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98

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Research Report 98

Multiple-Use Water Services to Advance the Millennium Development Goals

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Contents

SUMMARY

This research report presents the findings of the first phase of the action-research project “Models for implementing multiple-use water supply systems for enhanced land and water productivity, rural livelihoods and gender equity.” Multiple-use water services, or “mus” in short, is a participatory, integrated and poverty-reduction-focused approach in poor rural and peri-urban areas, which takes people’s multiple water needs as a starting point for providing integrated services, moving beyond the conventional sectoral barriers of the domestic and productive sectors. Three aspects are discussed. First, a typology is developed for the various efforts since the 1980s to overcome the shortcomings of conventional single-use planning and design. Second, the empirical evidence is analyzed to identify generic merits and drawbacks of needs-based and participatory water-services provision compared to conventional approaches with regard to well-being; gender; ability and willingness to pay for water services; water productivity and “more use per drop;” integrated local water management institutions; protection against illegal use; health; equitable and environmentally sustainable water allocation and protection of people’s basic multiple water needs; and incremental costs. Third, a framework is provided, based on principles grouped in “Learning Wheels” at the community, intermediate and national levels. The principles represent the conditions that the project team identified as pivotal for implementing and upscaling mus approaches at a larger scale. The ten principles include: service provision based on a thorough understanding of water-related livelihoods; sustainable, equitable and efficient use of water resources; appropriate technologies; inclusive institutions (at community level); adequate financing (crosscutting all levels); adaptive and learning-based management (at the intermediate level); coordination between sectors and actors; long-term support; participatory planning (at intermediate and national levels); and enabling policies and legislation (by governments at national level). Action-research guided by this framework is expected to generate better insights and better action to upscale this appropriate form of IWRM and multiply its benefits to advance the Millennium Development Goals.

Multiple-Use Water Services to Advance the Millennium Development Goals

Barbara van Koppen, Patrick Moriarty and Eline Boelee

Background and Aim of the Report

Background

The present research report is the outcome of the joint work of the team of the action-research project "Models for implementing multiple-use water supply systems for enhanced land and water productivity, rural livelihoods and gender equity" (see www.musproject.net).[1] This project develops a participatory, integrated, and poverty-reduction-focused approach to providing people with appropriate and sustainable water (and sanitation) services, which we call "multiple-use water services" or, in short, "mus."[2] The objective of the project is to advance the Millennium Development Goals by identifying and developing practical models, tools and guidelines for providing and upscaling improved water services that better meet poor women's, men's and children's multiple water needs.

The Millennium Development Goals acknowledge the critical and multifaceted role of water in realizing a world, which aims, by 2015, at achieving the following:

> Goal 1: halving the prevalence of hunger (water improves food and income from crops, animals and small businesses in poor rural and peri-urban areas);
>
> Goal 2: universal primary education (girls are liberated from domestic water chores, and boys from herding livestock to distant water points);
>
> Goal 3: women's empowerment (women are liberated from domestic water chores and obtain equal access to water for food and income);
>
> Goal 4: reduced child mortality;
>
> Goal 5: improved maternal health;
>
> Goal 6 HIV/AIDS, malaria and other diseases combated (more water of higher quality is available for drinking and hygiene, and water-related diseases are prevented); and
>
> Goal 7: enhanced environmental sustainability (water resources are used equitably, rationally and sustainably, and watershed management ensures adequate drainage and prevents pollution and land and water erosion) (UN Millennium Project Task Force on Water and Sanitation, 2005; www.unmillenniumproject.org).

In the past decade, broad consensus has been achieved amongst governments, NGOs, international development and financing agencies and donors on key changes necessary within the

[1]This partnership of researchers and implementers from the domestic and productive sector is, at global level, led by International Development Enterprise (IDE), International Water and Sanitation Center (IRC), International Water Management Institute (IWMI), Khon Kaen University, Thailand, and Mekelle University, Ethiopia. The action research is carried out in collaboration with national partners in five benchmark basins of the Challenge Program: the Andean basins (Colombia and Bolivia), Indus-Ganges basin (India and Nepal), Mekong basin (Thailand), Limpopo basin (South Africa and Zimbabwe), and Nile basin (Ethiopia). The project is funded by the Challenge Program on Water and Food (see www.waterforfood.org).

[2]The term "water services" is used broadly and includes both sanitation services and hygienic behavior change.

water sector, if it is to rise to the challenges posed by achieving the Millennium Development Goals, including:

- Good governance, including people's participation and the devolution of decision-making authority and the required resources to the lowest appropriate level.
- Participatory and demand-based technology choice, from a range of appropriate and affordable technologies.
- A central role for women in planning and managing water services, as expressed in the Dublin principles (1992).

Above all, it is widely recognized by now that, in addition to good governance, decentralization and participatory technology development, it pays to think and act in a more integrated and holistic way. This philosophy is reflected in the concept of Integrated Water Resources Management (IWRM), which is defined as *a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems* (GWP 2000). IWRM has become the overarching consensus of the water community, at least at the abstract level. However, at a more concrete level, the IWRM paradigm has been critiqued for being amorphous and open to multiple interpretations, and perhaps most seriously for lack of practical tools and approaches by which to implement it (Biswas 2004).

This research report focuses on a concrete, participatory, integrated, and poverty-reduction-focused approach to providing people with appropriate and sustainable water and sanitation services that meet their multiple water needs. We refer to this approach as "multiple-use water services" or "mus." A mus approach addresses the challenges mentioned above by recognizing that people's water needs are integrated and are part and parcel of their multifaceted livelihoods, and that the necessity to better meet people's multiple water needs is a main driver for integration within the water sector itself. Concurrent multiple water needs especially prevail among the primary target group of the Millennium Development Goals: the rural and peri-urban poor in developing countries whose diversified livelihoods depend strongly and in many ways upon water. They use water concurrently for domestic purposes, cropping, gardening, livestock, fisheries and aquaculture, tree growing, food processing (beer making, coffee processing, butchery), brick making, market places, weaving, handicrafts and other small businesses and ceremonial and cultural purposes. Table 1 illustrates such multiple water uses for a rural household. Hence, any water service that seeks to meet their real-life water needs can only do so by meeting multiple water needs at the same time.

