

# Water, poverty and gender: an overview of issues and policies

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## Abstract

This paper presents an overview of the theoretical, methodological and policy issues that are evident both in the extant literature on the subject as well as in the set of papers that are included in this special issue. In providing such an overview, this paper also develops an analytical framework using a schematic representation of some of the most important layers and pathways that underlie the water–poverty–gender nexus. Based on the overview and discussion, this paper attempts: (a) to indicate approaches and strategies for using water as a key instrument to address poverty and gender concerns and (b) to identify the research gaps in order to set the direction for ongoing and future research at the water–poverty–gender interface.

*Keywords:* Gender; Literature review; Poverty; Water; Water research

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## 1. Introduction

Poverty alleviation continues to be the dominant concern of policy makers, researchers and international donors ever since the independence of many developing countries and the establishment of a number of international research, funding and development agencies in the post-war period. Initially, it was hoped that the overall process of economic growth could take care of poverty through its “trickle down” effects. But, actual experience has belied this expectation, as poverty continues to persist despite the remarkable growth performance of many developing countries. The poverty-reduction experience of the Green Revolution is also similar, as poverty, in this case, coexists with food surplus. The general diagnosis then was that economic growth and agricultural production cannot have their full impact on poverty unless the social, demographic, institutional and technical bottlenecks are removed. As a result, the attention shifted to the distributional aspects of growth with an emphasis on policies such as land reform, subsidized food distribution and special employment programs. But, even these programs were not as successful as anticipated partly because of their partial coverage and partly because of their transitory nature.

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In the meantime, gender has also emerged as another related concern, especially during the last decade, as micro and household level research has shown that gender equality and female empowerment could contribute significantly to development at the household and community levels. In some sense, the focus on gender was partly an outcome of the household and group-specific approach to poverty. But, over the years, it has also acquired other dimensions, with developments such as feminist movements. Going by the historical experiences of developed countries, while there is a positive association between poverty alleviation and gender equality, this association becomes either weak or breaks down completely in most developing countries mainly owing to many social constraints. This suggests a need for a more direct focus on gender concerns in development policies and programs.

It is in this context of a general failure of traditional attempts to alleviate poverty coupled with the emergence of the additional but interrelated dimension of gender that recent research and policy attention has been directed towards a resource-specific approach to simultaneously deal with both poverty and gender. The resource-specific approach underlines the importance of specific resources such as water, forestry and other local resources in addressing poverty and gender concerns. In many contexts, an area dimension is also added (e.g. watershed and river basin) to meet the organizational and management requirements of the resource-specific approach to poverty and gender. Among the resources used in this approach, water assumes a particular significance because of its all-pervasive role in many facets of human life and environment. Obviously, water resources, if used properly, could be a powerful tool for tackling poverty and gender concerns on a more sustainable basis.

What does current research say about the actual nature and magnitude of the impact of water on poverty and gender? How can this research-based knowledge guide poverty alleviation and socio-economic empowerment policies and programs in different contexts? These are the issues for which the public, policy makers and the donor and development agencies are constantly seeking answers. This special issue on the water–poverty–gender nexus is a modest attempt to provide a forum for both the questioning and the answering process. While policy-related research papers on the subject are produced in many research organizations and published in many leading journals, there is a need to bring some of them together within a single volume. This is precisely the objective and also the justification for this special issue. In this paper, we present an overview of the papers both included in this volume as well as those in extant literature, not only to provide context and background for this special issue, but also to indicate the implications for future research and policy on the subject.

## **2. The water–poverty–gender interface**

What is the nature of the linkages between water, poverty and gender? To answer this question, let us consider Fig. 1, which presents a schematic representation of the layers and pathways evident in the water–poverty–gender interface. Obviously, this schematic representation is not exhaustive in covering all the factors mediating within the interface. While it tries to be as comprehensive as possible in capturing most of the macro aspects, it also sacrifices many micro details. Nevertheless, the schematic representation in Fig. 1 shows the most important layers and pathways that capture and transmit the impact of water on poverty and gender via a number of economic, agronomic, social, institutional, technological and environmental variables. While Fig. 1 is largely self-explanatory, a few analytical levels that are depicted therein need to be highlighted.

