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Performance, consumption and production: State governance and the uses and meanings of water in the Sardar Sarovar Project, Gujarat, India

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Performance, consumption and production: State governance and the uses and meanings of water in the Sardar Sarovar Project, Gujarat, India

Abstract

This paper analyses the performative, consumptive and productive uses and meanings of water in and of the Sardar Sarovar Project (SSP), a large dam with reservoir on the Narmada river, located at the border of Gujarat and Madhya Pradesh States, India.
The main focus of the paper is how water is being used in the State of Gujarat, of which the SSP covers the larger part, and the meanings that water and the infrastructure that it supplies have acquired since water was released from the dam in the early 2000s. The water and the project were carriers of meaning well before the project got constructed and became operational – the project is best known for the opposition against its building. The paper looks at that history briefly also, to assess how meanings have changed, continued and been added to. While originally designed for agricultural use and hydropower generation, the scope of uses and meanings has considerably expanded in the past decades, and particularly since the dam has become operational. The use of the water of the Narmada river for domestic purposes and, through that, for urban and industrial development is now prominent. The paper reviews the relatively limited amount of scholarship on the functioning and imagining of the project since it became operational in 2002, theoretically explores how water infrastructure functions as 'logistical power' in state governance, and outlines an interdisciplinary perspective for further research.

Keywords

Sardar Sarovar Project
Water infrastructure
India
Governance
Power

1. Introduction

The building of the Sardar Sarovar dam at the border of the Indian States of Gujarat and Madhya Pradesh in the 1980s and 1990s has generated controversy that reached the global level. Controversy initially focused on forest submergence and displacement of mostly Indigenous groups and demands for just compensation through resettlement & rehabilitation (R&R). The Sardar Sarovar Project (SSP) induced the emergence of social movements in Gujarat and India opposing as well as supporting it, the controversy was an important trigger for the establishment of the World Commission on Dams, it led to the adoption of new R&R and land acquisition legislation in India, and the opposition against the building of the dam generated a huge amount of academic scholarship. The dam was finally built from 1987 to 2017, in steps, following Supreme Court orders on what could be built, and water from the dam started flowing in 2002.[1] Primarily envisaged as an irrigation project, canals were constructed (see Map 1), covering 1.855 million ha of command area in the State of Gujarat.[2] The pipeline system for drinking/domestic water that has been constructed in addition to the irrigation canals has an even larger geographical reach (see Figure 3). The SSP has been labelled the 'lifeline of Gujarat' by its supporters, has been declared essential for Gujarat's future, and, indeed, the project has the magnitude to have a state-level impact.

It is, therefore, quite surprising that the volume of academic scholarship on the SSP's functioning and impact, more than two decades after water started flowing, is minuscule as compared to that on its contested genesis. The reasons for this are interesting and significant in themselves, but we leave them aside in this paper. Here, we focus on the relative absence of an active and evolving scholarship that critically reflects on the functioning and impact of this massive project, with urban water use being a partial exception.[3] Whether the projected objectives downstream of the dam development have been achieved or not, what has changed and happened in addition to original plans – there is only limited insight on it available in quite scattered scholarship. This paper aims to contribute to filling that gap and stimulate new research. Given the developmental

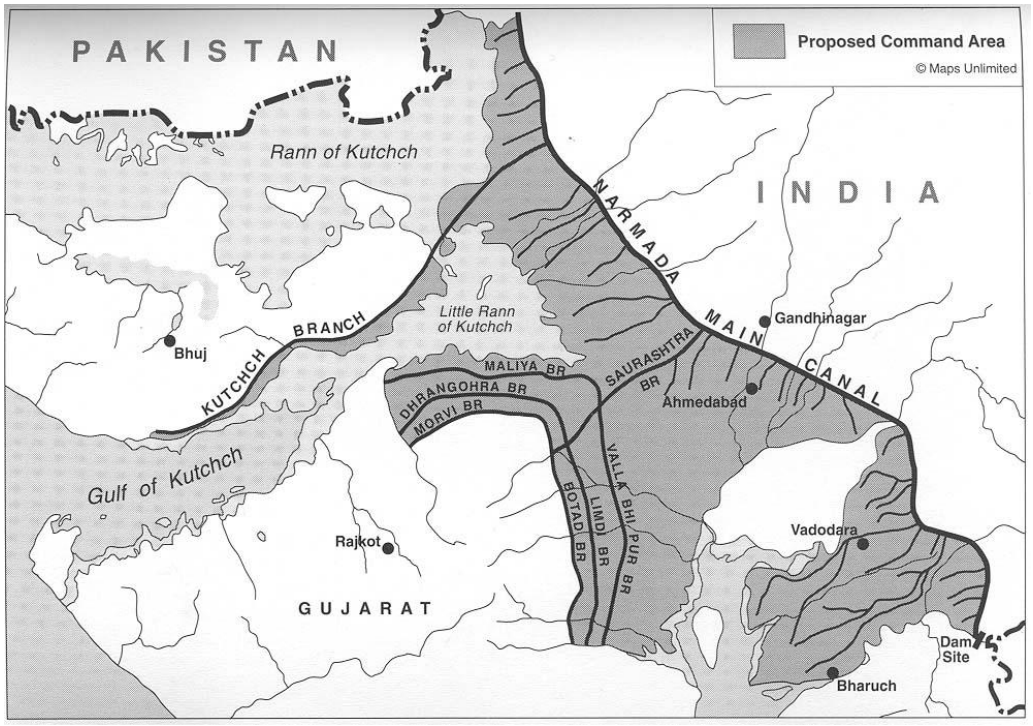
[1] Upadhyay (2004: 1881) reports *rabi* 2002 as the first agricultural use of water in the SSP command area. Also see https://www.indiatoday.in/magazine/states/story/20020909-narmada-waters-release-to-sabarmati-brings-hope-of-rich-agricultural-yields-better-life-796392-2002-09-08 and Shah (2002).

[2] See https://sardarsarovardam.org/document/pagecontent/MPR%20July%202024%20(1).pdf This paper focuses on the Gujarat part of the SSP system. However, the SSP canal system also reaches into Rajasthan, 'where a relatively small area is planned for irrigation: 0.246 million hectare (Kumar et al., 2022). The water allocation to Gujarat is 9.0 MAF (Million Acre Feet), that to Rajasthan is 0.5 MAF (see NPG, 1989). Payal and Poonam (2020) mention an area of 14,000 ha in Jalore district of Rajasthan foreseen to be irrigated in 2007-2008, while this canal water was also planned to be used for supplying drinking water to 281 villages in that district according to a *Times of India report* https://timesofindia.indiatimes.com/india/rajasthan-to-get-narmada-water/articleshow/2902814.cms. A 2021 *Times of* India report suggests that a much larger area is irrigated (https://www.indiatoday.in/india-today-insight/story/good-news-the-narmada-canal-project-miracle-in-rajasthan-1782801-2021-03-23); also see the 2012 report in *The Hindu* https://www.thehindu.com/news/national/as-narmada-water-trickles-in-life-blooms-in-barren-jalore/article2942781.ece). We have not made a field check of the status of SSP irrigation/water supply in Rajasthan.

[3] This statement is both evidenced and nuanced below through referencing available literature and the identification of lacunae in it.

challenges that the functioning of the SSP poses, such research is not only of academic interest but can potentially support adaptive policy-making and implementation.

Map 1: Command area of the Sardar Sarovar Project in the State of Gujarat



Source: http://www.narmada.org/sardarsarovar.html

1.1 Theoretical perspective

This paper brings together knowledge about the functioning and impact of the SSP under the heading 'uses and meanings of SSP water and infrastructure'. Apart from the direct consumptive and productive use of water released from the Sardar Sarovar dam, the water and the project have carried and are carrying different meanings, for different people, and over time. This performative use of the SSP, its water, and its infrastructure, as an *idea* had an impact long before the project's actual construction, and also, in new ways, in its current concrete existence.

The Gujarat state (referring to both its political and bureaucratic components) is actively involved in shaping the performative, consumptive, and productive uses and meanings of the SSP water and water infrastructure, and is pursuing particular goals with it, as part of its overall governance strategy and style (though not necessarily coherently orchestrated across different state apparatuses). A range of societal actors responds to these efforts, constituting a dynamic process of SSP imagining and functioning.
The understanding of culture employed in this paper is well summarised by Reed and Adams (2011:250).[4]

[4] This understanding is very similar to Archer's (1996) critical realist understanding of culture. In critical realism 'meanings are causes' (Sayer, 1984).

> «Culture is (…) meaning-in-society, and we define meaning as a system of signification deployed by actors to understand, describe, explain, evaluate, rationalize, sacralise, or otherwise grasp or map the world around them. Culture thus understood contains language but is not reducible to it; indeed, in many cultural analyses the term "language" is used metaphorically, so as to convey that the operative meanings in society possess a coherent and powerful structure resembling human language. Thus *when we use the term culture we mean, at the most general level, structures of meaning shared by social actors at a given time or place of interest. We are interested in these structures because we think they help explain social action and social transformation*. Broadly, we think that semiotic processes, the worldviews of actors both individual and collective, and actors' depth-psychological motives are consequential causal vectors in social life. » (p.250; our italics)

For the concept of state governance, we follow Joyce and Mukerji's (2017) framing of the exertion of state power.

> « Rather than treating states as centralizing institutions and singular sites of power, we treat them as multi-sited. They gain power by using logistical methods of problem-solving, using infrastructures to enforce and depersonalize relations of domination and limit the autonomy of elites. But states necessarily solve diverse problems by different means in multiple locations. » (p.1)

Apart from the multi-sited character and differential means aspect, the role of infrastructure is a key element of their approach and for this paper. Mukerji (2010) proposes that states exercising power (in pursuing development in our case) not only rely on 'strategics', but also on 'logistics'. Her proposition is that states not only exert social power by social (legal, political, administrative, ideational) means (strategics), but also use logistical power.

> « Logistical power (…) is the use of material world for political effect, physically reworking land to shape the conditions of possibility for collective life. A material regime cultivated this way favours some groups over others, but governs impersonally through an order of things. » (ibid.: 2010:404)

Mukerji goes on to give the following explication of logistical power, which resonates strongly with contemporary settings, notwithstanding the fact that her case study is the construction of the *Canal du Midi* in 17th century France during the absolutist rule of Louis XIV.

> « The exercise of logistical power depends on natural knowledge (…), either practical experience in working with materials, or formal knowledge useful for re-shaping the environment. This knowledge is employed for making built environments or material contexts for social life, conditioning action both practically and through symbolism embedded in the form of things. The effectiveness of the resulting material regime lies in its mute presence as a form of impersonal rule. Without words, the built environment often seems to lie outside of political dispute and thus can seem as inevitable as the natural order. And without people enforcing order, a system of impersonal rule provides little

> opportunity for resistance. So, the outcome of exercising logistical power is an inarticulate but deeply effective material regime inflected with cultural ideals and conveying a reality that seems inevitable, natural, or true: a figured world of power. » (ibid.: 2010:404)

Water infrastructure plays, as will be shown below, a key role in all three sets of uses and meanings associated with the SSP. How 'impersonal' and 'deeply effective' the material regime of SSP water infrastructure is in practice remains to be analysed, but the overall perspective proposed on the relationship between water, infrastructure and social power seems to us a fruitful perspective for understanding the 'water and development' dynamics associated with the SSP.[5]

1.2 Methodology

Data for this paper was collected through a review of the (limited) academic literature on the uses and meanings of SSP water and infrastructure 'downstream of the dam', selected grey literature and media reports, supplemented with key informant interviews and a series of six field visits in the 2015-2019 period. The second author's first field visits to the SSP command were in 2015 (February and December). Joint field visits of the two authors took place in August 2017, October 2018 and March 2019. In September 2019, a field visit by the first author took place where he conducted group interviews in the four identified regions (see Section 4). The field visits involved observation, semi-structured interviews, and group interviews. Observation focused on the state of infrastructure and water use practices. Key informants were (former) government officials (having been) directly involved in SSP implementation, staff members of Gujarat based NGOs active in the SSP command area, and faculty in research and teaching institutes. In 2017 a workshop was organised by and at the Gujarat Institute of Development Research (GIDR) in Ahmedabad with primarily academic and NGO staff participants. Key informant interviews were conducted in English. Semi-structured interviews took place (in English, Hindi, and when in Gujarati, with the help of an interpreter) with an uncounted number of people during the field visits. These included farmer-irrigators ranging from 'landlord' to small sharecropper status, agricultural laborers, village drinking water users, local political leaders, SME owners and staff, traders in drip irrigation equipment, staff of a textile factory, a real estate agent, municipal water administrators, and irrigation field staff. The five group interviews were with groups of 3-8 farmer-irrigators in different locations along selected Branch Canals. The interview and other qualitative data were stored in interview protocols and field notes.

The first version of this paper was largely written in early 2020, but then the Covid pandemic put the writing and some last bits of research on hold for several years.

[5] See the 2016 themed section on 'Water, infrastructure and political rule' in *Water Alternatives* 9(2) for a variety of approaches to the social dimensions of infrastructural technology (URL: https://www.water-alternatives.org/index.php/tp1-2/1894-vol9/301-issue9-2).

