

Decline of traditional water harvesting systems during British India:  
Exploring the issues of ‘knowledge incompatibility’, ‘breaking down of  
commons’ and ‘free ridership’

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Abstract

Recent scholarship on governance of commons is built around the concerns for free ridership. However, recognition of exclusive private property rights is a prerequisite for the problem of free ridership to arise. Conceptually, the idea of free ridership is inseparably linked with the kind of institutional structures within which a community has to manage its commons. This paper examines the significance of this linkage by comparing the pre-British system of governance of water harvesting systems with the British system during the colonial rule in India. It differentiates the two systems on the basis of their underlying knowledge systems, namely, the modern science that informed the British system of governance and the local knowledge that ran through the traditional rainwater harvesting systems in India. It explains the decay of traditional rainwater harvesting systems in India during the colonial period in terms of incompatibility of the local knowledge systems embedded in traditional rainwater harvesting systems with the institutions that the British introduced in India to manage water bodies. It argues that the British institutions were based on their ecological, cultural and social context, different from the Indian one. The two knowledge systems underlying them were also different on the same account and hence were incompatible. Subsequently, it is suggested that the free riders problem arose in India as a result of institutional change in terms of

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property rights introduced by the British. It discusses the then dominant discourse on universality of knowledge which destroyed the ‘human-nature’ relationship existing in the country during pre-British India and gave rise to free rider problem by creating a demarcation between ‘common’, ‘public’ and ‘private’ which never existed in the country. The paper pinpoints on the role of power relations in shaping and destroying the knowledge of the community.

**Key Words:** rainwater harvesting, common property, private property, community, commons, knowledge systems, traditional, British India

## 1. Introduction

The most commonly cited reason for the destruction of ‘common properties’ is the tragedy of commons *à la* Hardin (1968). Extensive work by Elinor Ostrom, however, shows that the aforementioned tragedy is not as prevalent as believed by Hardin, and various complex common properties exist in different parts of the world. Although the framework developed by Ostrom points out to the existence of diverse community level practices that helped sustaining the CPR (Common Property Resources), the framework still revolves primarily around the concerns for free ridership. Ostrom (1990) argued that the key mechanism to sustain the CPRs is communication between the individuals which ensured collective efforts to overcome free ridership, and helps avoidance of destruction of those CPRs. There are at least three reasons, however, to be careful and selective in applying Ostrom’s framework. Firstly, the issue of free ridership arises when, to put it crudely, property rights are distinguished between ‘private’ and ‘not-private’ (e.g. common or public), the latter being vulnerable to free ridership. It follows then that in the absence of private rights to property—for example, Kautilya (1987) in his *Arthashastra* mentions clear duties of citizen about common properties—the domain of free ridership becomes rather vague. Thus, making free ridership a key reason for the destruction of any common property system, independent of a community’s overall system of property rights, seems to rely on a-historical understanding of the system.

Secondly, participation, in Ostrom's (1990) framework, is guided by a complex calculation of discount rates by the concerned *individuals*. Such an individual-centric view, according to Gudeman and Rivera (2001), undermines the fact that commons is embedded in a community of shared and indivisible knowledge, experiences and interrelationships. In fact, Ostrom's (1990) framework does not recognize the possibility involving indivisibilities of knowledge about the governance of CPRs and assumes, implicitly though, that such knowledges are available in the public domain (or distributed uniformly across individuals) and, as a result, destruction of CPRs can be avoided only if the individual calculations of discount rates about future benefits from these resources fall in line. Thirdly, the framework developed by Ostrom (1990) points out that a blending of various kinds of knowledge is important for reducing the uncertainties for governance of CPR. However, the problems in blending such diverse knowledge systems are left unexplained. Indeed, during the various field visits by us in Rajasthan, the local people did not cite free ridership as the key reason for the decayed systems of water harvesting. They rather, put emphasis on non-use of their historical knowledge during the British regime. One wonders why a body of knowledge, so successful for centuries, was left unused during the British regime? We argue that such a phenomenon necessitates an institutional analysis, to understand the complexity involved in sharing and synthesis of different kinds of knowledge.