The single most important reason why planning and design of water services on the basis of multiple water needs are still not the norm, in spite of water services providers' genuine and intensive efforts to improve users' well-being, is that people's integrated need for and use of water do not match the ways in which the water sector itself is organized. The structuring of policymaking, implementation, subsidization and financing by governments and, often to a lesser extent, by nongovernmental organizations (NGOs), private water services provision and commercial financing, is sectoral and top-down, dividing water services provision into a domestic sector, an irrigation sector, a livestock sector, a fisheries and aquaculture sector, etc. In this setup, each sector specializes in one single water use and plans and designs its interventions according to what can be called a "single-use planning and design" approach. Implicitly, it is assumed that "other sectors" take care of the other water needs of their clients—whether "the other sectors" are actually present or not, and in many poor areas they are not. In water-scarce areas there may actually be only one source of water and once this has been allocated to a particular use, it cannot easily be used for other purposes. Thus, technical specialization and bureaucratic structuring

TABLE 1.
Water demand characteristics of a hypothetical rural household (eight persons; a cow, a donkey and six goats or sheep in a hot climate).

Characteristics of demand and benefits	Drinking-Humans	Drinking-Livestock	Bathing and sanitation	Washing	Fish culture	Irrigation	Enterprise
How frequently is water needed?	Daily	Daily	Daily to weekly	Daily to weekly	Continuous	Weekly	Varies
How much water is needed per year? (m^3)[1]	12	30[2]	45[3]	45	6,000	8,000[4]	Varies
How critical is good water quality?	Very, especially organic pollution and certain chemicals	Quite, less than for people	Not	Not, except for hardness	Hardly	Hardly, except for salinity	Varies
Elasticity of water use w.r.t. supply	Very low above minimum requirements	Very low above minimum requirements	Low	Low	High	Very high	High
Site of use	Homestead	Homestead, near distant, pastoralist	Homestead or near	Homestead or near	Homestead near or distant	Homestead near or distant	Homestead near or distant
Benefits	Health/hygiene	Food, income, draught power, asset	Health/hygiene/ sanitation	Health/ hygiene	Food/income	Food/income	Income
Monetary costs of water provision	Medium	Medium	Medium	Medium	Medium-High	High	Varies

Notes:

[1] Calculations based on daily requirements for people at 4 lppd (Howard and Bartram 2003); for cattle 27 lpcd, sheep 5 lpsd, donkey 16 lpdd (FAO 1986); for bathing (including sanitation) and washing 15 lpcd each (Thompson et al. 2001).

[2] This is water only for drinking. Water may also be used for bathing and cleaning of stables.

[3] One hectare of land with 0.5 ha rice requiring 8 mm/day during 120 days (4,800 m^3), 0.5 ha vegetables requiring 5 mm/day during 120 days (3,000 m^3) and a rain-fed crop during the rest of the year.

w.r.t. = with regard to; lppd = liters per person per day; lpcd = liters per cow per day; lpsd = liters per sheep per day; lpdd = liters per donkey per day.

become, on the ground, an unintended priority for one single water use, whether domestic or productive, ignoring the reality that the agencies' clients need water for multiple uses.

Moreover, this sector-based structuring goes hand in hand with efforts to formalize and standardize implementation procedures and norms for infrastructure, water quality, or water committees, especially by governments. This does not sit well with the informal and highly variable water situation of the rural and peri-urban poor. In these informal settings, where the presence of public agencies is limited, the priority of infrastructural development for better water control tends to be low. An individual's own initiative and private-sector initiative prevail in accessing water from rainfall, streams, ponds, springs, groundwater, or wetlands. Important synergies are derived from complementary use of multiple water sources. Access to multiple sources is also at the heart of strategies to cope with seasonal and annual droughts and floods. This water situation differs widely from the well-controlled conditions of the urban and industrialized middle class where formal, sector-based approaches work much better. So multiple-use water services in the interests of the poor stand for: *water services planning and design that take people's multiple water needs as a starting point and that searches for incremental improvements in access to water across the range of needs within informal settings and a highly variable water situation.*

The challenge, which has been recognized since at least the 1980s, is how to engender the changes required in the water sector to make such multiple use services a reality. In 2003, international symposia in South Africa (Moriarty et al. 2004a; www.irc.nl/page/9077) and Colombia (Agua 2003. www.cinara.org.co) brought together professionals from both the domestic and productive water sectors, who continued and expanded collaboration into the PRODWAT Thematic Group (www.prodwat.watsan.net) and also through the action-research project "Models for multiple water-use water supply systems for enhanced land and water productivity, rural livelihoods, and gender equity" the first results of which are presented in this report. Leaving sectoral boundaries behind, the specific aim was to search together for a more integrated approach to water services delivery that contributes to the Millennium Development Goals. Indeed, the Global Water Partnership, a key global network on IWRM, also refers to mus approaches as "appropriate forms of IWRM in poor areas with backlogs in infrastructure development" (GWP 2004).

The observed high potential of multiple-use water services taken together with the already mentioned general global trends towards decentralization and participation implies that broad and systematic upscaling of mus approaches in poor rural and peri-urban areas may well present a real opportunity to implementing IWRM while contributing to achieving the Millennium Development Goals. If mus approaches have proven to have systematic merits across quite a number of projects, their benefits will multiply manifold if applied nationwide. This research report seeks to systematically set out the existing evidence for the merits of mus, followed by presenting a framework within which further testing and validating of mus approaches can be carried out in preparation for rapid upscaling.

Aim of the Report

The aim of this research report is threefold. First, to analyze past empirical evidence of conventional single-use planning and design approaches and the various responses by water services providers to better accommodate people's multiple water needs. In the second section an overview of existing approaches to water service delivery is provided according to our typology of "single-use," "domestic-plus" or "productive-plus," and multiple-use water services.

Second, to compare this empirical material on mus approaches with conventional single-use water services in order to identify recurring merits and drawbacks. The third section analyzes how approaches based on the mus concept avoid some of the pitfalls of single-use approaches; and it examines whether the approach is replicable.

The third aim is to propose a set of principles that provide a conceptual background for the mus approach, that can frame and support research and implementation efforts to identify and upscale locally suitable mus. The fourth to seventh sections introduce such a framework of principles and hypotheses, as developed by the Challenge Program on Water and Food-supported project "Models for implementing multiple-use water supply systems for enhanced land and water productivity, rural livelihoods and gender equity" on the basis of their own and others' experience and literature from around the world.