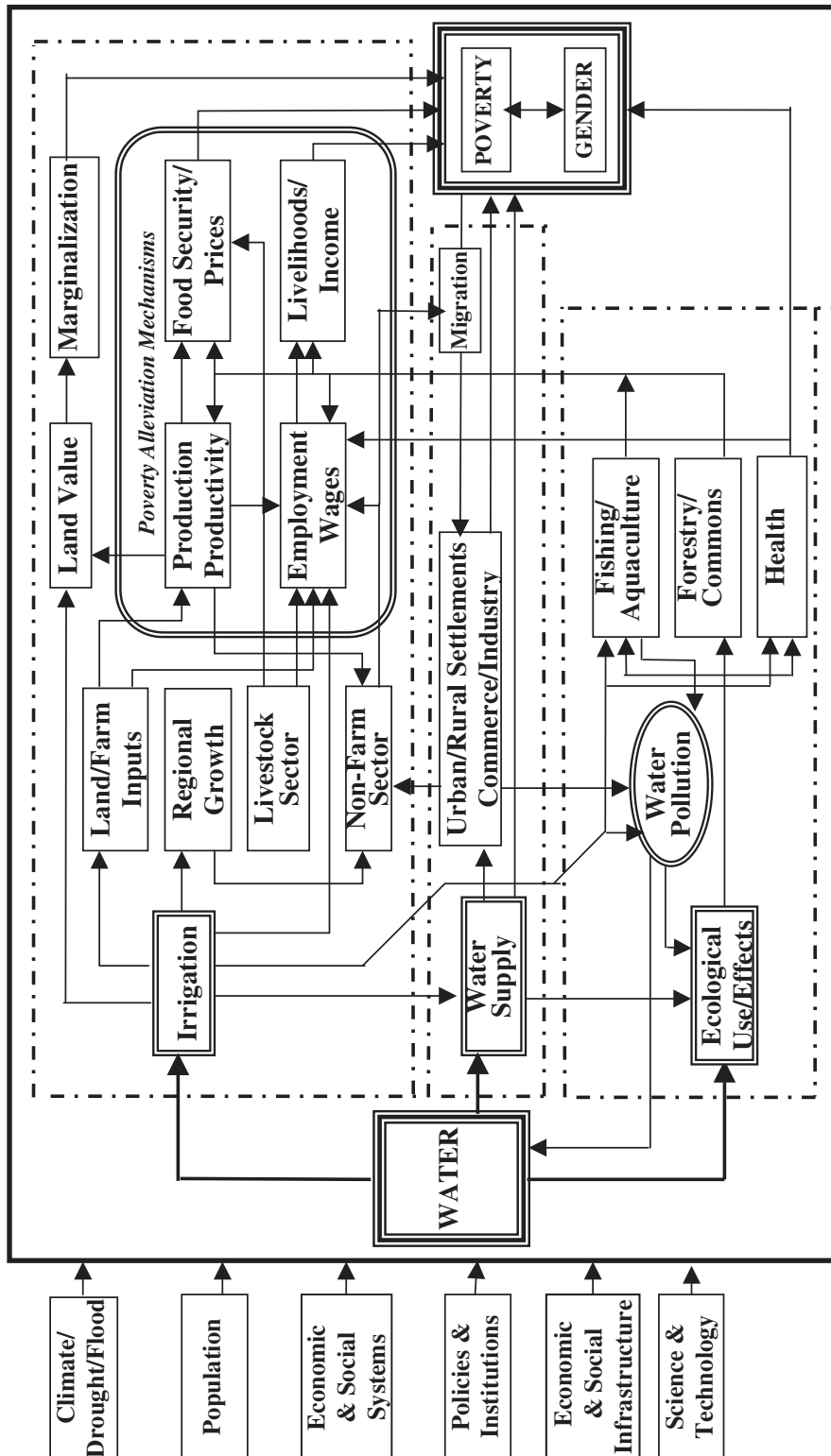


Fig. 1. A Schematic Representation of Water-Poverty-Gender Nexus.