The decline of various traditional water harvesting systems during the British rule has been studied mostly by historians and anthropologists (see D'Souza 2006 for a review). These studies focus on a complex array of factors responsible for the decay of such systems, ranging from 'imperialism' to incomplete understanding of 'local ecology' to 'disruptive social organisation' introduced by the British. We argue that all of them hinted at incompatibility of two knowledge systems, albeit implicitly. The reason for a lack of explicit reference to the literature on knowledge, in our view, is the then state of the global literature on knowledge, which was only in its nascent phase to appreciate plurality of knowledge. We argue that a more comprehensive understanding of the decline of these systems is possible by relating it to the literature on institutional characteristics of knowledge, which challenges the claim of universality of scientific knowledge. D'Souza (2006, p. 623) in fact, raises the need for studies which would "throw light on ...how colonial irrigation practices were shaped by a

cross pollination of *ideas*, evolved from various ecological zones.” In particular, we focus on how the institutional understanding of the British differed from the pre-British Indian conceptions of groundwater irrigation/harvesting and property, which eventually shaped the pattern of decline of various traditional groundwater irrigation technologies in British India.

The paper has 5 sections. Section 2 briefly discusses the literature on characteristics of knowledge, and the process of transformation of one type of knowledge into another and their transfer. Section 3 describes the institutional characteristics of knowledge. Section 4 underlines the differences between the two traditions of intellectual scholarship on water harvesting systems and property rights, to enable us to understand why the two systems of knowledge, socially and historically determined, could not be effectively synthesized paving way for smooth governance of water resources. Finally, section 5 gives a synthetic discussion of the paper.

## **2. Characteristics of knowledge**

That there exists plurality of knowledge is now well established (Gibbons 1994). Besides deductive reasoning, empiricism is now recognized as an important component of modern knowledge. Every society, it is believed, thrives to produce knowledge. Nonaka (2003) conceptualized knowledge creation as a dialectic process where new boundaries are created through dynamic interaction between agents as well as between agents and structure (structure meaning institutional structure, community). In this view, knowledge is created through interactions between human agency and social structures. Such knowledge are often based on a path-dependent framework where history and distinctive characteristics of the concerned society play an important role. Recent literature on ecological studies is replete with evidences of use and generation of local knowledge and community practices in the areas of biodiversity management and conservation practices (See, Berkes and Turner 2006, Wade 1995 for reviews). It is presumed that such locally developed knowledge is concerned with the immediate and concrete necessities of people's daily livelihoods. It may be noted in this context that in modern era, knowledge is often understood to attempt to construct general explanations of empirical realities across the board, denying such localness. Methodologically, modern knowledge is argued

to be open, systematic, objective, and analytical which rely generally on rigorously built conceptual frameworks. The modern/scientific knowledge, therefore, has a universal appeal that is divorced from any particular epistemology. Conventionally, local knowledge, on the other hand, was seen as closed, non-systematic, holistic rather than analytical, without an overall conceptual framework, and advances on the basis of new experiences, not on the basis of a deductive logic. In a nutshell, therefore, such knowledge is local-specific, anchored to a particular social group in a particular setting at a particular time. Historically, such forms of knowledge have also been in the form of tacit knowledge, sometimes in the absence of codification technologies, sometimes because of their very nature. Nonaka (2003) argued that knowledge creation starts with ‘Socialization’, which is the process of converting new tacit knowledge through shared experiences in day-to-day social interaction. Since tacit knowledge is difficult to formalize and often time and space-specific, tacit knowledge can be acquired only through shared direct experience, such as spending time together or living in the same environment, typically a traditional apprenticeship where apprentices learn the tacit knowledge needed in their craft through hands-on experiences. One can share the tacit knowledge of customers, suppliers, and even competitors by empathizing with them through shared experience. Giddens (Nonaka 2003) argued that we enact our actions with two main levels of consciousness: practical consciousness and discursive consciousness in our daily lives. While the discursive consciousness gives us our rationalizations for actions and refers to more conscious and therefore is more about explicitly theoretical knowing, practical consciousness refers to the level of our lives that we do not really think about or theorize. In that sense, we can say that tacit knowledge is produced by our practical consciousness and explicit knowledge is produced by our discursive consciousness. However, these two types of knowledge are not strict watertight compartments. Rather we enlarge our knowledge through our actions and interactions with the environment that help facilitate the conversion process of tacit and explicit knowledge. Nevertheless, such conversion processes depend heavily on availability of technologies (Witt *et al.* 2007), and methodological similarities between how these two bodies of knowledge are created. Nonaka (2003) described this process as ‘externalisation’, where various kinds of experiential knowledge are articulated, and

synthesized if found to be in conflict with each other. However, the process of synthesis of conflicting knowledge depends crucially on power relations between the agents. As Foucault (1977) argued that there is no knowledge which does not pre-supposes power relations. If power is used as a repressing tool, such synthesis may become biased.