Methodology

As indicated above this research report is the outcome of the initial phase of the Challenge Program on Water and Food-supported project "Models for implementing multiple-use water supply systems for enhanced land and water productivity, rural livelihoods and gender equity." The analysis of past empirical evidence and the identification of merits and drawbacks of mus compared to conventional approaches are based on both a global literature review and the expertise of the project members. The principle-based framework for the implementation of multiple-use water services was developed by the team during a series of intensive discussions, with the conceptual guidance and process facilitation of Juergen Hagmann (Boelee et al. 2004; Ramaru and Hagmann 2005; Hagmann 2005). Currently, this framework is being used to orient the action-research initiated by the project in eight countries in five basins, and to allow comparison across communities, districts, countries and basins. In each of the project sites, the action-research is organized around "learning alliances," which involve a wide range of key stakeholders, including administrative and technical government departments, NGOs, farmer movements and other Community-Based Organizations, rural development banks, international donors, as well as international and national research and knowledge development organizations. For an in-depth analysis of learning alliances as vehicles for conducting action-research, see Moriarty et al. 2005. At the end of the project by end 2007, field-tested lessons learned will be consolidated into country-level, organization-level, or more generic models, tools and guidelines for implementing and upscaling multiple-use water services approaches.

From Single-Use to Multiple-Use Planning and Design

This section synthesizes global experience of water service provision from the point of view of success in meeting people's multiple needs. To do so a typology is introduced of approaches to service provision as it is applied today. This consists of:

- Single-use planning but de facto multiple use.
- Domestic-plus and productive-plus.
- Multiple-use approaches.

Single-Use Planning but De Facto Multiple Uses

Discomfort with the sectoral divides in the water sector and the search for ways to better consider people's multiple needs in poor rural and peri-urban areas are not new, and important lessons can be learnt from analyzing these experiences. For long, professionals in the domestic and irrigation sectors—the two most important service

provision sectors—have highlighted the unexpected outcomes and shortcomings of single-use planning and design approaches and have proposed alternative and more integrated approaches that take people's multiple needs as a starting point (Yoder 1983; Silliman and Lenton 1985; Meinzen-Dick 1997; Boelee et al. 1997; Moriarty 2002).

Most concern arose as a result of the literally universal observation that externally facilitated schemes that were originally planned and designed for a single use, either a "domestic" or "irrigation" scheme (or a "livestock" of a "fish" pond) are invariably transformed into de facto multiple-use schemes by the users immediately after construction is finalized. Documented cases abound, from making unauthorized connections in South Africa (Pérez de Mendiguren Castresana 2004) to higher volumes of use than planned for in Bolivia (Bustamante et al. 2004) or the use of costly treated water for irrigation in Colombia (Sánchez et al. 2003). Domestic uses, animal watering, fisheries and tree-growing were commonly reported as uses of "irrigation" water (Yoder 1983; Bakker et al. 1999; Renwick 2001a; Nguyen-Khoa et al. 2005).

The de facto use of single-use planned systems for multiple purposes has often caused problems. Users or their livestock damaged the hardware and, within the domestic sector, additional use frequently caused low pressure resulting in the tail-end users not receiving any supply and increasing conflict (Moriarty et al. 2004a). In cases where non-planned uses threatened the functioning or even the existence of the scheme, water service providers often tried to prevent such uses. They declared such uses as "illegal," sometimes leading to fines. Cattle were banned from entering irrigation canals. Users of piped domestic schemes were banned from using water for gardening. However, interventions that were only taken during the use phase usually failed, perpetuated conflict between user groups and seldom resulted in a better functioning service (Schouten and Moriarty 2003).

In situations where non-planned uses provided little or no threat to scheme functioning, field staff usually tolerated such uses which provided obvious livelihood benefits. However, these non-planned uses were seldom mentioned in official reports, either because the "box" to fill such use did not exist or, worse, because there was a risk of being reprimanded for encroaching into another sector's mandate.

Awareness about the profound limitations of single-use water services provision was also expressed in Black and Talbot's (2005) study of UNICEF's 40-year involvement in India's "domestic water" sector.

> […] The thrust [of UNICEF] was safe drinking water, to pursue the goal of improved public health particularly of children. In spite of the needs of the Indian farmer for water to irrigate his crops during the dry season, without which his family's food supply would be threatened and children's and women's well-being jeopardized from another direction, UNICEF's concern was limited to water for drinking and domestic purposes. Indeed, if there had been any mention of agriculture during the debates surrounding the proposal, it would have stopped dead in its tracks. Some advocates of applied nutrition were keen to support domestic water supplies for kitchen gardens as an adjunct of family food supplies, but nutrition programs were then seen as an adjunct to health in the UNICEF perspective. […]
>
> But a policy that neglected other basic water needs and failed to integrate requirements for both agriculture and health has become, in more recent times, an albatross of terrifying proportions. Such a crisis has not been anticipated at the time. [...]

Domestic-Plus and Productive-Plus

A response to de facto multiple uses of single-use planned schemes that aims to better contribute to people's well-being and to enhance scheme sustainability is the anticipation of and catering for "additional" uses by designing infrastructural add-ons, while maintaining the sector's single-use as the starting point. This

response is occurring in both the domestic and productive water sectors, parallel to each other. In our typology we refer to these as “domestic-plus” or “productive-plus” water services. In the irrigation sector, where water quantities for domestic uses are few, if not negligible, compared to the quantities of water used for irrigation, various sorts of add-ons can be distinguished. For example, in schemes without year-round irrigation, water can be provided year-round for domestic uses by ensuring some water in canals even when crops do not need it. Another add-on is providing improved access for domestic and livestock uses, for example, steps in irrigation canals that allow access to people for drinking, bathing or laundry, and access points for animals.

Especially in arid areas where large irrigation schemes are the only source of water, the vital importance of such add-ons for domestic supplies is well recognized. In Morocco, for example, intakes for formal municipal water-treatment plants are sometimes constructed at main irrigation canals. In large-scale irrigation schemes, communities can also get special water allocations to fill their traditional communal cisterns for domestic purposes, while they may use their personal crop water allocations to divert water through self-made canals to their individual tanks (Laamrani et al. 2000; Boelee and Laamrani, 2004). In the Punjab region in Pakistan, canals were constructed that led water to open domestic village water reservoirs and animal ponds (Jehangir et al. 2000). The total dependency on the irrigation scheme shows most clearly when the canals are closed for maintenance. Household water consumption may drop to 10 liters per person per day (lpd) (Ensink et al. 2002).

Add-on productive-plus designs improve fisheries too. Particularly in Asia, water in canals, open reservoirs and also in paddy fields is often used for fisheries. With relatively simple adaptations to the infrastructure, such as fish-friendly drop-structures and cross-drainage culverts that reduce flow velocity and improve ecological connectivity for migrating aquatic organisms, fisheries are enhanced. While these water uses hardly “consume” any water, they require specific measures, e.g., minimum “dead” water reserves in dam reservoirs, to protect and capitalize on these uses (Nguyen-Khoa et al. 2005; Renwick 2001a).

