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## ***Viewpoint* – The Politics of Research on Farmer-Managed Irrigation Systems in Asia: Some Reflections for Africa**

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**ABSTRACT:** This article presents a reconstruction of the 1980s' research-policy debate on farmer-managed irrigation systems (FMIS) in Asia. Such a reconstruction yields important lessons for the role of academic researchers in the current research-policy debate on African farmer-led irrigation development (FLID). Two interrelated insights stand out: (1) academic irrigation research was (and is) produced in an institutional context that is infused with the politics of the professional tradition in irrigation, and more specifically, (2) academic knowledge on the institutional heterogeneity of farmer-organized irrigation was (and is) incompatible with how things really work in the institution of the irrigation tradition. These insights raise critical questions on the politics of academic research on FLID, whose research agenda is really pursued, what roles do academic researchers want to play, and how to make irrigation research in development more democratic?

**KEYWORDS:** Irrigation, knowledge, policy, politics of research, farmer-managed irrigation systems, farmer-led irrigation development

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### **INTRODUCTION**

In today's research-policy debates in Sub-Saharan Africa (SSA), the idea that smallholder farmers can be a driving force in irrigation expansion is now increasingly accepted and discussed. Yet it happens in very narrow ways, namely in terms of potential, technology, investments and water use efficiency, and hardly, for instance, in terms of control, access to water, participation, gender or the distribution of benefits (Reyes Tejada, 2018 is a notable exception). With the new policy focus on agriculture and irrigation, academic research on irrigated agriculture in Africa has returned at the foreground, and academics have coined the term 'farmer-led irrigation development' (FLID) to call attention to the dominant mode of irrigation expansion in Africa (Nkoka et al., 2014; Beekman et al., 2014; Woodhouse et al., 2016). Yet, in spite of this call and the academic research on which it is based, the central question in today's literature and debate is an old and familiar one; it is about whether Sub-Saharan Africa can feed itself and the technical potential of irrigation development in Africa (You et al., 2011; Xie et al., 2014, 2018).

Long-time observers and participants of irrigation research-policy debates are probably not surprised. In the world of irrigation, this is "how things really work" (Levine et al., 2013: 152); donors want to give loans, governments seek to administer them and need to deliver projects, and engineers' and agriculturalists' skills and mind-sets attract them to construction and technology (Chambers, 1988; 2013). As a result the focus is characteristically on the question of 'irrigation potential' in terms of the availability of water and soils to grow crops, and the type of technology and amount of investments/resources required to achieve this potential (Diemer and Vincent, 1992; Lankford, 2009;

Harrison, 2018). In this professional tradition, insights from academic research, especially qualitative social sciences research are customarily overlooked or disremembered.

Academic researchers have repeatedly reflected on (aspects of) this professional tradition in irrigation, expressing their concerns. For instance, Philip Woodhouse (2012), a researcher with years of experience in Africa, notes that agronomists in Africa do not overcome their fixation with technology and fail to escape the long-standing disciplinary boundaries in agricultural expertise. And in 2013, researchers such as Gilbert Levine (2013) and Robert Chambers (2013), with years of experience in Asia, note in a Special Issue of this journal, 'Voices of water professionals: Shedding light on hidden dynamics in the water sector', that we, as water professionals, continuously learn and mislearn our blind spots, errors and myths through professional, personal and institutional connections, defined by such things as education, position of employment and personal motivation.

Perhaps unsurprisingly, most of these reflections and 'self-criticisms' on the politics of professional practice in agriculture and irrigation are written by experts with a position (or foot) in academia. Paradoxically, they tend to treat the role of academic researchers, of themselves, as least problematic: "The different attitudes towards more open discussion (...) are influenced by a number of factors including, importantly, the positions individuals hold (...). Each position has its own probability of adverse consequences. Perhaps the most vulnerable is the government employee, followed by the consultant, the development worker in NGOs dependent on donor funding, the development bank employee, *and least the academic researcher*" (emphasis added) (Levine et al., 2013: 149).

I occupy myself the position of an academic researcher and I think that we, as academics in irrigation, should take a look at ourselves.<sup>1</sup> We have our own roles in global irrigation research-policy debates. We continuously attend conferences, writings and key addresses as part of our profession (Chambers, 2013). We are highly mobile, travelling the world, and generally, we are perceived by other actors in irrigation with a status of neutrality and objectivity. However, in spite of our privileged roles, our work plays in my view, too much the tune that the piper (the international development agenda and its funders) want us to play. We need to scrutinise our own blind spots, in the words of Robert Chambers, and reflect on our own errors and how they are linked to the limited uptake of qualitative social sciences insights in irrigation debates in SSA. More specifically, I argue, we need to start a debate on how to democratise academic research on irrigation development in Africa.

In my view, there are sufficient early warning signals to be concerned about the prospect that the professional tradition in irrigation is (and will be) prevailing. In 2009-2012, in the context of the Agricultural Water Management Solutions Project (AWM), led by the International Water Management Institute (IWMI) and funded by the Bill & Melinda Gates Foundation, the terms 'farmer-led initiatives' and 'farmer-driven investments' were used in research writings to identify 'investment opportunities' in agriculture in SSA (Giordano et al., 2012: 7). More recently, in 2018, the World Bank (WB), together with the Daugherty Water for Food Global Institute of the University of Nebraska, has initiated a set of conferences on 'farmer-led irrigated agriculture' in collaboration with the Alliance for a Green Revolution in Africa and the African Development Bank, to identify 'innovations', 'technologies and services', and articulate 'implementable policies' and 'strategies and plans for investment' (WB, 2018a; 2018b). In turn, the International Committee on Irrigation and Drainage (ICID), an institution of irrigation engineers and participant of one of the recent WB conferences, has started to equate 'farmer-led irrigated agriculture' with 'small-scale projects', and it has begun to advocate for the need for 'high tech' to promote 'inclusive growth' and 'sustainable irrigated agriculture' (ICID, 2018: 4-5).

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<sup>1</sup> The reflections that I present in this article are based on my professional experience as an academic researcher in a research project on irrigated agriculture in Sub-Saharan Africa: Unravelling the potential of farmer-led irrigation development in the Beira Agricultural Growth Corridor (BAGC), Mozambique (ARF, 2016-2019). They also are based on work that I undertook as part of my PhD studies on masculinities, engineers and professional expertise in irrigation in Nepal (2008-2014).

The editors of the earlier mentioned Special Issue emphasise "the need to explicitly learn from experience; not only from personal experience (though that is clearly important), *but from a more systematic review and analysis of the outcomes of development efforts*" (emphasis added) (Levine et al., 2013: 150). I take their call to the heart. To learn from the past and scrutinise our own ignorance (as academics) and, seeing strong parallels with the current debate on FLID in Africa, I present here a systematic review of the 1980s' research-policy debate on farmer-managed irrigation systems (FMIS) in Asia. Academic research on FMIS is credited to have made irrigation policies (more) farmer-oriented, albeit modestly (Levine, 2013), but at the same time, it laid the ground for far-reaching state interventions and regulatory programmes in irrigation. Through technical assistance farmers in Asia were brought under the ambit of central state administrations as beneficiaries, and as a result, the enormously diverse institutional and bottom-up arrangements of farmer-organisation, that once characterised irrigation in Asia, have disappeared. This observation raises some inconvenient reflections for those who do research on the dynamic of FLID in Africa today: what roles do we really want to play?

In the next section, I first systematically review the research-policy debate on FMIS in Asia, focusing on Nepal. Second, based on this account, I shortly recap the key processes that were at play in the articulation and life of the FMIS concept, identifying parallels with the current research-policy debate on FLID in Africa. Then, in the final sections, I compare, and reflect on, the research-policy debates in Asia and Africa, then and now, and I articulate some considerations for academic researchers in Africa today.