Photo 1: Classical group interview near teashop/kiosk in Limbdi (picture taken by GIDR staff, 21 September 2019)

1.3 Structure of the paper

This paper summarises available knowledge about the SSP's performative, consumptive, and productive uses and meanings in three sections. After the introduction in Section 1, in Section 2 we look at how the SSP has been imagined, and what the socio-political role of these imaginaries has been. We also discuss a material form with strong performative dimensions – the Ahmedabad riverfront. In Section 3 we discuss the consumptive uses and meanings of the SSP water: the provision of drinking water to cities, towns, and villages through the 'pipeline grid'. Section 4 discusses how SSP water is impacting agricultural development and agrarian and rural change. The larger part of the water, around 90%, was allocated for agricultural purposes[6] and actual use is, according to available data, also of that order of magnitude. Notwithstanding this numerical importance, the agricultural and agrarian-rural functioning impact is the least systematically documented and analysed. We develop a fieldwork-based relational typology of the spatially differential impact of SSP water on agrarian and rural change. We also briefly discuss the industrial use and meaning in this section. Finally, in Section 5 we return to the framing of the paper in terms of three sets of uses and meanings, water infrastructure and state governance, and outline avenues for further interdisciplinary research.

2. Performative uses and meanings: SSP imaginaries and the Ahmedabad riverfront

It is not uncommon that irrigation projects and dams have a long pre-history before they are actually built. The Tungabhadra dam in present Karnataka State, southern India, was first conceived by Sir Arthur Cotton in the 1850s/1860s; the engineers of Madras Presidency and the Nizam Dominions agreed on a design in the early 1930s. Political agreement followed in the early 1940s and first water was released in 1953, roughly 100

[6] Total allocation to Gujarat is 9 MAF (Million Acre Feet), as mentioned above, of which about 1 MAF is for domestic and industrial supply, which is roughly 10%. The rest is for agriculture/irrigation.

years after its first conception. The history of the SSP is not as long but still spans multiple decades.[7] The socio-political significance, role, and impact of it exceeded that of most other Indian large-scale irrigation projects, if not all.[8] In this section we trace the imaginaries associated with the SSP project (and the Narmada River on which it was built) in three periods and episodes: first, the idea that the project played in the creation of a separate State of Gujarat in 1960; second, the concrete conception of the project in the era of planned development and the supporting and critical narratives that were and are associated with it; third, how SSP imaginaries are conceived and mobilized in the post-2000 period – following and as part of broader transformations in the Gujarat cultural political economy.

2.1 The SSP and the creation of Gujarat state

Gujarat came into existence as a separate State within the Indian Union on 1 May 1960 – not in the immediate aftermath of Indian Independence in 1947. In independent India mainland Gujarat, Saurashtra, and Kutch started off as three different units. The latter two were joined into the greater, bilingual state of Bombay in 1956, of which mainland Gujarat was already part. Right from the period before Independence, there was dissatisfaction among the Gujarati elite that Gujarat was not getting enough attention in national and Bombay level debates and governance. This « sense of neglect became sharper after Independence when the First Five Year Plan did not provide for any major projects on rivers such as Mahi, Narmada and Tapi. » (Yagnik and Sheth, 2005:226). Yagnik and Sheth go on to argue that when after a prolonged struggle Gujarat had come into existence in 1960, the « new political entity provided the modern Gujarati elite with an autonomous space to implement their own pattern of development. »Though it would be far-fetched to argue that the desire to dam the Narmada was a key element of the struggle for the establishment of Gujarat as a separate State, the Sardar Sarovar Project did in due course become a significant component of the Gujarati development discourse and practice. Jawaharlal Nehru, India's first Prime Minister, laid the foundation stone for the Narmada dam on 5 April 1961, to be built by the State of Gujarat (Mehta, 2011:45).

2.2 SSP's planned development narrative: support and critique

The controversies around the building of the dam on the Narmada, creating the reservoir that was going to supply the SSP, are well known and documented, and will not be gone into here in any detail (cf. Morse and Berger, 1992; Baviskar, 1999). Important for the purposes of this paper is that the actual building of the dam only started in the 1980s. First, the Narmada Water Disputes Tribunal, established in 1969, had to come to an

[7] See Pathak (2011) for a brief history. First studies of the topography and hydrology of the Narmada basin with an eye to a project started in 1947. In February 1960 the Government of Gujarat gave administrative approval for the project, in May 1960 a separate State of Gujarat was formed and in April 1961 the project was inaugurated. Discussion on dam site and height between Gujarat and Madhya Pradesh led to the establishment of the Narmada Water Disputes Tribunal in July 1968. It reported in August 1978; final orders and decisions were gazetted in December 1979. Only after this construction could start in earnest.

[8] It is, of course, difficult to design a scale to measure 'significance' and evidence this statement. What we are suggesting in this paper is that the SSP is a unique project in the way it has been and is linked to state formation and state rule – in addition to the 'normal' aspects of large dams and irrigation projects. Rather than comparing it with other projects in India, a comparison with, say, the Three Gorges Dam in PR China would be more appropriate and instructive.

agreement on the sharing of the Narmada River waters among the States of Madhya Pradesh, Maharashtra, and Gujarat, the States through which the river flows. The Tribunal Award was gazetted, as mentioned above, in December 1979.

Immediately after construction started, public action around the neglect of the resettlement and rehabilitation of people affected by the dam building project, which were to a large extent tribal communities[9], emerged. NGOs picked up these issues and a social movement emerged that became ever more critical of the dam project. Mehta (2011:45-46) interprets this period of social activism as a process of deepening democracy, as it held the government to account for the way it was implementing its development interventions. The Gujarat government reviewed its Resettlement and Rehabilitation package, and in December 1987 announced compensation for displaced families. However, the deepening of democracy came to an end, according to Mehta, with a split in the left, critical movement, and an increasing polarisation in the debates on the Sardar Sarovar dam. One effect of this social activism was that the construction of the dam got delayed, notably through the court cases, up to the Supreme Court, that this process involved. Through the intensity and extended duration of public debates on the SSP, the project came to stand for much more than 'just another development intervention'. It became part of Gujarati identity, an icon of the development paradigm it embodied, the archetype of all that was wrong with that, and a key trigger and example for national and international development policy and activism. The history of the World Bank withdrawal of funding for the SSP was the major trigger for the establishment of the World Commission on Dams (WCD, 2000), while domestically the SSP became ever more strongly seen by an overwhelming majority of Gujaratis as 'the lifeline of Gujarat', generating unquestioned support among a vast majority of Gujarat's citizens (Mehta, 2011).

Aandahl (2010) includes a rare documentation of the discourse of the planners and builders of the project. This account includes their view on 'political interference' in the project, a common lament among technocratic planned development bureaucrats and engineers. Aandahl (2010) provides a vivid picture of infrastructural developmentalism that characterised the planned development era – what is called 'hydraulic mission' thinking in the international literature. Aandahl (2010:181) also refers to Patel (1991) on the importance of increasing national food-grain production for the task of nation building – after the 'humiliation' in the 1960s of India being dependent on US food aid. She also quotes an *Economic and Political Weekly* Advertiser's Supplement of 1991 (p.AS-17) as stating that the PAPs (Project Affected People), that is those displaced by the SSP, notably the reservoir, as having to « take a broader view of the Madhya Pradesh state itself and cooperate in speedy rehabilitation. By doing that, they will be improving their own lot and of course, with a little sacrifice by moving their habitats, they will serve many

[9] India is home to a diverse and large number of tribal communities, also known as *Adivasis*, and has the second largest population in the world. The constitution of India (in article 342 and article 366 (25)) lists certain communities in the country that suffer from extreme educational and economic deprivation, which is characterised by low-yielding agricultural practices, lack of access to infrastructure facilities and geographical isolation. Tribal communities have often been the victims of development projects such as large dams, mines, national parks, and industrial projects.

time more the people of the State »(as quoted by Aandahl, 2010:201).[10] This view of development is very clearly captured in the sociologist Vidyut Joshi's contribution saying « we [in India] have welcomed this change [the impact of so-called 'western culture'] in the interest of progress, development or modernisation. This being so, why should anyone oppose when tribal culture changes? (…) a culture based on lower level of technology and quality of material life is bound to give way to a culture with superior technology and higher quality of material life. That is what we call 'development'. » (Joshi, 1991:63 as quoted by Aandahl, 2010:202). In trying to unravel the 'why' of this particular discourse and form of development planning, Aandahl argues, using Li's 2007 book title, that the will to improve of the planners, their vision and dream in their own words, should be taken as genuine. The issue is what is understood by improvement and development. Arguably, in the case of the SSP a 1950-1960s view of development as modernisation landed in the 1980s and 1990s and reproduced itself, in quite an extreme form, as illustrated, in an increasingly polarised debate on whether the dam and the project should be built or not. Neither critics in the Nehru era (notably Gandhians) nor the social movements opposing the SSP in the 1990s were successful in displacing this dominant discourse.

SSP in operation: the lifeline discourse

All quotes above date from the pre-water release years of the SSP. Also, after the first water was released from the Narmada River in 2002, the SSP remained a key discourse in different public, policy, and political arenas in India. An illustrative example of this discourse is a video posted on YouTube by the office of the Chief Minister of Gujarat in September 2017 (https://www.youtube.com/watch?v=gGyTRCfJ_WU). The video shows images with a voiceover. Some of the voiceover text of this video is listed in the following.[11]

> Remember one and a half decades back the condition of Gujarat state, the occurrence of periodically devastating drought was a normal phenomenon in Gujarat. Women and children used to go for water at faraway places. You all have seen the competition and quarrels over water, powerful tanker operators and water-trains in the Gujarat. Scarcity of water had literally deprived us not just from health and education, but development also. We lost livestock and many from the young generation.
> But Chief Minister Narendra Modi found an opportunity in the crisis and imagined world's biggest water supply scheme for Gujarat. It's the Gujarat water supply grid, world's biggest wonder!
> The tap does not bring water alone…it brings education for girls and smiles on the faces of people…now women do not spend time for water collection but spend for earning livelihoods.

[10] Aandahl (2010:201) goes on to write that " The SSP planners argue that the preservation of traditional *adivasi* livelihoods is only in the interest of mainstream caste Hindus " for our research museum and tourism interest" (Joshi, 1991:63) (…) The goal of the planners is the " assimilation of PAFs [Project Affected Families] into the mainstream of the Society" (SSNNL, 2000)" Aandahl notes that the NGOs Arch-Vahini and Oxfam also supported this resettlement and rehabilitation scenario.

[11] The language used is Gujarati, translated by the second author.

> Waterborne diseases due to salinity, fluoride, chloride, arsenic have been reduced…and THE MOTHER NARMADA is in everyone's kitchen, the dry soils of Kutch and Saurashtra have ended the war with scarcity and poverty…migration has been stopped…..due to the vision and efforts of hon. Narendrabhai Modi the Sardar Sarovar has been completed after 71 years with a full height of 138.68 meters.
> Narmada is our lifeline and we live for it.
> The water which urban people drink, the same water now rural people also drink! Let's celebrate the moment of fulfilling the dream that Vallabhbhai Patel had seen….and achieved by Narendra Modi! Let's offer this great project to the nation! I bow to Deity Narmada!

Apart from the somewhat exalted tone overall, something one might expect in a video of this kind, we see the use of wording like 'lifeline', 'Mother Narmada', and 'Deity Narmada', elevating the role of the Narmada water for the State. The drinking water pipeline grid is presented as the centre of the project's appeal. The video provides details of how the laying of drinking water pipeline progressed in Saurashtra and Kutch (the driest parts of the state) with the help of an animated map, with details of towns and the length of the pipelines in different segments. It also gives details of the same for north and east Gujarat.

The continued importance of 'Narmada' in electoral campaigning is illustrated by a *Times of India* news item of 7 December 2022 just ahead of the State elections in Gujarat.[12] The campaigning parties entered into a war of words on who was supporting the SSP and who the social movement against it.
Though the 'lifeline' discourse was no doubt consciously and actively deployed, it is important to note that it stems from well before the start of the tenure of the BJP party in Gujarat (which continues uninterrupted till the time of writing, 2024). As the prominent advisor to the Chief Minister on water, B.N. Navalawala, states in the *Times of India* news item just cited, all political parties have contributed to the completion of the SSP over its more than four decades of history. The boon for the BJP party was that the release of water from the dam happened during its tenure. Though speculative, it seems very likely that had a different party come to power in the early 2000s it would have pursued along largely similar lines.[13]

Apart from the discursive forms of performance described above, performative uses and meanings of SSP and its water also take a material form. A clear example of this is the Ahmedabad riverfront, which we discuss next.

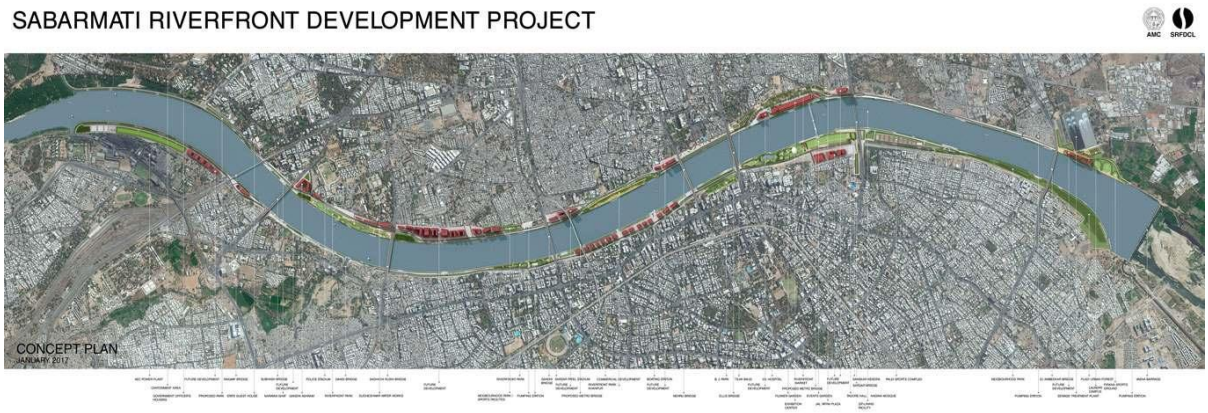
[12] See https://timesofindia.indiatimes.com/city/ahmedabad/narmada-gujarats-lifeline-that-defines-political-currents/articleshow/96044314.cms.
[13] Note that also in Madhya Pradesh, the upstream State in the Narmada basin, there is a 'lifeline' discourse. See for instance https://indiantribalheritage.org/?p=35783#gsc.tab=0 and https://www.mpinfo.org/Home/TodaysNews?newsid=20220424N221&fontname=FontEnglish&LocID=32&pubdate=04/24/2022

2.3 The Ahmedabad riverfront

The global wave of revitalization of riverfront development in the 1980s encouraged Indian policymakers to consider riverfront development (RFD) as one of the major drivers of urban economy (Gordon, 1998). In the case of India, RFD initiation was initially undertaken in many capital cities of States, such as Delhi, Guwahati, Lucknow and Mumbai, along with cities like Surat and Pune. Ahmedabad, the largest city in Gujarat, was one of the first cities to complete its RFD at the Sabarmati River (Phase I completed in 2012) and was projected as a model example of RFD in India (see Figures 1 and 2). A stretch of 22 kilometres of the Sabarmati River passing through Ahmedabad was filled in with water by redirecting water from the Narmada (SSP) main canal. In terms of civil constructions, 11 kilometres on both sides of the riverfront were redeveloped by vacating land from existing uses. It includes components like a jogging track, parks, promenades, hotels, residential and commercial buildings alongside the riverbank. Importantly, the civil constructions narrowed the riverbed and created a canal-like structure having a constant width of 250 meters. Thereby, 200 hectares of land on both banks of the river were reclaimed.