### **3. Knowledge and institutions**

Knowledge changes when institutional changes take place. Institutions are means of knowledge exchange (Cheng *et al.* 2004) and social conventions lie at the heart of institutions. Norms, rules and legitimization processes can be considered as social conventions which constrain action of individual (Cheng *et al.* 2004). In Eggertsson's (2009) view knowledge is a scarce resource and conditioned on complex economic, political and cultural conditions which are not well understood. Further, Eggertsson divides knowledge into two branches known as science and technology. Technology is further divided into physical and social technology. Social technology refers to application of social science for practical purposes and physical technology refers to application of physical science for practical purposes. Hence it can be said that production of knowledge involves joint application of physical and social technologies. Social technologies are difficult to implement than physical technologies. Social institutions emerge to mediate such knowledge problems (Eggertsson , 2009).

### **4. Discourses on water harvesting**

According to Kelly (1980) the facts of water are cultural, and not natural in nature. In this section we make an attempt to understand how the governance of water resources were conceptualized in the Indian and the British tradition.

#### **4 (a). Water harvesting systems in pre-British India**

In the past, it is argued, that both irrigation and water harvesting received State patronage. The State built large storages essentially for irrigation and water supply for the capital cities and important towns. However, these were found to be inadequate to meet diverse water usage of the village communities and individuals were encouraged to build their own water harvesting devices to meet their basic domestic requirement of water. It is argued that the

communities were closely knit and organising voluntary labour and material contributions for such common goods were not much of a difficulty. The management of rain water harvesting facilities also find a mention in the *Arthashastra*, the most ancient text on Indian politics and Economics (Rangarajan 1987). Thus, it seems that these facilities were managed and governed with active State patronage.

Technically, rainwater harvesting, means the catching, collecting and storing rainfall waters before they rush off and disappear beyond reach of a particular society's area of habitation and surroundings. Oweis *et al.* (1999) define water harvesting as the process of concentrating rainfall as surface runoff from a larger catchment area for use in a smaller target area for various purposes. There exist varied rainwater harvesting practices in India, dependent primarily on the diverse rainfall patterns. Rainwater is harvested mainly for storing it in a ready for use condition under or above ground and for groundwater recharging. The decision whether to store or recharge groundwater depends on the rainfall pattern and the potential to do so in a particular region. Delhi, Rajasthan and Gujarat are examples of places where groundwater recharging is practiced, presumably due to their extreme weather conditions and inadequate rainfall. In places like Kerala, Tamil Nadu, Mizoram and Bangalore, where rainfall is comparatively higher and more evenly distributed, the purpose of rain water harvesting is mainly to store water. We find four broad patterns of rain water harvesting systems in India, depending on agro-ecological variations.<sup>1</sup> The high-land agro-ecological region of India constitutes north-western Himalayas where rainwater harvesting systems such as *Zings* and *Kuls* are practiced. *Kuls* are used for carrying water from glaciers to the villages while *Zings* are small tanks used for collecting melted glacier water. The Arid agro-ecological region of India comprises of south-western parts of states of Punjab and Haryana, western parts of Rajasthan, Kacchh peninsula and northern part of Kathiawar peninsula in Gujarat state. Rainwater harvesting systems like *Kuis* are practiced in western part of Rajasthan, *Kuis* are 10-12 meter deep tanks below ground used for collection of water. *Khadins* are also practiced in Western Rajasthan which are used for surface irrigation. The semi arid agro-ecological region comprises of Gujarat, northern plains, central highlands and Deccan plateau. *Viridas* is practiced in Gujarat which are shallow wells in low depressions. Other

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<sup>1</sup> <http://www.fao.org/ag/AGP/AGPC/doc/field/Wheat/asia/india/indiaagec.htm>. FAO. 2011

rainwater harvesting practices such as *Johad*, *Baandh*, *Nada* are used for groundwater recharge. The tropical wet agro-ecological region constitutes of western coastal plains of Maharashtra, Karnataka and Kerala states, and parts of Tamil Nadu. *Kere*, *Kohli* tanks and *Bhanadaras* are practiced in this region. *Bhanadaras* are check dams built across rivers in Maharashtra. Apart from these there are several other traditional rainwater harvesting practices in North East region such as *Naula*, *Khatri*, *Kuhl* and *Zabo*. *Kuhls* are mainly used for irrigation while *Naula* and *Khatri* are tanks used for storing rainwater. *Zabo* is used for impounding runoff (Agarwal and Narain 1997).