## **A SYSTEMATIC REVIEW OF THE RESEARCH-POLICY DEBATE ON FMIS IN NEPAL**

Nepal, or rather research on irrigation in Nepal, occupied in the 1980s a prominent place in both the FMIS debate and the global discussion on irrigation policy reform, in addition to Sri Lanka, the Philippines and Indonesia (Levine, 1992; 2013). In fact, the term FMIS originates from Nepal, where it was introduced in 1983 by Edward Martin and Robert Yoder, then PhD researchers from Cornell University, at an international conference on water management in Nepal (HMG/ADC, 1983). However, the term was not necessarily their invention; it was grounded in almost two decades of academic research on farmer's participation in irrigation in Asia, spearheaded by a few researchers from Cornell.

### **Academic research on irrigation in Asia in the 1960s and 1970s – and Nepal**

In the context of disappointing results of donor-supported public irrigation development in Asia, a group of academic researchers from Cornell, funded by the Ford Foundation, started studying irrigation in the Philippines in 1963, together with the University of the Philippines at Los Baños (Diemer and Slabbers, 1992; Staples, 1992). They adopted an interdisciplinary research approach, combining agricultural engineering, economics and rural sociology. Gilbert Levine, then professor at Cornell, recalled that the results were surprising for that time. They found that "farmers were rational, if not totally optimal in their water management notwithstanding the fact that water deliveries were unknown in amount and irregular timing" (Levine, 1992: 26). They also found that behaviour of irrigators was prescribed by rules and norms of equity, and that operational rules were embodied in the physical infrastructure of irrigation systems and tenure arrangements among the landowners (Coward, 1980). These insights triggered a broad interest in how farmers manage irrigation, and Cornell University researchers initiated academic studies elsewhere in Asia, notably in Indonesia, Thailand and Taiwan.

In the 1970s, the work of Cornell researchers was increasingly supported by a network of actors, including the Bellagio Group, the Ford and Rockefeller foundations, CGIAR institutions such as the International Rice Research Institute (IRRI), the Agricultural Development Council (ADC, now part of Winrock International), the Canadian International Development Research Centre and the USAID (Taylor and Wickam, 1979; Coward, 1980; IIMI, 1986). This network, through projects such as the

USAID-funded Water Management Synthesis Project (WMSP, 1978-1987, led by Walt Coward, then professor of rural sociology at Cornell University), facilitated the production of a growing body of 'water management research' in agriculture in Asia.

Irrigation engineers in government, donor and international research organisations such as the FAO, however, paid initially little attention to this new body of studies. Their first reaction to the identification of system performance problems was to bring the technical design of tertiary units into the domain of irrigation engineers, and start considering organisational aspects in irrigation system operation (Diemer and Slabbers, 1992). In Nepal, this process was reflected in the organisation of two seminars by the government on 'water management and control at the farm level' in 1976 and 1978, with the FAO and the ADC, respectively (HMG/FAO, 1976; HMG/ADC, 1978). The audience consisted of engineers of the Department of Irrigation (DOI), agriculturalists of the Department of Agriculture (DA), and a handful of technical experts of the FAO, UNDP and IRRI – no academic researchers were present.<sup>2</sup> At these conferences, water management was exclusively treated as a subject at the farm level and as the expertise of engineers and agriculturalists. Topics discussed were, for instance, crop water requirements, system operation, on-farm land improvements, staggering, and the size of field canals.

By this time, Nepal had come into view of Cornell researchers. In 1979, Prachanda Pradhan, then a professor at the Centre of Economic Development and Administration at Tribhuvan University, Nepal, came to the US, to Cornell University as a Fulbright Visiting Professor to study local institutions and people's participation in rural public works in Nepal (Pradhan, 1980). At that time, the Cornell group was preparing a USAID-supported mission to the Gal Oya Irrigation Scheme in Sri Lanka, and the earlier-mentioned PhD students, Martin and Yoder, were getting ready for studies in Nepal. Martin and Yoder had worked in Nepal before as volunteers with the Mennonite mission on the improvement of water mills, and they knew about farmer's involvement in irrigation in Nepal. Pradhan soon became involved. He joined Martin and Yoder in their studies on irrigation, he assisted them with study site selection in Nepal (Argali and Cherlung irrigation systems in the hills), and he developed a third case study in the Tarai plains of Nepal (Chattis Mauja irrigation system) (Pradhan, 1984; Martin, 1986; Yoder, 1986).

### **The establishment of Nepal as an ideal irrigation research-policy laboratory**

Compared to other countries in Asia, Nepal's public irrigation development had started late and for this reason Nepal was considered a backwater in the irrigation debate. The first three planning periods (1956-1970) had focused on small schemes and the implementation of large-scale irrigation systems had only started in the 1970s (WECS, 1982; HMG/ADC, 1983). Nevertheless, in spite of Nepal's late start and small footprint in the sector, donors and government administrators started, like elsewhere in Asia, to have serious doubts on whether irrigation development was useful in improving food and export crop production, and the proposed approach of engineers and agriculturalists, of more engineering in technical and organisational terms, was not creating much optimism (Diemer and Slabbers, 1992). In Nepal, from 1976 onwards, these doubts were fed by the involvement of the Canadian International Development Agency (CIDA) in studies on water resources development (B.K. Pradhan, 2009). The CIDA mission was based on the premise that water planning in Nepal was poor (WECS, 1979) and its flagship was the set-up of a new national water authority: the Water and Energy Commission Secretariat (WECS). Under the name of WECS, Canadian consultants wrote an influential irrigation sector review (WECS, 1981). This particular review critically fed the irrigation research-policy debate in Nepal, linking Nepal to the new donor concerns in Asian irrigation.

The review openly questioned the rationale of public irrigation development and the role of engineers, building on the latest research insights on water management in Asia. In spite of Nepal's late

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<sup>2</sup> The DOI was then called the Department of Irrigation, Hydrology and Meteorology (DIHM). In this paper, I refer to the Department's current name, i.e. the Department of Irrigation.

and limited involvement in large-scale irrigation, the review stated that "one of the most flagrant areas in which investment efforts related to agriculture [in Nepal] have been disappointing has been government irrigation development" (WECS, 1981: iii). It stated that only about 100,000 hectares (ha) of the 240,000 ha supposedly developed for irrigation by the state, were in fact, irrigable (that was just 42%). The review criticised the conventional engineering definition of irrigation as "the controlled application of water to land", and instead proposed the term 'irrigated area' for future policy planning purposes (p.32). This particular definition of irrigation allowed the Canadians to identify *khet* land (flooded fields for rice cultivation in the monsoon) as "non-government irrigation development", i.e. "irrigation in Nepal [that] has been developed without direct government involvement" (p. 36). The review even produced a number for the non-government irrigated area, estimating it at 400,000 ha.<sup>3</sup> This number soon made the review the most quoted document in irrigation research-policy writings on Nepal; it portrayed that 80% (!) of the total irrigated area in Nepal was under farmer-management.

