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Irrigation development against rural poverty: an over-view of trends in research and development[1]

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Irrigation development, rural poverty, importance of water in development and poverty reduction, making water work for people

Abstract
Water is recognized as a key poverty alleviation resource, which is available through a myriad of sources, and has a host of functions and uses in human life. While there has been considerable literature assessing various linkages between water and poverty alleviation, most of the research in the past has tended to focus within the narrow confines of disciplines. This paper aims to review the past work from various disciplines in relation to water and its role in poverty alleviation. Through an extensive literature survey, this paper has attempted to identify the shifts and tendencies in research and development related to water and poverty. The paper takes the reader through the irrigation developments and research on irrigation and poverty during the past 50 years. The paper argues that poverty alleviation remained at the heart of water development agenda throughout the period, though indirectly. The major weakness of the research and development approaches was a lack of focus on people's incentives to make a real change in the way water is managed. The agendas of various stakeholders at different levels vary and need to be understood in order to develop smart incentives benefiting the poor and balancing competing demands over water.These incentives are the main drivers for adopting new systems and encouraging people to cooperate. However, these incentives might help to set a pro-poor system, only through a good understanding of people's opportunities and constraints. Therefore, the use of analytical approaches and frameworks that can reveal more complicated links between water and poverty, should be deployed while conducting primary research in the water sector for the future.

1.Introduction

Enormous investments occurred in irrigation development over the past half a century, but the success in reducing poverty seems partial, as half of the global poor had no secure access to water at the beginning of the millennium (Global Water Partnership (GWP), 2000; IFAD, 2001). While this simple statistic demonstrates the potential of

[1] The literature survey for this paper had been undertaken as one of the requirements for the degree of Masters of Research at the School of Development Studies of the University of East Anglia (Nizamedinkhodjayeva, 2006). The current paper analyzes that information from a different perspective.

water sector for contributing to the Millennium Development Goals (MDG) of halving poverty by 2015, it also demonstrates that the earlier approaches have not always succeeded in their intentions to lift rural people out of poverty. This failure is due to a number of reasons.

Firstly, a number of high profile pro-poor instruments and documents have failed to link sufficiently irrigation and poverty. For example, while the MDGs cannot be achieved without sound water management and use (SIWI, 2005), the significance of access to water for productive uses by the poor has not been sufficiently addressed by MDG documents (MERREY et al., 2005). Although growth in agriculture has been identified as a primary means for reducing poverty in many parts of the world (IFAD, 2001; DFID, 2003), the role of water for the poor is still not properly targeted in the global development agenda (HUSSAIN and HANJRA, 2002; HUSSAIN et al., 2003). The emerging livelihood approaches as well have not articulated irrigation and poverty link (CARNEY et al., 1999). Secondly, the earlier investments into the water sector are now being criticised for their techno-centric orientation. In particular, the techno-centric approaches of mid 20th century had overlooked the role of water for subsistence agriculture as well as for other non-farming diversified livelihoods activities and needs. While the irrigation development during the green revolution era did try to enable small farmers to participate in equitable agricultural growth, and the irrigation development was quite successful in reducing poverty but not everywhere equally (HUSSAIN, et al., 2003). Thirdly, poor access to water for food and livelihoods remains as a 'poverty trap for seventy per cent of the world's poor people' (RIJSBERMAN et al., 2006). Although the access to water is not the only input for improving the living standards of people, it is often identified as the major constraint or as the first need for survival, especially by the rural poor, for example in Central Asia, who need water as badly as they need air (WORLD BANK, 2006). Finally, there are important gender dimensions to all aspects of water use, whether related to domestic, irrigation for farming, and environmental needs. These critical oversights during the earlier decades are now gradually emerging on water research agenda.

While there is ample literature discussing discipline specific developments in irrigation over the past, a cross-disciplinary overview of research and development has not yet been undertaken. This paper aims to fill that essential gap. The objective of this paper is thus to review major research themes in irrigation development since 1950's and provide insights on development and research trajectories, and identify missing links, opportunities and challenges for irrigation development for poverty alleviation.

The paper provides a brief overview of the lessons learnt from the previous approaches in irrigation water development. The paper in particular discusses the following questions: what the major approaches and foci were; why previous developments failed to benefit the poor equally, and what were the missing links,

opportunities, and challenges in development to connect water investments with poverty reduction. Finally, the paper provides some reflections on how research in the water sector can better guide future intervention strategies to contribute to global poverty reduction.

The paper is structured into five sections. The second section describes the approach and methodology of the study. Section 3 comprises two sub-sections. The first subsection outlines the importance of water in development and poverty reduction, highlighting the water benefits and costs, defining water sources and related problems and explaining the irrigation water and poverty nexus from the economic, social and institutional perspectives. The second sub-section analyses the strength and weaknesses of the previous research strategies in the water sector. These strategies include construction, rehabilitation and management phases of the water sector development, struggles for better irrigation system performance, irrigation management transfer, top-down and bottom-up approaches, field-system-basin perspective about water, integrated water resources management and the need for operationalising of livelihood approaches to make water research recommendations to contribute to poverty reduction and to help the poor. The last section summarises the discussions and concludes the paper.

2. Materials and methods

The best way to carry out an overview of the past trends is to carry out a survey of various discipline and thematic research. Thus, this literature survey critically reviews major research themes evolving in the water sector from the time of the Green Revolution to the present day. Most of the published literature surveyed has been reported after 1990 and comprised overview papers, approaches and methodologies and empirical studies.In total, 68 studies were surveyed.

