad, undated

that they have existed for 130 years and their intensive use would have continued for a century. But only half of households with an operational system (5/10) and a minority of households (6/32) with a non-operational system know the materials that structure their cistern.

The knowledge associated with using the system is diluted when households no longer use it. Take the water collection method, for example: an aluminium or clay container, called a *dhol*, attached to a rope, is used to draw water through a trap door (Plate 7.1). While seven of the ten households in the operational system are aware of this process, only nine of the thirty-two households in the non-operational system mention it spontaneously.

Users' knowledge of certain characteristics of their tank decreases when it involves quantified measurements:

- Only one household per operational and non-operational system knows the precise storage capacity of its tank: this is a 300,000 litres tank (operational system) and a 10,000 litres tank (non-operational system): this situation reveals the magnitude of storage capacities;
- Only two of the ten households with an operational system know the surface area of their roof.
- Traditional knowledge is not made explicit in technical terms: linked to experience and use, it takes precedence over theoretical knowledge.

Knowledge on how cisterns work is a matter for the

households that use them. However, there remains a social bias in the responses, partly linked to the level of education. Thus, the success of the heritagization of cisterns is relative: if they benefit today from a positive image among the population studied, they interest only a handful of households that have proceeded to their rehabilitation, mostly from the upper castes and with high incomes. While heritage protection in the West is a matter for the upper and middle classes (Claval, 2003, p.51), in Ahmedabad, the literate castes share a stronger interest. However, it is risky to deduce that the brahmins have integrated this Western-style heritagization. They translate it into their own terms. For example, the possession of a traditional home constitutes an element of distinction. It reinforces their symbolic power linked to ancient knowledge and its transmission. In this way, they retain some practical knowledge about collecting rainwater for specific uses (worship of a deity) or in specific contexts (weddings, religious festivals, water shortages or work). These situations of high demand for water provoke exchanges around the resource through which knowledge spreads beyond the regular users. This knowledge is also known by the building craftsmen.

One of the users who is convinced of the quality of the rainwater specified an ancient practice of using the cistern: the water was collected according to the position of the constellations called *nakshatra*. In the local calendar, the year is divided into twelve months, each month having two *nakshatras*. The astrology to which the locals refer has seven odd *nakshatras,* which are considered favourable for storing rainwater: Mrigshirsh, Punarvasu, Pushya, Hasta, Anuradha, Muln, Shravan. During certain *nakshatras*, bacterial and microbial growth is said to be at its lowest.[72] This knowledge should be taken with caution: it is confined to a few individuals who have been using the cistern for twenty–thirty years, among the Nagar brahman in the Akasheth Kuva *ni pol*.

In this *pol*, all households with a functioning system direct the water from the first rains out of the cistern to remove impurities from the roof. At the entry point of the structure, the water is filtered through a cloth or a metal grid. To maintain the quality of the water, residents with knowledge on the system mention the use of alum, a salt with antiseptic properties. In Cambay (Gujarat), after the monsoon, users pour lime into the structure: it modifies the pH of the water, making it alkaline and eliminating bacteria.[73] The darkness that is altered by few sources of light prevents the proliferation of algae. Households report that the rainwater is clear, free of odour and impurities. Beyond the circle of users in the *pol* of Akasheth Kuva, this knowledge remains

Plate 7.7: Sources of light inside the cistern: Oil lamp.
Source: A. Bhatt, Ahmedabad, undated

diffuse and these practices not very well spread in the *pol* of Jadha Baghat.

Keller underlines that cultural practices contributing to revitalize non-living water and 'matching the indigeneous perception of purity' such as lightening a lamp were observed.[74]

From Lack of Interest in Reusing Tanks to Their Reconfiguration

If households praise the qualities of this system, are they willing to participate in rehabilitating their cistern in the absence of financial incentives? Only six of the thirty-two households with a non-operational system wished to use rainwater for domestic purposes, excluding food, and four of them are willing to finance its rehabilitation; the other two households would rather accept the idea of co-financing.