First, the water–poverty–gender interface is operating within the general context defined by the natural, demographic, socio-economic, institutional, infrastructural and technological factors<sup>1</sup>. It is these interrelated factors that determine both the effectiveness and vigor of various layers of linkages among the factors that mediate through the water–poverty–gender interface. Natural factors such as droughts and floods and demographic consequences ranging from population density to land fragmentation often have considerable negative effects on the economically and socially vulnerable groups including women. Similarly, the nature of the relationship between water, poverty and gender in dryland areas will be different from the same in already well-established irrigated areas<sup>2</sup>. It is true that irrigation can counter the effects of demographic factors with higher food production and better productivity of uneconomic holdings. But, such role is severely constrained when population pressure exceeds beyond the carrying capacity of land and water systems. Similarly, social factors (e.g. the caste system in India and racial issues in South Africa) also remain a major constraint on our efforts to strengthen the water–poverty–gender nexus. On the other hand, policies (e.g. caste and gender-based preferential treatments in education, employment and in the provision of food items and credit) and institutions (e.g. water allocation rules, irrigation management transfer and water rights) can reinforce the impact of water on poverty and gender. This is also true for technologies (e.g. green revolution technologies, water technologies such as low-cost drips and treadle pumps). As a result, the synergies or discordant effects of these contextual factors play a crucial role in determining the overall effectiveness of the water–poverty–gender interface.

Second, the impact of water on poverty and gender are generated through three main channels or routes, i.e. irrigation, water supply and ecological effects/uses. These channels are interrelated partly owing to multiple uses of water and partly through the mechanisms of allocation between its different uses. Obviously, an irrigation channel involves a land and farming system and a water supply route involves human settlement including urbanization, industrialization and migration. On the other hand, the ecological and environmental effects involve fishing/aquaculture, forestry/local commons/wetlands, the health impact of water-borne diseases and more importantly, water pollution as contributed by irrigation (e.g. chemical residues) and urban settlements (e.g. industrial effluents). We have distinguished these three main channels only for analytical convenience. But, as can be seen from Fig. 1, these channels are interlinked with effects flowing across them.

Third, taking the impact of water transmitted via various layers of linkages within each of the three channels, irrigation involves eight main pathways of impact. Some of these impacts are positive whereas others are negative. With land and other inputs, irrigation leads to higher output and larger employment, contributing thereby to food and income benefits to the poor. Irrigation schemes, apart from their direct contribution to employment in their construction and maintenance, also lead to regional growth, which, taken with the effects of agricultural growth, leads to the expansion of non-farm and livestock sectors which have considerable employment and income benefits for the poor. Multiple uses of irrigation water for domestic and environmental uses also have some amenity benefits for the rural poor. On the other

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<sup>1</sup> Notice that there are fundamental interactions among these factors themselves. For the sake of simplicity, these interrelationships are not shown in Fig. 1.

<sup>2</sup> The marginal impact of water on poverty alleviation, for instance, will be stronger in the initial stages of water development and in rainfed regions compared to the same in the later stages of water development and in water-wise well-endowed regions. It is on the basis of such declining marginal contribution of water to poverty alleviation that researchers (e.g. Fan and Hazell, 2000) have argued for the reallocation of water and rural-related investments towards rainfed areas and other economically backward regions.

hand, irrigation has some negative effects such as those in the form of the health and environmental consequences of water pollution as well as through the process of land alienation and marginalization associated with irrigation-induced land value changes<sup>3</sup>. Considering the impact of water through water supply, it is transmitted both through the basic need and amenity roles of drinking and domestic water provision as well as through the input and infrastructural roles of water supply schemes for urbanization and industrialization. The impact of water through its ecological uses are both positive (the income, food and livelihood benefits of fishing/aquaculture and forestry/common lands) and negative (health impact of irrigation and water pollution).

Fourth, whatever the impact of water on these three routes, it can have an effect on poverty and gender only through the following three mechanisms for poverty alleviation and socio-economic empowerment: food security/prices, livelihoods/income and basic needs/amenities including health<sup>4</sup>. While those owning or having access to land are the direct beneficiaries of the production/productivity impacts of irrigation, the poor groups—mostly with no access to land and capital—are only the indirect beneficiaries. Obviously, these indirect benefits for the poor are essentially in terms of farm and non-farm employment and lower food prices, as facilitated by agricultural productivity growth. However, in so far as irrigation supports the small and marginal farmers and tenants—both males and females—in maintaining an income and consumption level above the poverty line, even the direct benefits also have an indirect effect on poverty and gender.

