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DIFFERENT ASIAS, SAME PROBLEMS

Negotiating the State-User Interface in Surface Irrigation in China and India

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Abstract

This paper explores the dynamic interface of state-water users relationships in large scale surface irrigation in India and China, to inquire (with Wittfogel looking over our shoulder) to what extent the issues encountered in large scale irrigation management and governance are independent of regime characteristics. Though operating in very different overall political regimes, China and India exhibit strong similarities in the way a central state has attempted to relate with local water users (and enrol them into state led development), in the types of policy instruments deployed to shape that relationship, and in the problems encountered. Both China and India have a long history of state involvement in irrigation management. Both saw massive expansion after the late 1940s, with India adapting and adopting the models developed in the colonial period and China opting for a modified Stalinist model. There has been a historical tendency to extend state water control further down in response to 'underutilisation' of the created infrastructure, revenue shortfalls and perceived inefficiencies and yield gaps. In recent decades the policy approaches have, at least rhetorically, emphasised water users self-management and governance, including financial self-management/cost recovery. In both countries the instrument for this since the late 1970s/early 1980s has been the establishment of WUAs (Water Users Associations). Results have been mixed, to say the least, on all counts. Larger institutional and policy characteristics adhering to the problematic of the state-user interface subvert stated reform objectives.

1. Introduction

At the peak of the first Cold War, Karl Wittfogel, an anti-Communist Marxist historian, wrote an influential polemic entitled *Oriental Despotism* (1957), building on his previous work on China, which itself builds on observations of Max Weber and Karl Marx on Asiatic modes of production. *Oriental Despotism* links imperatives of traditional water control (including flood control and navigation canals as much or more than irrigation) to the social and political structures, notably to the domination of an agrarian "hydraulic" bureaucracy that impeded the development of civil society. Unfortunately, Wittfogel's obsession with "despotism" and "total power", his extension of his theory to non-hydraulic societies such as the Soviet Union while not accounting for colonial or, for the most

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part, post-colonial democratic India, and the civilizational threat he saw posed to the West by ascendant Stalinism, "theoretically contaminated" the topic of hydraulic societies, and perhaps even more, of hydraulic bureaucracies, "for many Western scholars" (Elvin et al., 1994, 7), especially water professionals and political scientists.[3] Hence we know less about the relationship between infrastructure and rule, and the role of bureaucracies in canal irrigation than we could have – at least in the domain of (policy related) water studies.[4]

Not surprisingly, Wittfogel's theory was not popular with Asian Marxists either. China under Mao adopted a linear logos of history placing the country in a universalist Marxist paradigm, with the significant modification of replacing "feudalism" with "semi-feudalism" to acknowledge the private ownership of land in traditional China. In India, the influential Marxist historian Kosambi in a review published in the leading journal *Economic Weekly*[5] found Wittfogel's terminology of hydraulic civilization, agromanagerial society and agrodespotic regimes "profoundly meaningless". (Kosambi, 1957). Indian Marxist scholarship rejected Marx's notion of an 'Asiatic mode of production' as an orientalist perception of western scholars, and thereby Wittfogel's 'oriental despotism' was automatically rejected too.[6]

Here, with the Cold War Wittfogel looking over our shoulder, we would like in turn to look behind him to the young scholar of the 1930s and before him, to Marx and Weber, to consider the relationship between large-scale water control and hydraulic bureaucracies (following Molle, Mollinga and Wester, 2009), with the very specific focus of state-operated surface irrigation districts. Even more, we would like to put doctrinaire explanations aside for the moment, and explore an interesting empirical puzzle that Marx, Weber and Wittfogel foreshadow: the intriguing parallels in the development of irrigation in the two otherwise very different Asian giants, China and India, over the course of the past 60-odd years. Related to the issue of hydraulic bureaucracies, we would like to explore the management of large surface irrigation districts, and in particular the institutional barriers that have impeded effective reform to that management in a way that would provide greater empowerment to the irrigators. While these hurdles are systemic in both PR China and India, the precise system features that constitute them are distinct. Behind these issues is the broader question of whether user-based management makes sense at all in large surface systems that serve numerous small farmers.

[3] There are notable exceptions, especially in archaeology and anthropology. Elvin's point is made in contrast to Japan, where the idea of a distinct Asian mode of production based on irrigation, especially for rice irrigation, remains attractive and has generated a great deal of continuing scholarship on historical water and society in China as well as Japan.. Another scholar squarely in the hydraulic bureaucracy tradition is Robert Wade's *Irrigation and Politics in South Korea* (1982a). For a critique that claims Wade overstates the role of the state in Korean agriculture, see Chang (1983).

[4] Times are beginning to change. See, for example, Mollinga (2005), Molle et al. (2009), Nickum (2010) and Suhardiman et al. (2014)

[5] Now *Economic and Political Weekly.*

[6] On Karl Wittfogel and the Asiatic mode of production debate and its connotations in debates on socialism/communism and revolutionary politics, see Vidal-Naquet (1964). On the critical reception of Wittfogel's 1957 book in 'non-western' parts of the world, see also Herman (1960).

This essay draws primarily on our respective decades of research and publication on state irrigation management in India (Mollinga) and China (Nickum, also Mollinga).

The paper is structured as follows. In section 2 we discuss how large-scale surface irrigation has been part of efforts at state-led, planned development in both China and India. In section 3 we present the 'performance problems' as encountered in surface irrigation, while in section 4 we compare the policy approaches that were used to address these problems. In section 5 we assess similarities and differences between the Chinese and Indian trajectories. Section 6 concludes.

2. Large-scale canal irrigation and state-led development

In this section we give an overview of state-led large-scale irrigation development in China and India over the period since 1950.

China

When the People's Republic of China was born in 1949, after roughly a century of turmoil, the country's major water systems were in a mess. The Yellow River, which had been diverted southward out of its elevated bed in the 1930s, had been put back in its bed only two years before. The damage that it had done to the Huai river system in its brief silty sojourn had to be repaired, with new outlets to the sea. Only one-sixth of the farmland was irrigated (although this was perhaps not particularly unusual historically). Although the water bureaucracy, centred on the Ministry of Water Resources, was placed in the hands of a former Nationalist general, Fu Zuoyi, who promoted a professional, bureaucratic approach along Soviet lines (Pietz, 2015, 157-158).

