INTERSECTING PRODUCTIVITY AND POVERTY: LESSONS FROM THE GANGA BASIN

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ABSTRACT

Increasing water productivity appears at the top of most agricultural water policy agendas around the world. It is usually assumed that gains in water productivity will always directly or indirectly improve livelihoods and reduce poverty through increased water availability, higher food security and agricultural incomes. Whereas many economics studies have established a strong correlation between agricultural growth and poverty, numerous activists in India and elsewhere have increasingly questioned the productivity paradigm. This paper adopts a qualitative approach to investigate some of the links between productivity and poverty through an institutional analysis of livestock water productivity interventions across three districts of the Ganga Basin, North India. We do not pretend giving a comprehensive review of the water productivity / poverty nexus but rather discuss a few prominent issues: the differentiated forms of capitals required to access to water, equity and democratic decentralisation.

Water productivity; access; equity; decentralisation; discourses; Ganga Basin; India.

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"It is clear that the human dimension must be the principal determinant of agricultural policies and not just production in physical terms".

(National Commission on Farmers - India 2006, p.2)

INTRODUCTION

Agricultural water debates and policy agendas have been dominated by an increasing concern over anticipated water shortages for food production. As a result, the concept of water productivity has gained significant prominence since the mid-1990s (Zoebl 2006). According to the mainstream scientific and policy debates, the only way forward to address the predicted food and water crisis is to develop technical and biophysical options to get more "crop per drop", i.e. raise the efficiency of water use at the production system or farm level. Introduced as a measurement of how a system converts water into goods and services (Molden 1997), water productivity has become a key indicator of the effectiveness and efficiency of rain-fed and irrigated agriculture. Progressively, the concept has been used as guiding principle to support the design of pro-poor agricultural water schemes, thereby heralded as a tool for poverty alleviation.

Yet the productivity/poverty nexus has been increasingly challenged, notably in India. Critics have come not only from a few activists but also from established agricultural experts and policy-makers. For instance, in his latest 2006 draft national policy for farmers, the National Commission on Farmers[3] emphasized the need to "focus more on the economic well-being of the women and men feeding the nation than just on production" (National Commission on Farmers - India 2006, p.2).

From a scientific point of view, the application of what was originally a purely biophysical concept to the analysis of socio-ecological systems or to guide development interventions is also not without raising doubts or at least questions. For a matter of fact, several scholars have recently discussed the relevance and usefulness of the concept of water productivity for sustainable water management (Zoebl 2006; Molden et al. 2010).

In this paper, we take a critical look at the concept of livestock water productivity (LWP) through an institutional and capability-based approach. After a short introduction on LWP and its conceptual underpinnings and implications, we identify the conditions under which the analysis of LWP can effectively guide the design of pro-poor interventions, based on empirical data from nine case studies across the Ganga Basin in North India.

[3] It is a committee set up in 2004 and appointed by the Ministry of Agriculture to prepare recommendations and strategies for the development of a sustainable agriculture. It is currently chaired by Dr. M. S. Swaminathan, "the father of the green revolution in India".

WATER PRODUCTIVITY AND POVERTY: DEFINING CONCEPTS AND IDENTIFYING ISSUES

Water productivity and LWP: an introduction

The concept of water productivity started to be popular in the 1990s. Based on water accounting principles (Molden 1997), it is defined as the ratio between the output derived from water use and the water input.

$$WP = \frac{Output\ derived\ from\ water\ use}{Water\ input}$$

First used for comparing the water use and water efficiency of different crops, the concept was then extended to the analysis of farming systems and practices (Zoebl 2006), and notably to the study of mixed crop-livestock systems. This recent development stems from the recognition that a large share of small farmers in the world combines crop and livestock activities, producing no less than half of the global food (Herrero et al. 2010). Although water requirements for crops have been thoroughly studied, water needs for livestock have often been neglected, or largely underestimated, usually considering solely animals drinking water requirements. The latter is a gross misevaluation as drinking water represents only a very small fraction of the total water requirements of animals (Peden, Tadesse, and Misra 2007). More than 90 percent of the water consumed by animals actually comes from the water necessary to produce animal feed. Several scholars have underlined the potential for large water savings through a higher water use efficiency by animals (Singh 2004; Peden, Taddesse, and Haileslassie 2009). For example, it was estimated in a recent study that the volume of water required to produce 1 liter (L) of milk through the production of alfalfa feed varies between 1,960 and 4,600 L[4] in the state of Gujarat in India (Singh et al. 2004). Variations do not result only from climatic and biophysical conditions but rather from the combination of these factors with farming systems and cropping practices.

This provided the rationale for creating the concept of LWP (Peden, Girma Tadesse, and Mulugeta Mammo 2002; Taddese 2005). LWP is defined as the ratio of net beneficial livestock-related products and services to the water depleted in producing them (Peden, Tadesse, and Misra 2007). In the LWP framework that Peden *et al.* (2007) proposed (Figure 1), all water inputs are considered, notably the water transpired by plants for feed production. The framework does not only consider the quantity of water consumed in the system but potential environmental externalities too such as water contamination and the impact of animal grazing on vegetation and soil (and thus on water hydrology) at the landscape level.

[4] The worldwide average water volume required to produce 1 L of milk is 788 L (Chapagain and Hoekstra 2003).