Following his involvement in a conference in Manila organised by the Asian Institute of Management under the leadership of Coward, and being inspired by discussions on "the roles of social scientists in the recognition, documentation and implementation of existing water user systems" (Coward et al., 1982: 3), in 1983, Pradhan initiated a conference in Nepal (HMG/ADC, 1983). He explicitly aimed to bring "together government people, technicians and researchers".<sup>4</sup> Contrary to the seminars of 1976 and 1978, it brought together representatives of diverse backgrounds (engineers, agriculturalists and academic researchers), including high officials of various government bodies in Nepal and many foreign delegates. The foreign party included, for instance, a Cornell delegation (including Gilbert Levine), the Canadian consultants of WECS and a programme officer of the Ford Foundation (Robert Chambers). The conference coincided with the newly approved Decentralization Act of 1982, in which the government of Nepal instructed its departments to implement new projects through people's participation and the mobilisation of local resources. It also coincided with the set-up of a new International Irrigation Management Institute (IIMI, 1986), for which the Ford Foundation was acting as the implementation agency. In this context, the conference helped Cornell researchers and its donors to present Nepal as a particularly promising international testing ground for research on irrigation management and the formulation of new neo-liberal irrigation aid policies.

The organisation of the seminar, however, and the whole idea of involving academic researchers and social scientists in debates on irrigation, met with strong reservations, especially among DOI engineers: "they were skeptical about the utility of a seminar" (HMG/ADC, 1983: iii). They felt that the "large gamut of issues on irrigation" (p.i) was ill-addressed by academic deliberations. In an attempt to settle the matter, the organising committee "*unanimously* settled on Water Management as a theme for the seminar" (emphasis added) (p.iii), and it iterated that "[t]he seminar had the broad objective of contributing to enhancing the performance of both the Government and the farmer managed irrigation system, by providing a lively forum for interaction among personnel engaged in irrigation development" (sic) (underlining in the original) (p.1). The organizers also strategically suggested that "[t]he seminar was *perhaps* a sequel to the Water Management Seminar sponsored by [HMG]/ADC in 1978" (emphasis added) (p.1).

### **FMIS: From an academic concept to a type of irrigation and a policy model for public intervention**

In their conference contribution, titled Review of farmer-managed irrigation in Nepal, Martin and Yoder (1983) introduced the term FMIS as an academic concept, as indicated in a footnote: "We have chosen to use the term *farmer-managed* rather than community-managed in referring to *irrigation systems*

<sup>3</sup> The Canadians consulted the state taxation records to arrive at this number, because high tax had always been imposed on irrigated land in Nepal (including *khet*) (see Regmi, 1977).

<sup>4</sup> Interview Prachanda Pradhan, 20 January 2011.

operated by the irrigators with little or no input from the government or other outside agencies. The reason for this term is that the word community is ambiguous" (emphasis added) (p. 82). As can be surmised, this definition considered three conceptual building stones. The first was that the practice of irrigation and the extent of the irrigated area is linked to a system and the potential command area of that system (p.82); the second was that irrigation construction and system operation is a relatively delineated activity in rural communities, mainly or exclusively involving groups of farmers as direct beneficiaries (p.83-84); and the third was that irrigation systems are operated by irrigation organizations with little or no external assistance (p.83). These descriptions clearly applied to the irrigation case studies of Martin and Yoder. In fact, Pradhan had proposed the sites to them precisely *because* of these reasons: they could be identified as *surface irrigation systems* in which (limited) water flows (in the dry season) were *managed by groups of farmers with a high degree of organization* (meetings, functionaries, water allocations). To recall, the goal of their research was to study in detail how farmers were organizing irrigation and to assess the performance of the systems, with the objective to compare it with the (under)performance of public irrigation systems. The term FMIS thus fitted these specific systems, but this was not necessarily the case for other irrigated areas in Nepal.

Coward (1980), for instance, one of their tutors at Cornell, predominantly used the terms locally managed or community managed – not just farmer managed – as concepts to describe the embeddedness and diversity of irrigation development schemes in Asia – not just systems (see also Coward et al., 1982). Likewise, the Canadian consultants preferred to talk more broadly about irrigated area and non-government irrigation development (WECS, 1981), referring to a particular type of irrigation development. The Canadians also iterated that the division of government/non-government was, in fact, empirically ambiguous. The irrigation sector review identified seven "intermediate types of development", based on a mix of government and farmer input, including for instance, schemes "re-developed" by the DOI (WECS, 1981: 34-35). The difficulty of categorization was partly based on the diverse land tenure arrangements that existed in Nepal. There were irrigation canals on government land, management by farmers but sanctioned and taxed by the state (*raj kulo*, or king's canal), but also, for instance, irrigated areas managed by farmers under a (religious) trust (*guthi* land tenure).<sup>5</sup>

In spite of academic arguments on the meaning of "non-government irrigation *development*" (emphasis added) (WECS, 1981: 36), and the relation between this type of irrigation development and irrigated areas and systems, the conference of 1983 established Nepal as the "Land of Farmer Managed Irrigation Systems" (emphasis added) (Ansari and Pradhan, 1991: ii). The academic work of Martin and Yoder on two gravity irrigation systems paved the way for this translation in which the idea of irrigation as a *process of development without direct government involvement* was narrowed down to the idea of *surface irrigation systems managed by farmers*. As Martin articulated in his PhD thesis: "[t]he irrigation sector in Nepal is *unique* in that an estimated 80 percent of the irrigated area is serviced by *systems* which are *managed by the farmers themselves*, rather than by government officials" (emphasis added) (Martin, 1986: 9-10).

Clearly, this particular translation was so successful in Nepal because FMIS was seen as a legitimate concept by both national and foreign actors. The studies on non-government and farmer irrigation openly discredited the role of state officials and DOI engineers, but the term FMIS recognized, at least in theory, that irrigation development was (still) about systems that required management. Notably, the irrigation sector review of WECS (1981), in which DOI engineers had some say, presented non-government irrigation schemes as "far superior to their government developed counterparts" (p.40), *but also*, as being in a critical state of decay. It noted the "*principal technical constraints*" (emphasis added) (p.42) in the schemes, such as the lack of intakes and canal crossings, and it identified "considerable scope for further expansion of [public intervention] programmes involving *low cost*

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<sup>5</sup> Interview Prachanda Pradhan, 20 January 2011.

*technological improvement* of existing irrigation [systems]" (emphasis added) (p.27). And in the minds of foreign actors, Nepal already existed as a particularly backward and dependent nation in Asia (Eckholm, 1976; Blaikie et al., 1980). By implication, the country was seen by donors as a nation that was disproportionately confronted with the negative impact of public irrigation development and they considered the term FMIS to be especially applicable for Nepal.

In the course of the 1980s, this particular image of irrigation in Nepal, as consisting largely of *farmer-managed surface irrigation systems*, was strengthened by its (foreign) advocates. In 1984, Pradhan visited various seminars in the region, including one of the American Social Science Research Council and the Indian Institute of Management, in Bangalore, India. There, he presented a paper on his case study in the Tarai plains: "Chattis Mauja irrigation system: community response in resource management" (Pradhan, 1984). As he explained in an interview, it gained a lot of attention at the conference: "my paper became (...) really popular (...), identifying a kind of very successful medium-sized – medium-sized means at that time [a] 3500 ha [surface] *irrigation system* (...), and many people (...) quote that (...) paper, in many, many articles, about the (...) *ideal type of farmer's organization*" (emphasis added).<sup>6</sup> Through such international presentations and research writings, the surface irrigation systems of Argali, Churlung and Chattis Mauja in Nepal soon became iconic, well-performing case studies of FMIS in the research-policy debate (Pradhan, 1984, 1989; IIMI/WECS, 1987; Martin and Yoder, 1988).