In the 1950s, China adopted a modified Stalinist planning system with its focus on extraction of resources from agriculture to support an urban-led industrial economic growth. Irrigation was a means to provide a surplus of grain that could be extracted from agriculture at suppressed procurement prices in order to allow the wages of urban workers to be held down and thereby extract rents that could be used for force-fed investment in heavy industry.. Under Chairman Mao, China carried the Stalinist model one step further, using collectivization of agriculture as a mechanism not only to procure grain but to mobilize labour for the construction of farmland capital works, notably irrigation and drainage (Oksenberg, 1969 for 1957-58; Nickum 1978 for the 1960s and early 1970s). Unlike the case in India, this reflected an anti-professional voluntarist bias even in the water sector. With the work point system providing a redistributionist incentive system, each year tens of millions of farmers were put to work moving earth and stones during the winter farm slack period with minimal mechanised support. (Nickum, 1978). Many large earthen dams were built during the Great Leap Forward of the late 1950s using labor-intensive methods. Yet despite all this activity, much of it wasted or worse, reported irrigated area only increased to 30% of total farmland by 1965. A further burst of winter collectivist activity followed with the Cultural Revolution of 1967-76, with up to 100 million farmers a year said to be out in the trenches.

The role of the hydraulic bureaucracy per se is unclear in all this activity. First of all, the formal state system has usually stopped at the county (xian) level. [7] Most state personnel have "iron rice bowls," with secure employment and incomes, and benefits. Below that are the "masses," typically organized (from the base up) at subvillage and village levels, who lack the security and usually the income of state sector employment. Lying between these two systems is the critical transitional level of the township, which is usually too low to staff on the state payroll but too high for direct contact with the base. One attempt to bridge this administrative gap was the people's commune system, which persisted until 1979, the apex of which was at the township level, and was declared to be both state and mass at that juncture. A later, externally-driven attempt to bring together state and local administrations in irrigation management, were the SIDDs (self-financed [or managed] irrigation and drainage districts) described subsequently.

The Communist Party system bridges the gap, with personnel and branches all the way down to the village level, and officials (cadres) who are judged according to a centralized set of performance criteria. In the era before 1979, one of the principal concerns of the Party was hydraulic management. In a sense, during that era, the Wittfogelian identification of water management with Asian authoritarianism was not entirely off the mark, but it was not primarily in the hands of the water bureaucracy. Certainly, the attacks on professionalism that accompanied the Great Leap Forward and the Cultural Revolution and the use of mass mobilization techniques may have "democratised" hydraulic engineering and placed it beyond the control of trained professionals. Here China's experience during the nation building period is in stark contrast with India. In retrospect, this was a period of quite voluntarist, nearly blind despotism.

At the same time, the Ministry of Water Resources did stay open during all the turmoil, unlike many other government agencies. Furthermore, while irrigated area did go up by roughly 50% during the turmoil of the Cultural Revolution, it did so nearly entirely outside the ambit of the water bureaucracy, with the spread of tubewell irrigation throughout the North China Plain, with an average command area of 7 ha each. Food grain production did not increase commensurately, however, due to increasing inefficiencies of collective agriculture and diminishing returns to traditional inputs.

Another limitation in generalizing from irrigation to authoritarianism is the geographical concentration of irrigation districts. In no province do large districts irrigate more than half the effectively irrigated area. They are most present in the northwestern provinces of Xinjiang (50%), Gansu (43%), and Inner Mongolia (29%). plus coastal Shandong (35%) and central Hubei (31%). In area covered, these five provinces contain more than half the large irrigation districts. They are virtually absent in southern rice-growing provinces and not common in the Hai River Basin, where the seat of power in Beijing is located and tubewells predominate (MWR 2013, 65, 67, 84).

[7] According to Wittfogel (1957: 4), this "lower limit of the bureaucratic pyramid" would be determined by the "law of diminishing administrative returns" and would in no way contravene his theory of "total power". It is this "absolute administrative frustration point" (Wittfogel 1957: 110) that would seem to bound his theory but is of the greatest interest to us here.

Still, irrigation districts are part of the extensive portfolio of the Ministry of Water Resources in Beijing, interprovincial river and lake basin commissions directly under the MWR, and local counterparts (at the provincial level, Water Resources Departments) of the MWR that are on local budgets. This system, which covers many domains aside from irrigation, including flood control and hydropower, constitutes a sizeable hydrobureaucracy, with 70,000 employees attached to the central ministry and over 930,000 in the 31 provincial water departments (MWR, 2014, 30, 49).

The general principle applying to projects and oversight of irrigation districts is that they are directly administered by the smallest encompassing level. Virtually all large-scale irrigation districts are operated under provincial affiliates of the MWR.

An on-going institutional concern of surface irrigation districts is that of inadequate "ancillary" delivery (*peitao*) works, especially at the "mass" level below the county, to convey water adequately and efficiently.[8] This concern extends back to the pre-reform period of the 1960s and 1970s, and has continued to the present day. A typical problem narrative (shared by the Chinese government and the World Bank) is as follows:

> Under the old command economy, irrigation-system management was dispersed among different levels of government administration, rather than concentrated in more efficient hydraulic units. Water was priced below cost, or not charged at all. As a result, each new irrigation system became another burden on government administration, which lacked funds for the operation and maintenance (O&M) of any of them. There were widespread 'gray water charges,' fees nominally collected for water but used for other purposes. Moreover, the water charges that the farmers actually did pay were calculated by land area irrigated rather than… volumetrically… (Lin, 2003).

Prototypical water user associations (WUAs) were set up in the mountainous areas of Hubei Province as early as the 1980s but were not fully participatory and met relatively sporadically. They were vigorously promoted as legal persons in the mid-1990s as part of the SIDD (self-managed irrigation and drainage district) approach introduced in the Yangtze River Water Resources Project of the World Bank (Nickum, 2005, 2010). The WUAs did improve service and reduce conflicts, so irrigators were more willing to pay, but prices remained too low, and were out of control of the irrigation bureaucracy. The pricing bureaux, which had the deciding voice on water prices, were more responsive to the goal of increasing the income of farmers, and water fees were seen as one of the burdens they should not bear (Lohmar et al. 2007: 284-285) WUAs encountered a number of additional problems in practice, both institutional (the existing village and township governments reluctant to change their modi operandi; no real space for collective action, especially across village

[8] Where efficiency is commonly defined in terms of the percent of water entering a canal that reaches the field through surface conveyance. This has been criticized as misleading, seeing seepage as a loss, even when it recharges groundwater for use by well operators or irrigators outside the designated command area. Hence total system efficiency may be much higher than that measured by canal efficiency, and efforts to improve the latter, notably through investing in impervious linings in conveyance systems, may not actually reduce water lost to the water use (cropping) system as a whole.

boundaries) and practical (need for counterpart state funding that was not forthcoming for ageing facilities and lack of adequate delivery structures) (Nickum, 2010: 547).