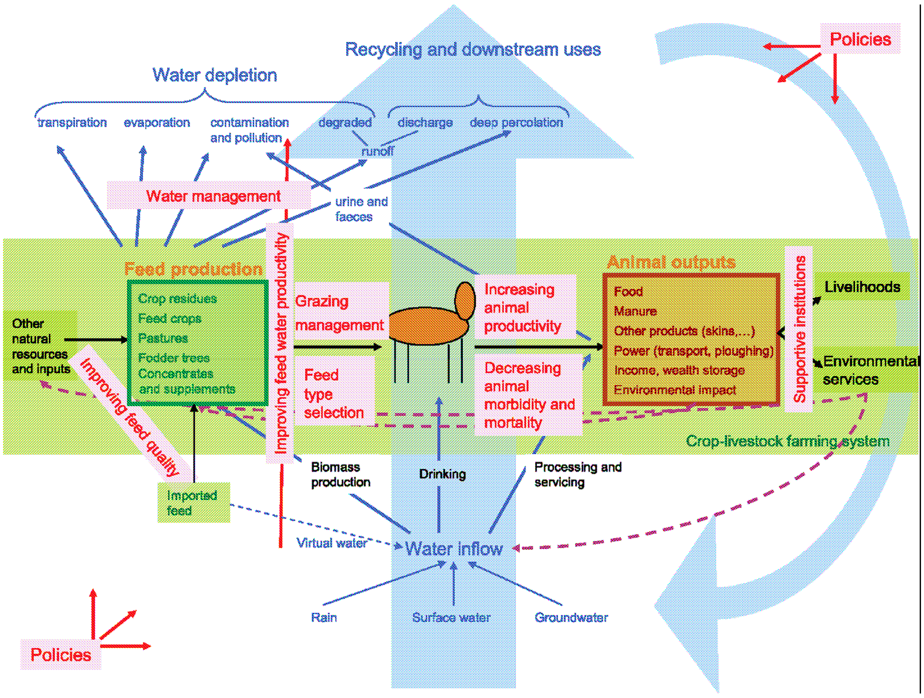


Figure 1. LWP framework
Source: Descheemaeker et al. 2009 from Peden et al. 2002 and Peden et al. 2007

The LWP framework has been recently linked with a gendered sustainable livelihood framework in order to evaluate the social impacts of water-related interventions on livelihoods on a gender basis (van Hoeve and van Koppen 2006). A few studies have furthered efforts geared towards "socialising" and "politicising" the framework by stressing how policies, institutions and culture shape the adoption and outcomes of LWP interventions (e.g. Descheemaeker, Amede, and Haileslassie 2009; Mapedza et al. 2008). We propose to go beyond considering institutions and policies as instruments to support the adoption of technical interventions by critically examining the rationale for increasing water productivity. Whereas the potential of the approach for reducing water efficiency at the farm level is not much questionable, what is more disputable is the claim that LWP is a useful tool to guide pro-poor interventions and that increasing LWP will automatically improve farmers' livelihoods and reduce poverty. As developed further, the link between LWP and poverty is shaped by a wide range of contextually-dependent social determinants. We will particularly explore the influence of institutions power distribution and discourses in this paper, notably through the examination of farmer's differentiated access to capitals, the integration of equity in water interventions and the form and extent of decentralised planning and decision-making.

A few conceptual and critical arguments on the use of LWP as a poverty alleviation tool

Following the works of Townsend (1979) and Sen (1985; 1999), most development international organisations have shifted from a unidimensional definition of poverty, usually based on income, to a multidimensional vision of what poverty entails – a notable example being the Human Development Index promoted by the United Nations

Development Programme (UNDP) (see also Ruggeri Laderchi, Saith, and Stewart 2003; Saith 2005). We considered poverty in our study as the lack of "capability or freedom people have to achieve the various 'beings' and 'doings' they have reason to value", as envisioned by Sen (1999). In this perspective, income is a means to achieve one's ends but not an end *per se*. Generating profit or fostering economic growth constitutes only one way to expand one's capabilities or reduce poverty.

Water productivity is defined as the ratio of output unit produced per unit of water used. In the case of LWP, outputs include all types of products such as milk, ghee, dung, services in the form of traction for ploughing or for transportation as well as cultural or cognitive benefits. Scholars have usually expressed outputs under two forms. One, called 'physical water productivity', is expressed in a physical unit, i.e. the volume of milk produced. The second one, called either 'water use efficiency' or 'economic water productivity', is expressed as an economic value derived from the outputs. The denominator is usually expressed in a physical unit, but can be measured differently, either as the volume of water depleted or as the volume of water supplied[5].

Relating either physical or economic water productivity with livelihood improvement or poverty raises a few challenges. Basically, there are two ways to increase LWP. One is to produce a greater value of outputs for the same quantity of water. In this case, linking water productivity increase and poverty alleviation requires assigning a meaningful value to the increase in outputs which reflects its contribution to livelihood improvement. Several methods of economic valuation have been developed for converting the net total benefits from different livestock products and services in one single economic value (Cook, Andersson, and Fisher 2009). However, besides the limitations of these methods, such an approach is seriously constrained by the inadequacy of economic values to represent poverty. More fundamental questions which have not been given much attention in agricultural water productivity studies include: how is the output actually transformed into benefits; who has access to the benefits; how these benefits are shared; and is the distribution process perceived as fair and legitimate. That is to say, such issues require an accurate understanding of the institutional and political context within which water productivity interventions are designed and implemented.

The second way by which one can increase LWP is to produce the same quantity of output using a reduced quantity of water. It is generally assumed that the available water surplus can be used for other productive or non-productive uses, thereby contributing to enhance livelihoods. In this case, similar questions regarding household access to the surplus water and capabilities to actually use the water have been often neglected in the design of water productivity interventions.

Other critics have disputed the concept of water productivity in general. One set of criticisms disputes the application of productivity to water. The arguments are that productivity makes sense when considering an organising system with a range of inputs but might be useless and misleading when calculated for a single input factor, because

[5] The choice depends on the system of interest, objectives of the study and the scale chosen: for example, irrigation officials would be interested to know the output for the amount of water delivered, whereas, researchers who want to improve crop water efficiency might be more interested to evaluate the output per unit of water actually consumed by the crop.

the outputs depend on other input factors (Wichelns 2003). Increasing water productivity is justified only if it is not made at the expense of other inputs such as labour, money or land. Lastly, a more radical argument disputes the exercise of measuring efficiency. There are many examples in the agricultural and industrial sectors showing that efficiency is not necessarily the most important factor for human beings. For instance, whereas a mixed farming system has often a lower production efficiency compared to a monocrop system, diversification has been a common strategy of rural households over centuries for increasing their resilience to external shocks (Ellis 1998). There are numerous examples of communities showing a higher preference to social acceptability and sustainability than to efficiency[6]. This argument has been particularly developed by environmental anthropologists (Cleaver 2000; Klooster 2000; Mosse 1997).