The newly established IIMI also played an important role in the promotion of the FMIS image of Nepal. In 1984, IIMI started with a research program on 'farmer-managed irrigation systems' in Nepal and Sri Lanka (IIMI, 1986: 6). The new institute was shaped by some of the most prominent advocates in the irrigation debate, notably the Cornell fellows Martin, Yoder and Pradhan (IIMI, 1986). They shaped IIMI's research agenda on irrigation management and they placed themselves as resident scientists in Nepal (Yoder and Pradhan) with "a dual role: to carry out direct research there and to *promote* FMIS research in India, Pakistan, northern Thailand, and Bhutan" (emphasis added) (IIMI, 1986: 29). Using funding of the Ford Foundation and IFAD, and in collaboration with WECS, they set up an action-research project in Sindhu-Pulchowk district, not far from Kathmandu. There, the government aimed to rebuild two irrigation systems with the active participation of farmers in the design and construction stages, and IIMI researchers followed the process of intervention in the area (IIMI, 1986).

In the act of conducting FMIS research in Nepal, the term FMIS became increasingly understood as an ideal type of farmer's organization, to put it in the words of Pradhan, and it (partly) became a synonym for a particular type of irrigation (a surface irrigation system managed by farmers) and policy model (local resources mobilization and farmer's participation in irrigation development) that was to be promoted abroad. The gradual shift in the use and meaning of the term FMIS, from academic research on *water management in agriculture* to a type of *surface irrigation system* and policy model of *public irrigation development* is clearly visible in IIMI's first annual report (1984-1985): "With the growing awareness of potential benefits in agricultural production, many governments are seeking ways to assist farmer-managed irrigation systems (...). The research [of IIMI] has three objectives: 1) to identify farmers' irrigation management needs; 2) *in collaboration with the relevant agencies, to identify appropriate and sustainable responses* to those needs (...); and 3) to gain a better understanding of the principles underlying farmer managed which might have *relevance for agency-managed irrigation systems*" (emphasis added) (IIMI, 1986: 7-8). In sum, areas/communities under FMIS were increasingly identified in the research-policy debate as a promising type of area for public intervention and as a model for management in state-constructed systems.

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<sup>6</sup> Interview Prachanda Pradhan, 20 January 2011.

### The closure of the research-policy debate on FMIS

In 1986, IIMI organized an international seminar in Nepal, in collaboration with WECS, on "Public intervention in farmer-managed irrigation systems" (IIMI/WECS, 1987). Various governments in Asia had started to implement public assistance programs in systems/areas in which the government previously had not intervened. Hereby, the focus was on providing technical assistance and keeping farmers in charge. Through such interventions, however, farmers typically came to view the government as the owner of the system, and hence, as responsible for its operation and maintenance. In Nepal, for instance, the government had started in 1985 a water use inventory in the Tarai to identify FMIS systems and explore possibilities for intervention. It recorded 836 systems in eight districts, and noted that many of the "farmer-managed canals do not have sufficient *control structures* and appear to be *poorly designed and of irregular size*" (emphasis added) (Upadhyay, 1987: 235). Based on this study, DOI engineers felt justified to provide technical assistance to FMIS and the research-policy debate at the seminar was about a relatively narrowly defined topic, namely about the effectiveness of public interventions in FMIS. For the debate on this topic, further academic research into farmer irrigation was not really necessary. Or as Coward and Levine noted in 1986: "*No longer are farmer-managed irrigation systems merely of academic interest; they are the object of many public programs in irrigation development and are now within the purview of most mainline irrigation agencies*" (emphasis added) (IIMI/WECS, 1987: 11).

The proceedings of the conference indicate that the Cornell/IIMI researchers (Coward, Levine, Yoder, Martin, Pradhan) were unhappy about how FMIS research was taken up in new irrigation policies, even though farmer-organized irrigation was now included in national statistics of irrigated area. An "*alarming concern [was] expressed*" at the conference about the trend that public intervention was triggering "more and more requests coming to the [government] agencies asking assistance not only for rehabilitation but also to taking over of the system management by the agencies" (sic) (emphasis added) (Ansari and Pradhan, 1991: iii). The Cornell/IIMI researchers suggested therefore "an agenda for future research [that] aimed at addressing two explicitly endemic problems in many programmes for assisting farmer-managed systems: 1) *transforming* highly autonomous farmer-managed irrigation *units* into *systems* that are overly dependent on government actions, resources, and staff; and 2) forcing a *standard logic* of operations, and the hardware needed to operationalise that logic, on these farmer-managed systems, many of which have multiple objectives and whose logic may or may not emphasise *the efficient use of water*" (emphasis added) (Martin and Yoder, 1987: iii-iv).

In their conference contribution 'Studies of farmer-managed irrigation systems: ten years of cumulative knowledge and *changing research priorities*' (emphasis added), Coward and Levine (1987) proposed an ambitious new research agenda in relation to irrigation development and farmer-managed systems, with the following questions (p.11):

1. What are the forces leading to government intervention?
2. What are the factors leading to dependence?
3. What are appropriate planning, design, and operational criteria?
4. What are the effects and implications of extended involvement of government in farmer-managed irrigation systems?

They aimed to open a debate on the socialisation of professionals (engineers, agriculturalists) in particular disciplines, "studying the irrigation bureaucracies" (p.14). They criticised the focus on hardware solutions (intake construction, canal lining) and questioned the rationale of water use efficiency in engineering designs and economic evaluations. They also reconsidered the concept of FMIS from an academic point of view: "*many of the systems that we now see as indigenous and independent may in fact have origins associated either with general policies of some earlier State or with direct past actions of the State*" (emphasis added) (p.13).

In spite of the concerns raised by Cornell/IIMI researchers, in 1988 and 1989, the government of Nepal agreed on new loan packages of the WB and the Asian Development Bank, respectively, for the rehabilitation of FMIS systems (Shukla et al., 2002). The new policy consensus was, on the one hand, that "assistance and support from outside is desirable (...) in order to rehabilitate [FMIS] to improve their performance and utilization" and on the other, that the state "should take strong measures in avoiding the creation of [a] dependency syndrome and destroying the spirit of self-help" (Ansari and Pradhan, 1991: ii-iii). Irrigation research on FMIS, sometimes in relation to the questions above, continued in academia, notably in a study group at the Institute of Agricultural and Animal Science in Nepal in the period 1986-2002, funded by IIMI (Liebrand, 2017); in the research group of Elinor Ostrom (Shivakoti and Ostrom, 2002); and under the umbrella of the Farmer Managed Irrigation Systems Promotion Trust, set up by Pradhan in 1998 with support of the Ford Foundation. By and large, however, this research no longer informed the research-policy debate on irrigation development in Asia.

### RECAP AND PARALLELS WITH THE RESEARCH-POLICY DEBATE ON FLID IN AFRICA

As can be surmised in the historical reconstruction above, the success of FMIS research, roughly from conception in the early 1980s to policy reformulation between 1983 and 1986, and the adoption of FMIS as a particular type of irrigation and model for new irrigation policy interventions in 1988-1989, were not achieved overnight; it was the result of a long process of negotiation. In this section, I highlight the key processes in the research-policy debate on FMIS in Asia, because I think that they are also currently, at least partially, at play in the research-policy debate on FLID in Africa.

(1) FMIS and irrigation management research in Asia relied on a frame that problematised the dominant engineering vision on irrigation as narrow and the focus on infrastructure and water use efficiency as wrong. Such a vision, Cornell researchers argued, explained the *underperformance* of public irrigation systems. This particular articulation of the problem was deeply informed by anticipated funding cuts of donors for public-sector development. A similar dynamic is visible in research on FLID in Africa. It is often based on the argument that the engineering view on irrigation and the focus on technology and water use efficiency are problematic, not necessarily because of an underperformance of public projects, but mainly because such a vision tends to *overlook* farmers' activities in irrigation, in the sense that it *disqualifies* them as being practices which embody a form of development, and in the sense that it portrays them as *inefficient*, and therefore as *wasteful* and *harmful*. In Africa, rather than budget cuts, it is an increase of public funds and renewed (donor) interests that inform the debate, and a preoccupation with the regulation of water scarcity (Woodhouse et al., 2016). Nonetheless, the debate is the same: to what extent can FLID inspire or guide public irrigation policies?