Recent policies have put water fees back on the agenda but note a continuing problem of investment funds at the state level going to construction to the neglect of operations and management, exacerbated by the adoption of a contract system for construction that removes the builder altogether from responsibility for maintenance. A major program of investment in ancillary works of large-scale irrigation districts began in 1998, directed at canals with a flow above 1 cu.m/sec. In the first 15 years, the Central government invested 45.8 billion yuan to 434 districts, while local governments contributed 31.2 billion yuan (MWR, 2014: 203). The total, about US $12.5 billion at current (October 2014) exchange rates, averages about US $2 million per district per annum, no small sum, but appears to be an instance of "deferred maintenance," where repeated investment continues to be called for because of the weaknesses of mechanisms to fund operation and maintenance. In addition, reform below that level was left to localities, where the problem of delivery is often the most intractable.

It should be noted that in terms of where the money is, irrigation is not the primary concern of the central hydrobureaucracy in China, at least as embodied in the MWR, and may never have been. Large-scale irrigation districts in 2012 only took 12.5 billion yuan out of a total construction budget of 257 billion yuan, well behind flood control (101 billion yuan), turnkey water source projects (49 billion yuan) and the provision of drinking water for rural people and livestock (43 billion yuan)(MWR, 2013, 144). Even in its Wittfogelian past, flood control (and canal transport) received more attention by the central government than irrigation.

Recently, focus has increasingly been placed on transfering water from irrigation to higher economic value uses in a reasonably efficient and equitable way. Hence there is considerable discussion, and some pilot projects, on exchangeable property rights to water vested in irrigation districts.

India

At Independence in 1947, India inherited a surface canal system, not as much from its deep history, but from the colonial British Raj. With it came a colonial hydrobureaucracy that like its counterparts elsewhere (e.g., the Japanese in Korea and Taiwan) was ruthlessly self-supporting financially, and relatively well-functioning (Shah, 2011). Under the Raj, 'productive' was seen in terms of revenue collection and agricultural growth for export, while with independence its referent migrated to agricultural growth for national development through green revolution farming. In a similar fashion, 'protective' went from protecting against famine and political instability to "protection" against rural underdevelopment, poverty, and inequity, promoting reversals in all these socioeconomic conditions.[9]

[9] Overt political (stability) considerations to build irrigations systems in the colonial period included providing a settlement project for the defeated Sikh army, and in the independent period the desire to have agriculture and settlement near the Pakistan border (as in the Indira Gandhi Canal and the Sardar Sarovar irrigation projects).

For the purposes of this paper Indian post-1950 canal irrigation history can be divided in the following phases. The three decades from 1950 to 1980 were ones in which the 'creation of new irrigation potential', that is, the building of dams and canal systems, was predominant. While pre-Plan (around 1950) major and medium irrigation utilisation amounted to 9.7 million ha, by 1984-85 it had grown to 25.3 million ha, and in 1993-94 to 29.3 million ha (Vaidyanathan, 1999: 60, Table 2). At the end of the XIth Plan Period (2007-2012) it was reported to stand at 35.0 million ha (Planning Commission, 2013:183, Annexure 5.5).[10] Canal irrigation was one of the cornerstones of India's planned development approach. In terms of the way irrigation systems are designed and the way the hydraulic bureaucracy is organized post-independence, there is a lot of continuity with the colonial period.[11] India's independent irrigation engineers were, literally, nation builders and were held in high esteem. A clear example of this is Sri. M. Visvesvaraya, a Bombay Presidency engineer whose very long career spans the period from the late 19th century till well after independence (Visvesvaraya, 1951). He was also *Dewan* of the Mysore Princely State. In the 1930s he published a book on planned development (Visvesvaraya, 1934).

There are discontinuities as well. A major one, at least for this analysis, is financial. While colonial irrigation paid for itself and more in colonial times (it was meant to be and functioned as a revenue generator for the colonial government), after independence irrigation fees were reduced, and collection was much less systematic. The XIIth Plan document summarises the situation as follows: "In many States, ISF [Irrigation Service Fee] to be collected from irrigators has been abolished; where it is not, actual collection of ISF is 2–8 per cent of dues." (Planning Commission, 2013:151)[12] Canal irrigation became a subsidized sector in the government budget. The rationale to invest in irrigation was a combination of cheap food policy (agriculture fuelling industrialisation), rural development objectives, and the political logic of a constituency based democratic electoral system in a mostly agrarian society – securing the rural vote.

Another discontinuity was the coming into being of what Robert Wade has seminally described as 'the system of administrative and political corruption' (Wade, 1982b). The Public Works Department, including the Irrigation Department, became an important source of funding for the electoral process, involving a 'market for public office' (Wade, 1985) financed with (among other sources) money from civil engineering works and bribes paid by farmers to irrigation managers for securing

[10] Irrigated areas at state and district levels, by groundwater and by surface water, can be found at http://www.fao.org/nr/water/aquastat/irrigationmap/ind/index.stm. This data, prepared by FAO Aquastat and Bonn University refers to the early 2000s. There is considerable discrepancy in figures on irrigated areas, reflecting in part a disparity in the registered command area, which could in principle be irrigated by existing projects, and that actually receiving water. The Aquastat/Bonn source has 58.13 million ha as actually irrigated for all India; the already mentioned XIIth Plan document has a total potential utilised of 81.00 million ha at the end of the IXth Plan (1997-2002) (Planning Commission, 2013: Annexure 5.5, p.183) – almost the same year as the reference base for the Aquastat/Bonn figures. A similar but less marked disparity can be found in Chinese irrigation statistics (Nickum, 2003).

[11] The 1972 *Irrigation Commission* report (GOI/MOIP, 1972) is a good illustration of this continuity.