The Sabarmati Riverfront Development Project comprised a series of very different meanings to different actors linked with this project, materially, economically, politically, and culturally. In a material sense, this use of water established a new linkage between land and water in the urban context of Ahmedabad. Planners rationalised the usage of water for transforming riverbanks into leisure space on several functional grounds. This included flood management, protection of the river from sewer pollution, and creating value for the land that is 'wastefully used' (SRFDCL, 1998). The Sabarmati Riverfront Development Project created avenues of capital investment for real estate developers. The creation of a land market was one of the key objectives of the Sabarmati Riverfront Development Project to support the city's economy.

Figure 1: Master plan: Sabarmati Riverfront Development Project



Source: http://sabarmatiriverfront.com/master-plan, last visited 24th March 2019.

The material benefits of the Sabarmati Riverfront Development Project were carefully blended with the political and cultural narratives of city development. In a political sense, the planners justified this makeover as transforming the riverbank into a 'public space', which had been used by different 'private agents' for various purposes, including marginalized people living in slums, using the river bed for vegetable cultivation during

the dry season, vending by hawkers, a space for local markets, and washing clothes. These uses of the riverbed were interpreted as the 'private' capture of the otherwise public resource, which the Sabarmati Riverfront Development Project would bring back in the public realm (Mathur, 2012). However, it is claimed that the construction of the Sabarmati Riverfront Development Project proved exclusionary to 40.000 (official figure 14.000) poor and marginalized families who were living on the riverbank in slums as those were forcibly evicted, displaced, and poorly rehabilitated by the state agencies (Desai, 2014; Mahadevia, 2011). Interestingly, the private benefits of the Sabarmati Riverfront Development Project realized through real estate development were not considered by its proponents as 'private' use.

Figure 2: Showcasing SRDF project in a Vibrant Gujrat Summit

Source: https://hcp.co.in

In a cultural-political sense, the Sabarmati Riverfront Development Project was instrumentalized for a conscious disposition of 'modern' thinking in transforming the urban space as an elite good. The redefinition of 'public space' disseminated a strong political message to the growing middle class in Ahmedabad that the urban development agenda would cater to their tastes and preferences. Two simultaneous developments aided this middle-class influence in Ahmedabad. Firstly, Ahmedabad grew as a middle class 'megacity' in the post 1991 era of globalization and liberalization, both ideologically and in terms of its material development through global and domestic investments (Mehta, 2016). The launch of Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in 2005 by the central government aided this process by bringing in urban governance reforms. The JNNURM was an infrastructural aid *cum* reforms programme implemented for 60 major cities in India. The funds disbursal was closely tied with performance of urban local bodies in implementing reforms. The JNNURM, with its slogan of 'cities as engines of growth', facilitated liberalisation of municipal governance to let private sector participate in public services. City development plans under

JNNURM touted the visions of transforming cities to the standards of Singapore and Shanghai as mega cities, an imagery quite attractive to the urban middle-class. Secondly, a resurgence of a Hindu majority after the 2002 riots (Patil, 2017) in the socio-cultural, commercial and political dimensions of urban life provided the middle class a greater handle to grab opportunities facilitated by liberalization. This resulted in domination of middle-class imaginaries of beautification, cleaner surroundings, and sophisticated built environments in civic spaces. The Sabarmati Riverfront Development Project thus became one of the objects of capturing the middle-class thinking not just as a leisure place but also as a major tourist attraction. As Mehta (2018) writes,

> « ...the Riverfront has emerged as the top destination in tourist itineraries for Ahmedabad since its launch in 2012. It has quickly superseded the famed *Jaali* (latticework in stone) of the city's famous Sidi Syed Mosque (symbolizing the city's Indo-Islamic architectural heritage) as the most iconic landmark of the city. » (p.22)

The Sabarmati Riverfront Development Project had great performative potential, which was used to build the image of Ahmedabad as a city with world-class infrastructure. The Sabarmati Riverfront Development Project was also instrumentalized to blend the narrative of *Gujarati Pride* or Gujarati-ness — with the entrepreneurial skills of Gujaratis in the centre (see Streefkerk, 1997; Patankar and Mehta, 2018) — with infrastructural development narratives. The Sabarmati Riverfront Development Project was strongly marketed in the *Vibrant Gujrat*[14] summits and exhibitions as an attempt to showcase the city of Ahmedabad in transformation (see Figure 2).
The entertainment value of the developed riverfront was harnessed by domestic real estate developers by creating higher middle-class neighbourhoods in the surrounding area. The Sabarmati Riverfront Development Project thus established itself as an emblem of cultural choice of the middle classes. This character of the riverfront project was strategically used in rightist political discourse by equating *public-ness* with Hindu middle-class sentiments. Soon the Sabarmati Riverfront Development Project became a hub of a range of cultural activities, including organizing *Navratri* festival dance, and Sabarmati *Arti*[15] which helped depicting the image of Sabarmati river as a goddess, like the Ganga river in north India.

In addition to the public good dimension and its cultural blending, the Sabarmati Riverfront Development Project was also instrumentalised to build an international

[14] *Vibrant Gujrat* summits, as an initiative of the state government of Gujarat began in the year 2003 with the carefully chosen timing of *Navratri*, the famous Hindu goddess festival across India, but celebrated with more engagement in Gujarat. The objective of the summit was to attract domestic and global investment for domestic projects and thus boost the economy.
[15] *Arti* is a ritual in Hindu religion which involves the waving of lighted lamps before an image of a god or a person to be honoured. The worshiper makes circular movements with the lamp (standing before the idol of the deity) until the chanting of the prayer is finished. The Ganga Arti was encouraged as religious-cultural event by the department of National Mission for Clean Ganga of the Indian government in 2014, and was subsequently replicated for other rivers. The Sabarmati Arti was started by the then Chief Minister of Gujarat in July 2014 (see *Deccan Herald*, 29th July 2014).

image. The visits by a Pakistani delegation[16] to the Sabarmati Riverfront Development Project in 2014, and especially the hosting of Chinese[17] and Canadian[18] presidents in the river park area, in 2014 and 2018 respectively, added political symbolism to the riverfront project. The Pakistani delegation said to the reporters:

> « We have been studying riverfront development projects in different parts as we found that conditions here and back in our country were similar, so we came here to study the project. River Ravi is also not a perennial river (like Sabarmati). Developing such a riverfront here is a good gift given to the city of Ahmedabad by the AMC (Ahmedabad Municipal Corporation). »

The hosting of visitors was an attempt to exemplify intelligent and capable governance driven by corporatized and 'efficient' state agencies, a role model for other cities, and an object of aspirational politics.

3. Consumptive uses and meanings: the pipeline grid project

The pipeline project of the SSP is one of the starkest diversions from the original plans of the SSP, especially in terms of the scale and technology deployed for the drinking and domestic supply. The authors of the initial vision document of the SSP (titled *Planning for Prosperity*) primarily technocrats, politicians, and economists, cursorily proposed 1.1 MAF of water for non-agricultural use (primarily drinking and domestic) against the 1.09 MAF of the total drinking water need, and mention that 0.75 MAF of water will have to be met through the Narmada Canal System (NPG, 1989, pp. 324, 546). The initial document did mention water supply to 8800 villages, in addition to the urban and industrial use, at least impressionistically. Broadly consistent with these figures, the Narmada Control Authority's website[19] states that the SSP aims to provide 1.06 MAF (3571 MLD) of water for domestic and drinking purposes. Interestingly, unlike the design of the Narmada Canal System and the regional distribution of the irrigation system, the initial SSP planning document did not provide any concrete plan to supply drinking and domestic water to urban and rural areas.

Hirway and Goswami (2008) argue that the decision to supply drinking water to villages as part of the SSP (by supplying new drinking water pipelines with water from the canal system) was based on the extreme water scarcity faced by villages in the Saurashtra, Kutch, and north Gujarat region. The droughts of 1974, 1984-85, and later in 2001 forced the Government of Gujarat to take measures which included laying of emergency pipelines to Saurashtra villages and sending trains carrying wagons filled with water to

[16] https://economictimes.indiatimes.com/news/politics-and-nation/pakistan-delegation-visits-sabarmati-riverfront-pms-pet-project/articleshow/38803508.cms?from=mdr

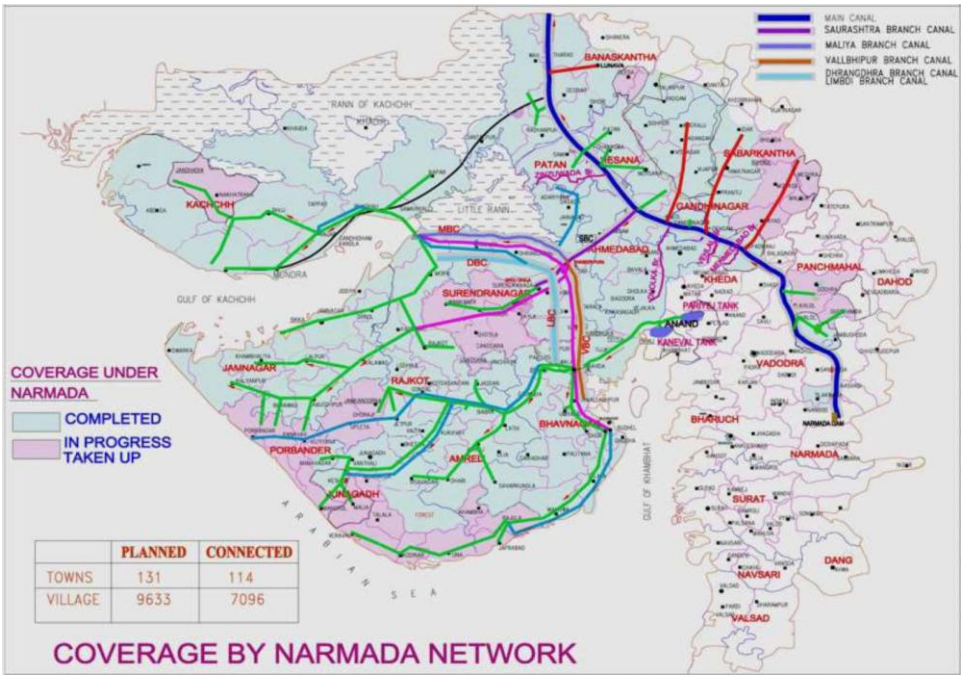
[17] https://www.pmindia.gov.in/en/news_updates/chinese-president-and-first-lady-visit-sabarmati-riverfront-accompanied-by-the-pm/

[18] https://indianexpress.com/photos/india-news/candian-pm-justin-trudeau-family-sabarmati-ashram-gujarat-5069704/

[19] See http://nca.gov.in/ssp_index.htm, last visited 5th October 2018

Rajkot city against the background of a threat of evacuation of the city[20]. Hirway and Goswami also argue that a tremendous push came due to the declaration of 1991-2000 as an international water and sanitation decade. Subsequently, the Government of India pushed drinking water and sanitation reforms in India with an aim of achieving drinking water security. This all provided considerable momentum in Gujarat for using water from the Narmada River for drinking and domestic purposes.

Figure 3: Narmada Pipeline Project - Grid Map



Source: GWSSB, 2014

However, based on her extensive research in the Kutch region Mehta (2003) argues that scarcity is a multidimensional construct as well as a reality that is produced socially and politically. She shows how the temporal and cyclical nature of scarcity — in sheer material sense, insufficiency of supply — has been essentialized to claim water from the Narmada River for the Kutch region by political elites, businessmen, and powerful farmers.[21] In the same vein, experts mention that the possibility of supplying drinking water to the arid regions of Gujarat has been used instrumentally and discursively to develop an argument in support of the SSP.[22] The scarcity argument was so powerful that it could be used effectively to nullify the impact of SSP anti-dam discourse. The projection of water from the Narmada river as a 'lifeline of the Gujarat state' became a powerful narrative, a 'sanctioned discourse', that side-lined the anti-SSP dam discourse

[20] Interview of Mr. S. S. Savdaria, Ex. Chief Engineer, Gujarat Water Supply and Sewerage Board
[21] For a useful recent overview of Gujarat's water resources, see DSC (2023), in which, however, official data also ends in 2015/16 to 2017-18, depending on the type of data.
[22] Interview of Prof. Ghanashyam Shah, 6th October, 2018

in the State of Gujarat in a substantial way. [23] This performative element of the consumptive use of water from the Narmada River converted into a strong political rationality for drinking water provisioning and gradually evolved into a grand design of the state-wide drinking water grid popularly known today as the Narmada Pipeline Project (NPP). The impact of this can be seen from the progressive increase of the number of villages in Gujarat to be served through NPP. As declared by the Government of Gujarat, in 1990-91 the number of villages served by the NPP were 4000, in 2001 it increased to 8215, and in 2005 the number was 9633 villages.