Various combinations of cropping and fisheries and also duck breeding and tree-growing are explored nowadays, also expanding beyond the boundaries of irrigation schemes, for example, for productive uses in holistic watersheds. A recent workshop on Multiple Water Use Systems in Asia, supported by the Challenge Program on Water and Food, proposed to distinguish between “productive-plus-multi-agricultural enterprises” (such as rice-fish-duck systems) and “productive-plus-other business enterprises,” and also to rename Participatory Irrigation Management as Participatory Watershed Management (Challenge Program on Water and Food et al. 2005).

In domestic-plus designs, the major issue is enhancing water quantities, for example, by increasing the capacity of abstraction, storage and delivery infrastructure by augmenting the diameters of pipes or the abstraction capacity of pumps (Lovell 2000; Moriarty 2002). Village drinking troughs fed by piped domestic supplies enable animal watering, while maintaining water quality for humans. Domestic-plus designs are sometimes as simple as advancing the time of the use of the full capacity of schemes. Anticipated future expansion is often already designed into a scheme (for example by “over”-dimensioning pumps, pipes or storage tanks), but not used upfront because of the prevailing very low norms for water services that are assumed to be for domestic purposes only. Using the full capacity from the outset avoids infrastructure lying idle while the scheme is vandalized because people have more water needs than domestic uses alone.

In these “domestic-plus” and “productive-plus” technical designs, the range of water needs is much better recognized, but the predominance of the sector-based priority water use does not fully disappear. This is seen, for example, when cattle-drinking troughs are located too close to domestic tap-stands leading to unsanitary conditions and contamination. Women’s preferences may also

still be ignored. For example, in Colombia, many water schemes have been developed with the purpose of domestic supply and water for processing of coffee beans. But using water for pig rearing, a women's activity, is considered a waste (Butterworth et al. 2005). In Zimbabwe, water points were designed to meet water demands for domestic uses and cattle watering, but the designers had not considered water for backyard gardening, which is women's responsibility (Smits, Zimbabwe, 2005, personal observation). Also, while the hardware becomes more user-friendly, the newly established users' organizations sometimes perpetuate the main sectoral mandate. Even though the committees managing such domestic- or productive-plus schemes are called "water user associations," in reality it is either a farmers' committee (with farmers without land titles, livestock keepers, fishermen, and representatives of the domestic sector at best in a secondary role), or a domestic water committee that regards other uses as secondary (Meinzen-Dick and Bakker 2001).

Towards Multiple Use Water Services

Recently, some NGOs have adopted something close to a full-fledged multiple-use water services approach. Because they are often less hindered by sector boundaries or sector-based government policies, and have a strong mandate to tackle poverty and incentive to meet clients' needs, they tend to be able to operate more flexibly and holistically than governments or many donor-driven programs. The most widespread example is traditional and upgraded household roof-water and runoff harvesting and storage (Agarwal et al. 2001) including groundwater recharge (Shah 2005). Household storage is also increasingly being promoted by governments, as in Thailand, South Africa and Ethiopia.

In a number of other NGO cases mus approaches have been driven by technological innovation, such as the rope-pumps (Alberts and Van der Zee 2004; Robinson et al. 2004) and treadle pumps (Shah et al. 2000; Polak et al. 2004; ApproTEC 2004). These technologies are now provided through largely self-financing supply chains in many parts of the world. The small-scale enterprise AguaTuya in Bolivia, which sells pipes and equipment to groups and individuals for multiple-use schemes, is another illustration of private-sector services that meet people's water needs and users' willingness to pay for such services. Many small collective schemes also work well in municipalities, as also seen in Bolivia (Bustamante et al. 2004). In other cases, multiple-use schemes remain partly subsidized. In Ethiopia and elsewhere, for example, the NGO Catholic Relief Services implements subsidized multiple-use village gravity schemes (Ebato and Van Koppen 2005).

The problem that, wherever water is limited, water for productive uses needs to be used as efficiently as possible is also being addressed. Nepal Smallholder Market Initiative (SIMI), with International Development Enterprise (IDE) and Winrock, introduced multiple-use systems in Nepal. They consist of collection tanks at springs or small stream diversions that deliver water to a reservoir near village settlements by gravity flow through a pipe. These systems serve 10–40 households for both domestic purposes and homestead horticulture. The introduction of small-scale drip irrigation systems supported farmers in more efficient use of water, labor-saving and better plant growth (Nepal SIMI 2004). On the other hand, where water is less scarce as in the above-mentioned case in Colombia, the district government supported by the research institute CINARA negotiated the augmentation of water supplies, also for pig rearing. This was feasible from a water-resources and financial perspective, but was blocked by formal limits on the use of "domestic" water (Butterworth et al. 2005).

Some NGOs started focusing on the institutional aspects of mus. For example, the South African NGO Association for Water and Rural Development is piloting livelihood-based bottom-up planning for multiple uses, which is fully integrated into the Integrated Development Plans of Local Government (Maluleke et al. 2005).

Innovations by global organizations also moved towards multiple-use planning and design. The UNDP continued various initiatives through

the “Community Water Initiative,” which is another example of service delivery to villages without a preconceived notion of the water uses that communities want to develop first (www.undp.org/water/initiative). An early example, supported by the Water and Sanitation Program of the World Bank, is the Kabuku Water Project in Kenya in which the water service was designed for domestic uses, extensive gardening and other uses from the outset (video Sustainability: productive use of water at www.odi.org.uk/wpp/films.html). The Community-Driven Development Program of the World Bank aims to empower local groupings through self-controlled investments in any activity of their choice. In a number of cases, communities opted for water initiatives (Binswanger and Tuu-Van Nguyen 2005; De Regt 2005).

Conclusions

The interest in the concept and the actual implementation of domestic-plus, productive-plus, and multiple-use water services, which have existed since the 1980s, seem to be rapidly gaining momentum nowadays. The cases cited above represent diverse conditions across the globe: from individual self-financed manual pumps or small gravity schemes to large-scale publicly financed irrigation-cum-domestic schemes; in water-scarce and water-abundant areas; in socioeconomically more- and less-developed areas; among the poorest and somewhat wealthier; initiated from both the “domestic” and the “productive” sector; initiated by NGOs but increasingly also by the large international organizations and national governments. All schemes contribute to achieving the Millennium Development Goals, albeit at a very limited scale. If mus approaches work in many different settings, the potential for upscaling across the water sector and multiplying its benefits may be substantive. However, before drawing that conclusion, a more rigorous analysis is needed of the merits and drawbacks of multiple-use services. This is the aim of the next section.