Amongst the twenty-six households who did not wish to rehabilitate their system, we still noticed a number of alternative supply strategies:

- Seven households have installed an overhead tank in combination with a bore well, and only two of them have a monthly income of less than 2,000 rupees.
- Seven households use a neighbour's connection: their income is less than 2,000 rupees. These cases confirm that the lower the income, the more time is spent coping with discontinuity of service.[75]

The use of cisterns would reduce the cost of this discontinuity, which includes monetary costs (maintenance of equipment) and the cost of time spent collecting water from neighbours or storing it.[76] The few estimates of the cost of renovating cisterns vary according to source, size and

year: from 120,000 rupees (2,170 euros) in 2004[77] to 500,000 rupees for a 15 m^2 cistern (or about 7,000 euros) in 2016.[78]

Users sometimes reconfigure the use of cisterns in a socio-technical context characterized by a multiplication of water supply methods: they attribute new functions to them such as the storage of groundwater pumped from bore wells. They are diverting them from their storage function into a precious metal workshop, a storage cellar. As Gupta mentions: 'traditional practices and knowledge are not static but constantly evolving in the face of changes in the economy'[79] and changes in lifestyles, in this case the adaptation of a traditional habitat to the new aspirations of the inhabitants.

Towards a Revitalization of the Technical Knowledge of Craftsmen?

If the use of the cisterns is limited to a few users, their rehabilitation is the responsibility of the construction communities. The rehabilitation of a dozen cisterns (see p. 12) has rekindled the interest of a handful of owners. The documentation from this initiative served to guide the Porbandar fire brigade in cleaning 2,500 tanks.[80] But do the artisans, the custodians of these technical skills, continue to practice restorations/renovations in Ahmedabad? The extinction of the technical know-how of the craftsman weakens the social organization associated with these communities.[81] Here, the Indo-French project for the rehabilitation of the old city centre has contributed to the training of craftsmen and architects in renovation techniques: in 2017, there were half a dozen craftsmen competent in the renovation of buildings, including cisterns. Certain processes are being reintroduced (e.g. whitewashing walls with lime).[82]

Plate 7.8: Cisterns out of use or converted into workshops.
Source: Author, Ahmedabad, 2002

This perpetuation of technical knowledge is partly due to private initiatives centred on the rehabilitation of houses to transform them into guest houses. The continuation of craftsmen's knowledge is based on the interest of private

individuals for structures that take longer to renovate and require costly materials: a situation that runs counter to an era in which saving time and money is paramount. Today, confined to a few craftsmen that it seems difficult to limit to particular castes, the dissemination of this technical knowledge presupposes institutional support for training and for the financing of work (subsidized loans). Somehow, the heritagization movement has slightly reshuffled the knowledge that was transmitted in particular communities.

Conclusion: Is the Cistern Supply System at Odds with Modernity?

The rainwater harvesting system is an unfamiliar supply method for generations that have only known the municipal water network. Despite their confidence in the quality of rainwater, their reluctance to reuse cisterns remains: it is the result of the gradual transition from a decentralized supply system managed by the inhabitants to a centralized system such as the public water supply service, where individuals delegate their local management power to a supervisory authority to cover their water needs.

The discontinuity of the water supply service leads households to resort to compensatory strategies to make up for the lack of water. Why is it that the rainwater cistern is not one of these strategies? Users recognize a system that has proven its worth, but which gives the impression of being archaic, whereas they aspire to appropriate the trappings of modernity. This modernity is characterized by access to continuous services that require a minimum of technical interventions on their part, and in particular maintenance: the reluctance of using *tankas* is linked to the wish to be free from maintenance costs and efforts The distribution system embodied by the tap epitomizes this modernity, which is

certainly not complete given the discontinuity of the service. The cistern would allow them to benefit from an additional water supply to minimize this insufficiency. But costly work does not encourage spending: the owner's social status is not enhanced in comparison to other extravagant expenditures, unlike Western-style 'heritagization' which would be a source of prestige. The possession of recent and visible storage systems (e.g. roof-top cisterns) constitutes a visible marker of social ascension; conversely, the traditional (and invisible) underground cistern embodies neither modernity nor power in the eyes of its users. More broadly, the traditional concept of storing raw food resources (e.g. water, grain) is losing ground[83] in a society oriented towards ready-to-consume products.

The possibility of rehabilitating cisterns generates limited interest: it is out of the reach of modest populations who rarely own a cistern in working order. Their income and the cost of traditional materials (brick, lime, etc.) mean that they cannot afford to restore them. The preservation of heritage is not a priority, and even less so an evidence. It can mean a symbol of backwardness, a state to be overcome in order to reach the 'modern'. The practical dimension takes precedence over aesthetic considerations, and the architectural constraints imposed by the heritage process could limit their freedom of construction.