Local knowledge depends on varied use pattern, soil type of the region, rainfall pattern of the area, intersurface fractures of the ground. Based on these parameters, communities used to select site for rainwater harvesting by preparing first the outline of possible rainwater runoff flow slopes or directions, and then prepare drainage outlet for exit of excess water from the area. The shape, elongation, height and width dimensions were chalked out to raise the barriers laterally opposite the water flow-in ditches. The excavated material was used to raise the barrier. This was the simplest method adopted by the hydro-experts in the pre-British period. Although this entire body of knowledge is completely experiential and is often undocumented.

The ecological region inhabited by people played an important role in shaping their knowledge of rainwater harvesting (Coward 1980, Kelly 1980, Escobar 1998) as the agro-ecological regions determined the rainfall pattern and soil type of the region. In the semi-arid and arid (Marusthali) parts of Rajasthan, for instance, people developed covered wells for drinking water purposes (saving from evaporation and dust and sand in these windy areas), while deep and wide open *talaabs* were built for bathing, washing and animal stock watering purposes. The large raised embankments of these *talaabs* were shaded by growing huge leafy shady trees in rows to reduce evaporation (Jacob 2008). In addition to ecological particulars of a region, other reasons of having varied structures in different regions might have been communities' own understanding regarding water usage (Wade 1995). For example, to keep the temperature of water low for drinking purposes, in very hot areas, people would have developed the technique of underground structures. Such knowledge is acquired through experience and transmission from one generation to another (Berkes and Turner, 2006). The cultural practices reflected the

cumulative wisdom of a community. Harvesting of water and its management has been an integral part of the native culture and community life such that these practices were perceived by the common man as his sacred duty and by the communities as part of good local self-governance and social responsibility.<sup>2</sup> For example, there has been an age old tradition of Hindus of having a temple in the village, a tank and a sacred grove associated with it. Sacred groves represent major effort to recognize and conserve biodiversity in its holistic form. Besides influencing the water cycle in the neighbouring areas, these places also preserve many endemic and rare wild plant species which have benefits to humans such as medicine, agriculture and industry. In a nutshell, these places represent the traditional practices where the management of land, forest and water are not separable. These evidences show that water was also considered as sacred and perhaps the reason for constructing tanks in the temple premises was to give respect to water and treat water as sacred.<sup>3</sup>

To summarise, the control and management of water systems was significantly decentralized (Vani 2009). The political, legal and technical arrangements responded not only to diverse agro-ecological systems but also to cultural and religious values associated with water, land and forest, often in a holistic manner. It also gave enough scope to local communities to nurture these resources based on locally developed knowledge, but active state support, at a point of Indian history when common properties were the order of the day, and people hardly owned any property in their individual capacities.

#### **4 (b). Institutions for water governance in British India**

It is argued that the concept of rainwater harvesting was absent in British natural resources policy, presumably because of differences in the rainfall patterns between the two countries. While India receives most of the rainfall during two months of monsoon, Britain has a temperate rainfall pattern which is equally distributed across the year. The British authority, therefore, could afford to treat water “as *given*, to be used at *will*” (Vani 2009). Harvesting of water was, therefore, not a requirement in Britain. Also, historically, water had limited use in Britain, perhaps due to its harsh climatic conditions. Indeed, the

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<sup>2</sup> <http://megphed.gov.in/knowledge/RainwaterHarvest/Chap2.pdf>. PHED Meghalaya

<sup>3</sup> [http://forest.kerala.gov.in/index.php?option=com\\_content&view=article&id=75:sacred-groves&catid=37:common-trees&Itemid=56](http://forest.kerala.gov.in/index.php?option=com_content&view=article&id=75:sacred-groves&catid=37:common-trees&Itemid=56). Kerala Forests and Wildlife Department. 2009

scanty amount of historical evidences available for 16<sup>th</sup>-17<sup>th</sup> century Britain available, point out that drinking, taking bath or washing were not among the main uses of water. Reportedly, the main purpose of water was to facilitate agriculture (Harvey 2011<sup>4</sup>). As a result, it has been argued that British colonizers in India continued to treat water as a prime resources for agriculture only, which is *given*, and can be used to raise revenue at *will*. Incidentally, traditional water harvesting structures which had multiple uses were de-legitimized and categorized as minor irrigation systems.