And, finally, we also note that Fig. 1 also captures the linkages between poverty and gender. We can say that the nature of the linkages are direct in the sense that prosperity generally leads to female empowerment and gender equity mostly contributes to poverty alleviation. As a result, positive impacts on any one of the two are likely to lead to positive changes in both. While there is a positive association between poverty alleviation and socio-economic empowerment, it is necessary to recognize the differential nature of the poverty and gender impact of water. Generally, the impact of water on poverty is more direct, immediate and often observable (e.g. food availability and employment and income). But those on gender are mostly laggard, implicit or tacit, making them difficult to observe or measure in many situations. This does not mean that there are no direct impacts such as the impact of better water supply on women's time allocation or water-induced employment and income benefits for women. But, in order to understand the real and long-term impact of water resources on gender concerns, we need to evaluate the ultimate impact of all these direct and implicit impacts on aspects such as female empowerment and gender equity.

### 3. Analytical overview of existing literature

Despite its relative simplicity and unavoidable limitations, Fig. 1 does provide considerable insight into both the internal mechanics of the water–poverty–gender nexus and its external environment, as it

<sup>3</sup> As can be seen from Fig. 1, there are also possible conflicts between irrigation and aquaculture (e.g. prawn farming in coastal zones) as there is synergy between irrigation and fishing in many South East Asian regions where both rice cultivation and fish farming can work together. In many cases, irrigation tanks and ponds also contribute to both fish production and tree cultivation.

<sup>4</sup> Notice that the same mechanisms also come into play even when other non-water-related and direct poverty alleviation programs (e.g. basic needs program, special employment schemes and subsidized food distribution) or female empowerment schemes (e.g. micro financing schemes) are implemented.

is affected by the changing socio-economic, demographic, institutional and technological systems. In addition to its pedagogic role, Fig. 1 also has an analytical and contextual role because it can be used as a framework for our review of both the papers included in this special issue as well as others in the existing literature. Before dealing with the papers in this special issue, let us first provide an overview of the literature with a particular attention to its coverage of the issues involved in different analytical layers of the water–poverty–gender nexus depicted in Fig. 1.

Using Fig. 1 as an analytical tool for the overview of the existing literature, we can present some illustrative sets of studies that deal with various layers of both the micro relationships that operate within the water–poverty–gender interaction, as well as the macro relationships that influence the process of this interaction. The studies on micro relationships include those dealing with one or more components of the large chain of water–poverty–gender linkages. The studies on macro relationships include those dealing with the impact of macro aspects such as investment policies, infrastructural development and institutional change on the water–poverty–gender interface<sup>5</sup>. It is important to recognize that the primary purpose of the overview being attempted here is to indicate only which layers and pathways of the water–poverty–gender interface that are addressed and which are not addressed in the present literature. As a result, a comprehensive and comparative review of these studies in terms of issue coverage is beyond the immediate purpose of this paper. Thus, this overview aims only to indicate the nature and extent of present research on the subject and indicate the direction for future research.

Within the studies dealing with various micro relationships underlying the larger relationships between water, poverty and gender, we can include those dealing with the relationships between technology, agricultural growth and poverty (e.g. Ahluwalia, 1978; Singh, 1990; Beck, 1995; Saleth, 1997a; Datt & Ravallion, 1998). The same is also true for studies dealing with the impact of agricultural growth on farm–non-farm linkages (e.g. Haggblade, Hazell & Brown, 1987; Hazell & Haggblade, 1993; Block, 1999) and regional growth (e.g. Harriss, 1987; Hazell, Ramasamy & Rajagopalan, 1991). There are also studies covering specific aspects such as productivity-induced land price changes and landlessness (e.g. Jatileksono & Otsuka, 1993; Balisacan, 1993) and technology-induced labor absorption (e.g. Jayasuriya & Shand, 1986; Reddy, 1989). In contrast, there are studies that start with irrigation development and evaluate its impact on agricultural growth in particular (e.g. Dhawan, 1988; Ray, 1992; Huang *et al.*, 2002) and regional development in general (e.g. Brown & Shane, 1981; Bharara, 1985).