In its material sense, the NPP is unique in several ways. First, it is claimed to be the biggest drinking water project in the world. It aims to supply water to 9633 villages and 131 towns covering the Kutch, northern Gujarat, and Saurashtra regions, which geographically cover the larger part of Gujarat State (GWSSB, 2014)[24]. As Upadhyay et al. (2008) mention, the allocations for villages gradually increased in the past decades as the grid expanded to an increasing number of villages in Saurashtra and Kutch regions. Although the actual figures of the allocation for rural, urban, and industrial water are not publicly available, our expert interviews revealed that the quantity of water used for non-agricultural use is not cast in stone. Experts guess that the existing use of drinking water has exceeded the 1.06 MAF of allocation stipulated in the 1979 Narmada Tribunal decision. However, one of the presentations by the GoG in *Vibrant Gujarat* in January 2017 mentioned that the NPP was supplying only 0.49 MAF of water[25].

Second, the drinking water grid in Gujarat is closely linked with the irrigation system as the NPP draws water from the Narmada (SSP) main canal and its branches and sub-branches. Since the design of the NPP came as an afterthought, when the canal design was already completed, the supply of drinking water is sourced from canals that are primarily designed for irrigation purposes. This makes the operation of the canals a prerequisite for delivering drinking water to the cities, towns, and villages, in most cases throughout the year[26]. Although the intertwining of the drinking and irrigation water supply systems, in general, is not entirely new in the Indian scenario[27], the massive scale of sourcing drinking water through irrigation canals creates considerable complexities in the operation of this mixed system. Cities, towns, and villages require water throughout the year, based on their daily demand for domestic consumption, whereas the irrigation system is typically designed with pre-determined discharge capacities with rotations for

[23] Sanctioned discourse is a term used by Allan (2003: 2), cited by Zeitoun and Warner (2006), as a process of " constraints imposed upon those who may wish to speak or think outside of the discursive hegemony". The discourse of 'Narmada as a lifeline of Gujarat' was systematically constructed using a scarcity narrative. The lifeline discourse became hegemonic and used in such a way that the alternative anti-dam discourse was severely constrained in Gujarat.

[24] Report downloaded from SSNNL website, showing the overall status and progress of drinking water using the SSP water, downloaded on 5th October 2018

[25] Presentation made by GIWL in Vibrant Gujarat Summit of January 2017, downloaded from: https://cdn.vibrantgujarat.com/.../Bulk-water-pipeline-from-Budhel-to-Rajula.pdf, *last visited: 9th October, 2018*.

[26] Interview of Mr. R. K. Sama, Former Director, Water and Sanitation Management Organization, Government of Gujarat, 8th October, 2018.

[27] The design of the Tungabhadra system this paper started with referring to, included a component of drinking water supply to the district capital of Raichur located at the tail end of the left bank canal for instance.

an assumed cropping pattern, including closure periods. Fulfilling a year-round domestic requirement of water thus would need complicated scheduling so that offtake points located on the canals can withdraw water for cities, towns, and villages. Using canals to deliver drinking water implies that the canals are sometimes operated for drinking water only, which can easily be leveraged by farmers for intensification of agriculture, both by cultivating a larger variety of crops in more seasons/cycles in a year as they can pump water out of the open canals. This can thwart the water planning for domestic and irrigation purposes. Moreover, cities are growing rapidly in India, and assured availability of water for cities is one of the factors that intensifies the growth of the cities. In the future, cities in Gujarat, and elsewhere in India, would demand more water from the canals and the grid creating further tensions of the allocation of water between irrigation uses and non-irrigation uses.

Third, the NPP grid is not the sole source of drinking water for Gujarat's cities, towns and villages. Most cities, towns, and villages have their pre-existing bulk drinking water sources, which are, however, proving grossly insufficient due to increased population and depletion of local resources. These pre-existing sources, mostly smaller dams and reservoirs in urban areas and groundwater (bore wells and dug wells) in villages serve the population seasonally, especially during the monsoon and post-monsoon months. This implies that during the dry months the cities, towns, and villages. would mainly depend on water from the canals and pipelines of the SSP.

Fourth, in addition to the above NPP initiative, the government of Gujarat launched two important irrigation schemes for the Saurashtra and North Gujarat regions, based on the 'excess flood waters' of Narmada and Mahi rivers. The Saurashtra-Narmada Avataran Irrigation (SAUNI) scheme and the Sujalam Sufalam scheme aim to fill the reservoirs and tanks (the pre-existing sources of domestic and irrigation water) in the dry regions of Saurashtra and north Gujarat. These schemes use the excess monsoon flood waters primarily to serve the cities longer, in addition to increasing recharge of groundwater through the tanks.

These features of the SSP/NPP raise important questions about everyday practices and governance of the water system in Gujarat. Our field visits to the Kutch and Saurashtra regions showed that farmers having lands adjacent to the canals are using the water informally by pumping directly from the canals as per their crop-requirements. The rationale for this informal use emerges from the fact that the construction of the canal system has not been completed at the level of sub-minors and field channels, and farmers cannot wait until the water is delivered through the canal system. However, this informal pumping does not correspond to the designed allocation of the irrigation delivery systems[28]. This creates possibilities of extracting excess water above the designed allocation based on crop choices and crop planning, both by compromising of the planned cropping pattern and irrigating farms outside the envisaged command area. Especially, when water is released in early summer months for drinking, the informal abstraction of water from canals for irrigation of crops can seriously impact the drinking

[28] The canal irrigation system is based on the Supervisory Control and Data Acquisition (SCADA), which is an automated, computer-based system of delivering water to the farms.

water needs of villages and towns. Similarly, the inherent uncertainty in the floodwater-based schemes of SAUNI and *Sujalam Suphalam* also can intensify the contest of accessing water for various purposes, including drinking water. Similarly, as Hirway and Goswami (2008) write, the NPP is also affected by the typical tail-ender problem. Towards the end of the network, water pressure drops due to excess abstraction of water by upstream users, depriving tail-end cities, towns, and villages of their just allocation.
The nature of the NPP project and its interlinkages with irrigation and the industrial use of water has created a contested waterscape, especially in the Kutch and Saurashtra regions of Gujarat. There is a high level of uncertainty in the everyday operations of the water delivery system. Water delivery is influenced by the different ways of accessing water through the canals and pipelines by influencing the valve operators and engineers who manage the system. Our field visits[29] in the tail-end villages in the Madavi taluka of the Kutch region showed an intense dynamic among local politicians across four major towns to influence water deliveries by manipulating valve operations.

4. Productive uses and meanings: industry and agriculture

In this section, we discuss industrial and agricultural water use in Gujarat with regard to the SSP project as the two main (potential) productive uses of SSP water. The discussion of industrial water use is a brief discussion as, despite concerted fieldwork on this, we did not find a major productive role of water from the SSP in industrial production in Gujarat. After that discussion, we turn to water use for agriculture, which was initially the main objective of the SSP design and justification. The use of water for agriculture was and is the bulk of SSP's water use, but it is also a poorly researched form of use. We briefly summarise the trajectories of agricultural growth triggered and facilitated by the SSP, and present our own fieldwork-based relational typology of the spatially differential impact of SSP water on agrarian and rural change.

4.1 The SSP and industrial water use

Jagadeesan and Kumar (2015; table 6.1)) present the following table specifying sector water allocation/use in the early years of SSP water releases.[30]

Table 1: Sectoral water allocation/use

Gujarat's Share of the Volumetric Water Allocation from the Narmada River Basin and Utilization over the Years

Period (1 July to 30 June)	Total Utilizable Flow (MAF)	Gujarat's Share of Utilizable Flow (MAF)	Allocation to Various Competitive Use Sectors (MAF)			Total Utilization (MAF)	Percentage Utilization by Gujarat
			Irrigation	Domestic	Industries		
2006–2007	41.42	13.31	1.00	1.03	0.03	2.40	18.00
2007–2008	31.71	10.19	1.91	1.03	0.02	2.96	29.00
2008–2009	19.11	6.14	3.24	0.60	0.05	3.89	63.40
2009–2010	21.66	6.96	3.41	0.85	0.05	5.09	73.10

Source: Data from SSNNL, dated June 30, 2011.

[29] Interview with Mandvi Mayor, villagers and Rajkot Planner.
[30] MAF – Million Acre Feet. The categories of 'allocation' and 'use' are not consistently used as distinct categories in many publications, including the one cited. Sometimes allocation figures are presented as use figures.

This table shows that, according to SSNNL data, water utilization for industry is a very small proportion of the total SSP water use (only about 1% in 2009-2010).[31] Specific data on industrial water use in Gujarat (per industrial sub-sector or plant, over time) is very difficult to come by, and we have not found systematic data in the public domain. We even had to extract state-level totals mostly from media reports. In a *Times of India,* report of 2 July 2020, a 349 MLD (million litres per day) demand in the GIDC (Gujarat Industrial Development Corporation, a state organization responsible for stimulating industrial development in Gujarat) areas is reported – on the authority of the Principal Secretary to the Chief Minister.[32] This amounts to 0.1033 MAF, about double the 2011 figure in the table reproduced above.[33] However, the percentage of total industrial water use in Gujarat remains very low.

In the past decade, the Gujarat government has been regularly raising the water tariffs for industries, with 10% per year. A *Times of India* report of 26 September 2021 quotes an industry source as stating that:[34]

> « Costs incurred to procure water accounts for roughly 12-15% of the production cost in textile, bromine, steel, TMT bar manufacturing units, among others. While rising water charges are impacting our competitiveness, we are not getting enough water. Even though GWIL [Gujarat Water Infrastructure Ltd] has signed a contract with industries in Kutch to provide 90 million litres per day (MLD) water, the actual supply is barely 50% »

Industries in Gujarat however, do not only suffer from rising costs for water but, more interesting for our analysis, complain that they are not getting enough water supply.[35] When we visited the WELSPUN textile factory in the Kutch area in 2017 we found that this

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[31] The draft Gujarat State Water Policy (2015) mentions an allocation of 2% for industrial water (item 1.2.1). See https://guj-nwrws.gujarat.gov.in/downloads/draft_state_water_policy_eng_2015.pdf

[32] See 'Industrial power, water demand back to normal in Gujarat'. https://timesofindia.indiatimes.com/city/ahmedabad/industrial-power-water-demand-back-to-normal/articleshow/76739162.cms

[33] For a 2022-23 figure in line with this, see below. However, there are contradictions in media reports quoting government sources. For example a 2015 *India Briefing* report https://www.india-briefing.com/news/industrial-water-rates-india-supply-16547.html/) states that " The regulatory body overseeing this supply, the Sardar Sarovar Narmada Nigam Ltd (SSNNL), announced that industries in Gujarat would only receive 0.06 million acre feet (MAF) of water this summer, against the previous 0.2 MAF." The 0.2 MAF for the summer is double the yearly amount reported elsewhere. Nevertheless, all numbers are in the low percentage range. For a discussion of the divergence in estimates of industrial water use in India, see Joseph et al. (2019).

[34] See 'Gujarat: Industries seek a cap on water charges amid pandemic blues'. http://timesofindia.indiatimes.com/articleshow/86517623.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst On water prices for industry, also see: https://indianexpress.com/article/india/industries-being-provided-water-at-rs-27-54-per-1000-litres-gujarat-govt-to-assembly-6320907/ .

[35] The industry lobby led to government contemplating a lower yearly increase – 3% rather than 10%. See 'Water tax hike for industries may be slashed in Gujarat' (July 22 2023) http://timesofindia.indiatimes.com/articleshow/102027243.cms?from=mdr&utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst This report mentions a 401.62 MCM (million cubic metres) supply for industry needs in Gujarat in 2022-23, amounting to 0.119 MAF. According to the webpage of the Gujarat Water Supply and Sewerage Board the SSNNL tariffs were increased with 10% from 2021-22 to 2022-23 (see https://gwssb.gujarat.gov.in/water-tariff).

factory was procuring wastewater from a nearby town to treat it to a level that allowed use in its production process. Producing textiles is relatively high water consuming. We have found no evidence for the suggestion sometimes heard in critical civil society circles that large amounts of water are diverted from the Narmada canals and pipelines for industrial use, at least not for productive use. If that would have been the case, the WELSPUN factory would have tapped water from the pressurised drinking water pipeline running nearby.[36]

Photo 2: Directions to Welspun and a call for saving water (picture taken by Peter Mollinga 14 August 2017)

Even more difficult to ascertain quantitatively are the water allocations for domestic supply and the actual use of water in industry-related settlements (housing for staff/workers). Guarantees for these play a strategic role in government support for industrial development, arguably particularly so in the driest regions of Gujarat, Saurashtra and Kutch. These regions have seen industrial expansion in recent decades (in Kutch particularly after the Kutch earthquake of 26 January 2001, see Bansal and Parthasarathy, 2021). The usage following such guarantees would come under domestic water supply, the data about which also has its challenges. Even when fine-grained and reliable use data would be available, it would be difficult to unravel industrial development-related water allocation and use from other uses.