On the decline of traditional water harvesting systems<sup>5</sup>, the work by Sengupta (1980) and Rosin (1993) are noteworthy. Rosin argued that the local people of western Rajasthan perceived harvesting of rainwater through groundwater recharge and established a direct relationship between their surface water storage facilities and quality and supply of soil and groundwater. Furthermore, Rosin discussed that removing accumulated silts in turn improved the permeability of the bed to increase infiltration rates for soaking and recharge according to local understanding. But the British hydrologic engineers' viewed high groundwater levels as threat to kinds of irrigation systems they built. They were not in favour of removing silt from the bed of the dam either because soakage through dam bed or through walls of canal may contribute to water logging and high loss of surface water diverted from irrigation. Rosin thus underlines the connection of locally embedded knowledge to sustenance of traditional practices.

Sengupta's (1980) work informs that the British changed the existing community organisational structure in South Bihar. There existed interdependency of land and water during pre-British period which was disrupted in the British period after the introduction of land rights in the country. The *ahar-pyne* system of irrigation practiced in south Bihar decayed primarily because of shift from produce rent system to fixed rent system after the introduction of Tenacy Act (1885), which came into force in Bihar in 1904. Before the British rule, the irrigation system was maintained by the local people and patronised by the *zamindars*. Sengupta (1980: 73) points out that "once the rents were fixed, and the *zamindars*

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<sup>4</sup> In an informal meeting with Prof. Mark Harvey, University of Essex, this discussion was carried out.

<sup>5</sup> D'Souza (2006) discusses Mosse's study of decline of tanks in South India which says that 'pre-British village communities were unstable entities driven by hierarchies and were shaped and impacted by larger processes of statecraft and regional politics. In effect, Mosse suggests that tanks in South India underwent various phases either of efflorescence or decline prior to colonial rule.'

had nothing to lose by decline in irrigation, they stopped taking care of those works. In addition, in order to increase their income, they sought another course of action by using irrigation works as the level of control.” As a result, the *zamindars* became less interested in maintenance of these structures which led to the decline of *ahar-pyne* system.

Thus, to summarise, while Sengupta (1980) emphasises on how the British rule disrupted the social organisation of such systems, Rosin (1993) focuses on the incomplete understanding of local ecological characteristics by the British. In making that argument, Rosin explicitly refers to the traditional practices as ‘local hydrology’. In our view such a description is intended to locate these practices in the larger body of scientific knowledge of hydrology, which hitherto recognised only the modern scientific understanding of irrigation. According to Rosin, this understanding had no place for the diverse local ‘hydrologies’ existed in various parts of India during the British rule. Mostly such hydrological knowledge was tacit or experiential in nature and was shared by the community members in an indivisible manner. Our fieldwork in the villages of east Rajasthan also reveal that people neither know about the knowledge in entirety nor do they know the distribution of the knowledge in the population. Thus even if they are willing to participate, they are held back by the uncertainty of their effort yielding any comprehensive result because of incomplete knowledge about the system. As discussed in the previous section, knowledge (or technology) has two parts: physical and social, while Rosin’s work focused on incompatibility in physical technologies, Sengupta focused on the social technologies, a change which made the physical technologies obsolete.

However, since water and land were interlinked systems in pre-British India, the decline of the system cannot be understood without analysing the rupture created by the British system of property rights. In the next subsection, we make an attempt to understand the concept of property and property rights in pre-British and British Indian periods.