[12] In the Planning Commission's XIIth Plan document it is also mentioned that major irrigation systems have had cost overruns of on average 1382%. "28 out of the 151 major projects analysed witnessed cost overruns of over 1,000 per cent." (Planning Commission, 2013:147)

access to water. The proliferation of this system is likely to be one of the reasons of the much lower public esteem that civil/irrigation engineers enjoy at present.[13]

The 1970s saw the articulation of the 'performance problems' of canal irrigation in public discourse. Canal irrigation was not fulfilling expectations in terms of areas irrigated ('underutilisation') and the 'yield gap', as well as exhibiting poor revenue collection.[14] This translated in government policy in the form of the Command Area Development (CAD) programme, which focused on On-Farm Development (the construction of minors and field channels to bring water to the plots of individual farmers) and on enhancing 'farmer participation' in the form of establishing Water Users Associations (WUAs) at local level. Though the CAD programme in its original formulation had ambitious aims to make irrigation contribute to rural development, and for its integrated management and governance through Command Area Development Authorities (CADAs), policy implementation factually concentrated on the local level 'below the outlet', leaving the domain of Irrigation Department control and activity untouched. This approach characterised the second period, of the 1980s and 1990s, with WUA establishment as the major institutional innovation attempted (see further below).

In the second half of the 1990s the (purportedly successful) Mexican irrigation reform exercise became the reference point for a more ambitious irrigation reform approach, involving 'farmer participation' at all irrigation system levels. Andhra Pradesh under Chief Minister Chandrababu Naidu inaugurated the third period of irrigation reform (usually referred to as PIM, Participatory Irrigation Management) with its APFMIS (Andhra Pradesh Farmer Management of Irrigation Systems) Act. This Act was subsequently adopted by a number of Indian States in almost unchanged form.

An important contextual factor in Indian irrigation reform is that, like in China, agriculture has become much less important for the national political economy post-1990. Under liberalisation policy focus has shifted to urban, industrial and other 'modern' concerns. This stands in sharp contrast with the 1970 and 1980s when the so called 'new farmers movements ' were a significant factor in Indian national and state politics (Byres, 1988; Brass, 1995) These movements were dominated by, and the vehicle for, the class of larger farmers that had become dominant in rural areas on the wave of green revolution agriculture. Mostly commercial irrigated farmers, the movements focused on price, tax, fee, and subsidy issues. Though still important in the electoral process as the controllers of rural 'vote banks', the political clout of the farming community has significantly reduced in the past two decades, partly also because many larger farmers expanded their activities into the 'modern sector'. However, the class differentiation of large, middle and small farmers remains a significant factor in irrigated areas, as elsewhere, with strong implications for irrigation management.

[13] Another likely reason is the rise of other professions as 'cutting edge', notably, from the onset of liberalisation in the mid-1990s, business/management and IT. Yet another may be the critique of large dams from the 1990s.

[14] An early, articulation in a government report was GOI/PC/Programme Evaluation Organisation (1965). The 1982 report of Andhra Pradesh's *Irrigation Utilisation Committee* is one of the most in-depth and insightful government reports on canal irrigation performance. (GOAP, 1982), Robert Chambers has produced the most comprehensive policy-oriented scholarly account (Chambers, 1988; also see Wade and Chambers, 1980).

Though the importance and clout of (irrigated) agriculture in national and state policy and politics has significantly declined in the past two decades of liberalisation, the (promise of the) construction of irrigation systems remains an attractive political instrument for governments and politicians. Examples of this are the huge budget allocations for irrigation in the state budget of the newly created state of Telengana (KCR promises, 2014), and at the national level, the pushing of the 'interlinking of rivers' plan (Mohan, 2014).

After these general sketches of state led canal irrigation development in China and India, we can now move on to discuss large-scale irrigation's performance problems in some more detail.

3. 'Performance problems ' in canal irrigation

The post-1950 expansion of large scale irrigation infrastructure can be seen, in both China and India, as an effort to enrol rural citizens in a project of nation building and national development. It was projected as a key factor in achieving of food security and growth, a national interest overriding regional, local and individual interests.

In India, this enrolment through dam and canal building stands as heavily criticised and opposed. Firstly, it tends to involve large-scale displacement of people living in reservoir submergence areas while resettlement and rehabilitation programmes remain poorly implemented. Secondly, it tends to lead to significant environmental damage through forest submergence and changes in river hydrology (Dhawan, 1990; Singh, 1997; Baviskar, 1999).[15] Project planners "saw a temporary trauma of displacement as a necessary sacrifice for the greater common good." (Aandahl 2010:201; referring to the planners of the Sardar Sarovar project) "The goal of planners is the 'assimilation of PAFs [Project Affected Families] into the mainstream of the Society (SSNNL 2000).'" (Aandahl 2010:201) While the 'will to improve' of the planners is genuine, the views of development of proponents and opponents of dam building could hardly be further apart.

The large-scale displacement of people due to dam and canal building is widely recognized in China as well, most famously in the case of the Three Gorges Dam, where well over a million people have been resettled.[16] The cost of providing for these "reservoir migrants" (*shuiku yimin*) was one of the biggest expenditures in the dam project, and a division was set up within the Ministry of Water Resources specifically to address displaced people. Nonetheless, numerous reports have indicated that from the viewpoint of at least many of these "migrants" these state-directed arrangements were seriously inadequate, financially and in many other regards. [17]

[15] Singh (1997:187-193) estimates the number of people in India displaced by dams as anywhere between 33 and 50 million.

[16] It should be noted that the Three Gorges Dam was constructed primarily for flood control and power generation, not irrigation, and to facilitate indirectly the construction of the middle route of the South-North transfer project, which itself has displaced 300,000 people.

[17] An interesting perspective on displacement was provided by Shi et al (2001:2) who estimated that a total of 45 million people were displaced by projects in China between 1950 and 1999. In the first two decades, most of them were displaced by reservoirs (7.8 out of 14 million), but since then more were displaced by

In surface irrigation systems that have been constructed and that are in operation, enrolment problems manifest in different ways. We focus on canal irrigation's disappointing agricultural performance, the unequal distribution of water, and revenue collection problems. At a significant level, while there are differences, there appear to be common features and evolutions of these systems in the two countries that are independent of differences in political and administrative systems.