Widening the debate to the impact of technologies and interventions which sole focus is to improve productivity on poverty, it is worth examining the very large body of literature has discussed the effect of the green revolution on poverty (Lipton 1989; Yapa 1979; Harriss 1991; Das 2002). Whereas most authors agree on the increase in inequality among farmers, the relationship between the green revolution and the overall level of poverty has been the object of a polarised debate. On the one hand, the green revolution has been said to enrich the better-off farmers at the expense of the poorest (Beck 1995), to increase the reliance of poor farmers on external inputs and push them into a vicious circle of debt, and to make them more vulnerable to droughts (Shiva, Emani, and Jafri 1999). On the other hand, the gains of productivity of the technology adopters have been said to result in increased agricultural labour demand and employment opportunities for labourers and reduction in food prices due to increased food production (notably Lipton 1989; Jewitt and Baker 2007, see a review in Das 2002). These latter arguments have also been criticised and refuted based on economic arguments (e.g. lowered food prices have resulted in reduced benefits for farmers located in other areas left untouched by the green revolution and thereby reduced employment opportunities for labourers) (Das 2002).

Many scholars have more specifically investigated the relationship between enhanced agricultural productivity and poverty. They have usually found a negative correlation, based on an economics approach linking farm productivity and household incomes (e.g. Huang et al. 2006; Minten and Barrett 2008; Saleth, Namara, and Samad 2003). We propose in this paper to re-examine this relationship from a different view angle by adopting a capability-based definition of poverty and exploring the institutional and political implications of selected productivity interventions. The next section introduces the framework we used for this endeavour.

ANALYTICAL FRAMEWORK AND METHODOLOGY

The Capitals and Capabilities Framework (Bebbington 1999) offered a relevant analytical frame to investigate the relationship between productivity and poverty at the community and household level. The framework is based on the five capitals (or assets) upon which people draw to base their livelihoods: the natural capital, produced capital,

[6] These objectives are sometimes, but not always, mutually exclusive.

social capital, cultural capital and human capital[7]. Produced capital means man-made capital and includes physical and financial capital. In addition, it acknowledges the dynamic process of how the different forms of capitals are continuously being substituted within a changing political-economic context (Figure 1). It also stresses the importance of access to capitals and how capitals are transformed into benefits. Benefits include not only material well-being but also the meaning capitals might give to one's livelihood and the capabilities to be and to act (Bebbington 1999).

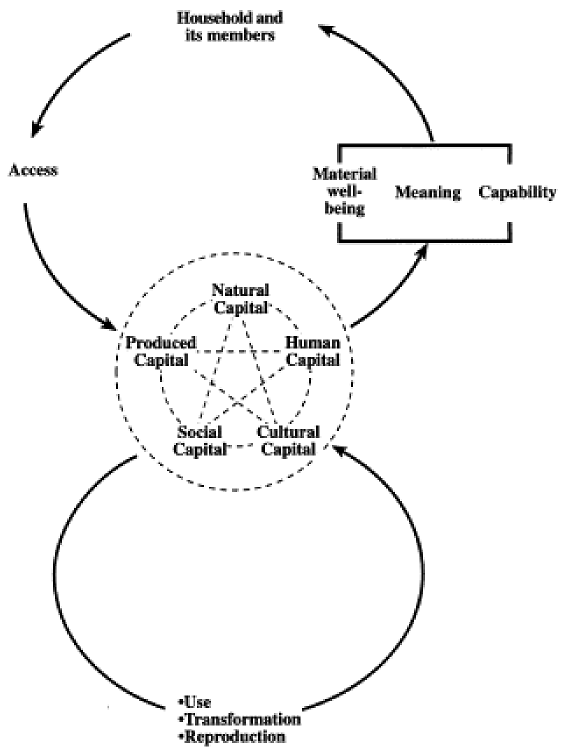


Figure 1. Capitals and capabilities framework showing assets, livelihoods and poverty linkages (Bebbington, 1999)

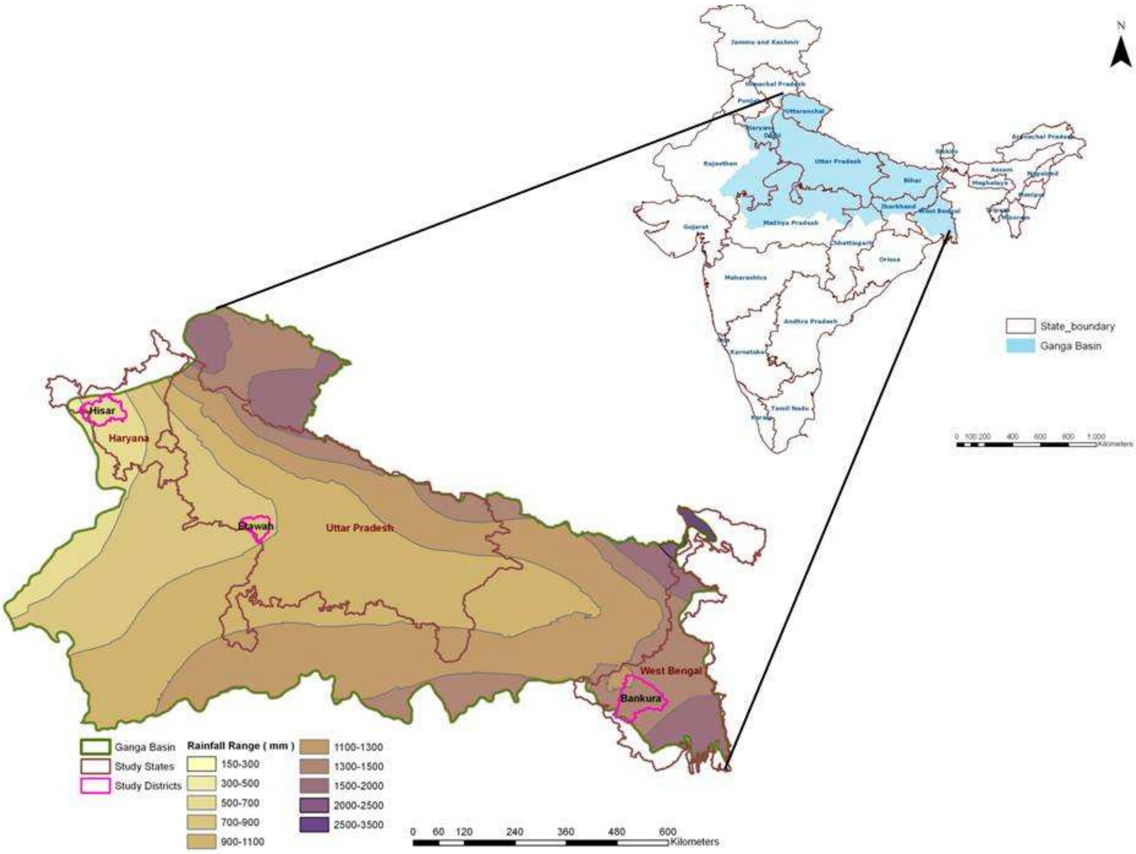
In this paper, we more particularly looked two capabilities: farmer's capability to access and control agricultural water and the capability individuals and communities have to change the institutions that govern the use and control of resources.