#### **4 (c). Rights on properties: the discourses in the colonial era**

Historically, the Western European way of thinking about property comes from practices and legal codes of the Roman Empire. The British understanding of property was a mixture of Roman and the Norman influence. The transfer of land from old owners to the followers of the Conqueror was made possible by a legal theory that land belonged to the king and people were king’s tenants. The relationship between political control and land

ownership was a dominant feature of British social and political history. The eighteenth century British thought about property was rooted in the writings of John Locke. Locke interpreted nature of private property ownership as “law of nature. While the earth was given in common to all men every man has property in his own person. Locke insisted on right of individual rather than state” (Embree 1969: 39). Baden Powell argues that from the fact that the word ‘possession’ lies in Western jurisprudence and not articulated in Indian thought “What emerges is an understanding of property admirably suited to a society dependent upon trade and commerce, where land was scarce, and political stability had been achieved. Ownership meant that neither sovereign nor intermediary landlord could prevent the sale or transfer of property, nor was the use of property hindered by any services to be rendered to them” (cf. Embree 1969: 41).

In the literature on bundle rights, it is generally assumed that the owners have the authority to sell or lease the property which reflected ownership of the land. Also, ‘owners’ automatically meant possession of all four kinds of rights (access, withdrawal, management, exclusion) including alienation right (See, for instance, Ostrom 2000). In contrast, in India property did not reflect ownership rather shared rights on land existed. Although the *zamindars* or the ruler could sell or lease the land but could not sell various other rights people had on that same piece of land. In the words of Embree (pp. 46) “one might have absolute rights of a certain kind in a piece of land, but others might also have rights of another kind, equally absolute, in it. Alienation of these rights was possible, but not alienation of the land itself in a way that excluded the exercise of the rights enjoyed by others.” The idea of claims of interests was apparently in operation. Layers of rights existed on common lands which protected interests of people of the community. As a result, there emerged a variety of land rights, where rights of various kinds were superimposed on each other (Hasan 1969). These layers of rights gave rise to layers of duties for the management of land in the Indian as well as Mughal periods. D’Souza (2004) argues that the Mughals absorbed the existing infrastructure of the previous regime giving a sense of continuity of the legal framework on land rights through the Mughal period. Perhaps, this shows that the governance regime existing in pre-British India strongly bound the community among themselves even though the property had been sold to another *zamindar* or ruler. Embree (1969) mentions J. H. Nelson in his

writings that “ordinary people had no idea of *meum* [mine] and *tuum* [yours] and spoke always of ours” not “mine”. A thing of value was regarded as being part of an aggregate, rather than belonging to a single person” (p. 45).

In pre-British India, the questions relating to property were dealt with in caste-panchayats or some other form of group organization which was regional and local. The law courts that British inherited in Bengal had one of their functions of settling disputes between landlords and tenants but it did not survive for very long. New concepts and definitions of property gave rise to different kinds of problems, and the new courts were required to solve such property related problems (Embree 1969).

Thus the British rulers had a complex job in hand-transforming this network of rights to a system of private *AND* public rights, where either an individual or the state would hold ownership over land. To *simplify* the system they also took measure which separated the rights on land from rights on water, and made laws to incorporate almost all water bodies under the ownership of the state. Arguably, the most adverse impact on the concept of RWH was this separation of land, forest and water resources under different legal and administrative systems. The preamble to the Limitation Acts (1859-71), the Northern India Canal and Drainage Act 1873, the Bengal Irrigation Act, 1876 and the Specific Relief Act, I (1877) reflected that the Provincial Government was entitled to use and control for public purposes the water of all rivers and streams flowing in natural channels and other natural collections of still water. These Acts do not mention about varied patterns of rights on these water bodies that existed in pre-British India, and instead, bestowed the State the exclusive authority to use and control water (Vani 2009). As Vani succinctly puts it: “The colonial period of history abruptly suspended the practice of rainwater harvesting and the modes of governance that enabled it. They were supplanted by an alien ‘scientific’ perspective, environmental philosophy, political economy and governance systems” (Vani 2009:169). A separate department of irrigation was formed by the State, creating a centralized government-driven system for maintaining varied water structures in India: tanks, *tankas*, *kunds*, *baolis*, wells, canals and large dams. This department had fixed procedures for maintaining the structures which did not always match the conventional diverse procedures for maintenance and use of the system by villagers (Jacob 2008).

Thus, the difference in the British and the Indian concept of property rested on historical differences on concept of individual rights. Moreover, Indian system of property rights were often based on shared understanding at a local level. It did not give the absolute supremacy to either the individual or the state as owners of property, rather portrayed complex social relations and responsibilities, facilitated by the State but not to be controlled by the State.