(2) FMIS research in Asia gained gravity because a strong coalition of donor organisations and actors was built in the process, led by a core group of Cornell researchers. This coalition, based on Cornell's research agenda, gave weight to the promotion of an alternative irrigation development vision – one that was based on farmers' knowledge and practice rather than on engineering knowledge and practice – and it provided Cornell researchers and their fellows support to deal with tensions around the articulation of this vision, especially vis-à-vis state irrigation engineers. In debates on FLID in Africa, there clearly exists a similar unease, not just among irrigation engineers, but also among agriculturalists and state administrators. In Africa, research on FLID and agricultural water management is not led by a core group of researchers; it takes place in a much looser network of actors and the debate on FLID is characterised by a wide diversity of understanding of what FLID is or should be. However, the tensions around the articulation of FLID and what it represents (and what not) are the same, especially the tensions between irrigation engineers/state planners and their focus on engineering approaches to irrigation development, and social scientists and their focus on farmer-oriented approaches to irrigation development (cf. 'putting the last first', Chambers, 1983).

(3) FMIS research in Asia had a big impact on policy-making because the term FMIS resonates with an engineering view in policy that portrayed public irrigation development as an outcome of the construction and management of surface irrigation systems. In other words, the term FMIS fitted existing policy labels and categories of irrigation (surface/groundwater irrigation, canal/pump irrigation). FMIS was internalised in policy as a particular type or category of irrigation, i.e. an irrigation system that was (to be) managed by farmers without relying on government resources for operation and maintenance (O&M). The term FMIS also resonated with the new global economic motto of rolling back the state, and FMIS in Asia came to represent a new policy model for irrigation development that involved local resources mobilisation and farmers' participation. Overall, in the course of the research-policy debate on FMIS, the term shifted from an academic process-oriented definition of irrigation to a more static policy one. In Africa, I reckon, many of the debates on FLID are developing in similar ways. Academic researchers mainly use the term FLID as a process-oriented definition of irrigation, calling attention for a certain type of irrigation development in SSA, but when the term is picked up by donors, the D of FLID – of development – disappears, and the words farmer-led irrigation come to represent an (ideal) type of irrigation in SSA, of small-scale irrigation that can be promoted, supported and financed through the introduction of micro technologies, such as motor – and treadle pumps, drip kits, and solar irrigation (Merrey and Lefore, 2018). Increasingly, the debate is about the implications of FLID research *for policy and public interventions*.

### **SOME REFLECTIONS FOR THE RESEARCH-POLICY DEBATE ON FLID IN AFRICA**

In comparing the debate on FMIS then, with the debate on FLID now, and articulating some reflections for SSA, I am aware that it is hardly appropriate to compare irrigation in Africa with that in Asia (Woodhouse et al., 2016). Nevertheless, in spite of the differences, including those in the histories of the debates, I think that the research-policy debate on FMIS in Asia, as it unfolded in the 1980s, holds valuable lessons for irrigation and agricultural experts who are currently involved in the debate on FLID in Africa, *particularly* for academic scholars. Two interrelated insights/problems stand out:

#### **Academic irrigation research is produced in an institutional context that is infused with the politics of the professional tradition in irrigation**

The above account reminds us that research on FMIS in Asia was embedded in an institutional context that was infused with the politics of the professional tradition in irrigation. From the start, when the Ford Foundation started to fund Cornell researchers in the early 1960s, academic research was linked to a donor-driven development agenda in agriculture and concerns about the underperformance of public surface irrigation systems, built by engineers. These concerns determined the objective of research, steering the process of academic thinking: How to make irrigation systems work? What technologies are most appropriate and efficient, and what resources or investments are required? It is true, as the account shows, that Cornell researchers translated these objectives in broader research questions (how do farmers organise irrigation; what resources do they use; how to interact with farmers), studying the institutional heterogeneity of farmer-organised irrigation, but they were never really in a position to question the core objectives of research itself.

The above account also clearly shows that the research agenda on FMIS was controlled by Western researchers (Cornell academia, Canadian consultants, and programme officers of the Ford Foundation) and Western donor representatives (Ford and Rockefeller Foundations, CGIAR, ADC/Winrock, USAID, CIDA, and later IIMI). I consider this a typical characteristic of the professional tradition in irrigation. In the early 1980s, no less than eight professors at Cornell were working on irrigation in Asia (including Levine and Coward). These men and their PhD students (including Martin and Yoder), as well as visiting scholars (including Pradhan), acted as the leading figures in the practice of research on farmer-organised irrigation in South Asia (acting as programme officers in the Ford Foundation and researchers

in IIMI). The promoting of FMIS research in Asia was important to them because it created a professional space for social sciences and interdisciplinary research in irrigation.

In this institutional context, national actors and researchers in Asia played a secondary role and the practice of research on FMIS was critically influenced by the tradition and incentive structure in Western academia. In the Western academic tradition, research was (and is) an individual exercise (students individually write a PhD) in which researchers are encouraged to claim and advance ideas through publications (by means of personal authorship). It is true that Cornell researchers put effort in dialogues, bringing together engineers, agriculturalists and researchers, but the dominant trend was, nevertheless, that Western researchers studied and wrote on Asia rather than with Asian researchers. Overall, as the account above reveals, Asian scholars were hardly involved in research themselves. The trend was also that Cornell looked for a receptive audience in the donor community and interesting research testing grounds at the national level, ultimately with the objective to inform policy debates on irrigation. At this point, the interests of Cornell researchers and donors at least partly matched those of Nepalese state officials, who sought to attract funding to finance new national development plans.

I reckon a similar trend is visible in research on FLID in Africa. Leading research projects on FLID, such as the Agricultural Water Management Solutions Project (2009-2012) of IWMI, and two research projects (Studying African Farmer-led Irrigation: SAFI, 2014-2018 and ARF, 2016-2019) undertaken by Manchester (UK) and Wageningen University (the Netherlands), were/are funded by Western donors (Gates Foundation, DFID/ESRC, Dutch government/NWO, and now the WB), and the term FLID itself is an invention of Western (European) scholars. The academic focus in these projects clearly was/is linked to a donor-driven development agenda in agriculture, and the core objectives and the orientation of research was/is the same, compared to FMIS research: to increase agricultural productivity, improve water use and discuss investment opportunities – and in relation to this objective – study how African farmers practise irrigation, and use and mobilise resources. It is true that some researchers are explicitly calling attention for issues such as diversity, equity and gender, almost in a similar fashion as Cornell researchers did in Asia, but they are not in the position to challenge the core objectives of research.