Canal irrigation agricultural performance

For China, food security, especially in grains, was a policy priority central to the national project, especially after the breakdown in interprovincial trade that followed the collapse of the Great Leap Forward, that continued to drive irrigation and fuel the hydrobureaucracy. At the same time, it did not necessarily drive output, in the face of the disincentive effects of collective agriculture, the low procurement prices for mandatory deliveries of grain, lack of crop diversification, and limited use of manufactured inputs, notably chemical fertilizer. With decollectivization in 1980, the concomitant widespread introduction of agrochemicals, a resurge in investment in agriculture, grain output has increased (although the proportion devoted to fodder has increased with shifts in diet), and with the trade liberalization accompanying China's entrance to the WTO and securing of food supplies abroad, food security has receded as a critical priority.[18] At the same time, as in India, the development of canal irrigation has at the very least lagged behind that of tubewell irrigation. Focus in China has been at least as much on increasing productivity of water use in surface systems as on increasing production, given the rising demands of other sectors of the economy and a growing recognition of the importance of environmental uses. "Water-saving irrigated area" (*jieshui guan'gai mianji*) has become a key reporting indicator in recent years, and has risen significantly, both in absolute terms (by 39% between 2006 and 2012) and relative to effectively irrigated (command) area (from 39% to 50% over the same period) (MWR 2013: 65). This category is divided into the specific technologies adopted: canal lining, sprinkler, micro-irrigation, low-pressure pipes, and "other". There is anecdotal evidence that often the equipment, supplied with government support, is not actually used effectively, and canal lining has not significantly increased the canal water use efficiency rate (itself a controversial measure) despite the considerable investment devoted to it.

National food security was an important policy concern in the first decades after India's independence.[19] The use by the US government of American food aid under PL 480 for political

transportation and particularly urbanization than by reservoir construction (6, 20.7 and 4.4 million respectively).

[18] Lester Brown's (1995) dramatic question a generation ago of "Who Will Feed China?" became one of Who Will China Feed? (Lohman and Gale, 2008)

[19] Per capita annual average food production in India had been declining from 254 kilo in the 1906-07 to 1915-16 decade, to 181 kilo in the 1936-37 to 1945-46 decade. (Bhatia, 1991:315; cited in Mooij, 1998: 79). The falling away of rice imports from Burma during the second world war, and the speculation and hoarding that triggered the Bengal Famine (which informed Amartya Sen's entitlements theory), triggered the first food distribution policy formulation in India in 1940-43.With *Grow More Food* campaigns not successful, "the situation became only more difficult after Independence and partition. Independent India got 82% of the total population of the subcontinent, 75% of the cereal production, and 69% of the irrigated area (Chopra, 1988:61)." Mooij, 1998:81) The early 1950s, however, saw growing production and declining imports, and

leverage in the late 1960s after two extreme drought years (1965-66 and 1966-67), shifted development policy priority to enhancing green revolution agricultural expansion and intensification, with canal irrigation as an important component (Srinivasan, 1989). The Agricultural Prices Commission started advising minimum support prices with an eye to enhancing production – consumer oriented price policy became producer oriented price policy, paralleling a similar shift in China's agricultural price policy in the 1980s. Whether subsequent production increases are mainly due to price controls, area expansion or yield increases is much discussed, but by the late 1980s India was exporting food grains. Crop yields in India have, however, lagged behind and are low when compared globally.[20] Though multiple factors explain this 'yield gap', poor irrigation service delivery is certainly one of them.

Revenue collection problems, aging systems, and skewed distribution

In China, in the past, despite admonitions to "use water to nourish water," the hydraulic bureaucracy was not really set up to collect water fees. Such fees were included with procurement taxes and collected by revenue departments. Only a small percentage of collected fees were retained at the lower levels, even when recycled into water, leaving low level state water officials strapped for funds and heavily reliant on contract or collective labour. Conditions became particularly critical when, after several years of budget cuts, the Ministry of Water Resources in 1985 directed that irrigation districts move towards self-funding through the collection of water fees. District staff were moved off the state payroll, often putting them in a precarious position, as it was no simple matter to collect water charges. Where they could, district managements turned to other activities, "economic sidelines," to try to make ends meet, but most units were not blessed with suitable conditions (Nickum, 2010: 541; Calow et al., 2010: 44; Turner and Nickum, 1995).

Since 2000, the Chinese government has sought to raise rural incomes in order to reduce the widening gap between them and urban incomes. Various agricultural taxes have been abolished, and collaterally, "[t]he political imperative to protect farmers' interests… has made it difficult to … achieve full irrigation cost recovery." (Calow et al., 2010: 43) At the same time,

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'hands off' food policy. After 1955 production declined and by 1957 the Indian government reintroduced controls, establishing a public distribution system (PDS) which distributed cheap food to the poor – mainly American imported wheat under the PL 480 food aid programme. In 1966 India imported 10 million tons of food grains, 14% of total food availability. Imports kept food relatively cheap for urban consumers, underpinning the post-independence development policy focus on industrialisation (Mooij, 1998; also see Byres and Crow, 1983),

[20] While 1993-2013 average rice (paddy) yield levels and yield increases in India (2.8 to 3.6 ton/ha) were similar to that in Thailand (2.2 to 3.1) and Laos (2.3 to 3.8), yields were significantly lower than in Indonesia (4.4 to 5.2), Vietnam (2.3 to 4.4) and PR China (5.8 to 6.7). For wheat, some figures are: India 2.3 to 3.2;Pakistan 1.9 to 2.8; Mexico 4.1 to 5.3; PR China 3.5 to 5.1 (All data from http://faostat3.fao.org) While India ranked third in area and total production of cotton in 1997-2006, it ranked 70th in yield. (Gruère et al., 2008: table 4). The rice (paddy), wheat and cotton areas are, of course, only partly canal irrigated. For further discussion of rice yield gaps, see FAO (2000).

> …investment priorities have shifted from new projects to the renovation and maintenance of existing surface water systems, with much more emphasis on local management, farmer participation, financing arrangements and water conservation. (Calow et al., 2010: 43).

In India, canal irrigation has undoubtedly contributed to agricultural growth and food security in the past six decades. However, it has not been successful in enrolment of farmer-irrigator citizens in the project of national development in at least three ways.