Merits and Drawbacks of Multiple-Use Water Services

Improved Well-Being

Many studies on de facto multiple-use schemes identified and quantified the livelihood benefits of these unplanned uses. The benefits from using “irrigation” schemes for drinking, washing, bathing, laundry, livestock watering and income-generating activities are mentioned in several studies (Ault 1981; Yoder 1983; Bakker et al. 1999; Palanisami and Meinzen-Dick 2001; Meinzen-Dick and Van der Hoek 2001). Inland fisheries, which may provide rural households with 10 to 30 percent of their total income, are especially important for the poor (Nguyen-Khoa et al. 2005). The return value from unrecognized fisheries in the Kirindi Oya Irrigation and Settlement Project in Sri Lanka was estimated at 18 percent of the income from paddy (Renwick 2001b). Nowadays, the irrigation sector rightly argues that these additional values should be fully considered in decision making in policy and programs whether to invest in “irrigation” or not.

Similar studies were done in the “domestic” sector. WaterAid, for example, identified small-scale productive uses at the household level as a major unplanned benefit from the schemes that they implemented in the early 1990s (WaterAid 2001). In South Africa, Perez de Mendiguren Castresana (2004) found that the rural poor, and particularly women, use “domestic” water supplies for a wide range of productive activities. Comparing villages with lesser water supplies with those with higher water supplies, he found that the total incremental value of all water-dependent

activities divided by the total population amounted to R293 (US$45) per person. This increase in activities depending upon domestic water supplies represented an increase from 17 to 33 percent of the total income. Elsewhere in South Africa, backyard gardens appeared especially important for home-based care givers supporting persons infected by HIV/AIDS, as, otherwise, they would not have any access to high-quality food, such as vegetables (Kgalushi et al. 2003). In Cochabamba in Bolivia nondomestic uses of peri-urban water supplies were also found to give significant additional income (Duran et al. 2005).

Unfortunately, few studies differentiate between the user groups to whom the benefits accrue according to wealth class. One study in which specific attention was paid to the land-poor was an assessment of the impact of irrigation investments on poverty alleviation. Silliman and Lenton (1985) observed that the direct benefits to the land-poor from irrigating their lands are inevitably less than those with more land, although the land-poor were acknowledged to benefit indirectly, for example, from employment generation. However, nonirrigation water uses were acknowledged to be especially important for them (Silliman and Lenton 1985). A study of the West-Gandak Irrigation Scheme in Nepal also confirmed that 44 percent of the poorest third of the population used water from irrigation canals for nonirrigation purposes, while none of the wealthiest third did so (Van Koppen et al. 2002). Also, in Pakistan, where livestock is an asset to the poor more than to the nonpoor, animal watering provisions do benefit the poor disproportionately and, hence, contribute to poverty reduction at a larger scale (Jehangir et al. 2000).

These empirical studies underscore the well-known understanding of human well-being as being multidimensional. Broader and cumulative water uses fulfill a broader range of water needs, and so contribute more effectively to people's well-being. As also acknowledged in the relationships between water and the Millennium Development Goals, water uses concern core dimensions of well-being and poverty: health for adults and especially children, food, income and reduced labor for water provision.

Moreover, the multiple benefits of water mutually reinforce each other for the better, and the effects of lack of water reinforce each other for the worse. For example, food production and processing, which require water, are essential for nutrition and health. Health also depends on access to and correct use of domestic water and sanitation. Good health gives higher productivity resulting in production of more food and more income, which allows taking more preventive health measures and paying for health services. Better nutrition, in turn, decreases susceptibility to disease (Cooper Weil et al. 1990). Reduced drudgery of meeting domestic needs for women and children or watering animals often for boys frees up precious time for productive activities, domestic and child care, or schooling. While it is difficult to quantify these and many more interrelationships between water and well-being (Hussain 2005) the assumed pathways are sufficiently plausible to corroborate that meeting multiple water needs simultaneously contributes more effectively to people's well-being than a mere addition of the beneficial effects each use would suggest. Indeed, multiple water uses improve different dimensions of multifaceted well-being in a virtuous circle taking the poor out of poverty.

Evidently, water is only one factor contributing to people's well-being. Hygienic education, output markets, soil fertility, know-how, inputs and financing—all influence how access to water is turned into health, food and income. IWRM in the sense of understanding and integrating water development within the wider socioeconomic context and programs may even be more effective for poverty reduction than moving from single-use water services to multiple-use ones. However, the conclusion here is that multiple-use water services contribute more effectively to people's well-being than single-use ones, and if also well targeted to the poor, they can be an important opportunity to contribute to achieving the Millennium Development Goals.

Gender Equity

Improved well-being under multiple-use water services benefits women in particular in three ways. While the domestic sector already recognizes the importance of improved domestic water supplies to alleviate women's and children's burdens, domestic-plus approaches add productive activities which are often around the household. This is of special interest to women in societies where their mobility is limited or where they lack access to fields of their own—a situation similar to that of land-poor and landless households in general. For them, water provision around the household is the major opportunity to make productive use of it. A study in Nepal confirmed how women benefited, in particular, from the newly installed domestic-cum-gardening water supplies and drip irrigation kits (Upadhyay et al. 2005).

From a productive-plus perspective, the added devices for domestic uses are often the most important, if not the only benefit of public irrigation investments for women (Hussain 2005), especially in the past when women tended to be entirely excluded from newly introduced irrigation and when, sometimes, even their former land rights were eroded (Van Koppen 2002). Sometimes irrigation projects even weakened women's former domestic water rights. For example, night reservoirs in Tanzania were traditionally designed for multiple uses, but they became "irrigation canals" governed by male-dominated "water user associations" after "improvements" by public irrigation agencies (Van Koppen, Tanzania, 1996, personal observation). By now, the roles of women, especially those of poor women, as farm decision makers and livestock keepers in need of access to water, are better recognized and this has led to a more gender-balanced irrigation intervention. As women tend to spend a higher proportion of their incomes for family welfare than men, this also benefited their families (Meinzen-Dick and Zwarteveen 1998; Van Koppen 2002).