In addition to the studies that address the overall role of irrigation, there are also studies that deal with the specific roles of irrigation, for instance, in technological change (e.g. Ahmed & Sampath, 1992) and employment generation (e.g. Wade, 1982; Ray, 1992; Saleth, 1997b). The research attention on the direct relationship between irrigation and poverty has also grown recently (e.g. Hasnip *et al.*, 2001; Narayanamoorthy, 2001; Lipton & Litchfield, 2003; Hussain & Hanjra, 2003; Bhattarai & Narayanamoorthy, 2003). Gender issues have received considerable attention in contexts such as agricultural growth (e.g. Blackden & Bhanu, 1999), non-farm employment (e.g. Unni, 1998; Newman & Canagarajah, 2000) and technological changes (e.g. Rehman & Routray, 1998).

In recent years, poverty and gender concerns have been used as the basic justification for most water supply projects, especially in the rural areas. As a result, there are many studies that touch the role of

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<sup>5</sup> Notice that the studies dealing with micro relationships relate to aspects endogenous to the process of the water–gender–poverty interaction. In contrast, those dealing with macro relationships relate to aspects exogenous to the process. However, a concurrent evaluation of both aspects is critical for a more comprehensive understanding of the interaction process in question.

water supply in poverty reduction and gender equity in one way or the other. But studies that try to establish a direct connection between water supply, poverty and gender are disproportionately lower and are also methodologically not as rigorous as studies dealing with these issues in the context of irrigation<sup>6</sup>. Nevertheless, there are notable studies that address the implications of water supply in meeting livelihood and gender needs in different contexts and with varying details (e.g. Whittington, Lauria & Mu, 1991; World Bank Water Demand Research Team, 1993; Asthana, 1997; Briscoe, 1996, Meinzen-Dick & Pradhan, 2002). In contrast, the poverty and gender implications of the input and infrastructural role of urban and rural water supply can be mostly inferred only from the studies that deal with these roles in various other contexts.

Although water-use conflicts have received significant research attention, the same cannot be said about the implications of these conflicts on the livelihoods of the poor and women groups. While irrigation and aquaculture are often in conflict (especially in coastal zones), there are studies (e.g. Haylor & Bhutta, 1997; Fernando & Halwart, 2000) that investigate the scope for integrating fishing with irrigation. There are also interesting findings about the relative economic value of irrigation, fishing and other non-crop water uses. For instance, Renwick (2001) finds that the value of fisheries in the Kirindi Oya reservoir in Sri Lanka represents 16–24% of the total value of paddy produced in the command. For the same study area, Renault *et al.* (2001) report that the downstream trees and home gardens use more water than paddy cultivation and Bakker *et al.* (1999) find that the economic value of irrigation water used for drinking, livestock and home gardens and other ecological needs to be a substantial part of the total benefit of the irrigation system. But what we need is a systematic treatment of the relative contribution of the irrigation and non-irrigation uses of water for poverty alleviation and gender equity within a comparative context of regions or time periods.

There is considerable research on environmental consequences of irrigation development in particular (e.g. Umali-Deininger, 1993; Dhawan, 1994) and agricultural development in general (e.g. Singh, 2000; Stockle, 2001). Recently, the attention has also shifted to the negative impacts of water development schemes on the poor, women and the environment, as these schemes often displace the poor and destroy their livelihoods from floodplain-based farming, fishing and gathering (e.g. Scudder, 1994; Barbier & Thompson, 1998; Baruah, 1999). Apart from their implications for poverty and environment, in some cases, the dams are also found to have serious negative effects on women (e.g. Carney & Watts, 1993). There are also studies focusing on the health impact of irrigation (e.g. Olivares, 1994; Ijumba & Lindsay, 2001), water (e.g. Gleick, 1998) and large dams (e.g. Lerer & Scudder, 1999).