After bringing the water bodies under state control, the British started modifications and construction of irrigation facilities employing ‘expert engineers’, ‘cheap labour’ and ‘machinery’-deviating from the earlier practice of employing local people in construction and repair of water harvesting facilities. Thus, use of local knowledge became prohibitively difficult under this new regime of ownership. In other words, the layers of rights which existed on common lands among the local people broke down. Since, rights were strongly linked with ‘duty’ and ‘obligation’ in the Indian legal discourse, a removal of rights got translated in to removal of obligation and duties.

The knowledge of rainwater harvesting which existed in the community was shared knowledge which people had and rights existing among the individuals for the common land protected the interests of people. Hence it can be said that there existed strong community bonding among the individuals and denial of access to commons would destroy community itself as Gudeman and Rivera (2001: 360) quote that “taking away the commons destroys community, and destroying a complex of relationships demolishes a commons. Likewise, denying others access to the commons denies community with them, which is exactly what the assertion of private property right does.” Hence it can be said that seizing of rights of lands from the community broke community bonding and therefore the shared knowledge of people was destroyed.

## **5. A Synthesis and discussion**

The British and Indian knowledge systems about irrigation were culturally, socially and ecologically shaped. While India receives monsoonal rainfall which varies in different parts of the country, Britain receives uniform rainfall throughout the country. Also in India, water finds various uses such as drinking, bathing, cleaning, irrigation and since it has varied rainfall pattern in different regions, water needs to be *harvested* for various

purposes. In Britain since water was not scarce, rainfall pattern is more uniform and water uses were not so diverse, the requirement to *harvest* water did not arise. Moreover, the main use of water as a raw material for agriculture helped them craft an economic logic around management of water, where water could be used to raise revenue at *will*. In India, on the other hand, water has had uses other than economic and it was difficult to develop a governance system purely around economic logic. As a result, water-land and forest were seen as interdependent entities shaped by religious practices and cultural ethos. Clearly, a synthesis of these two types of knowledge, envisaged by Nonaka was difficult. Moreover, the then colonial perception of knowledge perhaps relied on the belief that scientific knowledge was universal, objective and deductive, and therefore can be applied in all situations and context. This unequal power relation also acted as a barrier to the synthesis of the two types of knowledge.

The then dominant discourse of knowledge also did not appreciate, perhaps drawing upon objectivity of scientific knowledge, the interlinkages between physical and social technologies. We observed how various changes in the social organizations also led to decline of knowledge of traditional water harvesting technologies, over and above those direct engineering overlays in the forms of canal and large dams.

Conventionally, it is assumed that free ridership is a natural phenomenon. We, however, argue, may be in a rather premature way, that free ridership is an institutional phenomenon, created by the logic of certain kinds of institutions. To recollect, the pre-British institutions in India were created on the principles of duties and obligations. The rights were overlapping in nature with a strong local fervor in management of resources. The British sought to remove such a complex interdependent social layers by clearly defined ownership of either the individual or the state. This step squeezed the space of commons. Subsequently, properties brought under the state ownership employed cheap labour irrespective of their place of belonging. The non-local workers did not share the same amount of affinity and commitment with the local problems like the local workers. Jacob (2008) indeed finds that engineers indulged in corrupt practices in those irrigation projects initiated by the British. Sengupta (1980) points out that the British converted the 'produce based' rents to 'fixed rents'. In mainstream economic theory, fixed rents purportedly, reduces the cost of monitoring, assuming there exists an agency problem

(here between the tenant and the *zamindars*) with self-interested agents and principal. While the previous set of institutions was not based upon the assumption that agency problem existed between the tenant and the *zamindars*, the institutions created by the British seemed to be crafted around that logic. Not surprisingly, it created an atmosphere of mistrust and withdrawal of duties, and gradually, led to the decay of not only the earlier social organisations but also the physical technologies based on common properties. Once again, we need further evidence to substantiate this claim. However, recently emerging literature in political science on how accountability has a tradeoff relationship with responsibility (Lerner et al. 1998, Benabou & Tirole 2006), or in economics how individual centric incentives crowds out pro-social acts can be used to substantiate the claim that free ridership is not a-historic concept, but rather a product of certain kinds of institutional design.