From a third angle, full-fledged multiple-use water services, which encompass women's and men's entire range of water needs, may take gender issues further to the center stage of water services planning and design. If service providers take the multiple water needs of all users as a starting point in inclusive community-based participatory planning fora, women are likely to prioritize reducing their and their children's excessive labor demands of fetching water and watering animals, and to try and convince their male kin and service providers to support that (Van Wijk-Sijbesma 2001). Meeting domestic needs would be discussed as the shared responsibility of men and women for household welfare. This would expose current divisions of the responsibilities for domestic water provision, in which women bear the heaviest labor burdens while men may contribute through, for example, well digging (Van Koppen 2001). Inequitable burdens may be somewhat better shared once new opportunities arise. Similarly, taking everybody's needs as equally important as a starting point implies that opportunities to better use water for productive purposes would, a priori, be equally open to women and men. Such negotiated consensus between the genders at the start of the planning process is a firm basis for technical design, institution building, and any water-prioritization issue later.

Willingness and Ability to Pay for Water Services

Improved well-being among the poor is not only the yardstick of achieving the Millennium Development Goals but also an important determinant of the willingness and ability to pay among all users. According to the principle of economic rationality, at the basis of all economic science, humans are willing to pay more for a good or a service than for another (a multiple-use service versus a single-use service) if the utility derived from the former is higher than that derived from the latter. Moreover, "domestic" schemes that shift to domestic-plus and multiple-use designs also enhance the ability to pay using income from the additional productive activities.

This merit of mus is closely linked to perhaps the thorniest issue in the public water sector,

where tariffs and fees either in domestic or irrigation schemes seldom cover even basic operational costs—let alone capital costs (WHO/UNICEF 2000). The higher willingness and ability to pay for schemes that better meet one's needs can be harnessed to attain a better level of or even full cost-recovery and, thus, higher financial and technical scheme sustainability. Moreover, own investments and fully self-financing of schemes through loans become feasible, at least if appropriate mid-term private- and public-sector loan facilities become available at much larger scales than they are now. However, for making water available to the poor and certainly to the poorest in areas where incomes from water-related production are low, well-targeted subsidies and cross-subsidies are needed (Kouassi-Komlan and Fonseca 2004; Savage 2003). This issue is especially important if domestic-plus systems deliver greater per-capita quantities of water at higher capital costs.

Higher Water Productivity

The additional benefits from multiple uses of water compared to single uses of largely the same water resources imply a higher water productivity (value created per unit of water), for example in optimizing crop-fish-duck systems. More studies of the implications of "more use per drop" for water productivity are warranted. Such research will be using the traditional strengths of the sector-based approaches, that is, the disciplinary expertise on how to ensure that water suits the very specific needs of people, animals and crops best. By acknowledging that there are other uses beyond the single use of a field of expertise and looking into existing and possible new synergies to improve productivity, such expertise will be even more valuable.

Ownership by Water Users

The concept, technologies and institutions of multiple uses of water are rooted in the holistic local practices of agrarian communities. As long as history recalls, when communities themselves developed their own water supplies, they catered to multiple uses (often drawing on different water sources) (Moriarty et al. 2004b). This is illustrated by the centuries-old village tanks in India and Sri Lanka used for paddy cultivation, livestock and domestic uses (Palanisami and Meinzen-Dick 2001; Somaratne et al. 2005); the sophisticated surface and underground rainwater-harvesting structures in arid areas in the Middle East used for people, animals and crops alike (Yoder 1983); or the streams in the mountains of Tanzania, Nepal and the Andes used for domestic purposes, livestock and cropping. Water sources near to, or within, homesteads, including shallow dug wells, boreholes with rope-pumps or mechanized pumps, ponds, homestead tanks for harvesting roof water and runoff are most intensively used and invariably also reused to meet a range of requirements. Local community-based water institutions reflect that integration (Van Koppen et al. 2005).

By recognizing and building upon the strengths of communities' own integrated water arrangements, while seeking to address weaknesses such as intra-community hierarchies, mus approaches are bottom-up and owned by communities. This avoids external agencies from eroding precious social capital. It also avoids the turf wars that are bound to emerge when the irrigation association (created by the Irrigation Departments) and the domestic water committee (created by the Domestic Water Departments) are supposed to function in parallel but govern connected water resources and overlapping uses and users (Sokile 2005).

Reduced Costs of Improper Use

Damage to infrastructure, disruption of allocation schedules and deprivation of the tail enders through the de facto multiple uses of single-use planned schemes constitute a widely reported problem (Schouten and Moriarty 2003). By designing services from the outset to meet all

reasonable demands of all water users this damage can be reduced or eliminated. By involving all water users within the planning process, and ensuring that their voices are heard, it can be hypothesized that even where it is impossible to meet all users' demands, there will be more general acceptance of rules and norms that restrict use to certain groups or uses.

Dealing with Water Quality

A strong barrier to greater integration of service delivery in the past has been concerns surrounding water quality. As early as 1977, this issue emerged in the irrigation sector during the Mar del Plata UN Water Conference of 1977:

> ".. the large supplies needed for irrigated crops ensure that the much smaller human needs are satisfied without difficulty, almost as a by-product. .....*and the big problem becomes not the difficulty of provision but the need for unpolluted water for human consumption, which is rarely obtainable from the canals and the ditches"* (UN/FAO 1977: 10, cited in Yoder 1983, our italics).

So although it was realized that, in areas without alternative domestic water supplies, the use of irrigation water for drinking purposes improved livelihoods the quality was a concern. However, as Yoder (1983) warned, generalizations about unacceptable water-quality risks for drinking water are often too sweeping. In the many situations in which groundwater and even surface streams are used, the water quality is acceptable for domestic uses other than drinking and in specific cases also for drinking. Later studies confirmed that regardless of its sometimes disputable quality, the availability of any additional quantities of water has a beneficial impact on people's health (Esrey et al. 1991; Jensen et al. 2001; Van der Hoek et al. 2001; Howard and Bartram 2003). Access to increased quantities of water for cooking and consumption, combined with improved hygienic behavior was found to significantly diminish fecal-oral diseases (Van der Hoek et al. 2002b). So within reason, water quantity is more important than water quality, and other alternatives such as various point-of-use treatments exist for the small quantities needed for actual drinking. It should be noted that very small children are something of a special case as, though they also benefit from water for bathing and health, for them the low quality of water remains a major risk for diarrhea (Hebert 1985; Clasen and Cairncross 2004).

Moreover, indirect effects of using irrigation water may be more important: irrigation water seeping from canals and feeding domestic wells can provide the best-quality drinking water in the area (Meinzen-Dick 1997; Shortt et al. 2003). However, in other cases chemicals for agriculture are major polluters.