Studies dealing with the poverty and gender effects of demographic factors and socio-economic, institutional and infrastructural policies are aplenty. As an illustration, we consider studies addressing the effects of demographic and social factors in rural employment (e.g. Harriss, 1991), special employment schemes for poverty alleviation (e.g. Osman-Rani, 1987; Gaiha, 1996) and public investments in income distribution (e.g. Fan & Hazell, 2000; Fan, Zhang & Zhang, 2002). There are also other studies that deal specifically with the food, income and gender effects of irrigation investment and distribution policies (e.g. Sampath, 1984; Rosegrant & Svendsen, 1993). The income and poverty effects of infrastructure (e.g. Binswanger *et al.*, 1993; Fan, Hazell & Haque, 1999) and that of income distribution policies (e.g. Thakur *et al.*, 2000; Hossain *et al.*, 2000) have also received attention. The impact of irrigation management policies on women has also received research attention (e.g.

<sup>6</sup> This is because most studies establish the connection between, for instance, water supply and poverty alleviation more by argument or with descriptive information than in any quantitatively convincing manner.

Zwarteveen, 1998). Although the impact of water on gender have not been analyzed in any systematic way, especially as a part of the larger issue of the irrigation–technology–agricultural growth–poverty interface, there are few notable studies on water and gender (e.g. van Koppen & Mahmud, 1996; Adams, Watson & Mutiso, 1997; Zwarteveen, 1997; Cleaver, 1998). The focus of these studies was mostly on water rights and women’s role in water management and how these factors can contribute to improved water use, female empowerment and poverty alleviation.

#### 4. Overview and synthesis of papers in this issue

The analytical review of the extant literature and its implications for current and future research and policy provides the general context for this special issue, especially in understanding the significance and contribution of each of the papers included here. Apart from this overview paper, this issue has ten papers contributed by some internationally known scholars with longstanding research and policy experience in the field. They evaluate the impact of water (especially irrigation) on poverty and gender in varying contexts and detail. While the lead paper by Rijsberman places the subject in the larger canvas of water management and international development policy, others deal with specific questions in a country or regional context adopting different analytical and empirical approaches. They include both analytical papers (Lipton *et al.*; Hussain & Hanjra; Saleth, Regassa & Samad) and comparative analysis (Hussain & Hanjra; Upadhyay). They cover not only quantitative evaluation (Bhattarai & Narayanamoorthy; Saleth, Regassa & Samad) but also policy analysis both within an empirical context (Hoanh *et al.*) and with a case study-based descriptive perspective (Schreiner & van Koppen). There are also two papers (Sullivan & Meigh; Molle & Mollinga) on the pros and cons of indicator development in the particular context of water, poverty and gender. Let us provide here a brief overview of these papers.

To begin with, the lead paper by Rijsberman takes the water–poverty–gender nexus to a larger plane of water management and development policy. Contrasting the decline in international funding in the water sector with an ever increasing international commitment and political priority, this paper suggests a few strategies for augmenting water sector funding for poverty alleviation. First, the poverty alleviation impact of water has to be established systematically and convincingly. This requires research to shift its focus from the poverty alleviation impact of “traditional irrigation” to that of “new irrigation” covering a range of systems from irrigation in canal regions to supplemental irrigation in rainfed areas and from large scale irrigation systems to small and micro irrigation technologies. Second, the poverty alleviation and gender balancing roles of water in terms of its water supply and environmental amenity functions have also to be factored into the overall water–poverty calculus. And finally but importantly, since there is no single silver bullet to reduce poverty, research and policy should focus on the combination of sustainable water resources development, allocation and management and appropriate pro-poor institutions and technologies that will effectively address poverty and gender issues in different locations and contexts.

In recent years, the perception of the role of irrigation has undergone important changes. While irrigation is considered to be crucial for food security, an important question that is often asked is: what has been the impact of irrigation on poverty? Four papers in this volume address this question. The paper by Lipton *et al.* elaborates a conceptual framework for analyzing the effects of irrigation on poverty. This framework attempts to assess the impact of irrigation on poverty in terms of enhanced agricultural output, increased employment, especially for resource-poor farmers and the landless, improved farm incomes, lower food



prices and better nutrition and improved health. Hussain and Hanjra adopt a similar framework to analyze the linkages between irrigation and poverty by comparing the situations in irrigated and dryland areas. Using secondary data from several developing countries and primary data from two irrigation schemes (one in Pakistan and the other in Sri Lanka), they identify the conditions under which irrigation can have a larger poverty alleviation impact. They conclude that the conditions that matter the most for the anti-poverty impact of irrigation are land tenure, infrastructure and supporting farm inputs.