In these research projects, Western academia typically act as the lead researchers (I am one in the ARF project!) and African researchers act as the counterparts, and debates on the FLID agenda tend to take place in relatively exclusive settings, such as the earlier-mentioned Daugherty Institute in the US and the Rockefeller Foundation's Bellagio Centre in Italy. This particular centre facilitated a convention on groundwater irrigation in Africa in the early 2010s (van Koppen et al., 2013), and again, in 2018, it hosted a conference for academic researchers and policy-makers from Africa and Europe to discuss the extent of FLID in SSA. In this institutional context, research on FLID is directly linked to the career prospects of academic scholars and the individualistic incentive structure of Western academic practice. The writing of this particular paper, and perhaps, the publication of this whole special issue, is a case in point; it helps (Western) academic scholars to claim output in their research projects. A typical concern (a challenge) in research projects is also to find a receptive audience in the donor community and African governments, to inform policy debates on irrigation development. In 2016, for instance, researchers of the SAFI project participated in a workshop of the National Irrigation Commission in Dar es Salaam, Tanzania, to discuss "new directions for irrigation development in Tanzania in the context of public private partnerships" (see [www.safi-research.org](http://www.safi-research.org)). In such an institutional context, the future of FLID research in SSA is invariably embedded in the politics of the professional tradition in irrigation.

### **Academic knowledge on the institutional heterogeneity of farmer-organised irrigation is incompatible with how things really work in the institution of the irrigation tradition**

The above account reminds us that a donor-driven agenda of decentralisation and new loan-making, under the global motto of rolling back the state, produced an enabling environment in the 1980s for the

promotion of a farmer-centred development agenda. By means of academic research on water management in agriculture, Cornell researchers succeeded in calling attention to the enormously diverse institutional heterogeneity of farmer-organised irrigation in Asia; their studies were widely discussed in research-policy debates in the 1970s and 1980s. At the same time, the account clearly shows that the rich insights of academic knowledge on the institutional heterogeneity of FMIS were discarded, by and large, by donors, state administrators and engineers. Eventually, the concept of FMIS was useful for them in terms of a particular type of irrigation (a surface system to be managed by farmers) and a policy model for public intervention (irrigation development through resources mobilisation and farmer's participation). This happened in spite of empirical insights of FMIS research that (implicitly) questioned the purpose of public interventions and the role of engineers (farmer-irrigation performs better than public-irrigation; the use of technology and capital investment is no prerequisite for irrigated agriculture; the operation of farmer-managed systems is rarely based on water use efficiency), *and* in spite of Cornell researchers, more than once, raising the alarm about government-takeover of farmers' systems.

As the account shows, in the end, donors wanted to make loans, the government of Nepal was looking for development projects and administrative interventions, and the engineer's professional outlook predominantly framed the issue of farmer-organised irrigation as a challenge of *system* water management and *technical* constraints. To recall the words of Levine (2013), "this is how things really" work in the institution of the professional irrigation tradition (p.152): the focus in the donor community is overwhelmingly on the creation of new loan packages and optimising disbursement rates; the focus in the government is on the making of a legible society (Scott, 1998) for administrative purposes (creating typologies, categories, and standard policy models); and the focus of engineers is on building things and introducing modern technology in society. In the end, as the account testifies, the rich insights of academic knowledge on the heterogeneity of farmer-organised irrigation in Asia were, by and large, incompatible with the structure of incentives and the culture of practice in the institution of the professional tradition in irrigation.

Again, I see a similar trend in research on FLID in Africa. From 2008 onwards, agricultural development in SSA is back on the international agenda, and since then, donors and national governments in SSA have discussed new loan packages and the opportunities for public interventions in agriculture (Woodhouse et al. 2016). Hereby, the focus is mainly on the question of how to improve the availability of irrigation technology, for instance through (micro) finance (Merrey and Lefore, 2018), and a key concern in the debate is about the effectiveness of implementation and the design of appropriate budget categories and disbursement rates. In the debate, there is also a preoccupation with the regulation of water scarcity; the engineer's professional outlook is dominant in framing the issue of FLID as a problem of low water use efficiency, and hence, as a problem of technical constraints. In this professional institutional context, the idea of farmer-led irrigation is increasingly used by donors and administrators to make small-scale irrigation legible for intervention, i.e. making it visible as a type/category of farmers/areas that can be supported through the promotion of small-scale technologies (pumps, pipes, drip kits). In spite of interactions between academic scholars and donors and administrators to discuss farmer-led irrigation in terms of a development process and as modernity, the insights of academic knowledge on the dynamic and heterogeneity of FLID simply seem incompatible with how donors and governments seek to advance, and think about, modern irrigation development in Africa.

The lesson that we should learn here is that academic researchers explicitly need to problematise their own positions in the research-policy debate on FLID. We, as academics and social scientists, historically have an institutionally embedded role in debates on irrigation development. In the current debate on FLID, our academic practices, similarly as the practices of donors, governments, consultants and NGOs, are infused with the politics of the irrigation tradition; we help to shape these politics. We should clearly not pretend to hold an objective outsider position. More specifically, if we fail to

interrogate our own errors and blind spots, we know more or less what will happen with our research in the debate: it will be shaped by a donor-driven irrigation agenda in terms of potential, technology, investments, and water use efficiency. I consider the earlier mentioned conference of the WB and the Daugherty Water for Food Global Institute on farmer-led irrigated agriculture, held in 2018, an apt illustration: the focus was almost exclusively on technologies and defining plans for investments (WB, 2018a; 2018b). We need to think about how to make research and debate on FLID more democratic.

### **THE FUTURE OF ACADEMIC RESEARCH ON FLID: POINTS FOR FURTHER DISCUSSION**

Based on the reconstruction of the research-policy debate on FMIS in Asia, it is possible to extract a few points that might inform a further discussion on the everyday politics of academically oriented, social sciences-based irrigation studies in development:

1. *Academic researchers should use all their intellectual powers to advance the conceptual idea of irrigation as a process of development.* In using the term FMIS, Cornell researchers aimed to make irrigation policies more farmer-oriented, creating legitimacy for the idea that farmers are capable of managing irrigation. In the process of the research-policy debate, however, FMIS became a synonym for a particular type of surface irrigation system, of a technology in need of management and technical assistance. It also was internalised in the debate as a policy model for public intervention, representing a standard logic of operations for the government, of implementing infrastructure (canal lining) and (partly) charging farmers for it, based on the idea of improving water use efficiency. As a type and policy model, the popularisation of FMIS, in fact, worked against a more critical research-policy debate on farmer-organised irrigation as a process of non-government irrigation development – the term used by the Canadians. As a result, farmer-organised groundwater irrigation hardly entered the debate, while it certainly took place in the Tarai (Ansari and Pradhan, 1991), and farmer-organised surface irrigation ended up being discussed in terms of systems, while many areas in Nepal were, in fact, part of a hydrologically connected valley-network or landscape of irrigation (Coward, 2005).

In using the term FLID for Africa, academic researchers have a similar objective: to create legitimacy for the idea that farmers are a driving force in irrigation expansion. In line with this objective, the academic concept of FLID defines farmers' involvement in the expansion of irrigated agriculture as a process of development. Donors such as the WB for instance, seem to interpret it as market-led irrigation, representing an ideal type of small-scale irrigation development in Africa. It suggests that the term FLID attracts attention in research-policy debates partly because of its capacious nature; it provides space for interpretation. The challenge is thus to prevent it from becoming a synonym for a particular type of irrigation or policy model, for instance, for (the promotion of) small pumps or bucket irrigation. This requires a vigilant attitude of academic researchers. More specifically, we need to explicitly question the dominant frame in the irrigation research-policy debate in SSA, i.e. the technical benchmarks of perceived low agricultural productivities and low water use efficiencies in African agriculture. Such a frame harmfully portrays African farmers as unproductive and wasteful, and it wrongly presents class and gender inequities as secondary causes of rural poverty. We also need to challenge the engineers' and agriculturalists' definitions of irrigation and irrigation development in the debate, for instance, by using terms, such as irrigated area (as it was done in Asia) or agricultural water management (in Africa).