We conclude, admittedly on a thin evidence base, that water allocation and use from the SSP for industry in Gujarat is strategically important but quantitatively not very significant as compared to the total water allocation and use.

4.2 The SSP and state-level agricultural growth

Agricultural growth was a major element of the justification for the building of the SSP. « The pace of low growth and intense fluctuations in the agrarian economy will be over after

[36] See the *Times of India* report cited in the text for additional examples supporting the inference that there is unlikely to be large-scale diversion of water from the SSP for industries. We also visited industrial areas in Saurashtra, notably the Morbi region, with ceramics industry, a potentially higher water consuming industry. However, water pollution through wastewater seems to be more of an issue than the quantity of water consumption, plus the energy intensity of production, as is the case with several other industries also (see f.i. Del Rio et al., 2022).

the completion of the Narmada Project. »(NPG, 1989:9)[37]. It is therefore important to assess to what extent SSP has actually induced agricultural growth in Gujarat, and what kind of growth. Gujarat has experienced unusually high agricultural growth rates in the 2000s. « Semi-arid Gujarat has clocked high and steady growth at 9.6% per year in agricultural state domestic product since 1999-2000. (Shah et al., 2009: 45); « during the period from 2001–02 to 2014–15, Gujarat's agriculture grew at 8.6% per annum »(Gulati et al., 2021: 113). [38] Though there seems to be agreement on the existence of agricultural growth rates in Gujarat that are higher than in India on average, there is debate on what are the main drivers of that growth. Of interest to this paper is the role of the SSP in that growth – after water was released in the early 2000s.

Shah et al. (2009) in a regionally disaggregated analysis argue that most of the 'miracle growth' in an otherwise historically not very agriculture-focused state took place in Saurashtra, Kutch, and North Gujarat, regions that were not (yet) reached by the SSP canal system. However, widespread watershed infrastructure had been constructed in the form of check dams and other water-conserving and recharging infrastructure and practices, enabling, particularly, a boom in Bt cotton production[39]. The southern and central parts of the SSP, where water was distributed in the 2010s, showed, according to the authors, comparatively little agrarian dynamism.

> « Our hypothesis – which needs a more comprehensive probe – is that it is doubtful if Saurashtra and Kachchh, and to a lesser extent, North Gujarat, would have benefited as much as they have done in the absence of the mass-based water harvesting and groundwater recharge movement. During the relatively good monsoons between 2003 and 2008, the vast corpus of check dams, percolation ponds, boribunds and farm ponds increased the availability of groundwater that made rabi irrigation on such vast scale possible. Rationing of farm power supply post-Jyotigram brought about a certain order and discipline in the extraction of groundwater, but the improved quality and reliability of farm power supply also

[37] Also cited in Aandahl (2020: 167, with further quotes). The title of the Narmada Planning Group (NPG) document is in line with this: *Planning for Prosperity*. Mahesh Pathak's (1991) edited volume is called: *Sardar Sarovar Project: A Promise for Plenty.* He was an executive member of the NPG for 15 years. The NPG was established in the early 1980s under the chairmanship of Y.K. Alagh, shortly after the Tribunal Award. A major objective of the project was " to introduce modern, sophisticated and more efficient irrigation management system" (NPG, 1989: iii; in *Foreword* by Sanat Mehta, chairman SSNNL - the Sardar Sarovar Narmada Nigam Ltd., Nigam for short). It can be noted that domestic water provision is not mentioned as a (major) objective at this point in the text, nor is industrial water supply. The SSNNL was established in 1988 to reduce the implementation time of the SSP from 17/22 years to 10/12 years (ibid.: iii). In the chapter on agriculture it is stated that " it is predictable that with the provision of the type of irrigation which is visualised for Narmada command, the average farmer is capable of bridging to a large extent, the yield gap which at present exists between the best and average performance" (ibid.:85). For different crops, the document projects total crop output increases ranging between 209% and 593% going from the without-project to the with-project situation (ibid.: 542, table 14.3), with projections of increase of net value of agricultural production lying between 208% and 689% for different regions (ibid.: 544, table 14.4).

[38] Post 2016 no officially published agricultural growth rates are available (personal information R. Parthasarathy). Gulati et al. (2021) presents data up to and including 2016-17. Behera (2013) is another source.

[39] On the specific effect of watershed *movements* in this respect see Patel et al. (2020). On the spread of Bt cotton, see Viswanathan and Lalitha (2010).

> made it possible for farmers to make ambitious plans to grow Bt cotton and wheat on a large scale. Promotion of micro-irrigation, too, must have helped irrigation of Bt cotton and horticulture crops. » (Shah et al., 2009:54)

This stands in contrast to agricultural impact assessments of the SSP, in the 'before and after SSP canal water' mode. Vaidya (2011), based on a 2006-2007 study in 25 villages in the upstream part of the Narmada canal command area[40], reports that the canal has made rabi (second season) irrigation possible. Crop production has increased by 50-100 percent (ibid.: 675) and income of smallholders with 4-5 bighas (0.65-0.81 ha) « has increased three to four times » (ibid.: 676; also see table 22 on p.680). Irrigation, according to this study, has also raised groundwater levels and access to drinking water and increased opportunities for wage work, but the increase in milk animals has led to a higher work burden for women (ibid.: 691) In the same volume, Garg et al. (2011) report an increased and stable growth rate, again in upstream parts of the SSP command area, including increased gross revenue per hectare between 310% and 435% in Gandhinagar, Vadodara and Ahmedabad districts (ibid.: 663). Jagadeesan and Kumar (2015: chapter 6[41]), based on data from 2009-2010, state that it is « undisputable to say that the impact of the SSP on agricultural production and growth has been remarkable ». These authors report the widespread illegal pumping of water from the main canals (with diesel pump sets) in areas where lower-level channels have not been constructed yet, and the huge investments of farmers in these pump sets and the sometimes kilometers of pipes to convey the pumped water. This must mean, indeed, that using surface canal water brings considerable benefits.[42][43] Like others, Jagadeesan and Kumar report an increase in rabi irrigation area, increased crop yields, a shift to commercial crops, and increased income (notwithstanding increased production costs), with cotton being the most profitable (ibid.: table 6.11). The increase of commercial crop cultivation means that agriculture became more commodified and market-oriented.

It is not obvious how to reconcile these contrasting assessments on the impacts of the SSP on agricultural growth in Gujarat. There could be issues with the quality and availability of data, the temporality (studies refer to the first 5-10 years of SSP water availability after water was released, not going beyond 2010), the exact interaction between canal supply and groundwater recharge, a potential selection bias in the case

[40] While many of the larger canals had been constructed, most of the command area had not been developed for irrigation yet further downstream at this point in time. This means that the impact studies done till, say, 2015 inevitably only refer to the upstream part of the SSP command area.

[41] Our pdf copy of the book has no page numbers – hence the reference to chapter 6 only.

[42] This is supported by our own field observation in the Kutch area in 2017 when farmers were awaiting the first release of water into a section of the Kutch Branch Canal. Farmers had installed pump sets and pipes along the canal to irrigate pomegranate trees and other crops as soon as the water would come.

[43] Simultaneously, Jagadeesan and Kumar's (2015) argument seems at times to be reasoning towards a predetermined conclusion. For example, they state that " [the data] shows a gradual recovery from the major dip [in agricultural growth] which occurred in 2000–2001 in the subsequent seven years. This also coincided with the time period, which witnessed gradual expansion in the area irrigated by the SSP." They do not mention Shah et al.'s (2009) observation that this period was also characterised by a series of good monsoon rainfall years and that it is unlikely that the limited coverage of the Narmada canal irrigation at that point can explain the state-level growth rates. All authors observe, in passing or with analytical intention, that agricultural growth rates tend to plummet in (consecutive) drought years.

study selection, a lack of attention to the question of who benefits or not in specific communities, and a multicausality of agricultural growth as such.[44]

It is beyond the scope of this paper to develop a full-scale analysis of agricultural growth and the related (uneven) rural development in the command area of the SSP. Such an analysis would require a quite massive research effort given the limited academic work on this that is available, particularly after 2015, and the overall generalising and quantitative nature of the existing research. Relational approaches are conspicuous by their absence. Our modest first step in the direction of such an encompassing analysis is to substantiate the hypothesis that the way in which the SSP impacts agricultural and rural change is regionally differentiated.

4.3 A regional pattern of agricultural and rural change?

This section discusses how the agricultural and agrarian-rural change pattern induced by the SSP project's irrigation water is spatially diverse. The discussion is based on individual and group interviews with farmer-irrigators in parts of the SSP command area that were operational (see section 1 on methodology) and our field observations. The larger part of the Kutch region had not yet received irrigation water during our field visits in 2019 and is therefore not part of the discussion below.[45] The methodology used in each of the regions was to identify a branch canal for observation and sample head, middle, and tail parts of it to get an overview of the irrigation-related dynamics in that particular region. The division into four regional patterns presented below emerged from the early exploratory field visits and discussions with irrigation researchers and practitioners.[46] It was then more systematically investigated through targeted field visits and group interviews along the branch canals. Secondary literature was used to the extent available, but that extent, as already observed, is limited. The analysis is qualitative and tentative, meant to structure and inform more intensive fieldwork. The starting assumption was that the release of a large amount of new irrigation water into a region will in all likelihood have a strong, at least a discernible, agrarian impact, with this impact depending on existing agrarian and rural practices and relations. The fact that the state of Gujarat is a historical composite of different regions (Yagnik and Sheth, 2005) that are different in agro-ecological, economic, political as well as cultural senses, a regionally differentiated reception of the irrigation water is a reasonable starting assumption. Moreover, the regions in Gujarat have different locations along the Narmada Main Canal,

[44] The sources cited outline these other causes in considerable detail, including a diverse set of government policies, including minimum support prices and many others. Another factor is the organisation of water distribution management through PIM (Participatory Irrigation Management). For an interesting pre/post PIM assessment in the Dharoi irrigation project in Gujarat, see ACT (2011: section 3.7, chapter 4). Gidwani (2002) is a study of the older Mahi-Kadana irrigation system (now lying within the area commanded by the Narmada Main Canal, but still a separate system), which documents the agro-economic impacts of this canal irrigation system in chapter 5 and the social and economic effects in chapter 6. This study does have a strong emphasis on social differentiation of the impact, and is exceptional in the sense of being a detailed study of changing agrarian relations in the context of canal irrigation development in Gujarat. See below for further discussion.

[45] We anticipate though that the irrigation water related dynamics will be similar to Saurashtra as discussed below.

[46] In developing the fourfold classification we particularly benefited from the stimulating interaction with Sachin Oza of DSC (Development Support Centre) and many exchanges with Prof. R. Parthasarathy, then director GIDR (Gujarat Institute of Development Research).

that is, a different distance to the dam, and are in that sense in a queue. That also shapes impact, as well known from the literature on India's large-scale irrigation.

After a brief review of the agrarian relations literature, we present our attempt at a fourfold regional typology of SSP's impact on agrarian and rural dynamics.

4.3.1 Commodification, canal irrigation and agrarian relations

The most detailed study available on canal irrigation and rural change in Gujarat is the already mentioned Gidwani (2002) study of the Mahi-Kadana project, covering the 1960s-1990s period.[47] Though not about SSP as such, the themes addressed in this study are relevant to the SSP process, and the system is now actually part of the SSP command area, though not irrigated with SSP water (at least per design). We therefore briefly discuss the study.

Gidwani's study[48] is in line with many other studies that show that the introduction of irrigation in rainfed semi-arid areas can stabilize agricultural production, increase yields and total production, involve widespread adoption of modern varieties of crops, and expansion of area cultivated, generate wage labour employment at higher wage rates, and enhance farmer income. Studies on the so-called green revolution in India showed that the adoption of modern agricultural technologies came almost always in combination with irrigation.[49] Specific to Gujarat is the strong increase in fodder production as a result of the expansion of irrigated agriculture. This helped to support a 'white revolution' of dairy farming and milk cooperatives affiliated with the Anand Milk-Producers' Union (AMUL), in which the labour class also took part, in the 1960-1990 study period[50]. The Mahi-Kadana region is in the heartland of that dairy development. Gidwani's study shows that an increase in social differentiation/polarisation is not strongly apparent – the socio-economic position of wage laborers improved in the study period, particularly in the 1962-1982 period, after which employers started to deploy strategies to reduce the bargaining power of laborers. There is no strong further concentration of land, partly as a result of the increase of sharecropping, though there is a process of

[47] It is to our knowledge the only study of this kind for Gujarat. Other agrarian change literature is concentrated on the 'tribal areas' of Gujarat (see for instance Daftary, 2019) where the SSP does not reach, or is more generic in nature. Examples of the latter are the analysis of the high levels of agricultural growth in combination with abysmally low Human Development Indices and high levels of poverty (see for example Viswananathan and Bahinipati, 2021; Dixit, 2013) and thematic analyses like those on the feminisation of agriculture (see Pattnaik et al., 2018) and on female land rights discrimination (see Pattnaik, 2017); on inequality and inclusiveness in the dairy sector see (Dervillé et al., 2019). On land see f.i. Sud (2007). Labour relations have been studied very intensively in Gujarat, notably through the work of Breman (1993).

[48] It should be noted that Gidwani's detailed analysis of irrigation impact has a different aim than our paper. Gidwani seeks to critique post-development theory and interrogate the concepts of development and modernity as posited to be exclusively 'Western' by post-development theorists: " I hope to shed light on the curious cultural and moral geography of development." (p.60). We are in overall agreement with the thrust of Gidwani's argument that the many problems associated with large-scale infrastructure development, like the building of dams for irrigation, calls for " different ways of enacting development, without veering into the neo-Luddite, anti-development stance of the new critics." (p.74), the 'new critics' being post-development scholars. In the present paper the case study serves the more circumscribed aim of thinking about the potential impact of the SSP on agrarian relations.