3. Results and discussion

3.1 The importance of water in development and poverty reduction

3.1.1 Water functions, benefits and costs

Apart from being essential to life, water has economic, social, political, spiritual, aesthetic and environmental functions. In particular, at the household level, water is needed for drinking, washing, and cooking, irrigating, manufacturing, livestock rearing and agro-processing. The importance of water is increasingly recognized regarding its economic production value, including agricultural, industrial and transport uses and benefits from return flows as well as adjustment for societal objectives (BHATA, 1997; GWP, 2000).

However, the costs for construction and reconstruction, operation and maintenance (O&M) as well as for ensuring environmental sustainability of water supply and use in irrigation projects became increasingly high in irrigation projects (BHATA, 1997). Thus, for majority of the poor, the constructive value of water could become destructive, if not properly managed. For example, water mismanagement could lead to water pollution, which causes health, life and economic risks. The revealed health implications of water mismanagement could be malarial infection, typhoid, allergies and, in some instances, a decrease in male fertility. Other consequences of mismanagement include contributing to increasing droughts, flooding, desertification, waterlogging and land degradation. These outcomes threaten livelihood sustainability, increasing poverty and placing human beings, flora and fauna at the edge of survival. Therefore, water management taking into account environmental considerations is vital for sustainable human development (MERREY, 1997).

3.1.2 Water sources

Water is available from various sources: glaciers, streams, rivers, lakes, precipitation, oceans and seas. Water in oceans and seas is an important means for transportation and fisheries. However, it is rarely used for other productive purposes. Water sources commonly in use by people include surface water, ground water, municipal, industrial and agricultural waste water (return water) and rain water. In general, surface irrigation water is captured, stored and delivered through irrigation systems, comprising of reservoirs, river basins and delivery canals, while ground water is extracted at a local scale.

The contemporary definition of 'waters' distinguishes between blue and green water (FALKENMARK, 1995; GWP, 2000). Blue water has been approximated to be 40 per cent of the total rainfall worldwide, and is defined as precipitation that contributes to stream runoff and groundwater, withdrawn for human use. Green water is the other 60 per cent, which is precipitation, evaporated or transpired by vegetation. The new paradigm in the water sector and research is to shift to management of complete water cycles, including green and blue water (GWP, 2000), departing from the perceptions during the Green Revolution of the 1960s.

During the Green Revolution era, irrigation development, in particular, diversion and use of surface irrigation waters, in relatively dry-area countries, played an important role in increasing crop production through development and increasing both the area planted and land productivity (KIKUCHI, 1992). However, the capacity of constructed irrigation canals was often lower than the planned. As a result of growing pressure on irrigation systems as well as their deferred maintenance, the performance of irrigation systems decreased in terms of equity, reliability, efficiency and timeliness of irrigation water supplies. This made tail-end farmers more dependent upon pumped groundwater to secure their production. For example, there was a ground water boom in South Asia when hundreds of thousands of new ground water

extraction systems were installed between the 1970s and 1980s (KIJNE, 1992). In some cases the quality of groundwater decreased from the head to the tail of irrigation canals. The head-end farmers would tend to over-irrigate their fields because of irregular water supply. Then this water, polluted with agricultural chemicals and dissolved salts, would become ground water, raising the water tables and salinity for downstream users. In the case of drainage system connected to the main irrigation system, like in Central Asia, the polluted drainage water would return to the system and contaminate the water available to the downstream users. Although the extensive ground water use mitigated the threat of water logging (KIJNE and KUPER, 1995, cited in MERREY, 1997), it caused other serious problems, such as increasing water pollution, adverse implications for hydropower supply, degradation of soils, etc. These implications posed a serious threat to sustainable development and environment (KIJNE, 1992; MERREY, 1997; GIORDANO, 2005).

As a response to these emerging problems, research began to focus on increasing equity, reliability, efficiency and timeliness of irrigation water supplies, i.e. irrigation system performance. However, a number of researchers have asserted that there was too much focus on only technical perspectives of these problems (KLOEZEN and GARCES-RESTREPO, 1998; MOLDEN and GATES, 1990).

Other approaches to the above mentioned problems were related to the conjunctive use of surface and ground water. These included: 1) calculations of water and salt balances in order to determine realistic critical limits for surface water/groundwater ratios; 2) development of models to predict salinity changes over time in relation to different intensities of groundwater use; 3) predictions on the impact of groundwater use on agricultural productivity and possible ways to mitigate the adverse consequences of poor quality water use. For example, some of the solutions were seen in changing cropping pattern, mixing poor quality water with better quality water, etc. (MURRAY-RUST and VANDER VELDE, 1993).

Meanwhile, urban population growth and its associated domestic systems resulted in the release of growing volumes of mostly untreated wastewater into the environment. The wastewater use had serious implications for human health and the environment, proven by research. However, wastewater was and still is increasingly used in agriculture, yielding high crops and generating a considerable value for livelihoods in urban and peri-urban agriculture (HOEK, 2004). In this contest, recent research has started focussing on the need to minimize risks and increase the benefits of wastewater use (SIWI, 2005).

In sum, much of the past research remained focused on technical performance aspects and implications of management for the environment. As a result, the research recommendations could rarely be operationalised or sustained. The imposed research recommendations have often further restricted already limited opportunities of the poor and did not provide people, struggling for survival, with better alternatives to