2. *Academic researchers should explicitly hold the institutions that enable their research accountable for their roles in the professional tradition in irrigation:* The account of the research-policy debate on FMIS in Asia reveals that the focus was primarily on field studies and studying down, in the hope that such type of studies would produce lessons for new policies and would convince those in power to take action. A study-up strategy, to reverse the research gaze and analyse the powerful themselves, those who conduct research, and influence and implement policies (Zwarteveen, 2008), was not an integral part of Cornell's research agenda. It is true that Cornell researchers proposed to explore the forces

behind public interventions and study the irrigation agencies, but these questions were raised relatively late. The review above is a testimony of the result: FMIS ended up being used as a type and new policy model.

Already there is a large body of qualitative social sciences work on smallholder irrigation in Africa, old and new (see for instance: Barnett, 1984; Widgren and Sutton, 2004; Woodhouse et al. 2016). We know from this work that African farmers are very active in irrigation, capitalising on opportunities and taking risks, organising themselves, and using resources such as labour and natural materials. However, we also know that donors, policy-makers, and engineers and agriculturalists often do not see this conclusion as legitimate; they qualify the evidence as anecdotal and question the relevance of case studies. I suggest that we should critically examine this attitude, using a study-up strategy to ask the question why they keep on saying this in spite of all the empirical work. The review on FMIS above makes one thing very clear: the absence of statistically significant large-scale studies is certainly not the answer. In Nepal, it was a handful of well-developed case studies (Argali, Churlung and Chattis Mauja) that inspired the debate, and it was *qualitative research* that was used as resource to redefine public interventions. Learning from this we should promote our work more vigorously, because the policy lessons for the 'right irrigation' in Africa that follow from our work are straightforward, to quote Lankford (2009): "it comprises a mixed approach that is technologically selective, comprehensively delivered, locally contextualised, institutionally sound, appropriately engineered and professionally supported" (p.479). Yet, it is precisely this mixed approach that is incompatible with the institution of the professional tradition in irrigation.

To reverse this trend, we need to rest our field studies for a while and think about ways to hold the institutions that enable our research accountable for their roles in the professional irrigation tradition, starting with the agendas of donors and the incentives of research funding schemes and the academic tradition. How do research funding criteria and incentives in academia shape the production of academic irrigation knowledge, and how does it feed into the professional irrigation tradition?

3. *Academic researchers should strategise in their alliances and research methods with the objective to challenge the current research-policy debate on irrigation.* The Cornell researchers created an impact with FMIS research in Asia because they successfully built a new professional community of practice in irrigation. They made sure to involve social scientists (Coward, Pradhan) in irrigation studies and safeguarded a social sciences-oriented research agenda, based on qualitative research methods. This created a conducive environment for the generation of non-engineering insights on irrigation. For instance, it helped the Canadian consultants, to create credibility for new facts on irrigation in a non-technical way. In their review, they produced an estimate for non-government irrigation in Nepal without field visits and doing measurements: they used the state taxation records of high-productive land to arrive at a legitimate estimate and a new fact was born: 400,000 ha FMIS area in Nepal.

In the debate in Africa, researchers are keen to establish the scale and potential of FLID with the intention to convince policy-makers. In the ARF research project in Mozambique, for instance, an important goal is to establish a technical and statistically significant method to estimate areas of FLID, using Remote Sensing and GIS software. This is a time-consuming exercise and the focus is on getting the method and the numbers right. However, if the objective is to influence the current research-policy debate on irrigation, based on insights from qualitative research, we need to act more strategically and think about how to create a number on the scale of FLID that starts to live a life as a new fact.

Taken together, these lessons and points pose important questions about the roles that we – academic researchers – want to play in the current research-policy debate on FLID.

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## REFERENCES

- Ansari, N. and Padhan, P. 1991. *Assistance to farmer-managed irrigation system: Experiences from Nepal*. Proceedings of a seminar held on 27 June 1990. Kathmandu: Department of Irrigation.
- Barnett, A.S. 1984. Small-scale irrigation in Sub-Saharan Africa: Sparse lessons, big problems, any solutions? *Public Administration and Development* 4(1): 21-49.
- Beekman, W.; Veldwisch, G.J. and Bolding, A. 2014. Identifying the potential for irrigation development in Mozambique: Capitalizing on the drivers behind farmer-led irrigation expansion. *Physics and Chemistry of the Earth* 76-78: 54-63.
- Blaikie, P.; Cameron, J. and Seddon, D. 1980. *Nepal in crisis: Growth and stagnation at the periphery*. Oxford: Clarendon Press.
- Chambers, R. 1983. *Rural development: Putting the last first*. New York: Longman.
- Chambers, R. 1988. Normal professionalism. In Chambers, R. (Eds), *Managing canal irrigation. Practical analysis from South Asia*, chapter 4, pp. 68-85. New Delhi: Oxford and IBH Publishing.
- Chambers, R. 2013. Viewpoint - Ignorance, error and myth in South Asian irrigation: Critical reflections on experience. *Water Alternatives* 6(2): 154-167.
- Coward, W. (Eds). 1980. *Irrigation and agriculture development in Asia: Perspectives from the social sciences*. Ithaca: Cornell University Press.
- Coward, W. 2005. Property and FMIS governance: Two books that may be unfamiliar, but that inform the discussion. In Pradhan, P. and Gautam, U. (Eds), *Farmer managed irrigation systems and governance alternatives*, pp. 19-31. Kathmandu: Farmer Managed Irrigation System Promotion Trust.
- Coward, W.; Koppel, B. and Siy, R. 1982. *Organisation as a strategic resource in irrigation development*. A conference report. East-West Center: Resource Systems Institute, Honolulu, Hawaii, USA. Conference held at 15-19 November 1982, Asian Institute of Management, Manila, the Philippines.
- Coward, W. and Levine, G. 1987. Studies of farmer-managed irrigation systems: Ten years of cumulative knowledge and changing research priorities. In IIMI/WECS (International Irrigation Management Institute and Water Energy Commission Secretariat). *Public intervention in farmer managed irrigation systems*, pp. 1-31. Colombo: IIMI and Kathmandu: WECS.
- Diemer, G. and Slabbers, J. (Eds). 1992. *Irrigators and engineers. Essays in honour of Lucas Horst*. Amsterdam, the Netherlands: Thesis Publishers.
- Diemer, G. and Vincent, L. 1992. Irrigation in Africa: The failure of collective memory and collective understanding. *Development Policy Review* 10: 131-154.
- Eckholm, E. P. 1976. *Losing ground. Environmental stress and world food prospects*. Worldwatch Institute. New York: W.W. Norton & Company.
- Giordano, M.; de Fraiture, C.; Weight, E. and van der Bliet, J. (Eds). 2012. *Water for wealth and food security: Supporting farmer-driven investments in agricultural water management*. Synthesis report of the AgWater Solutions Project. Colombo: International Water Management Institute (IWMI).
- Harrison, E. 2018. Engineering change? The idea of the 'scheme' in African irrigation. *World Development* 111: 246-255.