Since agricultural water interventions in India supposedly largely rely on decentralised planning, it was of particular interest to assess the form and actual extent of decentralisation. Related issues included how the international and national productivity paradigm is translated into practice by decentralised institutions and to which extent the current form of decentralisation supports the link between productivity and poverty. This analytical component was guided with the Actors, Power and Accountability framework developed by Agrawal and Ribot (2000).

[7] These are slightly different from the five capitals originally defined by Carney (1998) which are human, social, natural, physical and financial capitals.

Site selection

Our argumentation is grounded on empirical data and field observations collected from several case studies relatively representative of a wide range of farming systems of the Ganga Basin, north India. The latter are located in three districts of three different States of the Ganga Basin: Bankura District in West Bengal (4 villages), Etawah District in Uttar Pradesh (3 villages) and Hisar District in Haryana (2 villages) (Map 1).



Map 1. Location of case study districts in the Ganga Basin along a rainfall gradient

The districts and case study sites were chosen in order to have a sample of farming systems with a wide range of biophysical and socio-economic conditions, including annual rainfall average, access to different water sources, degree of agricultural intensification, and crops and livestock composition of the farming system (Table 1).

Table 1. Characteristics of the three case study districts

District Name	Hisar	Etawah	Bankura
Area (km^2)	4,072	2,212	6,936
Population density (hab/km^2) (2001)	386	586	464
Agro ecological zone	Arid	Semi-Arid	Sub-humid
Annual average rainfall range	Low (500-700 mm)	Medium (700-800 mm)	High (1300-1500 mm)
Access to irrigation water in study villages	Canal + Tube wells	Tube wells or canal + tube wells	Dug wells, small streams, ponds

Degree of agricultural intensification	Intensive	Intensive	Semi-intensive
Major livestock species	Buffaloes, camel, sheep	Cows, buffaloes, goats	Goats and sheep
Major crops grown in *kharif* (monsoon season)	Cotton, rice, guar and pearl millet	Wheat	Vegetables
Major crops grown in *rabi* (dry season)	Wheat, potatoes, mustard	Rice, pearl millet, vegetables	Rice and vegetables

We first conducted a baseline census survey among all 1,283 households of the nine villages in order to assess the level of heterogeneity of farming systems (types of crops and animals), of the perceived importance of different livelihood activities (crop cultivation/livestock breeding/off-farm work) and of water access. Results were used to select a representative sample of households in each village regarding these three components. Two different exercises were led with the selected sample of farmers. One group (203 households in total) was selected for a detailed household characterisation of land-use, livestock, feeding system and water use through a questionnaire survey. A qualitative approach was led with a second group (126 households in total) to gain a qualitative and in-depth understanding of livelihood strategies, gender issues, and institutional arrangements. It was complemented by focus group discussions and semi-structured interviews with key informants in the village (e.g. local elected representative, head of organisations, and customary head of the village). Lastly, interviews were conducted with 33 elected officials of local government executive bodies (*panchayat raj* institutions) and government officers of state line departments at the district and block level to analyze the institutional forms of government interventions regarding agricultural water, livestock and crop activities.

Sampled farmers were grouped according to their ownership/access to key forms of livelihood capitals, namely land, livestock and water, for the livelihood analysis as well as for the evaluation of LWP among different livelihood groups. These also ultimately represent distinct livelihood strategies and vulnerability. This led to the creation of four groups:

- Landless without any farming activity (no livestock and who do not produce any crop) – called in this study “off-farm poor” ;
- Landless with livestock or who work on land sharecropped in/ rented in – called “poor farmers”;
- Landowners with 0 to 1 asset – called “medium farmers”;
- Landowners with 2-3 assets – called “better-off farmers”.

Assets were defined as the following:

- Land size above the average of the surveyed farmers in the district case study sites;
- Livestock index[8] above the average of the surveyed farmers in the district case study sites; and
- Access to irrigation water.

[8] The livestock index is calculated by assigning a weight to each animal (large or small ruminants) depending on its specie, sex and age. The score is obtained by summing weights for each animal owned.

RESULTS AND DISCUSSION

Preliminary observations on LWP and poverty

LWP basically depends on three factors: 1) feed management; 2) animal management; and 3) water management (Peden, Tadesse, and Misra 2007).

From our interviews and discussions with farmers, a few observations can be made, based on a qualitative understanding of differentiated farmers' capabilities. In respect to animal management, poor and medium farmers might be more affected by the low service quality and accessibility of public veterinary services than better-off farmers due to their lack of financial capital to pay for private services – this is particularly true in Bankura District where households' financial capital is very low. One could therefore expect that the animals of the better-off are healthier than the animals of the poor and medium – with potentially higher milk yields. Better-off farmers also have the capability to purchase better animals. Regarding feed management, better-off farmers generally have better access to a higher diversity and quality feed such as concentrates, crop residues and green fodder because of larger landholdings and higher financial capital. The relationship between poverty and the capability of farmers to manage water in an efficient way is however less straightforward and will be discussed in the next section.

Before, as a preliminary exploration of LWP and poverty relationship, we examined the variation of LWP values calculated for each of the three livelihood groups who own livestock previously defined, i.e. the poor, medium and better-off farmers (Table 3) (Haileslassie et al. in press).