The wealthy classes and the educated castes have a better understanding of the knowledge associated with the use of cisterns. They use it to reassert their social rank and, by extension, their symbolic power, in *pols* where lower castes or more recently settled castes cohabit. But they are the only ones to have recourse to these cisterns, and to the knowledge associated with their use, which is diluted when households no longer use them.

This decentralized system of water supply attracts limited attention from local elected officials, who have no immediate

interest in supporting their reuse. On the other hand, the municipal water system is a strong electoral issue for them, because of their influence on the water rates.

The environmental and economic interest of a reappropriation of local water management should be emphasized: the intensification of pressure on this resource leads to a continuous decrease in the level of the underground water tables. This search for deeper water (e.g. deep wells) or water from further afield (e.g. canals, desalination plants) requires heavy investments and sometimes provokes social movements and political tensions. The attraction of centralized infrastructure in the postcolonial period is the responsibility of the major state bodies.

The piecemeal rehabilitation of cisterns in Ahmedabad has remained in the shadow of the larger architectural renovation effort. The latter has helped revive the knowledge associated with the use of rainwater, which was previously shared only by activist movements. Since the mid-2000s, public authorities have taken up the need to use traditional techniques that contribute to the preservation of resources. The dialectical relationship between reappropriated exogenous knowledge and reinvented local knowledge is superimposed on this other reality: that of a political discourse of symbolic scope that hardly translates into support measures for the artisans responsible for reviving indigenous knowledge and techniques. While the knowledge has been revived, it has by no means been rehabilitated: rehabilitation would be an additional process that would include a phase of legitimization of this knowledge.

Notes

1. G. di Meo, 'Processus de patrimonialisation et construction des territoires', paper presented at *Colloque Patrimoine et*

industrie en Poitou-Charente: connaitre pour valoriser, Poitiers, 2007, p. 2.

2. Referred to as 'patrimonialization' in the francophone world (see ibid).
3. M. Gravari and S. Guichard-Anguis, 'Regards croisés sur le patrimoine dans le monde à l'aube du 21ème siècle', Paris: Presses de l'Université Paris-Sorbonne, 2003, p. 52.
4. H. Arendt, 'Tradition and the Modern Age', *Between Past and Future: Six Exercises in Political Thought*, New York: Viking Press, 1961, pp. 17–40.
5. Gravari and Guichard-Anguis, 'Regards croisés sur le patrimoine dans le monde à l'aube du 21ème siècle', pp. 46–53.
6. In 2002, this study led to the writing of a master's thesis in comparative development research at the *Ecole des Hautes Etudes en Sciences Sociales* (EHESS) under the direction of Marc Gaborieau: 'Rainwater harvesting: an alternative supply in an Indian city (Ahmedabad)'. The research was co-financed by a Lavoisier grant (Ministry of Foreign Affairs) and by Veolia, within the framework of a research stay at the Indian Institute of Management in Ahmedabad (IIMA).
7. In addition to Ahmedabad, the cities of Bharuch, Pathan, Junagadh, Dwarka, Porbandar are home to a significant number of underground cisterns. Only the case of Bharuch is documented in the context of a Parsi community project carried out in partnership with UNESCO (Parzor project).
8. A.W. Najimi, 'The Cistern of Char-suq: A Safavid Building in Herat', *The Afghanistan Journal*, vol. 2, 1982, pp. 38–41.
9. J. Berking, B. Beckers and B. Schütt, 'Runoff in Two Semi-Arid Watersheds in a Geoarcheological Context: A Case Study of Naga, Sudan, and Resafa, Syria'. *Geoarchaeology,* vol. 25, 2010, pp. 815–36; J. Berking, B. Beckers and B. Schütt, 'Ancient Water Harvesting Methods in the Drylands of the Mediterranean and Western Asia', *Journal for Ancient Studies*, vol. 2, 2013, pp. 145–64.
10. A century-old cistern for collective use is in use in an inn in the Calanques (Cassis) in France. Those identified in Lazio (Orvieto, Civita-di-Bagnoregio) in Italy are no longer used.