- HMG/ADC (His Majesty's Government of Nepal and Agricultural Development Council). 1978. *Water management and control at the farm level in Nepal*. Report of a seminar, Kathmandu, Nepal, 25-27 October 1978. Kathmandu: HMG and ADC.
- HMG/ADC (His Majesty's Government of Nepal and Agricultural Development Council). 1983. *Water management in Nepal. Proceedings of seminar*. Kathmandu: HMG and ADC.
- HMG/FAO (His Majesty's Government of Nepal and Food and Agriculture Organisation). 1976. *Water management and control at farm level*. Proceedings of a national seminar, Kathmandu, Nepal, 8 to 13 March 1976. Kathmandu: HMG and FAO.
- ICID (International Committee on Irrigation and Drainage). 2018. *ICID News: Managing water for sustainable agriculture. First quarter*. New Delhi: ICID.
- IIMI (International Irrigation Management Institute). 1986. *IIMI: Annual report 1984-85*. Colombo.
- IIMI/WECS (International Irrigation Management Institute and Water Energy Commission Secretariat). 1987. *Public intervention in farmer-managed irrigation systems*. Colombo: IIMI and Kathmandu: WECS.
- Lankford, B. 2009. Viewpoint – The right irrigation? Policy directions for agricultural water management in sub-Saharan Africa. *Water Alternatives* 2(3): 476-480.
- Levine, G. 1992. The irrigation programme at Cornell University. In Diemer, G. and Slabbers, J. (Eds), *Irrigators and engineers. Essays in honour of Lucas Horst*, pp. 25-31. Amsterdam: Thesis Publishers.
- Levine, G. 2013. Viewpoint – The search for understanding irrigation: Fifty years of learning. *Water Alternatives* 6(2): 259-264.
- Levine, G.; Solanes, M. and Dikito-Wachtmeister, M. 2013. Introduction – Voices of water professionals: Shedding light on hidden dynamics in the water sector. *Water Alternatives* 6(2): 148-153.
- Liebrand, J. 2017. Performing maps and masculinity in irrigation planning in Nepal: Why modernization myths live on in spite of professional reflexivity. *Anthropologie & Développement* 46-47: 153-187.
- Martin, E. 1986. *Resource mobilization, water allocation and farmer organization in hill irrigation systems in Nepal*. PhD thesis. US: Cornell University.
- Martin, E.D. and Yoder, R. 1988. A comparative description of two farmer-managed irrigation systems in Nepal. *Irrigation and Drainage Systems* 2(2): 147-172.
- Merrey, D.J. and Lefore, N. 2018. Improving the availability and effectiveness of rural and "micro" finance for small-scale irrigation in Sub-Saharan Africa: A review of lessons learned. IWMI Working Paper 185. Colombo: International Water Management Institute.
- Nkoka, F.; Veldwisch, G.J. and Bolding, A. 2014. Organisational modalities of farmer-led irrigation development in Tsangano District, Mozambique. *Water Alternatives* 7(2): 414-433.
- Pradhan, B.K. 2009. Personal reflections: Nepal-India water relations. In Dungel, D.N. and Pun, S.B. (Eds), *The Nepal-India water relationship: Challenges*, pp. 243-267. Kathmandu: Institute for Integrated Development Studies and Dordrecht: Springer.
- Pradhan, P. 1980. *Local institutions and people's participation in rural public works in Nepal*. Ithaca: Cornell University, Rural Development Committee.
- Pradhan, P. 1984. Chattis Mauja irrigation system: Community response in resource management. Paper for Social Science Research Council-Indian Institute of Management, Bangalore Seminar, January 4-7.
- Pradhan, P. 1989. *A comparative study of 21 farmer-managed irrigation systems*. Colombo: International Irrigation Management Institute.
- Regmi, M.C. 1977. *Landownership in Nepal*. First Indian reprint. Delhi: Adriot publishers.
- Reyes Tejada, N. 2018. Women in farmer-led irrigation development: The case of Infulene Valley, Maputo, Mozambique. *Crítica y Resistencias* 8: 31-43.
- Scott, J.C. 1998. *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven and London: Yale University Press.
- Shivakoti, G.P. and Ostrom, E. (Eds). 2002. *Improving irrigation governance and management in Nepal*. Oakland: Institute for Contemporary Studies.

- Shukla, A.; Shivakoti, G.P.; Benjamin, P. and Ostrom, E. 2002. Toward the future of irrigation governance and management in Nepal. In Shivakoti, G.P. and Ostrom, E. (Eds), *Improving irrigation governance and management in Nepal*, pp. 225-241. Oakland: Institute for Contemporary Studies.
- Shukla, A. and Sharma, K.R. 1997. *Participatory irrigation management in Nepal*. A monograph on evolution, processes and performance. Kathmandu: Printers Universe.
- Staples, E.S. 1992. *Forty years: A learning curve. The Ford Foundation programme in India, 1952-1992*. New York: Ford Foundation.
- Taylor, D.C. and Wickham, T.H. (Eds). 1979. *Irrigation policy and the management of irrigation systems in Southeast Asia*. Proceedings of conference jointly sponsored by the ADC, IRRI and the Southeast Asian Regional Center for Graduate Study and Research in agriculture. June 22-25, 1976. Bangkok: Agricultural Development Council.
- Upadhyay, S.B. 1987. Public intervention in farmer-managed irrigation systems in Nepal. In IIMI/WECS (International Irrigation Management Institute and Water Energy Commission Secretariat). *Public interventions in farmer-managed irrigation systems*, pp. 233-236. Colombo: IIMI and Kathmandu: WECS.
- WB (World Bank). 2018a. *Water for food international forum. Farmer-led irrigated agriculture: Seeds of opportunity. Agenda*. 29-30 January 2018. World Bank Group and the Robert B. Daugherty Water for Food Global Institute. Lincoln: University of Nebraska.
- WB (World Bank). 2018b. *Special invitation to the farmer-led irrigation for the smallholder farming enterprise exhibition*. World Bank Group, African Development Bank and the Alliance for a Green Revolution in Africa. Lincoln: Daugherty Water for Food Global Institute, University of Nebraska.
- WECS (Water and Energy Commission Secretariat). 1979. *A positioning paper on the organizational structure of the secretariat of the national water resources and energy commission*. Kathmandu: WECS.
- WECS (Water and Energy Commission Secretariat). 1981. *Irrigation sector review*. Report no. 3/2/190981/1/1. Kathmandu: WECS.
- WECS (Water and Energy Commission Secretariat). 1982. *Performance review of public sector intensive irrigation based agricultural projects*. Kathmandu: WECS.
- Widgren, M. and Sutton, J.E.G. 2004. *Islands of intensive agriculture in Eastern Africa: Past and present*. Oxford: James Currey.
- Woodhouse, P. 2012. Water in African agronomy. In Sumberg, J. and Thompson, J. (Eds.), *Contested agronomy: Agricultural research in a changing world*, pp. 102-115. London: Routledge.
- Woodhouse, P.; Veldwisch, G.J.; Venot, J.P.; Brockington, D.; Komakech, H. and Manjichi, A. 2017. African farmer-led irrigation development: Re-framing agricultural policy and investment? *The Journal of Peasant Studies* 44(1): 213-33.
- Xie, H.; You, L.; Wielgosz, B. and Ringler, C. 2014. Estimating the potential for expanding smallholder irrigation in Sub-Saharan Africa. *Agricultural Water Management* 131: 183-193.
- Xie, H.; Perez, N.; Anderson, W.; Ringler, C. and You, L. 2018. Can Sub-Saharan Africa feed itself? The role of irrigation development in the region's drylands for food security. *Water International* 43(6): 796-814.
- Yoder, R. 1986. The performance of farmer-managed irrigation systems in the hills of Nepal. PhD thesis, Cornell University, USA.
- You, L.; Ringler, C.; Wood-Sichra, U.; Robertson, R.; Wood, S.; Zhu, T.; Nelson, G.; Guo, Z. and Sun, Y. 2011. What is the irrigation potential for Africa? A combined biophysical and socioeconomic approach. *Food Policy* 36(6): 770-782.
- Zwarteveen, M. 2008. Men, masculinities and water powers in irrigation. *Water Alternatives* 1(1): 111-130.