1) Governments are struggling to maintain the production capacity of large-scale canal irrigation. Irrigated areas are declining[21], little is invested in maintenance, the existing incentive and support structure for agricultural production does not seem very favourable to the closing of 'yield gaps', and groundwater irrigation has overtaken canal irrigation.
2) Rather than large sections of the rural population benefiting from canal irrigation the skewed distribution of water implies that only a small section has access to direct irrigation benefits, and some are victims of irrigation development.
3) With insignificant recovery of costs from users, as noted above, canal irrigation is a drain on the national budget.[22]

The institutional strategy of enrolment has been the establishment of Water Users Associations, which is the subject of the next section.

4. Enhancing the 'participation of users'- WUAs as a policy instrument

In addition to physical rehabilitation of canal systems, the governments of China and India have attempted to establish a more effective relationship between government managers and farmer-irrigator users through 'farmer participation' programmes, focusing on the establishment of WUAs. In both countries experimentation has played a significant role, though in different ways.

For the Chinese irrigation districts that had to find funding from end users after losing state core funding in 1985, there was a problem of who to collect from, as the rural collective economy had also evaporated in the early 1980s. Collecting from individual farmers was clearly infeasible under the conditions then present, so pressure mounted to form water users' associations who could be responsible management at the tertiary levels, and for ensuring payment. . As described previously, WUAs were set up two decades ago in connection with a World Bank Yangtze River project, and the organizational form, sometimes apparently quite formalistically, has been expanded into other parts of China. The pace of that expansion has been steady but relatively slow, with 50,000 WUAs established covering about one-third of total irrigated area by 2008 (World Bank, 2011). Performance has been mixed, in part due to the tension between the existing institutional framework and the principles for success that were set out by World Bank project managers. These included legal status, with elected leaderships, organization along hydraulic rather than

[21] According to Shah et al. (2016), quoting a Reserve Bank of India source (Balakrishnan et al, 2008).
[22] More than 'unwillingness to pay' of farmers this perhaps reflects an ''unwillingness to be paid', that is collect, on the side of the government (see Doraiswamy et al. 2009).

administrative boundaries, volumetric delivery and financial transparency (equitable levies from members, and payment for water delivered). Wang et al. (2010) found that Bank-supported WUAs were most likely to have legal status and farmer participation, as well as transparent financing. They were also the most likely to be organized on hydraulic lines rather than village boundaries. WUAs that were nearby but not directly supported by a Bank project were a bit less likely to meet these criteria, but performed similarly in terms of improved water efficiency. WUAs in their sample that were set up entirely independently were unlikely to have obtained legal status, have farmer participation, or be based on non-administrative boundaries.

Fewer than half of WUAs in China were registered as "legal entities" allowing them to operate independently from their local village administrations (World Bank, 2011). They have not been able to transcend the system concentrating power in village administrators and their counterparts at higher levels. Thus there are glimmerings of a new model of state-user interface, possibly propelled by wider trends such as economic diversification and mass migration to the cities, trends that are also very much ongoing in India. But, as yet, they are only glimmerings.

In India, the 1980s were a period of 'pilot projects' to establish WUAs, financially supported by the Ford Foundation and Union government, and implemented by NGOs. This effort was inspired by the Philippine irrigation reform experience, then seen as a successful model (Sengupta, 1991; Singh 1991). Maharashtra state experimented a lot with local WUA organisation (Lele and Patil, 1994), as did Gujarat and Andhra Pradesh (Sivamohan and Scott, 1994). The 1990s saw a slow move from pilots to wider policy coverage and implementation, an experience reported in Brewer et al. (1999), Joshi and Hooja (2000) and Narayanamoorthy and Deshpande (2005). However, the coverage of active WUAs established in this way has remained very patchy, with Maharashtra and Gujarat states having probably the best record, yet with only several hundred active WUAs , well below potential. This approach of beginning with pilots and expanding coverage, sometimes spottily, is a feature of Chinese administration as well (Heilmann, 2008).

The irrigation reform of the late 1990s, started in Andhra Pradesh, as discussed above, began to address multiple levels of the irrigation administrative hierarchy as well as the local level of groups of irrigators. Such reforms projected the Irrigation Department in a facilitating role for farmer management at three levels: WUAs, Distributary (secondary canal) Committees, and a Project Committee for each large-scale irrigation system. While in Andhra Pradesh, the WUA and DC levels of committees were quickly formed, there was a "deliberate attempt by government not to create the project level or water resources allocation organization (called the Project Committee in the Act)" (Sivamohan and Scott, 2005: 400), as the government "fear[ed] that the project committee will be all too powerful, and may be difficult for the administration to handle" (ibid.: 402). Ironically, this may have been a reaction to the demonstrated capacity shown by initiatives of self-federation of farmers at the project level. The unwillingness to seriously consider devolution, or even sharing, of decision making power over financial and water resources, that is, control over works and water, remains the fundamental stumbling block to irrigation reform. Madhav (2007:18) summarises that "the reality of the Andhra Pradesh reforms is characterized by ill informed, unmotivated water users associations, an elite capture of power of the newly formed decentralized units, a bureaucracy that is opposed to change and an overall top down approach to changes that are being effected."

Though big successes have been claimed for these more encompassing reforms, the performance of canal irrigation does not reflect any success, whether measured in terms of the declining irrigated area (Shah, 2011), apparently stagnating yields, or insignificant improvements in revenue collection. Whether recent initiatives to establish Regulatory Authorities for the water sector in Maharashtra, Andhra Pradesh and Uttar Pradesh, will inaugurate a new era of irrigation reform remains to be seen. Shah et al. (2016) argue that since 2000 the Gujarat and Madhya Pradesh governments, as an exception to the general trend of declining areas, have had extraordinary success in expanding irrigated area and enhancing agricultural growth, while inceasing the irrigation service fee collection in the case of Madhya Pradesh. They have done this through a change in governance strategy, including targeted building and improvements of water and energy infrastructure. The chief ministers of these states are said to pursue "agricultural growth through irrigation development as a political strategy for capturing agrarian vote banks rather than rent seeking." (Shah et al., 2016: 20) In MP "after sacking a corrupt irrigation secretary, the chief minister brought a dynamic, upright and pushy officer (…) to run the irrigation department with the promise of a stable tenure and total support in stamping put political interference in running canals." (Shah et al., 2016: 21)

Whether this top-down approach of 'legitimacy by delivery' can be sustained remains to be seen. As Shah et al. note, it has yet to be consolidated institutionally. Still less do we know what a "depoliticization" empowering the hydraulic bureaucracy means exactly at the field level.