Table 2. Milk production, water consumed and LWP of dairy cows and buffaloes across farm clusters and farming systems

District	Variables	Poor		Medium		Better off	
(crops)		Desi cow	Buffalo	Desi cow	Buffalo	Desi cow	Buffalo
Bankura (paddy rice)	Milk (L day^{-1})	1.0	-	1.2	-	1.9	-
	Milk (USD day^{-1})	0.36	-	0.43	-	0.69	-
	Water requirement (m^{-3} day^{-1})	29.40	-	26.0	-	19.5	-
	Volume of water per L milk (*1000 L)	290	-	22	-	10	-
	LWP_PHYSICAL	**0.03**	**-**	**0.056**	**-**	**0.10**	**-**
	LWP_ECONOMIC	**0.01**	**-**	**0.02**	**-**	**0.04**	**-**
Hisar (millet-pulse)	Milk (L day^{-1})	-	7.50	6.00	7.50	7.00	6.70
	Milk (USD day^{-1})	-	2.63	2.11	2.63	2.46	2.35
	Water consumed (m^{-3} day^{-1})	-	18.20	15.15	22.12	20.17	22.67
	Volume of water per L milk (*1000 L)	-	2.4	2.5	2.9	2.8	3.3
	LWP_PHYSICAL	-	**0.41**	**0.40**	**0.34**	**0.35**	**0.30**
	LWP_ECONOMIC	-	**0.14**	**0.14**	**0.12**	**0.12**	**0.10**
Etawah (wheat rice)	Milk (L day^{-1})	-	7.00	5.50	7.00	5.50	6.33
	Milk (USD day^{-1})	-	2.46	1.93	2.46	1.93	2.22
	Water requirement (m^{-3} day^{-1})	-	12.16	6.96	8.16	10.12	11.50
	Volume of water per L milk (*1000 L)	-	1.7	1.3	1.2	1.8	1.8
	LWP_PHYSICAL	-	**0.58**	**0.79**	**0.86**	**0.54**	**0.55**
	LWP_ECONOMIC	-	**0.20**	**0.28**	**0.30**	**0.19**	**0.19**

Source: Our detailed questionnaire survey, 2009, values to be published in Haileslassie et al. (in press)

Whereas the LWP values *per se* do not provide a very thorough understanding of the relationship between LWP and poverty, it is interesting that these do not indicate *a priori* any direct relationship between LWP values and asset ranking. In Bankura District, the economic and physical value of LWP is twice as high for the desi cows of the better-off farmers as for the cows of the poor farmers. On the contrary, in Hisar District, the value of LWP for buffaloes is slightly lower for the better-off farmers than for the poor farmers. In Etawah District, the poor and better-off farmers perform equally, while the medium farmers have the highest LWP.

A close examination of collected data and field observations helped to gain better insights in the causal relationship of the two variables In Bankura District, the difference in LWP between livelihood groups is somehow conform to the previous observations. The key factor which emerged as determinant in the variation of LWP values among farmers was the access to good quality feed. While better-off farmers feed their animals with oil cakes, rice straw and husk, the cows of the poor (landless) graze in the forest area where good quality grass is scarce. These feed sources show the lowest ME water productivity. Better access to high quality feed translates into both higher milk yield and lower water requirements for feed production, thereby conducing to higher LWP.

In Hisar District, the difference in LWP is also driven by feed access. Most of the better-off farmers cultivate wheat in irrigated fields and therefore have good access to wheat crop residues, whereas other farmers only grow rainfed crops such as millet and pulses and commonly have to travel around 30 km to buy wheat straw. However, the LWP of the buffaloes of the better-off farmers is lower because the latter tend to over-feed their animals. Over-feeding does not only increase the volume of water consumed per animal but also reduces milk yield (Gillespie and Flanders 2010) – thereby decreasing the animal water productivity. Ironically, in this case, poverty – translated into farmers' limited access to good quality feed – has had a positive effect on LWP.

These observations have highlighted the prominence of access to feed in the relationship between poverty and LWP. Since access to feed is primarily dependent on access to irrigation, we further explore in the next section farmers' access to water for irrigation and water management.

Differentiated access and capitals

The LWP framework represents water – and other inputs – as a resource naturally flowing into the system. As already highlighted, farmers have however different capabilities and capitals necessary to access and manage the different inputs of the system (animal, feed and water). Farmers' access to water is often highly skewed among the communities.

In this respect, it is worth first underlining that the lack of reliable access to agricultural water was reported as a major problem by landowners over all three case study districts. Water scarcity is most acutely felt in the surveyed area of Bankura District where there is no canal infrastructure and very limited groundwater extraction (Figure 3). However, even in the canal and tube-well irrigated areas of Hisar and Etawah Districts, a majority of respondents also reported to suffer from a seasonal lack of agricultural water due to unreliable and insufficient canal water supply. Electricity shortages also severely constrain the use of groundwater in the case study villages of Etawah District.

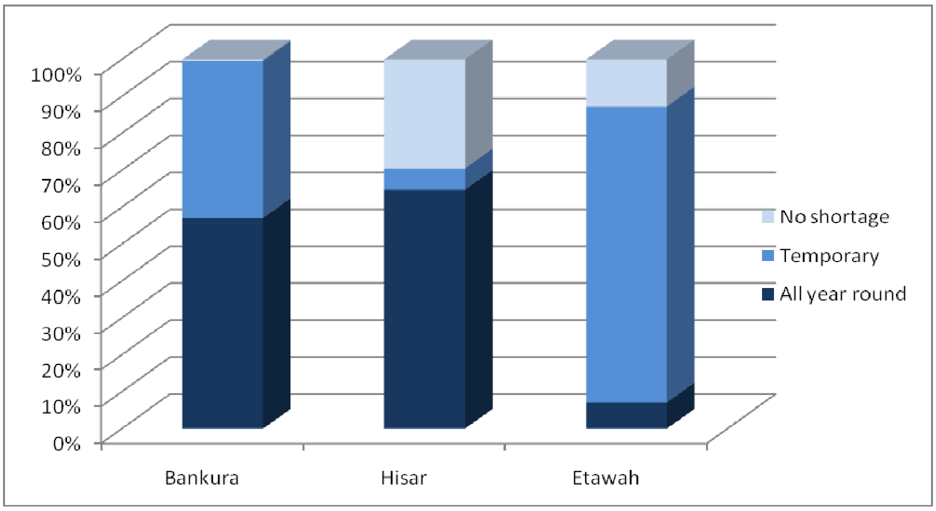


Figure 2. Percentage of landowners reporting agricultural water scarcity in the three surveyed districts
Source: our census survey, 999 households in nine villages, Dec 2008 – March 2009

In Bankura, farmers use a variety of sources to irrigate their fields: river, dug wells and rainwater harvesting structures (ponds or *happas*[9]). Access to these sources makes a significant difference during the dry season in the range of livelihood options available to farmers as those with water access can cultivate vegetables thereby having a supplementary source of income. During the monsoon season, access to supplemental irrigation is crucial to avoid crop failure during the frequent dry spells. Even within the four surveyed communities which are relatively homogenous in terms of ethnicity (90% are Santhal) and of landholding area (Table 1), households' capabilities to access these different water sources were found to be very heterogeneous. Access to irrigation emerged as the main differentiating factor between the medium and better-off farmers in the area compared with land and livestock assets (what Table 1 suggests was largely confirmed by household interviews and group discussions).