## References

Agarwal, A. and Narain, S. (1997). Dying Wisdom. State of India's Environment: A citizen's Report. 4. New Delhi. Centre for Science and Environment.

Benabou, R. and Tirole, J. (2006). Incentives and prosocial behavior. *American Economic Review*. 96(5). pp. 1652-1678.

Berkes, F. and Turner, N. J. (2006). Knowledge, Learning and the Evolution of Conservation Practice for Social-Ecological System Resilience. *Human Ecology*. 34 (4). pp. 479-494.

Coward, E. W. (1980). *Irrigation and Agricultural Development in Asia*. New York, Cornell University Press.

Cheng, P. Choi, C. J. Chen, S. Eldomiaty, T. I. and Millar, C. (2004). *Journal of Knowledge Management*. 8 (5). pp. 96-106.

D'Souza, R. (2004). Rigidity and the Affliction of Capitalist Property: Colonial Land Revenue and the Recasting of Nature. In (Edt.). Alam, A. Bhattacharya, N and Roy, K. *Studies in History*. XX (2). New Delhi. SAGE Publications. pp. 237-272.

D'Souza, R. (2006). Water in British India: The Making of a 'Colonial Hydrology'. *History Compass*. 4(4). pp. 621-628.

Eggertsson, T. (2009). Knowledge and the theory of institutional change. *Journal of Institutional Economics*. 5 (2). pp. 137-150.

Embree, A.T. (1969). Landholding in India and British Institutions. In Frykenberg, R.E. (Edt.). *Land Control and Social Structure in Indian History*. London. The University of Wisconsin Press.

Escobar, A. (1998). Whose Knowledge, Whose nature? Biodiversity, Conservation, and the Political Ecology of Social Movements. *Journal of Political Ecology*. 5. pp. 53-82.

Foucault, M. (1977). *Discipline and Punishment*. London: Tavistock.

Gibbons, M. (1994). *The New Production of Knowledge: The dynamics of science and research in contemporary societies*. London. SAGE Publication.

Gudeman, S. and Rivera, A. (2001). Sustaining the Community, Resisting the Market: Guatemalan Perspectives. In Richards, J.F. (Edt.). *Land, property and the environment*. Place of publishing, publisher. pp. 359-381.

Hardin, G. (1968). The Tragedy of Commons. *Science*. 162. pp. 1243-1248.

Jacob, N. (2008). *Exploring India's Traditional Water Management Systems Jalyatra*. India. Penguin Books.

Kelly, W. (1980). *Japanese social science research on irrigation organization: A review*. Yale University. New Heaven. CT.

Lerner, J.S. Goldberg, J.H. and Tetlock, P.E. (1998). Sober Second Thought: The effects of Accountability, Anger, and Authoritarianism on Attributions of Responsibility. *SAGE Social Science Collections*. 24(6). pp. 563-574.

Nonaka, I. and Toyama, R. (2003). The knowledge-creating theory revisited: knowledge creation as a synthesizing process. *Knowledge Management Research and Practice*. 1. pp. 2-10.

Ostrom, E. (1990). *Governing the Commons*. New York. Cambridge University Press.

Ostrom, E. (2000). Private and Common Property Rights. In (Edt.) Boudewijn Bouckaert and Gerrit De Geest. *Encyclopedia of law and economics*. II. Cheltenham. Edward Elgar pp. 332-379.

Oweis, T. Hachum, A. and Kijne, J. (1999). Water Harvesting and Supplemental Irrigation for Improved Water Use Efficiency in Dry Areas. *IWMI*. pp. 1-52.

Rangarajan, L.N. (1987). *Kautilya The Arthashastra*. New Delhi. Penguin Books.

Rosin, R. T. (1993). The Tradition of Groundwater Irrigation in Northwestern India. *Human Ecology*. 21(1). pp. 51-86.

Sengupta, N. (1980). The Indigenous Irrigation Organisation in South Bihar. *The Indian Economic and Social History Review*. XVII (2). pp. 157-189.

Vani, M. S. (2009). Community Engagement in Water Governance. In Iyer, R. R. *Water and the Laws in India*. New Delhi. SAGE Publications.

Wade, R. (1995). The ecological basis of irrigation institutions: East and South Asia. *World Development*. 23 (12). pp. 2041-2049.