Though it is clear that the irrigation reform exercises of the past decades have achieved very little in India concretely, a more difficult to answer question is whether the unimpressive impact of these reform attempts still constitutes a slow process of structural transformation of irrigation management and governance. We would suggest that in some cases that seems to be so, but that the real impetus for change, such as it is, would appear to stem from economic, demographic, and even hydrological factors that lie outside, and beyond tinkering and fine-tuning within the irrigation sector.

5. Conclusions

In a recent review of the concept of water governance, and problems in its application in practice, Lautze et al. (2014: 33) point to an apparent paradox:

> In India, governance processes could be considered relatively open and governance structures relatively inclusive. In China, governance processes are relatively closed according to conventional international metrics, as decisions tend to be made in a top-down fashion that may lack transparency and extensive stakeholder consultation. Applying international standards of good governance, therefore, might suggest that the processes are better in India than in China. However, if one were to examine the efficiency and effectiveness of China's on-the-ground water resources outcomes according to conventional indicators (e.g., water

productivity), that would appear equal to or better than those of India. In short, despite its comparatively better governance practices, India generally appears to have worse outcomes.

Perhaps it is time to reconsider "governance". In some respects the post-1950 history of large-scale surface canal irrigation in China and India might be described with the subtitle of James Scott's influential book *Seeing like a State*: how certain schemes to improve the human condition have failed.[23] For some critics of canal irrigation (those on the left side of the political spectrum) canal irrigation exhibits the fallacies of 'high modernism' as the hubris of the post-colonial development project, requiring an alternative 'post-development' paradigm. For others (those towards the right side of the political spectrum) problematic irrigation management and governance signifies 'state failure' and the need to introduce market logics as the way forward. Neither of these two proposals for alternative arrangements carries much realism. Global capitalism is certainly crisis-prone, but both China and India seem to be firmly on a trajectory of capitalist accumulation with intensifying market relations. Alternative development paradigms that seek to replace this are unlikely to move beyond informing oppositional forces for (re)shaping the capitalist trajectory, in distributive, democratic, ecological or other terms. Notwithstanding this context, introducing market(-like) relations in large-scale surface irrigation water resources management has met with very little success, and is arguably unfeasible. The reasons for this have been well documented (though routinely ignored by market advocates), and have partly to do with the regulatory challenges that the bulkiness of water and the spatial extent and complexity of large-scale surface canal infrastructure pose (Moore, 1989; Molle and Berkoff, 2007).

An alternative perspective has been provided by Shah (2011). He proposes to accept that India's large-scale surface irrigation no longer fits our times, as visible in its declining coverage and its supersession by groundwater irrigation. Recasting canal distribution systems as groundwater recharge systems, leaving extraction to individual well owners, is the proposed way forward.[24] This could be read as a proposal to abolish the state-user interface in canal irrigation: the state bureaucracy 'drops' the canal water into the groundwater reservoir while farmers pump it out – no direct interaction is then required. There may well be areas where this is a technically feasible and sustainable approach, notably areas where groundwater availability is such that there are no constraints on pumping for agricultural use. Much of the water of the massive North-South Water Transfer projects currently coming on line in China is intended to go to recharging the stressed groundwater aquifers of the North China Plain. For India Shah's proposal may be feasible for parts of the Indo-Gangetic plain, and in some delta areas. In other areas socio-spatial distributional issues may present themselves when groundwater extraction approaches or surpasses recharge. In such cases a regulatory requirement of rationing presents itself once more, and with a vengeance

[23] In the *Introduction* of his book, Scott mentions that a case study of the Tennessee Valley Authority in the USA, the image of which inspired much large scale water resources development and organisation in Asia, was included in an earlier draft but not included in the published version (p.6).

[24] A variant of this proposal is where the irrigation bureaucracy runs the canals and private 'irrigation service providers' pump water from the canal, local surface storage filled up by the canal supply, or from the groundwater reservoir, and pipe or channelize this to individual users (Talati and Shah, 2009) . China has also experimented with privatization or contracting to private parties of both groundwater systems and of the management of laterals (Lohmar et al., 2007).

perhaps - so far, the regulation of the over-extraction of groundwater has remained elusive in both China and India.[25] In other areas (notably the 'black cotton' vertisol areas of interior South India) large scale pumping for 'conjunctive use' is not an option for hydrogeological reasons. These systems will have (limited and erratic) rainfall, (mostly) canal water and (limited) lifting from river and streams as their water sources, not groundwater.

The technical logic of Shah's 'surface canals for groundwater recharge' proposal is that decentralised forms of water management would greatly benefit from 'technical decentralisation' in the form of intermediate storage, either surface or subsurface. Such storages create buffers in the water infrastructure system, which enhances flexibility in distribution management.[26] One of the failures of efforts at institutional decentralisation is in our view indeed that there has been no attention given to the accompanying technical decentralisation that would be required.[27]

It would seem to us, however, that no matter how the transition from bulk water supply to localised use is institutionally and technically given shape, the problematic of the state-user interface cannot be circumvented, even when it can be given (very) different forms. As we have shown above, this interface carries much broader meaning and significance than the practical problem of water distribution. Therefore, as long as water runs through China's and India's surface canal systems, the issue of canal irrigation reform will present itself as a 'wicked problem'.

We have argued that notwithstanding overall very different political regimes the problems in China's and India's surface canal irrigation, and the approaches to address them so far, are and have been very similar. To conclude, we want to suggest that the avenues for more successfully addressing the 'wicked problem' of canal irrigation reform are contextual and regime dependent, between the two countries, as well as within them. This is so exactly because the state-water user interface in canal irrigation is a particular, and to some extent specific, instance of the state-citizen interface characterising the federal and state/province level political regimes in general.

There are in our view at least two structural reasons why canal irrigation reform leading to more efficient, equitable and productive, and perhaps sustainable, water use has better prospects in China than in India, at least in the short and medium term. The first is that in China, there is some form of

[25] In addition, groundwater irrigation, like canal irrigation, may induce soil salinisation/alkalinisation when no proper drainage is in place. Canal irrigation water brings not only water but also minerals into the soil-water-plant system, and groundwater extraction not only brings water to the surface but also dissolved minerals. Privatisation/marketisation approaches to drainage are even less practically imaginable than to irrigation distribution.