Table 1. Major assets and indicators of poverty of the three livelihood groups in the case study villages of Bankura District

Assets / poverty indicators	Poor	Medium	Better-off
Average land area (m^2)	/	3,602	3,925
Average livestock index	2.1	2.3	3.9
% hh with access to irrigation in *rabi*	/	33.3	55.6
% hh with high social capital*	0.0	16.7	25.0
% hh with paddy production covering annual food needs	/	6.6	25.0
% hh with mobile phone or TV	0.0	12.1	38.9

Source: Our detailed survey, sample: 55 households in 4 villages, Feb – Dec 2009

[9] A *happa* is a ditch covering 5% of the land holding. It is rectangular in shape with stairs going down to about 3.5 m deep.

*** This entails being member of the Adivasi (generic term to designate indigenous people in India) club, gram panchayat (local elected government body) or watershed committee (committee set up to implement government watershed development programmes).*

Around 30 percent of farmers do not have access to any other water source than rainfall (Figure 4). It is not necessarily due to a lack of physical access (e.g. due to the unfavourable location of their fields). A lack of capitals to access a diesel pump[10] proved to be a major differentiating determinant in farmer's capability to irrrigate. The latter depends not only on financial capital (to rent the pump set and pay for diesel costs), but also, among some communities, on social capital (the access to the pump is restricted only to a few members of the community). A few farmers, however, manage to irrigate their fields during *rabi* without a pump. In the village of Lakhipur, some use the rainwater stored in clay lowland plots adjacent to their field for vegetable cultivation, transported to their fields with buckets. In Jhagradihi, poorest farmers also use buckets to carry water from the neighbouring river and irrigate vegetables. In this case, produced capital is substituted by human capital (labour).

In short, farmers' access to irrigation in Bankura district is contingent on a combination of two or three of the following forms of capital: produced, human and social capitals. The combination required highly depends on local characteristics, which were identified as the biophysical conditions, local rules-in-use and the historical, cultural and context in which the latter have developed (Clement et al. In press).

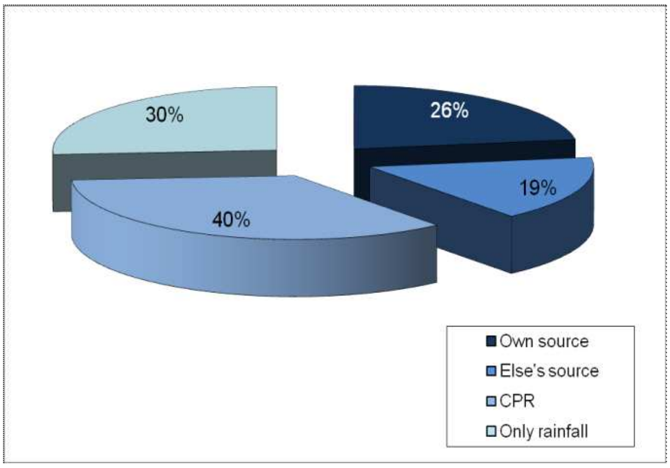


Figure 3. Forms of access to water sources in the four villages of Bankura District
Source: Detailed questionnaire and household interviews, 69 households in four villages, Feb 2009

In Etawah and Hisar Districts, canal infrastructure supplies water in four out of the five surveyed villages, and groundwater is used in all five villages at varying degrees. However, the forms of access to water also considerably vary among farmers (Figure 4).

[10] A large majority of pumps used in West Bengal are diesel pumps due to high electricity costs

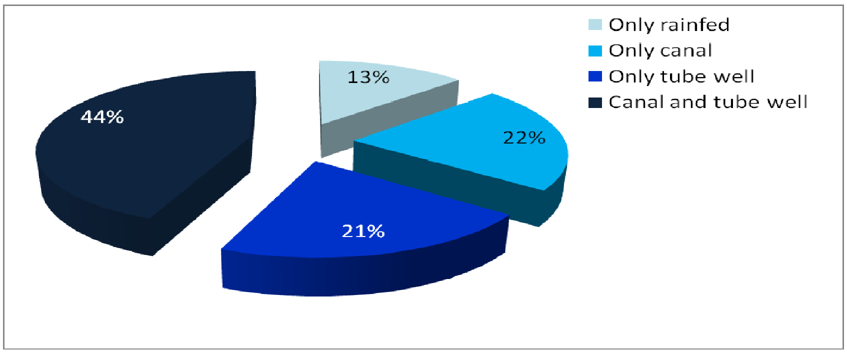


Figure 4. Sources of agricultural water in Hisar and Etawah Districts
Source: Detailed questionnaire and household interviews, 128 households in five villages, April-June 2009

In the study area, canal management, operation and maintenance, and water distribution are totally under the responsibility of the Irrigation Department, whose actions seem to respond more to macro political imperatives and to the vested interests of a political elite than to farmers' claims and demands (*source: interviews, Etawah and Hisar District*). Access to canal water was thus generally a factor of produced capital (ownership of land in the "[11]political canal command area" and preferably in the head section of the canal branch). Social capital (here in the sense of political capital) was found to play a role only occasionally to re-secure individual access to water, for example to support farmers' requests to the Department of Irrigation when construction works (e.g. land excavation for brick construction) obstruct a canal channel. Other types of claims regarding water flow timing and quantity were left unattended. The overall importance of social capital in farmers' capabilities to secure a reliable and sufficient water flow from the canal supply is tightly linked with the current institutional context, notably the form of decentralisation, under which canals operate – it will be discussed later on in the paper. Around 70 percent of the farmers who have access to canal water purchase groundwater in addition, either because they found canal supply insufficient, unreliable or inflexible. Access to groundwater in India is tied with land ownership and is driven by private markets. It therefore primarily relies on household's produced capital.