For the domestic water sector, water quality for drinking was initially the single most important concern. This is related to the history of the development of sanitary engineering in the nineteenth century Europe and the replication of this model in creating domestic water sectors in the Southern nations. The sector's emphasis on reaching "all with some high-quality water" led to high investments in centralized treatment of water. This in turn became the major argument against the inevitable use of domestic water for livestock or homestead gardening or other productive uses around the homestead: it was too expensive to use treated water for uses that do not require such high quality (Moriarty and Butterworth 2003).

However, again this argument is something of a generalization. Where treatment exists and can be maintained at low incremental costs and high economies of scale, treated water may well be cheap on a volumetric basis, and can be used economically for productive uses. More often in the reality of many developing countries, centralized water treatment is itself ineffective in ensuring water quality. Even where the treatment facilities deliver the required quality, water often gets polluted during transmission along leaky and under-pressurized pipes, at the standpipe, and during transport in containers and storage in houses (Jensen et al. 2002; Clasen and Bastable 2003; Clasen and Cairncross 2004; Scheelbeek 2006).

The most important point to address for all water intended for drinking purposes is that only small quantities of high-quality water are needed, typically not more than 2-4 lpd depending on the climate (Howard and Bartram 2003). Hence, point-of-use treatment through affordable filtration techniques or boiling, and backed up by hygienic education and behavior change are increasingly seen as more appropriate options in the domestic sector (Mahfouz et al. 1995; Mintz et al. 1995; Quick et al. 1999, 2002; Reller et al. 2003; Roberts 2003), particularly in dispersed or difficult-to-reach areas. This also solves the water-quality concern for those using groundwater wells that may be contaminated with arsenic or fluoride, for those using productive-plus schemes for drinking and, moreover, for the millions who have no access to improved supplies anyhow. This said, the costs of chemical treatment, filters or boiling, and the time that point-of-use treatment takes, may render this treatment beyond the reach of the poorest, and where integrated as part of a mus approach this would become a high priority for the use of subsidy. In any case, imposing unrealistically high water-quality standards is now recognized to be of little use in the search for incremental improvements to deal with health hazards. The World Health Organization recently also changed its focus from fixed water-quality standards to more flexible guidelines (WHO 2004).

Lastly, drinking water quality while a crucial issue is not the only health-related benefit or hazard related to increased access to water. Malaria and other water-related diseases need attention as well (Oomen et al. 1988, 1990; Bolton 1992; Hunter et al. 1993; Steele et al. 1997; Erlanger et al. 2005; Keiser et al. 2005a, b, c). Multiple-use services which take people's well-being, that is a balance of benefits, costs and risks, as a starting point, need to deal with these various risks in an integrated livelihood-based way (see box 1).

Equitable Access to Water, and Environmental Sustainability

The notion of multiple concurrent water needs allows for clarifying and quantifying the issues at stake in debates around the allocation of scarce water and financial resources to different uses and users, including the environment. This can lead to unambiguous policy recommendations for achieving the Millennium Development Goals. The recognition of multiple needs clarifies the reasoning that can be summed up as "some for all before more for some." This says that when there are limited water resources and inadequate financing available to develop water infrastructure for all, it is inequitable and anti-poor to use what money or water there is in providing high volume services to a few. This legitimate concern for proper targeting of public funds is much stronger in the domestic sector, with its explicit target of total coverage, than in the irrigation sector. Indeed, although the concentration of newly developed irrigation and land resources in the hands of the few is well documented, the various ways to better target services are hardly mainstreamed (Chambers et al. 1989; Van Koppen 1999; Hussain 2005).

While a powerful message on the equitable development of scarce water resources, the "some for all" should not, as is sometimes the case, be confounded with domestic access only. It is rather an argument for the equitable distribution of access to water resources, and as such is not a reason to brand as "illegal" the small-scale productive uses of poor families. In general, both international and national norms for "basic needs" and "basic human rights" are based on access to water for drinking, cooking and personal hygiene only, typically in the range of 25-40 lpd. However, many more small-scale water uses, in particular subsistence agriculture, need to be catered for to fulfill basic human (and animal) water needs below and around the

Box 1: Water-related diseases.

Relationships between human disease and use of water are complex and not always obvious. Incidence of some diseases tends to increase with water-resources development, while others tend to reduce. Different groups of people may be at risk of disease or, contrarily, able to improve their health. Three groups of water-related diseases are commonly distinguished by their transmission pathway (adapted from Cairncross and Feachem 1993).

a. Fecally-orally transmitted diseases. This group of diseases is transmitted if people ingest fecally contaminated water or food, and usually the main symptom is diarrhea. Examples are cholera, typhoid, dysentery, poliomyelitis and hepatitis-A. Diarrhea kills about 2.2 million people per year, most of whom are children under five (JMP 2005). Palliative measures to be undertaken as part of mus approaches are ensuring that drinking water is not polluted, constructing sanitary facilities and providing health and hygienic education.

b. Water-based and vector-borne diseases. This group of diseases is transmitted through vectors or intermediate hosts who spend some or all of their lives in water; they include malaria, river blindness, yellow fever, guinea worm, filariasis and schistosomiasis. Dam reservoirs, small ponds, canals and drains may create ideal breeding sites for mosquitoes, flies, or snails, bringing both the vectors and the disease closer to people. The most promising preventive approaches include designing water systems that avoid stagnant water or render open water bodies hostile for breeding of mosquitoes, flies and snails (see, e.g., Speelman and Van den Top 1986; Pike 1987; Oomen et al. 1990; Cooper-Weil et al. 1990; Tiffen 1991; Hunter et al. 1993; Slootweg 1994; Keiser et al. 2005a, b, c; Erlanger et al. 2005). Additional preventive measures are the use of bed nets to protect people from infectious mosquito bites or, in the case of schistosomiasis, sanitation and reduction of water contact. Infections with guinea worm can be prevented by filtering water through a cloth before it is consumed.

c. Water-washed diseases such as eye and skin infections. They are generally largely reduced by increased availability of water for bathing, regardless of the quality.

poverty line. This is recognized under the UN Economic and Social Council's Covenant on Economic, Social, and Cultural Rights General Comment No. 15 (2002) (Derman et al. 2005). The above-mentioned international symposium on "Productive uses of water at the household level" in South Africa estimated that quantities of water in the range of 50-200 lpd are closest to meeting multiple basic human needs (Butterworth et al. 2003; www.irc.nl/page/9077). This is of the same order of magnitude as exclusively domestic water uses by the urban middle-class. Therefore, in order to protect these basic human water needs to achieve the Millenium Development Goals, use- or sector-based prioritization of water allocations, so ranking, for example, all domestic uses first, then all agricultural uses, then all environmental uses, which, unfortunately, is also most common in the formal water laws, needs to be replaced by people-based prioritization of the range of basic water needs catering to everybody getting at least a basic minimum.