[49] Classical studies to this effect in the Indian context are Farmer (1977) and Dhawan (1988).

[50] On the history of AMUL, see f.i. Chandra and Tirupati (2003) and Kurien (2007).

increasing indebtedness of poorer/lower caste households, actively pursued by village moneylenders to eventually lead to land loss by the poorer/lower caste groups. Though Gidwani concludes that laborers and sharecroppers in his study region are generally somewhat better off with than without irrigation, he emphasizes that this gain is often under threat through indebtedness. Caste-related inequality is particularly evident in the access to credit, favouring higher caste farmers. All in all, this, here crudely summarised, process of canal irrigation induced agrarian change in the Mahi-Kadana irrigation system aligns with similar processes elsewhere in India: canal irrigation may give a boost to the agricultural economy from which all groups benefit at least to some extent, without agrarian relations exhibiting structural transformation. Key socio-economic relations of dominance and exploitation (through interlocked exchange relations of land, labour, and credit) continue to exist, be it in adapted forms and sometimes with a somewhat shifted balance of power between classes and castes[51].
Table 19 from Gidwani's conclusion chapter, reproduced below as Table 2, summarises the impact of the Mahi-Kadana irrigation system for employers and workers.

Table 2: Socio-economic impact of the Mahi-Kadana irrigation system

Capability to achieve functionings, post-irrigation, in Limbasi Division from the perspective of employers and labourers ((↑) has improved; (↓) has declined; (→) is generally rising; (←) is generally declining)

Type of functioning	Employers[a]	Workers[b]
Real income and consumption	↑	↑
Income risk	→	→
Employment security	na	↑
Control over land	→	←
Control over workers	↓	na
Access to other production means (such as cattle and non-farm jobs)	↑	↑
Labour relations	↓	↑
Diet	↑	↑
Marriage expenditures	↑	↑
Social status/caste dominance	←	→

[a] Mostly, members of the landowning Patel caste and the trading Thakkar caste.
[b] Mostly, members of the semiproletarian Koli/Baraiya castes and Vankars, Rohits, Vaghris and Harijans from the previously 'untouchable' scheduled castes.

Source: Gidwani, 2002: 68, table 19

In general terms, a similar process is likely to ensue in the case of the SSP. Our field data suggests, overall, a process of agricultural intensification and yield increases as an effect of the arrival of SSP water. This effect is geographically unevenly spread due to the gradual completion of the canal system and due to the differential 'take up' of irrigation by farmers in a given area. Part of the effect operates through groundwater recharge by surface irrigation. Rising groundwater tables in the SSP command area were confirmed by interviewed farmers in all the zones discussed below. However, coming at a later period than Gidwani's case study, from 2002, there are a number of different conditions.

[51] This nature of the agrarian change process is not reserved for canal irrigation. The process described by Prakash (2005) for tubewell irrigation in Mehsana district in roughly the same period, runs along very similar lines.

The most important of these is the advent of (neo)liberalisation in the 1990s, in which Gujarat is seen by many as the 'beacon or exemplar of market reform' in India (Daftary, 2019: 80, 81). A second difference is that by the early 2000s, the 'tubewell revolution' had run its full course and was in fact reaching the limits of over-extraction of groundwater.[52] Canal irrigation no longer arrived in agricultural systems with no or little irrigation, but in large, though not all, parts of the SSP command area there was widespread tubewell irrigation before.

In the next sub-section, we discuss the reception of SSP canal water in different zones in an effort to develop a relational typology of irrigation impact on agrarian relations. Given the very limited availability of agrarian social relations literature and the limited time and resources at our disposal, we decided to develop a qualitative typology based on semi-structured interviews with farmers and other key informants, group interviews with farmers, and whatever written documentation we could find. The objective is to develop a heuristic for further research rather than a definite statement on regional differentiation.

4.3.2 SSP irrigation's impact: four zones

Our fourfold classification of zones identifies the qualitatively different role that SSP water plays in agrarian and rural change in four zones in the SSP, which we have labelled using names of towns located in that zone.[53] The zones are, going along the SSP main canal from south to north and west, the following.

1) *Bharuch*: in the head-end of the SSP main canal, where water is not particularly scarce, and irrigation not particularly desired for agricultural development.
2) *Kheda/Anand*: the dairy heartland, with irrigation of relatively small landholdings where dairy farming is key – water from SSP flows into an existing irrigated farming system and may facilitate further intensification.
3) *Vamaj*: areas of the 'tubewell revolution' in the alluvial plains of central and northern Gujarat where groundwater extraction had lowered water tables to great depths and irrigated agriculture had become a challenge – SSP water may re-invigorate agricultural and rural dynamics.
4) *Limbdi*: areas in Saurashtra and northern Gujarat[54] where irrigation brought by SSP is 'new' in the sense that it vastly increases water availability, even when there was some irrigation and water conservation before earlier.

Our qualitative and heuristic approach has a number of limitations. What we are not capturing very well with the four zones that we distinguish, is the impact of the SSP in the low-lying areas north and west of the Gulf of Khambat, west and south of Ahmedabad. This is the low-lying (coastal) area that the Saurashtra Branch Canal crosses before the canal water is lifted into the more elevated parts of Saurashtra. Part of this low-lying area

[52] Gidwani's discussion of groundwater is mostly about the early phase of the 'revolution' and focuses on the problems associated with the functioning of government tubewells (Gidwani, 2002: 70ff.).
[53] We would like to acknowledge the inspiring discussions we had with Sachin Oza (Development Support Centre) on this typology.
[54] We also anticipate Kutch to fall into this category.

is nature protected area, and part of it is reserved for the Dholera SIR (Special Investment Region).[55]

We also do not capture in our typology of zones what is happening to farming in the areas that are being 'absorbed' by the expansion of cities and industrial areas or the prospect of that (for instance around Ahmedabad and along the DMIC). This dynamic is clearly a factor in agricultural land prices and land sales/purchases, as well as the propensity of farmers to invest in agriculture. It may be considered (tragically) ironic that this phenomenon is particularly present in some of the most agriculturally prosperous areas of the SSP command area. We are, however, not able to gauge the exact extent and importance of these dynamics and have focused on generating a typology and hypotheses for primarily agricultural areas. Put differently, our assessment of agrarian change is firmer than that of rural change. We have collected many interesting themes and questions about rural change in the broader sense, but combining this list with the regional typology would require more and larger scale research. The overall phenomenon that agrarian change can no longer be thought of as a process in which the drivers are primarily internal (agricultural accumulation and related social differentiation) is overly clear in the SSP command area. This expresses in the overwhelming sense in farming communities that agriculture is not the future. All, from large farmers to laborers, invest as much as they can to provide opportunities for their children outside agriculture. Education and employment aspirations, and the cultural aspirations of capitalist modernity more generally, are strongly 'urban' in nature. This is accompanied by a resurgence of sharecropping, while the arrival of SSP water can be seen as another 'lease of life' for smallholder agriculture providing resources for moving the next generation out of agriculture. In Meda Adraj, a middle-reach village in the Sanand Branch Canal near Ahmedabad, a farmer stated that « without the Narmada water this village would be empty »[56]. As a hypothesis, it may be suggested that the fortunes and dynamics of the urban cultural political economy now shape the social differentiation in the rural domain.

Our data on patterns of unevenness *within* zones (say, how wage labour/sharecropping relations have exactly changed, how gender relations in farming households have precisely changed, etc.) is not extensive enough to link these to the regional typology. Again, larger scale and more intensive research would be required to analytically move beyond a list of relevant themes and questions. That such patterns of unevenness exist and, overall, resonate with such patterns in other regions in India described in the secondary literature, is confirmed by our data. Another common finding in the four zones distinguished below is unevenness in canal water distribution – one of the main factors in shaping uneven agrarian relations in canal irrigation systems.

In terms of water distribution and water management, the four zones exhibit well-known features of protective irrigation and large-scale canal irrigation management more generally. In all areas we visited we sought out tail-end villages along longer branch

[55] For discussion of the SIR see Akhtar, 2024 Datta, 2015; Sampat, 2016; basic information can be found on https://en.wikipedia.org/wiki/Dholera_Special_Investment_Region and https://www.dholera-smart-city-phase2.com/dholera-industrial-park.php).

[56] He also stated that out of the 25 farmers in his *mohalla* 21 were staying 'outside' (that is, in the city and abroad). He also stated that there were now 500 labour households in the village staying on a year-round basis, mostly in sharecropping arrangements, implying that almost all (middle and larger) farmers had given their land in sharecropping rather than cultivating it themselves.

canals to find out whether there was a tail-end issue in water distribution. Tail-end problems were very clearly articulated and explained by farmers in Vedcha village for Miyagam Branch (Bharuch zone), Gangadasi village in the Mahemdabad Branch Canal (Kheda/Anand zone[57]), and Agol village in the Sanand Branch (Vamaj zone[58]). Problems with the layout of and levels relative to fields of smaller canals, stemming from construction-time lack of adaptation to local relief, were found in all zones too. Common to all zones was widespread pumping from canals with diesel pumps often over large distances (up to several kilometres, in one case we saw it was seven kilometres), farmers having stopped paying water fees after a few years, and Water Users Associations (WUAs) being largely inactive, though sometimes specifically active in securing water supply through informal payments to the staff handling canal gates. Low presence of government/Nigam staff on the canals was widely reported, but the Anand zone reported higher canal-level staff presence (in terms of a number of gatekeepers active on the canal). Because this overall pattern is as expected (and well documented for large-scale canal irrigation elsewhere) and is largely common across the zones we do not repeat these details in the zone descriptions that we now turn to as it does not distinguish them. The four zones we distinguish are indicated in the map below.

Map 2: Command area map with four zones and Mahi irrigation system indicated

Source: Command area map of SSNNL with insertion of zones (1, 2, 3, 4, and Mahi LSI) by authors

[57] Antroli, Kaletar and Gangadasi are the head, middle and tail villages we visited in this Branch Canal.
[58] In this Branch canal Vamaj was a head-end village, Meda Adraj a middle village, and Agol a tail-end village.

While the description given above is water-focused, the more detailed discussion below will show that each zone is characterized by a configuration of agroecological and human relations.

1. Bharuch – the zone at the head end of the main canal

We consider this zone to cover the first nine branch canals (blocks) or so of the Narmada Main Canal[59], roughly the command area located south of Vadodara city.[60] The characteristic is the relatively high average yearly rainfall in this area. Bharuch sub-district has 1009 mm as yearly average rainfall for the period 1981-2021, ranging between 200 mm and 1940 mm, with the larger part falling in the July-August-September monsoon months.[61] It thereby belongs to the higher rainfall zone of southern Gujarat. Apart from rainfall, the area is also crisscrossed by a number of rivers and streams supplied by the high rainfall hilly zones to the east, making for relatively favourable water availability conditions as compared to the other zones. A second physical characteristic is the prevalence of 'black soils' – heavy clay soils with low hydraulic conductivity. These soils suit rainfed agriculture as they can retain a lot of (the monsoon) rainfall water, but have been considered a challenge for irrigated agriculture as they easily saturate and are prone to waterlogging and salinization.[62] In terms of location, where this area was considered relatively isolated and 'remote' in the past, if not 'backward'[63], it's connectivity and economic dynamism is now much enhanced, not in the least by the DMIC (Delhi Mumbai Industrial Corridor) project, which passes through the western part of Bharuch district. All three of these characteristics play a role in the impact of the SSP in the area.

A main finding for this zone is that farmer interest in irrigation by SSP canal water is tentative and the pattern of intensification of agriculture (as a result of the introduction of SSP canal water) is (as yet) patchy, within an overall assessment of respondents that

[59] Branch canals are listed on https://www.sardarsarovardam.org/branch-canals.aspx and can be traced on https://www.openstreetmap.org/way/232998913#map=11/22.0761/73.5452 . No.7 is Miyagam Branch Canal No.9 is Vadodara Branch Canal.

[60] We deliberately use the terms 'or so' and 'roughly' as we do not seek to demarcate zones with definite boundaries – not for this zone and not for the others. By their nature, many of the differences/transitions described are gradual. As explained above, we aim to identify 'types' as a heuristic and set of hypotheses for further investigation.

[61] A table with 1981-2021 yearly rainfall data for Bharuch's eight sub-districts can be found in file:///C:/Users/pm35/Downloads/Standard_Precipitation_Index_for_drought_severity_.pdf A 115 year time series based annual average of 822 mm for Bharuch district can be found in Kumar et al., 2017). This source: https://www.worldweatheronline.com/ gives 1216 mm average yearly rainfall for Bharuch city. See below on the increasing trend in average yearly rainfall in Anand district.

[62] The challenges of irrigating black soils (also called black-cotton soils) have been debated for more than a century, particularly for the Deccan Plateau region (see Mollinga 2003: chapter 3 for discussion and references).