The paper by Bhattarai and Narayanamoorthy analyzes the impact of irrigation on rural poverty in India from a macro perspective. Using a panel data covering 14 Indian states and 25 years from 1970 to 1994, they attempt an econometric analysis of the relationship that poverty has with irrigation and other factors such as fertilizer use, high-yielding varieties (HYVs), education and rural road density. The results support the fact that irrigation, especially from groundwater, is a major factor contributing to poverty alleviation. But the results also suggest that access to irrigation is only a necessary condition, as sufficient conditions are ensured by other factors such as farm technologies (fertilizer and HYV) and human capabilities (education). This finding is consistent with that of Hussain and Hanjra. The paper by Saleth, Regassa and Samad is notable for an innovative approach to an empirical evaluation of irrigation–poverty interaction. Using a set of simultaneous equations and data related to 80 agro-climatic sub-zones of India for two time points, i.e. 1984–85 and 1994–95, they have evaluated the impact of irrigation, as captured in different layers of linkages and transmitted ultimately, on rural poverty. While their results support a positive impact of irrigation on poverty alleviation, they also suggest a declining and changing nature of such impacts. Specifically, the impact of irrigation, which was initially more in terms of labor absorption from area expansion and cropping intensity, tends to be more now in terms of labor productivity/income and falling food prices.

The next two papers evaluate the implications of policy and legal aspects for poverty alleviation and gender and racial equalities. The paper by Hoanh *et al.* presents the results of a well-conducted empirical research on the livelihood implications of policy changes related to rice cultivation and shrimp farming in the coastal areas of the Mekong River delta in Vietnam<sup>7</sup>. Based on their evaluation of the impact of this policy change on the livelihoods and environment in the study area, the authors conclude by arguing for a region-specific approach to balance, not only rice cultivation with shrimp farming but also the livelihood needs of the poor with the health of the fragile coastal ecosystem. The paper by Schreiner and van Koppen uses the recent legal and policy changes in the water sector of South Africa to illustrate how water law and policy can be used as an instrument to address poverty, race and gender concerns. The authors conclude that although the water law and water policies of South Africa are very progressive and, in many respects, far reaching, their implementation remains a major challenge. But, from a historical perspective, even these changes are certainly profound in terms of the inclusion of marginal and informal groups and the democratization of the water management process.

The paper by Upadhyay presents empirical evidence for a few important dimensions of water–poverty–gender nexus based on a careful review of the empirical literature as well as a few case studies pertaining to Asia and Africa. The author argues that since water policies and programs in Asia are largely detrimental to women's water rights, women's participation in irrigation institutions here is much lower than that of men. Despite this fact, an Indian case study shows that irrigation investment has

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<sup>7</sup> The initial policy of Vietnam government tends to promote rice cultivation uniformly in the whole coastal area. But economic problems and social tensions have subsequently altered this policy to allow shrimp farming in the western parts of the delta and to limit rice cultivation to the eastern part.

improved the livelihoods and often helped women, as the availability of water for domestic uses allowed them to reallocate their time for activities such as literacy classes, health care and micro-enterprises. Other examples from developing countries show that gender sensitive policies can help women. But, as an example from Malawi shows, when the policies are not gender sensitive, they do not reap their full benefits and, as a result, remain unsustainable.

The final set of two papers is concerned with the pros and cons of the indicator approach for incorporating some of the poverty and gender concerns both in general and in water sector contexts. The paper by Sullivan and Meigh describes the Water Poverty Index and shows how it can be used as a tool for assessing the degree to which water scarcity affects poverty. The Index has five components: water use, environment, resources, capacity and access. While the indicator has been already applied at the national scale in 147 countries, in this paper, the authors argue how it can be developed and used at the community and local levels both as an educational tool and as a policy instrument. The paper by Molle and Mollinga provides a critique of indicators in general and the Water Poverty Index in particular. The authors argue that since water scarcity is multi-dimensional and has both individual and collective considerations, it is too complex to be captured in a single or composite indicator. The authors caution that their political and communication appeals should not mask the fact that they are constructed to reflect specific objectives and interests. Therefore, they argue that indicators can be useful only when they are interpreted in the light of their data limitations, assumptions and even biases. Reading too much into an indicator, especially ignoring the process through which it is developed, can distort reality and mislead policy.