Compared to other forms of farm inputs, water holds probably the highest macro and local diversity in its forms of access and related forms of capitals. The variability of the forms of capitals required varies among farming systems and sometimes among communities. In Bankura District, where water sources are small private structures and common-pool resources (CPR), farmers use several forms capitals to access water – which proved to vary locally significantly. In one of the case study villages, social and human capitals were necessary, whereas in a neighbouring village, produced capitals were more important. On the contrary, in the canal and groundwater irrigated areas of Hisar and Etawah Districts, the forms of capitals farmers need to access agricultural water are relatively homogenous and are shaped by the macro-context (form and extent of decentralisation, groundwater property rights regime) rather than by the local context.

This has several implications regarding water management interventions aiming at increase water productivity. What will make a successful water management

[11] By "political canal command area", we mean the area within the physical command area which receives the necessary political support to get water supply.

interventions will not be so much about the provision of physical infrastructures to access water but rather about enhancing the capabilities of the most deprived households to access water in practice. We argue in the following sections that the focus on productivity conveniently masks farmers' differentiated capabilities and the need for institutional and political reforms which would benefit the poorest farmers.

Equity in productivity discourses

The lessons from the green revolution have highlighted the risks of increasing inequities by focusing on productivity improvement. In India, the rationale for agricultural and water productivity increase has particularly driven watershed development (WSD) programmes, the major national initiative in terms of agricultural water management since the 1990s. Activities conducted under these programmes have notably included the construction of new water infrastructures, such as check dams and rainwater harvesting structures (percolation tanks, farm ponds, etc).

First focusing on soil and water conservation, the WSD objectives have progressively shifted towards a combined goal of productivity increase and livelihood improvement (Government of India 2008). Linked with the productivity paradigm, an influential narrative present in the national discourses on the WSD programme calls for reaching the "potential" of natural resources to increase productivity (Shah 2006). The identification of suitable target area and communities under the WSD programmes talks of "area to be treated" underlining the focus on a physical unit which needs a technical fix to be brought back to a healthy (productive) status. Inequity, and more particularly one of its symptoms, conflicts, was also recognised by the Technical Committee in charge of evaluating past WSD programmes in 2005 as a major issue in WSD implementation (Shah 2006). Following the recommendations of th committee, equity has been integrated as a guiding principle of the latest WSD guidelines. However, there is no mention in the latest guidelines of how this principle will be achieved, monitored and evaluated (if to be assessed).

Other government interventions related with agricultural water have primarily focused on infrastructure development, more particularly since the start of the implementation of the national rural employment guarantee act (NREGA), a major central programme which guarantees 100 days of work to every household in India. The scheme aims at giving employment to poor people in rural areas and limiting seasonal migration by the construction of structures (roads, ponds, etc) which require low-skilled labour force. The focus has thus been on infrastructures rather than on the institutions which might allow poor people to access or to benefit from existing water sources or new structures.

Whether under NREGA or the WSD, the benefits of the water structures to the small, marginal farmers and landless have in general been restricted to a few days of wage labour (Calder et al. 2008; Chhotray 2007). The newly built structures have mostly benefited those who have already sufficient capitals to access and use the water from the structure. One of the "anti-poor" bias of WSD projects has included the shift from traditional community water tanks to the development of private tube-wells or the establishment of private plantations on common grazing land (Calder et al. 2008). In the village of Jhagradhi, a pump-set was given to the community by the *panchayat samiti*[12]. When the pump failed, only one household paid for its reparation and thereafter declared themselves as the pump owner. Since, only those who had tight links with the pump owner have been able to use it. Because of the isolation of the village, the other villagers could not access any other pump, and had to stop cultivating vegetables.

In Bankura District, the district magistrate[13] defined one of the government's primordial objectives in terms of rural development as "to utilise local resources" and "to create as many sources of water as possible" (*interviews, December 2008*). This discourse collides with the perception of the local communities surveyed in the District. A problem-ranking exercise was led with the three different groups of farmers (poor/medium/better-off) on issues affecting their livelihoods. "Inequalities to access water" was ranked by all groups (not only the poor) as the most important problem before "the lack of water harvesting structures".

Why do better-off farmers also value equity? One reason is the high reliance on CPR and collective action among these communities, which has been sustained by low market integration and strong norms. Collective action includes the shared purchase and care of animals, maintenance of collective water storage structures, share of labour, etc. Inequalities might significantly affect these forms of collective action, thereby reducing also the social capital of the community and when actions collapse, the overall productivity of the farming systems. It was the case in one of the villages where the community refused to participate to the annual construction of an earthen dam in the rivulet because of recent inequities which arose after the household appropriated the pump-set. Beside its importance for sustaining collective action, equity is also a significant cultural value for Santals (Bhattacharya 2004).

Productivity requires participation not decentralisation

As discussed in the previous section, the water and agricultural productivity narrative carries the assumption that farmers have to take technical actions to become more productive thereby masking the political nature of land and water management. It has become particularly evident in the way WSD programmes have been designed and implemented in India (Baviskar 2004; Chhotray 2007; Venot and Clement Forthcoming). Participation and participatory approaches have been emphasised in the series of national WSD guidelines issued since 1995. There has however been, in the WSD approaches, and in government rural development interventions in general, little emphasis on democratic decentralisation, e.g. on accountability and devolution of power and funds to local elected bodies.

In 1992, the Government of India passed a series of amendments to the Constitution designed to empower local political bodies, called the *panchayati raj* institutions (PRIs). These bodies are elected at the district, block (sub-district administrative level) and village (or group of villages) level and called *zilla parishad*, *panchayat samiti* and *gram panchayat* (GP) respectively. The subsequent process of decentralisation has greatly differed among states, with varying degrees of devolution of political, administrative and

[12] The panchayat samit is the name of the second tier of local government elected body at the block level
[13] The district magistrate, also called 'district collector' or 'deputy commissioner' is the administrative head of the district.

fiscal authority to local *panchayats*. The state of West Bengal has been pioneer in the decentralisation process by devolving discretionary powers over spending and staff to *panchayats*. It stands out comparatively better among the three studied states in regard to the actual extent of administrative decentralisation, with all 29 subjects devolved to PRIs (Table 10). One should note however that, out of the 29 subjects, only 12 have been entrusted with funds and functionaries.