[63] See for instance Purohit (1985), a PhD thesis defended at Gujarat University, titled *Labour market processes in developing industrial centres of a backward region: a study of Bharuch district, Gujrat state* (accessible at https://shodhganga.inflibnet.ac.in/handle/10603/30943)

the canal has led to improvements in livelihoods.[64] A number of factors explain this tentativeness and patchiness.
Black soil farmers reported that they considered the canal water 'cold' and groundwater 'warm'. According to them, canal water spoils the soil (makes it hard), and they were hesitant to use it directly for irrigation. Rising groundwater tables were reported universally and this has led to increased groundwater use in parts where this is feasible. In Akona village farmers reported that wells used to get emptied in 6 hours while drawing water for irrigation while now water is drawn from wells for 10 hours. Farmers also report that crops are now cultivated in all three seasons unlike earlier when cultivation was restricted to the monsoon season only. It was reported that canal water was only released in October/November, while some would prefer it to come in September for the irrigation of more remunerative crops.[65]

Bharuch zone is the one in which farmers, large and small, were most insistent about there being no future in agricultural cultivation, and them not wanting or expecting their children to take up farming, and their children having only/primarily urban aspirations. « In future, owing to having small land, cultivation will be discontinued in 10-15 years and villagers will prefer working in companies. »(Interview 19/09/2019) « The group [of farmers] makes stark statements on their sons and daughters. Daughters are all studying and are good at it. Sons are hanging around and drink country liquor, are only interested in cars, mobiles, gadgets. One says his son pressurizes him to sell land to buy a car. » (Umara village fieldnotes 21/08/2017). Though such statements are clearly somewhat of a caricature, the overall sentiment shone through very strongly in this zone. The Vagodhia industrial estate near Vadodara and the industrial city of Surat were mentioned as specific employment opportunities nearby.

In several of the villages that we visited farmers reported land sales to 'rich people' from Surat and Saurashtra. They reported these buyers were not necessarily interested in agriculture and often immediately rented out the land in sharecropping after purchase. Such land investment without immediately starting new economic activities is very likely

[64] This overall improvement was expressed in a number of ways. A common statement was that livelihood crises like those happened in the past ('when people were starving') have not occurred anymore since the SSP canal water came. It is also commonly expressed in the increase in investment in the education of children outside the village, in local towns, bigger cities, and abroad (for the richer groups). Another indicator is that land values have risen very substantially (reports ranging from 1.5 to 6 times the earlier value). Strongly increased literacy rates were also reported. In the zone, a number of tribal (Bhil) villages and villages with a substantial tribal population are found close to the Narmada main canal (examples are the villages of Parsal, Ghodisimel and Akona). The socio-economic differentiation within the tribal population was observed to be similar to the overall pattern, taking distribution of landholding size, type and intensity of farming, and housing as indicators.

[65] Note that the original design of the SSP was for a protective irrigation system, meaning supplementary irrigation (as compared to full crop water requirements) for a limited period of time. From that perspective, a relatively abundant monsoon (*kharif*) rainfall pattern creates a logic for aiming for *rabi* irrigation from October onwards only, particularly in higher rainfall areas. "As per original planning of the project, out of annual irrigation of 17.92 lakh ha, water is planned to be allocated for irrigation to Kharif is 24%, Rabi 29%, Summer 1.8%, Two Seasonal 22%, Perennial 1.7% and other crops 5.9%. During the summer season, irrigation water is allocated only to about 38000 ha near to the Sardar Sarovar Dam. Thus, there is almost no provision to provide water for irrigation to the summer crops. Only in the kharif and rabi irrigation season the SSP command area will be getting the benefits of irrigation." (https://sardarsarovardam.org/components-of-project.aspx

in anticipation of economic opportunities and further increases in land value through DMIC related developments. NGO staff working on WUA establishment in villages in this and the Vadodara region corroborated this. They opined that the lack of interest of farmers in making WUAs active organizations could be partly explained by farmers 'simply' waiting for their land to be declared an economic/industrial zone in order to cash in on increased land value. To establish whether this form of the land issue indeed sets this zone apart from the other zones requires further investigation, but we feel our field data merit a hypothesis to that effect.

2. Kheda/Anand – the heartland of dairy farming

The Kheda/Anand area (see above where we discuss Gidwani (2002)) is the heartland of dairy farming in Gujarat.[66] The groundwater in this region is available at relatively modest depths with favourable quality (as compared to north Gujarat for instance[67]). The Kheda/Anand area, and the region east of it, is relatively well-endowed with rainfall and has more streams and rivers, plus deep alluvial aquifers.[68]

Before the arrival of water from the SSP, the fodder production for dairy farming was largely groundwater-based outside the monsoon season. Due to more favourable rainfall and surface streams than in north Gujarat, the Kheda/Anand zone had more vegetation and availability of fodder. The arrival of SSP water facilitated fodder cultivation into the summer months (often *bajri* – pearl millet), giving a boost to and more stability in milk production, and generally allowed intensification of agriculture. Historically already a prosperous agricultural region, the SSP water allowed further intensification of smallholder cultivation, by supplementing via direct surface water irrigation and groundwater recharge. Apart from agroecological conditions, the regions is also well connected, presently favourably located along the Delhi Mumbai Industrial Corridor (DMIC).

A remarkable finding was that Kheda/Anand zone was the only of the four where farmers stated that migration had reduced after the SSP water came. We summarised in our field notes as follows. "Due to availability of wage labour in agriculture and the practice of cultivating leased-in land in the village, the magnitude of migration has reduced. The number of migrating persons has reduced from 100-150 earlier to 30-40 now. »(field notes Kaletar, 23/09/2019). In the same village, farmers stated in a group interview that they preferred to live in a rural area, rather than an urban area – the only place in our field visits in which that perspective was stated.

[66] As discussed above, the older Mahi canal irrigation system is enclosed in the SSP command area (see Map 2). We have not collected data in the Mahi command area. It does, however, belong to the second zone that we distinguish, the heartland of dairy farming Further see Jayaraman (1981) and Muralidaran and Krishna (1993).

[67] Anand's average yearly rainfall is 1150 mm, while for example Mehsana, the heart of the 'tubewell revolution belt', has 980mm, Rajkot, the capital city of Saurashtra has 892mm, Rapar in North Gujarat has 702 mm, and Bhuj, the capital city of Kachchh has 618 mm (all calculated from https://www.worldweatheronline.com). In this source Bharuch has 1216 mm. Going north and west rainfall in Gujarat declines. An academic source for Anand district is Priyan (2015). This has a 100 year time series, with increasing average rainfall in the last decades to 911 mm, but on the whole lower numbers. Rainfall figures are somewhat of a puzzle.

[68] On the hydrogeology of this region, see Krishnan et al. (2006).

> « Farmers think that village life is better. Fresh air and fresh milk and vegetables are available and there is no hustle and bustle in village life. However, they admit that in order to maintain this scenario, water needs to be saved; unnecessary expenses need to be curtailed and that they have to work hard and be prepared to work themselves. They also perceive that selling of land for industrial purposes will have adverse impacts. Expansion of industries will lead to increase in pollution, shortage of wage labour in agriculture, and degradation of cultivable land. Fertility of land will also decline. Villagers hope that in future, the village will have a clinic, general stores, fertilizer, and pesticide shops, and temples will be renovated and the village cooperative will perform in a better way. » (fieldnotes Kaletar, 23/09/2019)

Nevertheless, farmers still thought there was not much of a future in agriculture.

> « As informed by the farmers, area under cultivation will decline in coming 15-20 years and the land will become hard. As their children are not interested in agriculture, farmers want them to attain education and be involved in jobs or business. Farmers are thinking of cultivating horticultural crops such as mango and *chiku* [fruit of the *Manilkara zapota* tree] or leasing out their land to marginal landholders in future. » (fieldnotes Kaletar, 23/09/2019)

Though being 'farming oriented', the longer-term prospect is still that there is no future in agriculture. But farmers in this region will not give up their land but lease it out or extensify by growing tree crops.[69]

3. Vamaj – the 'tubewell capitalism' zone of North and Central Gujarat[70]

In this zone, the SSP surface water, apart from being directly used for irrigation, replenishes the (deep) groundwater that was the basis of the 'tubewell revolution' in North and Central Gujarat (by mining the deep alluvium aquifer of particularly the Sabarmati river). We have named the zone after one of the villages that illustrated the pattern in this zone very well (visits in 2015 and 2019). In this region, the groundwater was (and is) mined since the 1970s, mostly through group-owned tube-wells.[71] The cost and quality of groundwater became unfavourable over time due to over-extraction. There were no significant surface irrigation schemes in this region, especially in the present SSP command area.

Since the 1970s, with the tubewell revolution, the Vamaj zone experienced a steep rise in market-oriented intensive agriculture, which is supplemented with dairy production. A large extent of productive land and tube-wells are owned by the dominant caste of Patel

[69] Another interesting aspect is that they seem to have a good relation to the SSNNL – the canal is open long, things get repaired, they pay irrigation fees.
[70] 'Tubewell capitalism' is the title of Dubash (2002).
[71] See Shah (2010). Two detailed accounts of that intensive groundwater/tubewell based development are Dubash (2002) and Prakash (2005) already referred above, geographically located in Mehsana district and Mehsana and Banaskantha districts respectively. Interesting from an irrigation water management perspective is that in this region the underground pipeline systems constructed for the distribution of group-pumped groundwater ('pumping it up the hill') are now sometimes used as distribution systems for SSP canal water when location allows such reversal ('letting it flow down the hill').

farmers who also have significant influence on the making and breaking of the state-level governments[72]. Not only through land-holding, but through the access to labour surpluses, a well-developed social network that also functions as a credit network, and diversification of livelihood through out-migration to distant overseas places, notably the USA in recent times, the Patel farmers have maintained their dominant position in this region. Having a favourable location close to the economic and political capitals of Ahmedabad and Gandhinagar, and along the upcoming Delhi Mumbai Industrial Corridor (DMIC), this region has significant potential for highly market-oriented agriculture.

Symbolizing the potential of water from the SSP allowing a revitalization of highly commercialized, capitalist agriculture in this zone is a big plastic greenhouse horticultural farm near Vamaj that we visited in 2015 and 2019. It cultivated mostly cucumbers, and also capsicum. The investment was done by return migrants from the USA who stated that they had modelled the farm on Californian agriculture. The farm was located right next to a canal, from which the irrigation water could be pumped. The farm had strongly expanded from 2015 to 2019. However, the owners informed us, in 2019, that while there were 3000-4000 acres of such farming in Gujarat at one point, there were only 200 now (24 September 2019 field visit). The basic cause was nematodes they suggested, that is, pest and disease control under greenhouse conditions more generally. Marketing challenges were also mentioned by these entrepreneurs, as well as other smaller-scale greenhouse horticulture farmers we spoke with in this region. Greenhouse investment, like micro-irrigation investment, is heavily subsidized by the Gujarat government as part of its agricultural modernisation policy. It is, however, a considerable challenge to establish the profitable agro-industrial enterprises that the policy envisages, as the example illustrates.

The less spectacular version of SSP water allowing a reinvigoration of agriculture in the deep tubewell zone is illustrated by the situation in the Meda Adraj village discussed above: groundwater levels have risen[73], allowing cheaper groundwater extraction combined with surface irrigation. What we hypothesise to be typical for this zone though, is that this improved water availability for irrigation, while being a new 'lease of life' for agriculture, does not generally change the pattern of absenteeism of larger farmers and the prevalence of sharecropping arrangements, but does lead to the emergence/expansion of agro-industrial farming by a select group of farmer-entrepreneurs. Trajectories of farm/enterprise development would have to be mapped in a systematic manner to test this hypothesis.

4. Limbdi in Saurashtra - a semi-arid zone in western Gujarat

In this zone we club together the semi-arid areas of Saurashtra and hypothesise a similar pattern will emerge in the in 2019 still unirrigated areas of northern Gujarat and Kutch[74].

[72] See for instance Jaffrelot (2016).

[73] The farmer from Meda Adraj quoted above also made an interesting hydrogeological observation: that groundwater levels at 600-700 feet had not changed, but that there was groundwater at 300 feet now. This suggests a layered aquifer as often found in (deep) alluvial sedimentation areas, and complicates simple stories of 'groundwater recharge' as a uniform process.

[74] At the time of our field visits, only in the eastern part of Kutch district SSP irrigation water was available (to some extent because much of the local canal infrastructure was still to be completed).

We provisionally club these regions into one zone because they all exhibit the (dramatic) effect of the arrival of canal water in a semi-arid mainly rainfed agriculture and pastoralist area with little well irrigation and some surface water storage and recharge (water conservation through check dams notably)[75]. The different parts of this 'zone' are likely to exhibit differential development pathways over time. When we conducted our fieldwork in 2017 and 2019, however, the farmers in Saurashtra we interviewed were often irrigating for a first or second season only.[76]

We summarised statements by farmers in our fieldnotes as follows.

> « After the arrival of the SSP water, farmers started cultivating Bt. cotton, cumin seed, castor and wheat. Earlier they used to grow *deshi* cotton (G-13), *jowar* [sorghum] and *bajri* [pearl millet]. (…) Narmada water has helped in pursuing new businesses, people have purchased tractors, land etc. and there has been improvement in education. » (fieldnotes Limbdi 21/09/2019).

What this means is that the arrival of irrigation water through SSP has led to a strong response, particularly of farmers with larger landholdings.[77] The introduction of (new varieties of) crops that are higher yielding and more remunerative is one such response. We visited one farmer who explained to us that he had planted two of his fields with castor, conducting an experiment by irrigating one field with SSP water and cultivating the other rainfed. The yield difference between the two was more than obvious, which has convinced him to invest more in irrigated crops. He was growing irrigated castor and irrigated cumin when we visited him, using drip irrigation for the cumin (see photo 3).

3: Irrigated castor (left) and irrigated cumin (right) crop (picture taken by Peter Mollinga, December 22, 2015)

[75] On watershed development in Gujarat, see Gandhi et al. (2011); Groetschel et al. (2000); Shah (2001); Mehta (2007); Verma and Shah (2019).