11. S. Keller, 'Cloistering Water: Technological Rupture, Religious Continuity in Sixteenth Century Western India', *South Asian Studies*, vol. 37, no. 1, 2021, p. 28.
12. Ibid., pp. 30–1.
13. K. Rötzer, 'Architectures de pierre dans le Dekkan et le Malwa avant l'époque moghole', *Techniques et Culture*, vol. 14, 2010, p. 137.
14. J. Thakkar, 'The Art of Wood Carving in Traditional Houses of Gujarat: A Focus on Ornamentation', School of Design, CEPT University, 2004.
15. M-C. Mahias, 'Réflexions pour l'étude des savoirs techniques', *Le barattage du monde: Essais d'anthropologie des techniques en Inde*, Paris: MSH, 2002, pp. 85–108.
16. I. Habib, 'Changes in Technology in Medieval India', *Studies in History*, vol. 2, no. 1, 1980, p. 15.
17. Berking, Beckers and Schütt, 'Ancient Water Harvesting Methods in the Drylands of the Mediterranean and Western Asia'.
18. K.L. Gillion, *Ahmedabad: A Study in Indian Urban History*, Berkeley: University of California Press, 1968, p.129.
19. Ibid., p. 131.
20. S.U. Khan, *Ahmadabad (1411–1817): Environmental Facets of a Medieval Urban Centre,* New Delhi: Institute of Objective Studies, 2007, p. 122.
21. Keller, 'Cloistering Water', p. 41.
22. Ibid., p. 42.
23. Ibid., p. 46.
24. Ibid.,
25. Ibid., p. 44.
26. C.N. Rai, 'Traditional Neighbourhoods in a Walled City: *Pol*s in Ahmedabad', *Sociological Bulletin,* vol. 3, no. 57, 2008, p. 341.
27. Individuals from outside the predominant caste find a place there for practical reasons. For example, a dairy farmer in the *pols* provides a daily supply of milk; their presence is becoming rarer due to new consumer behaviour (e.g. refrigeration).

28. The traditional castes (e.g. Patel, brahman) are replaced by immigrant populations (e.g. Marwari), coming from the state of Rajasthan for economic reasons.
29. Gillion, *Ahmedabad*, p. 131.
30. Keller notes that 'Tanka water was usually reserved for cooking and drinking purposes … It is sweet with low TDS (total dissolved solids) and it is therefore appreciated for cooking hard items like leguminous plants (dal)' (Keller, 'Cloistering Water', p. 29).
31. Khan, *Ahmadabad (1411–1817)*, p. 123.
32. Ibid.
33. Gillion, *Ahmedabad*, pp. 136–8.
34. Ibid., p. 143.
35. Ibid., p. 142.
36. C. Dupavillon, 'Ahmedabad, la belle endolorie', *Revue des Deux Mondes*, Septembre–Octobre 2001, p. 112.
37. The use of cisterns as hiding places during conflicts is not an isolated phenomenon: in Naples, they were used as shelters during the Second World War.
38. Gillion, *Ahmedabad*, pp. 120–42.
39. Annual precipitation is concentrated in a few days or even hours, essentially during the monsoon season (June–September). Keller further precises that 'the annual precipitation randomly yields a total of 750 mm. (approximately 120 in June, 250 in July, 300 in August and 80 in September) and 750 litres on 1 m^2 every year' (Keller, 'Cloistering Water', p. 35).
40. Gillion, *Ahmedabad*, p. 131.
41. B. Barraqué, 'The Three Ages of Engineering for the Water Industry', *Anuari de la societat catalana d'economia,* vol. 18, 2004, p. 5.
42. A. Agarwal and S. Narain, *Dying Wisdom: Rise, Fall and Potential of India's Traditional Harvesting System. State of India's Environment: A Citizens' Report no. 4,* Delhi: Centre for Science and Environment, 1997.
43. D. Mosse, 'Collective Action, Common Property, and Social Capital in South India: An Anthro*pol*ogical Commentary', *Economic Development and Cultural Change*, vol. 54, no. 3, 2006, p. 696.