Table 3. Degree of administrative and political decentralisation in the 3 case study states

	Haryana	**Uttar Pradesh**	**West Bengal**
Number of subjects entrusted to PRIs	16 (none with funds or functionaries)	13 (including 12 with funds and 9 with functionaries)	29 (including 12 with funds and functionaries)

Source: India Panchayat Raj Report, 2001, Volume-I, National Institute of Rural Development

The 73rd and 74th Amendments to the Constitution provide arrangements for setting up a state finance commission (SFC) in each state to decide on the level of fiscal transfer to local bodies. In all states across India, PRIs rely almost exclusively on funds delivered by the central and state governments. Even when empowered by the State to levy taxes, most elected bodies are reluctant to take such initiative because of its unpopularity (Society for Participatory Research in Asia (PRIA) 2004).

The 73rd amendment envisions PRIs as key actors of planning for local development. It requests states to form a district planning committee (DPC) at the district level. However not every state has created a DPC. In Uttar Pradesh, the DPCs were constituted only recently following the DPC (amendment) Act 2007. The accountability of the chairmanship also varies, the latter being given either to elected (like in West Bengal to the head of the *zilla parishad*, the *sabhadhipati*) or non-elected officials (e.g. in Haryana the deputy commissioner and Uttar Pradesh the district in charge minister).

Planning has been in theory decentralised down to the village level. The Government of India has supported through the GPs the design of “village development plans”. These plans are to be elaborated by villagers, assembled in the *gram sabha*[14], and present the interventions that will contribute to the development of their village. Then, the village development plans are sent to the GP, transferred to the block development officer (BDO) and finally integrated into the district plan by the DPC. On the ground, villagers’ participation to the meetings of the *gram sabha* is mediocre (47.5% of participation in the case study villages). The primary reasons mentioned by farmers for non attending were a lack of interest and a lack of perceived benefits.

As a matter of fact, the GP and *gram sabha* play very little if any role in the planning of the development of their village as they do not have any funds or power to do so. In Bankura District, half of the interviewed farmers do not know what is the village development plan – though some of them said to participate to the *gram sabha* meetings. In Etawah District, the participation of interviewed villagers to the *gram sabha* meetings is relatively higher than in the other districts because villagers receive information on crops, seeds and agricultural practices during the meetings. But the *gram sabha* meetings do not provide a venue for discussing rural development or the specific issues they feel need to be addressed to improve or sustain their livelihoods.

[14] The *gram sabha* is constituted by all members of a village over the age of 18 years

Villagers do not perceive the GP as a representative organisation responding to their needs but rather as an executive agent which role is limited to ensure the cleanliness of the streets, install hand pumps and build roads (*semi-structured household interviews, June 2009*). Interviewed heads of the GP also perceive the role of the GP as implementing government schemes and distributing benefits – i.e. a top down approach rather than the bottom up process claimed by the government.

Even when village development plans exist and represent the voices of the local population, a major limitation is that the local needs expressed in the plan have to fit within existing state and central government schemes. The deputy commissioner of Hisar District was explaining that this was not an issue because: "*There is a scheme for every need*" (*interview, May 2009*). Local people participate to choose among a menu of interventions decided by the central or national governments.

In the irrigation sector, international assistance and government interventions have progressively shifted from canal infrastructure to institutions supporting the delivery of canal water supply. Several states of India have started forming water user associations (WUAs), devolving, at varying degrees, rights and responsibilities from government agencies to farmers. In Haryana, participatory irrigation management (PIM) and the creation of WUA were initiated in 1995 as a part of implementation of the Water Resources Consolidation Project. Farmers willing to form WUAs are expected to take an active role in the maintenance and rehabilitation of the watercourse, but not in its management. However, farmers currently do not have any control over water delivery and there is little transparency and information flow from the Irrigation Department to water users, due to low accountability of the former to the latter, as illustrated by this quote:

> *"Before, there was more water in the canal than now. I don't know why. We asked why, we were told that there was no water in the dam. We don't know where is the dam or where the water comes from. We don't know how much water will come next year"*
>
> (a farmer, Basra village, household interview, April 2009).

It seems therefore very unlikely that, unless services are improved or water management is devolved to water users, farmers accept to take responsibilities for canal maintenance (see Nikku 2002; Garces-Restrepo, Vermillion, and Muñoz 2007).

CONCLUSION

The debate on the productivity/poverty nexus has been polarised around the question of who directly or indirectly benefits from productivity gains. In the case of water productivity, our analysis based on case studies across the Ganga Basin indicates that there is no clear relationship between livestock water productivity (LWP) and poverty. In one of the communities, poor farmers had a higher productivity because they could not afford to over-feed their animals as better-off farmers did. This shows that setting water productivity as a goal might not be meaningful: poor farmers in this village have a high LWP, and so what?

The search for productivity gains has been indeed one of the shortcomings of many government or donor-driven interventions in the field of agriculture. Focusing on increasing agricultural outputs alone by providing technologies, infrastructure or equipment, the latter have failed to alleviate poverty because they have not considered the capabilities necessary to access, defend or sustain assets and the benefits one derives from them. This argument was particularly well developed by Sen in his analysis of the 1943 famine in Bengal. According to Sen, there was no shortage of rice this year but the famine was driven by the reduced financial capabilities of some groups (e.g. landless) to buy grains (Sen 1982).

For productivity to alleviate poverty, interventions need to be explicitly designed to increase the capabilities of the poor as individuals and as social groups. Interventions need to actively relate structures and technologies to institutional mechanisms ensuring equity. Otherwise, only those who already have access to capitals are likely to be able to benefit, as illustrated by the pump incident in the village of Jhagradihi in West Bengal. Reinforcing inequities might in turn jeopardize the social capital of the community and any forms of collective action in the village.

Drafting institutions to ensure equitable use and benefits of water requires acknowledging the political nature of water and agriculture interventions. However, productivity discourses tend to rationalise water management and mask the power distribution which shapes farmers' capabilities to improve their farming systems. Lastly, the form of participation currently advocated under water-related projects proves to be meaningless if not conducted within the framework of democratic decentralisation.

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[15] These two centers belong to the Consultative Group on International Agricultural Research (CGIAR)

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