[76] The Kutch Branch Canal, where we expect a similar pattern to occur, became fully functional in July 2022 and was inaugurated in August 2022. See https://indianexpress.com/article/cities/rajkot/canal-fully-functional-villagers-cheer-as-narmada-water-approaches-kutch-8013596/ and https://indianexpress.com/article/explained/kutch-branch-canal-pm-modi-inaugurate-8115418/ and https://www.opindia.com/2022/07/watch-people-of-kutch-celebrating-the-arrival-of-narmada-waters/ and https://www.youtube.com/watch?v=_QuRC1EfZ_4 , but on a canal breach on 8 July the day after water arrived at the last point, see https://www.youtube.com/watch?v=8Z63lNBP8IA . The canal was finally inaugurated by Prime Minister Modi on 28 August 2022 (https://www.news18.com/news/opinion/how-modis-innovative-in-depth-solution-for-gujarats-water-crisis-paved-way-for-gati-shakti-5893147.html) .

[77] In the Saurashtra region relatively large landholdings are found due to its history and semi-arid conditions with little groundwater recharge (basaltic rock underground).

Another response is (thus) investment in micro-irrigation. This includes both the installation of large micro-irrigation installations for plantation-type agricultural holdings by regional businessmen and smaller-scale micro-irrigation for individual farmers with smaller holdings. In Sami village, there was a proliferation of recently established shops providing micro-irrigation equipment when we visited in December 2015. « A dealer in sprinkler/drip installations we speak with [in Sami] in search of a farmer (…) said he had three hundred orders in the past three months – he has been here only for 3 months. » (fieldnotes Sami, 22/12/2015)

Photo 4: Large-scale lift micro-irrigation installation (picture taken by Peter Mollinga, December 22, 2015)

5. Water, infrastructure and state governance: (re)directing the flow of development?

In this section, we present our preliminary effort at grasping the dynamics of 'water and development' in the SSP in Gujarat, in the form of an outline of the research that we propose will help to develop further understanding and insight. We include references to theoretical perspectives that we suggest may be helpful in further work.

5.1 Uses and meanings

As stated in the introduction, we look at the Sardar Sarovar Project (SSP) as a large technological system, a huge piece of infrastructure that reaches a large part of Gujarat state. It was planned to supply irrigation water and drinking water, as well as generate hydropower electricity. Apart from these material supply functions, the SSP has a strong presence in the development process as an imaginary. We have distinguished three types of uses of the SSP and the water that flows through it: performative, consumptive, and productive. These uses take a number of concrete forms, as discussed in the preceding sections. They are listed in the 'concrete form' column of Table 3. The concrete forms of water and water infrastructures have particular meanings in the development process, which are listed in the third, 'meanings' column.

Table 3: Uses and meanings of SSP water and water infrastructure

USES		MEANINGS
Type	*Concrete form*	
Performative	▪ SSP in public discourse ▪ Ahmedabad riverfront	Narratives and imaginaries of modernity, development, and of the 'Gujarat model' as part of policy and political discourse, translated into material, including infrastructural, form
Consumptive	▪ Drinking water pipeline grid - Cities/municipalities - Villages	Provision of drinking water as a public service directly by the state, through the pipeline infrastructure, as part of the 'welfarist' component of state governance, reproducing particular configurations of state legitimacy and control.
Productive	▪ Agriculture ▪ Industry	Creation of favourable infrastructural conditions for industrial and agricultural growth, regionally and socially differentiated, as part of and feeding into the transformation of rural-urban linkages, co-constituting patterns of combined rural-urban development.

Not included in the table is the potential ecological use of water. The SSP design allocation schedule does not include allocation of water for ecological services. To our knowledge, no such allocations have been made since.[78] A water use that is also not figuring in the table is the hydropower generation at the dam, which is a design feature. Gujarat receives only 16% of the power that is generated at the dam, the remaining going to Madhya Pradesh (57%) and Maharashtra (27%)[79]. As this 16% is only a fraction of total power generation in Gujarat we have left it out of our analytical scope.[80] For our analysis, we have selected those examples that are, in our assessment, particularly important and instructive. There are, thus, additional examples that could be looked at.[81]

It should also be noted that the uses/examples plus the meanings they carry are not mutually exclusive. Water supplied through the drinking water pipeline grid can also be

[78] The SSP will, obviously, have ecological effects and impacts, both in the Narmada river basin and in the landscapes and waterscapes that it touches in Gujarat. Most literature is focused on the ecological effects of damming the Narmada river and the reservoir submergence. The major projected ecological damage in the command area is waterlogging and salinisation. We have found no good assessment on the prevalence and impact of that. Water pollution, through non-point source agricultural pollution and pollution through domestic and industrial use, could arguably be added to that. For a discussion of water pollution downstream of the cities of Ahmedabad and Surat (in the Sabarmati and Tapi basins respectively), not directly related to SSP, see Parthasarathy and Raja (2013). Biodiversity impacts of SSP seem to be unmapped for the SSP command area. For paper citing pre-2000 EIA studies, see Sabnis (2001).

[79] These figures can be found f.i. at https://sardarsarovardam.org/greenpowerinformation.aspx .

[80] In 2015-16 total installed power generation capacity in Gujarat was 24924 MW (see https://www.gidb.org/power-key-current-statistics ; in 2023 the installed state-level capacity had almost doubled https://npp.gov.in/public-reports/cea/monthly/installcap/2023/OCT/capacity2-Western-2023-10.pdf). 16% of the total 1450 MW installed capacity at the dam is 232 MW, which is less than 1% of the total installed state capacity in 2015-16. With almost 4000 MW installed capacity in 2025-16, wind power is a much bigger renewable energy source.

[81] Interesting infrastructural developments in the SSP command area include the installation of solar panels on top of conveyance canals (see f.i. https://india.mongabay.com/2023/07/solar-canals-prove-to-be-good-for-the-environment-but-not-for-business/), and the 'pipelining' of minor/field channels for local water conveyance (a farmers' innovation first resisted by government, see SSNNL (2010), now embraced as regular policy).

used by households and enterprises for productive purposes (as was reported during field visits in Rajkot, Saurashtra). All consumptive and productive activities arguably also have performative aspects, while there tend to be productive and consumptive dimensions associated with performative dimensions (for instance, the Ahmedabad riverfront consumes water and has water-based economic activities associated with it). We have focused on the particularly pertinent meanings associated with the examples, in order to capture the diversity of meanings associated with SSP water and water infrastructure. Understanding how these uses and meanings interconnect not just in principle but in practice, requires further theorisation and research. Such theorisation and research would involve unpacking the notion of 'development' as actually used. It acquires different meanings in different epochs, and is understood differently by different social groups. Any development imaginary selectively emphasises a particular route and certain dimensions of change, and thereby obscures other routes and dimensions – by default or by design (cf. Roe, 1991; Venugopal, 2015; Radcliffe, 2015; Desai and Roy, 2016). Well documented are the different development imaginaries associated with the building of the SSP dam and the opposition to that (cf. Baviskar, 1999). The (development and planning of the) city of Ahmedabad has been analysed as representing different imaginaries, including being/becoming a 'fundamentalist' city (Desai, 2011) as part of a 'neoliberalising' process (Chatterjee, 2010). Less prominent in the literature are 'bottom up' narratives and imaginaries, particularly beyond a focus on Ahmedabad, and attention to the social and regional diversity of such narratives and imaginaries (but see Zimmer et al., 2020), notably in rural areas.

Our ***first general conclusion*** is thus that the SSP water and infrastructure *have* multiple meanings, which are active in a diversity of practices, as part of the overall 'water and development' process. Like in the literature overall, we have narratives and imaginaries that aspire to be 'dominant' and 'hegemonic', articulating particular understandings of modernity and identity. An analytically less trodden path is a focus on social and regional diversity in narratives and imaginaries (related to SSP water and infrastructure). A focus on diversity and multidimensionality would avoid policy and analytical reductionism (standardised and one-dimensional approaches and understandings), while arguing for context-specificity in policy for acting upon and interdisciplinary analysis for trying to understand the development dynamics associated with the SSP.

5.2 Infrastructure and state governance

Our ***second general conclusion*** relates to the inclusion of infrastructure in the analysis of state governance. The strong emphasis on infrastructure in state policy is not an exclusive characteristic of contemporary Gujarat state governance. That this characteristic is not an artefact of the SSP happening to be a state-wide infrastructural system that accidentally attracted considerable political attention, is suggested by the broader emphasis on infrastructure like roads, electricity and communication technology in Gujarat, in India, and in emerging economies more generally (Dubash and Morgan, 2013). Arguably infrastructure is *always* an element in and of state governance, though the way in and degree to which may vary significantly. We thus suggest that governance and policy analysis is well advised to not only treat infrastructure instrumentally in its analysis, as setting or as tool, but conceive it as 'logistical power' (Mukerji 2010) for a deeper understanding of its role in development (policy).

We operationalised Mukerji's notion of 'logistical power' by looking at the uses and meanings for and in which water and its infrastructure are deployed. While water provision for industry and agriculture is part of a strongly market-oriented, 'neoliberal' economic drive, and investment in riverfronts are part of a view of cities as 'engines of growth', the construction of the state-wide drinking water pipeline grid represents the 'welfarist' and populist face of state governance. Water and water infrastructure are thus part of different governance strategies simultaneously.

Looking at governance strategies and regimes from Mukerji's 'logistics' perspective, allows, we suggest, a more fine-grained, concrete and 'development' oriented analysis of infrastructure's role than presently available in the rural water studies literature. Rural water studies literature with a focus on infrastructure includes, firstly, the type of analysis pioneered by Wittfogel's (1957) grand and sweeping linking of large scale irrigation with the despotic rule of 'hydraulic societies'. This has inspired less grand and sweeping, and much more convincing, (historical) analysis of water infrastructure and state formation and nation building (cf. Worster, 1985; Swyngedouw 2023). However, this literature generally does not enter into the detailed analysis of governance practices that we are interested in to understand the contestations that are part of state governance. Secondly, the rural water studies literature with a focus on infrastructure includes social studies of large technological systems (cf. the 2016 themed section referred in footnote 5). These tend to remain artefact/technology and innovation focused, also with limited attention to the details of governance practices. Mohamud and Verhoeven (2016) on irrigation development and state/nation building in Sudan is an example that comes closer the cultural political economy approach we have in mind. Given the 'infrastructural turn' in urban studies (Coutard and Rutherford, 2015; Graham and Marvin, 2022), approaches in this field may be of value for further research (see for instance Finewood, 2016), and not only for the urban part of the SSP water uses and meanings.

5.3 The performative dimension of water and its infrastructure

Our ***third general conclusion*** is that in analysing the role of water and water infrastructure in 'development' their performative dimension deserves more attention than it tends to get in water studies. In a critical realist perspective 'meanings are causes' (Sayer 1984). The meanings attached to water and water infrastructure are, thus, part of the causality that links these with 'development'. In the urban studies literature this performative dimension has been understood for example as the importance of 'spectacle' in building new (capital) cities, a spectacle in which water plays a key role (Koch 2015, 2018). The literature on riverfronts, including the Sabarmati riverfront can be read in similar fashion (cf. Luxion, 2017). However, we suggest such analysis can usefully be taken beyond iconic urban examples to the more mundane practices of agricultural and domestic water supply.

Looking at performativity, (critical) water studies also favours the iconic, for example in the analysis, and critique, of large dams as symbols and vehicles of modernity (cf. Kaika, 2006). Actor-Network Theory/Science and Technology Studies analyses, in contrast, often focus on the ethnography of the everyday, including mundane technologies like water meters, from a post-structuralist perspective (Anand, 2020; Von Schitzler, 2017).

Nash (2014), on water meters in South East England, has a helpful discussion of the (productive) tensions between Marxist and Foucauldian approaches to the politics of water metering. She argues that the approach of Jessop, a Marxist scholar of the capitalist state, to Foucault allows for a useful combination of governmentality and (historical materialist) political economy framings, to analyse different aspects of water metering (Jessop, 2011, cited by Nash, 2014:62). We would suggest that Jessop (and Sum's) elaboration of their 'cultural political economy' theoretical approach, allows for a more integrated approach to social power and rule/governance that does not need to alternate between these perspectives (Sum and Jessop, 2013).

5.4 Further research on the role of SSP water (infrastructure) in Gujarat's and India's development

We conclude by suggesting what would be, in our view, useful specific research directions on the role of the SSP in Gujarat's and India's development.

1) While the Sabarmati riverfront has attracted considerable analysis in its different dimensions, including the cultural/performative dimension, there is scope for broadening the analysis of the performative role of water (and riverfronts) in urban development, to deepen the theorisation of the relationship between state governance, urban planning and 'development'. Actually, existing governance and planning practices remain under-researched (cf. Priyadarshi, 2024 on urban renewal in Ahmedabad and Kanpur for a sense of direction), while the Indian government currently seeks to support riverfront development in 80-100 cities.
2) While some aspects of the pipeline grid for water supply have received academic attention, there is a dire need for more in-depth study of its differential impact and its governance and management. The, in a neoliberal setting, somewhat counterintuitive turn to state-led very large-scale water infrastructure building needs to be understood better, particularly as Gujarat's state-wide grid is something that other Indian States have taken as a model to be followed.
3) The least researched dimension of the SSP is the dynamics of its rural/agricultural impact through the supply of water for irrigation – while this was the main element and justification of its design. Studies of agrarian and rural change are less prominent in Gujarat than they are in some other Indian states, but enhancing our understanding of the massive intervention that the SSP is would seem to us highly practically relevant and greatly stimulating intellectually. How that impact varies in regional terms and along other axes, should, we suggest, based on the relational typology presented in section 4, be a main focus of such research. In a quantitative sense there would be use for economic analysis that looks at current cost-benefit profiles of SSP irrigation, say at the level of a branch canal as soon as post-2015 agricultural data would be available in the public domain. A related matter would be the hydrological interaction between canal water supply and groundwater recharge, which has changed as a result of the canal system being in operation now across large parts of the planned command area. This may fuel patterns of agrarian and rural change both within and outside the immediate designated command area, the form, scale and dynamics of which remain largely undocumented.

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