## **5. Implications for research and policy**

The analytical overview of both the existing literature and the papers included in this special issue shows the kind of studies that are dealing with various dimensions of the larger interaction between water, poverty and gender. Although it is neither comprehensive nor exhaustive, this overview does allow us to make few general observations about the nature of the overall research on the subject and its implications for theory and policy. From a general perspective, the studies dealing with the poverty and gender impact of water through its irrigation channel are relatively more, longstanding and empirically rigorous compared to those dealing with the impact of water through the other two channels. Such a larger focus on irrigation impact is obviously in line with its dominant, direct and more immediate employment, income and food security benefits. But the poverty impact of irrigation, though direct and immediate, occur only indirectly through the employment, income and price effects of agricultural growth and the latter's impact on the regional economy including non-farm and livestock sectors. This is essentially because the direct realization of irrigation benefits requires some form of access to land and capital, which most poor groups obviously lack in many contexts. As a result, the poverty alleviation benefits of water supply and environmental amenities assume importance as an essential complement to the same from irrigation.

Apart from their significant poverty alleviation impact, the water supply and environmental functions of water are also very important from the point of view of both their direct and subtle implications for gender concerns. This is in view of their amenity benefits such as drinking water, health and household nutrition. Considering the total poverty and gender impact of water from all its three channels, irrigation may have a larger share in many contexts. But this does not mean that the role of irrigation has to

dominate research and policy to the extent of underestimating the roles of water supply and environmental amenities. Since the supplementary and subtle effects of the other two functions are very important, especially in the context of the lack of access to land and capital, their poverty and gender impacts can make a vast difference, especially at the margin for poverty alleviation and gender equity. Therefore, research and policy attention has to be directed equally to the poverty and gender implications of the water supply and environmental roles of water. Specific areas that deserve priority here include the water–health–gender–poverty interactions as well as the livelihood and nutritional effects of water-based eco-systems, especially in fragile coastal areas.

While the literature on the water–poverty–gender nexus is vast and varied, most studies deal with different pieces of the larger puzzle somewhat more closely rather than attempting to tackle the larger issue in an inclusive and comprehensive manner. The evaluation of the larger issue of water–poverty–gender interaction, if performed even with simple approaches and in the context of a small region, is very rewarding, as the numerical value of the total poverty and gender impacts of water resources are very powerful in justifying the flow of more investment into water resources development and management. Unfortunately, such studies are either rare or absent. As a result, current knowledge, though deeper on some aspects (e.g. irrigation–agriculture–poverty interaction), remains largely fragmented on other aspects (e.g. water–health–poverty dimension). Moreover, despite the increasing attention to gender in recent years, the gender impacts of water are not explored and understood fully. This, in an important sense, indicates the nature and extent of research gaps and their corresponding implications for public policy on the subject.

To formulate more effective policies for using water as a key instrument for poverty alleviation and socio-economic empowerment, what we need actually is research-based knowledge generated within a comprehensive framework such as the one indicated in Fig. 1. But it is obvious that frameworks similar to the one in Fig. 1 have a heavy demand for multidisciplinary data, methodologies and expertise. Furthermore, there is also the need for the development of additional conceptual and methodological frameworks, especially to map the amenity and health impacts on poverty alleviation and to relate such gender benefits with the larger goal of female empowerment and gender equity. As a result, undertaking research of such a comprehensive nature—even for a small region in a country—requires collaborative research across organizations with corresponding time and resource implications. This shows the magnitude of the research challenge as well as the extent of support needed from country policy makers and international donors in pursuing a comprehensive research program on water–poverty–gender nexus. We hope this special issue can catalyze the interest and support of the public, research community, policy makers and international donors towards this important issue of our times.

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