44. Mahias, Réflexions pour l'étude des savoirs techniques', p. 92.
45. Dupavillon, 'Ahmedabad, la belle endolorie', p. 110.
46. Thakkar, 'The Art of Wood Carving in Traditional Houses of Gujarat'.
47. CEPT, Center for Environmental Planning and Technology, Ahmedabad.
48. CRUTA, Foundation for Conservation and Research of Urban Traditional Architecture, Calcutta.
49. P. Chatterjee, *Politique des gouvernés. Réflexions sur la politique populaire dans la majeure partie du monde*, Paris: Editions Amsterdam, 2009, p. 82.
50. M-H. Zérah, *L'accès à l'eau dans les villes indiennes*, Paris: Anthropos, Collection Villes, 1999.
51. In 2011, more than 90 per cent of households have access to a municipal connection, which in 71 per cent of cases is located on the private plot and 19 per cent outside the plot (standpipe).
52. Institute of Rural Management, *White Paper on Water for Gujarat*, Anand: IRMA, 2000, p. 20.
53. Direction de l'architecture et du patrimoine (DAP) and Association française d'action artistique (AFAA), *Recommandations pour la conservation et la revitalisation du centre historique d'Ahmedabad*, Paris: DAP and AFAA, 2001, p. 7.
54. P. Lachaier, 'Une étude sociologique d'un quartier communautaire ou *pol* d'Ahmedabad par Ashok Patel', *Bulletin d'Études Indiennes*, vol. 28–9, Paris: Association Française pour les Études Indiennes, 2010–11, p. 210.
55. Dupavillon, 'Ahmedabad, la belle endolorie', pp. 109–15.
56. Lachaier, 'Une étude sociologique d'un quartier communautaire ou *pol* d'Ahmedabad par Ashok Patel', p. 210.
57. DAP and AFAA, *Recommandations pour la conservation et la revitalisation du centre historique d'Ahmedabad*, p. 62.
58. Ahmedabad Heritage Centre, 2004.
59. Gillion, *Ahmedabad*, p. 131; Khan, *Ahmadabad (1411–1817)*, p. 123.
60. Dupavillon, 'Ahmedabad, la belle endolorie'.

61. H. Kaushik and T. Parekh, 'Tankas Help Gujarati Tide over Water Woes', *The Times of India*, Ahmedabad, 22 May 2005.
62. S.S. Singh, *Reviving an Ancient Wisdom: Tanka, a Traditional Roof Top Rain Harvesting in the Walled City of Ahmedabd, A Pilot Project Undertaken by Ahmedabad Municipal Corporation,* Ahmedabad: Ahmedabad Municipal Corporation, 2000.
63. Area: 2 m. long, 2 m. wide, 5 metres high.
64. Keller, 'Cloistering Water', p. 32.
65. Sheet metal replaced tile, a material that had two disadvantages: higher cost and lower impact resistance (DAP and AFAA, *Recommandations pour la conservation et la revitalisation du centre historique d'Ahmedabad*, p. 36).
66. S. Zug and O. Graefe, 'The Gift of Water: Social Redistribution of Water among Neighbors in Khartoum', *Water Alternatives,* vol. 7, no. 1, 2014, p. 156.
67. T. Tvedt and T. Oestigaard, 'A History of the Ideas of Water: Deconstructing Nature and Constructing Society' in *A history of water*, ed. T. Tvedt and T. Oestigaard, series 2, vol. 1, London: I.B. Tauris, 2010, p. 20.
68. Zérah, *L'accès à l'eau dans les villes indiennes*, p. 114.
69. The annual water bill varies between Rs.150 and 200. This water tax, calculated on the basis of the house tax, varies according to the size of the house.
70. The population surveyed by Zérah in Delhi in 1998 wanted to pay more for a better service. In contrast, a survey conducted in Chennai in 2006 following an improvement in municipal water service and the installation of water meters highlights a fear among respondents that they would no longer be able to share water among neighbours (A. Amiraly and A. Kanniganti, 'The Impact of a Pilot Metering Project in an Indian City on Users' Perception of the Public Water Supply', *Field Actions Science Reports*, vol. 5, 2011, p. 6, see http://factsreports.revues.org/831).
71. An operational system is not necessarily rehabilitated.
72. Singh, *Reviving an Ancient Wisdom*, p. 30.
73. Ibid., p. 25.
74. Ibid., p. 46.

75. Zérah, *L'accès à l'eau dans les villes indiennes*, p. 114.
76. Ibid., p. 138.
77. Estimates by Ahmedabad Heritage Centre (2004).
78. Estimates by Mr Gandhi, a craftsman who converted himself into the renovation of *pol*'s houses (interview, March 2017).
79. Gupta, 'Demystifying "Tradition": The Politics of Rainwater Harvesting in Rural Rajasthan, India', *Water Alternatives*, vol. 4, no. 3, 2011, p. 361.
80. Kaushik and Parekh, 'Tankas Help Gujarati Tide over Water Woes'.
81. M-C. Mahias, 'Savoir ou faire en Inde', *Cahiers d'anthropologie sociale*, vol. 1, no. 1, 2006, p. 125.
82. Interview with Mr Gandhi and Mr Mohammad, craftsmen in charge of preparing lime walls in a house rehabilitation (interview, March 2017).
83. Interview with Professor Gaurang Jani, Department of Sociology, Gujarat University, Ahmedabad, March 2017.

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