[26] The 'tank cascades' of Tamil Nadu in India are an example of the existence of surface intermediate storages. In India's modern irrigation systems these were sometimes considered in the design stage but not built for cost reasons (for an example see Mollinga, 2003). Such 'balancing reservoirs' may become more economically feasible through their potential function as micro-hydroelectric stations. Another example of 'design for decentralisation' is the 'melons on a vine' design of local irrigation units (Nickum, 1977). This reduces the extent of queuing in irrigation distribution (by creating independent short queues instead of one integrated, long and levelled queue).

[27] In India, the standard phrase to describe degraded irrigation infrastructure rehabilitation, as part of reform exercises or otherwise, is 'to bring the system back to design state'. When systems are originally designed for centralised (government) control, this is not an approach that fits an institutional decentralisation programme.

financial incentive and feedback structure in place that is lacking in India. Builders rule in China, perhaps more than in India, a fact that was brought home in September 2014 by the agreement for China to invest US $20 billion in India's infrastructure over the next five years. This has certainly been the case in the water and irrigation sectors as well. Yet there has also been a standing concern with relying on users to build and maintain command area projects, and on finding ways of cost recovery. Recently in both countries, cities and industries such as mining have placed pressure on the "inefficient" and "uneconomic" traditional uses in irrigation agriculture. Efforts in China to create transferable property rights across uses may make canal reform more responsive to shifts in the larger economy, and facilitate the rapidly developing mining sector in the arid west, but may quite possibly exacerbate power and economic inequalities in the rural sector. In India, water is currently effectively being moved out of agriculture in locations with strong urban and industrial demand, regularly associated with considerable conflict (Joy et al., 2008; Mohan and Routray, 2015), while the emphasis in national policy discourse has shifted to urban and industrial concerns, as is clearly visible in the recent XIIth Five Year Plan document (PC/GOI, 2013). These reallocation processes and the associated conflicts happen, for now, through administrative, political and (il)legal routes, and not through the creation of transferable property rights in water.

The second structural reason is that in India it is not only the state-water user interface that is structurally embedded in the wider cultural political economy, but also the social differentiation of irrigators. The head end/tail end farmer division that summarises the unequal distribution of irrigation water, is a class division. It can intersect with other divisions, notably with caste, and with regional origin in the case of migrant farmers having settled in newly built canal systems (see Mollinga, 2003). China does not have a caste system, historically had widespread private ownership of land and a Confucian ideology of education-based social mobility, and even after decollectivization in other realms, has relatively equal land holdings. Its irrigation development also relied much more on village level participation, including the annual mobilization of obligatory labour that persists even after decades of reform. Where there is social differentiation is in the development of large irrigation districts to facilitate Han migration into previously minority borderlands (a process that continues to this date).

To conclude, we have explored whether there are imperatives of large-scale surface irrigation that lead to similar outcomes, and in particular dysfunctions, in countries that have quite different political and social systems. We have found some uncanny parallels, not only in the irrigation districts themselves, but also in the way the irrigation systems as a whole in China and India have evolved over the past 65 years. Some of this is because both countries adopted autarkic nation building policies in the 1950s and 1960s, and have moved towards openness to the world economy, and towards diversification of rural economies in recent times. Also, the rise of tube wells as an alternative, or at least another source of irrigation, despite its own pathologies, is similar in the two countries. Does all of this add up to some sort of hydrological determinism? Does the ghost of Wittfogel walk the canals of Asia? Our preliminary answer to this question would run something like the following. Where China and India were similar, notwithstanding strong differences in overall political regime, is that its governments conceived of large-scale irrigation as a technology of rule for planned development. It was meant to serve goals of economic growth and development, and had

strong political and symbolic functions as part of nation building and state legitimacy production – it was an artefact with simultaneous cultural, political and economic meaning. But it was a creature of the modern nation-state, not a creator of it. Yes, there has been a rigid hydraulic bureaucracy to some extent in both countries, but it did not rule the state. Megaprojects such as the South-North Transfer and link canals excite hydraulic state builders, but not the users. They can diminish legitimacy as much as they endow it.

The understanding of large-scale irrigation as a universal, scientific technological device, (high) modernity in concrete, was exactly the reason why context was thought *not* to matter.[28] Then, from the 1960s, the context started talking back, so to speak. The dream of the 'hydraulic mission' was gradually punctured by complications on the ground – the performance problems discussed above.

By the 1990s the planned development perspective had given way to (neo-)liberalisation, envisaging, at least ideologically, a different role for the state. The large scale canal irrigation infrastructures can be seen as artefacts that belong to a period that no longer exists as times have changed. Individual tubewell irrigation symbolises, and practically embodies, the new individualistic, private accumulation driven times. However, canal infrastructures are not like iPhones – a new model every year. Their longevity is to be measured in decades, and technically redesigning them is a challenge. Canal irrigation infrastructures are thus a (strong) example of how the past is structurally part of the present, and development and change always involve the tedious reshaping of inherited technical and institutional forms. The reshaping efforts of the past few decades through 'irrigation reform' have been quite unsuccessful in both China and India in the sense of finding 'working models' of large scale canal infrastructure that do fit present times. The hydro-bureaucracies have been unwilling to recast their organisational structures based on central (command and) control and their professional disposition of a technical focus. International development agencies have done little to change this.[29] Rethinking technical design concepts has not been on the agenda at all.[30] Incentive structures in general, and vested interests in particular, militate against structural changes. To fit large-scale irrigation into our times in a more productive manner is a process of 'embedding an artefact in society'[31], and does logically depend on context. These contexts are different in China and India - as regards governance structure, as well as regards the interests and forms of organisation of irrigators. It is here that Wittfogel's rulers' perspective has to be abandoned for context specific strategic analysis to have a chance of more productive trajectories of adaptation of large-scale canal irrigation than seen in China and India so far.

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[28] It is in this sense that Wittfogel can be said to adopt a rulers' perspective.
[29] On this point, see Suhardiman and Mollinga (2012) for a discussion of Indonesian irrigation reform.
[30] If anything there have been dreams of automated irrigation, as advocated by the French irrigation engineering community. The Paranjape and Joy (1995) proposal is an example of qualitative rethinking of canal irrigation design concepts, but it has not managed to spark government or social movement imagination.
[31] See the Science and Technology Studies literature on this 'embedding', f.i. Bijker and Law (1992)

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