The issue whether one person is depriving another person of access to water when using water for basic needs, or whether environmental sustainability is at stake, can be viewed from two perspectives, which are often confused: an overall water-resources perspective or the perspective of access to infrastructure that makes water actually available. From a water-resources perspective, in all but the most extreme cases, the relative quantities that are vital for livelihoods are minor, if not negligible, and in most cases far below an "equitable share" (see box 2).

Box 2. An example from the Olifants basin in South Africa.

The Gini-coefficient for (blue) rural water uses in the Olifants basin, South Africa, is 0.96. In other words, 0.5 percent of the population controls the access to 95 percent of the (blue) water resources. If the majority of the population were to double its current water use, the few large users would have to share only 6 percent of what they use now (Cullis and Van Koppen 2005). The situation in this closing basin, where all water has already been committed, is not an "environmental crisis," but a highly inequitable socioeconomic distribution of water resources requiring a redistributive water allocation reform, as the Government of South Africa has recently launched (RSA 2005).

Indeed, for the target group of the Millennium Development Goals, the issue is not a physical lack of water resources, but economic water scarcity: the lack of financial, technical and institutional resources to install and maintain the infrastructure required, in particular, storage, to overcome the dry season. If viewed from this second perspective, dimensioning hardware on the basis of lowest survival norms for domestic water only is only very partially addressing those needs. This insensitive scheme design causes vandalism and deprivation to the tail enders.

Incremental Costs of Meeting Multiple Needs

Meeting multiple needs does incur additional costs (expressed in terms of cost per unit water delivered) to service providers and users. The highest costs of water services provision in general are related to the hardware: infrastructural construction, operation, and maintenance, and the required engineering skills, which are usually three quarters or more of overall project budgets. There are also software costs, such as transaction costs, especially for planning, institution building and backstopping, and costs for other skill development. How do the costs for designs that better accommodate for people's multiple needs compare to single-use planning and designs? What are incremental costs?

In the case of the de facto multiple uses of single-use planned systems, there are no incremental costs whatsoever. Even if designed for only one use and its related benefits, water is used for more uses with more benefits. As mentioned above, during the Mar del Plata Water Conference, all merits came "almost as a byproduct," an unexpected bonus (UN/FAO 1977: 10, cited in Yoder 1983). In the case of domestic-plus, productive-plus schemes, and multiple-use household technologies, incremental hardware costs such as adding washing steps and cattle entry points, or channels for municipal water supply, or wells and pipes with larger diameters or somewhat larger village reservoirs or medium-sized dams are generally modest. According to expert opinions for larger schemes, they may have added 10–15 percent to the infrastructural costs. Moreover, the add-ons save the costs of repairing damage and preventing vandalism or even scheme collapse.

One exception to this rule is the case where shifting from single to multiple use implies a new service model. This is, for example, the case when moving from a minimal domestic service based on hand-pumps to a piped service. In this case, the cost implications can be important—representing a doubling or more of per-capita investment (Moriarty et al. 2004b). Nonetheless, while viewed from the point of view of per-capita costs, a considerably higher level of investment is required even if in this case the per-liter cost of water supplied may actually be lower. The issue therefore is to look carefully at costs and benefits.

With regard to the technical skills to design the add-ons and multiple-use schemes, they are not new or special. Technologies for meeting multiple water needs and reducing health risks are not basically different from conventional ones,

but the components are reassembled in new ways. The skills required are conventional basic engineering. The difference is the engineer's client-oriented creativity beyond single-use boxes and his or her building upon communities' own expertise on multiple-use technologies.

The evidence so far with regard to the incremental software costs is sketchy. Use-specific expertise needs to be brought in, for example, for fish-friendly "irrigation" infrastructure, but the more important issue appeared doing so in time, during the planning phase (Nguyen-Khoa et al 2005). Consultations with the population to design domestic uses in the irrigation scheme in Sri Lanka added to the transaction costs. For the establishment of self-financing supply chains for affordable pumps, however, transaction costs were not only relatively low but also largely borne by users themselves (Shah et al. 2000; Alberts and Van der Zee 2004; Polak et al. 2004).

What does appear to have considerable transaction costs is the effort to integrate planning of multiple-use water services into broader local government planning processes, as found in the above-mentioned case of South Africa (Maluleke et al. 2005). This is partly because local governments themselves were only introduced since 1994 in South Africa's former homelands. Yet, in many other developing countries the transaction costs for bottom-up planning for people's multiple water needs will also largely depend on general bottom-up planning processes on the long road towards decentralization. Costs should decline once the early learning-by-doing stages have generated workable methodologies that can be replicated elsewhere.

Conclusion: An Opportunity to Implement IWRM and to Advance the Millennium Development Goals

In sum, past evidence of the various ways of taking poor people's multiple water needs better into account suggests that mus approaches have considerable payoffs at acceptable additional costs. Mus approaches show a number of promising ways in which they can improve on current single-use approaches, including the following:

- Impacting on more dimensions of well-being and, hence, if well targeted to the poor, reducing poverty more effectively.
- Being implicitly gender-friendly.
- Enhancing willingness and ability to pay, which is vital for improved financing of public schemes and upscaling of self-financed schemes.
- Improving water productivity through "more use per drop."
- Increasing ownership by building upon local integrated water arrangements.
- Anticipating all uses, and so avoiding damage, conflicts, or scheme abandonment.
- Addressing water-quality needs for all risks and all water uses, also beyond public schemes.
- Allowing for transparent, equitable and environmentally sustainable sharing of scarce water and financial resources, and protecting people's domestic and productive basic needs.

Current experience also suggests that mus approaches do not bring with them unsupportable additional costs: that sometimes they come as a free bonus in the form of recognizing de facto multiple uses of single-use planned schemes; at a low incremental cost if designed as domestic-plus or productive-plus or multiple-use scheme; and adding the benefit of the productive potential of additional water.

Although still at the level of case study and anecdote, these merits seem generic. Also, they do not depend upon exceptional conditions that cannot be replicated elsewhere. Hence, while more work needs to be done on better understanding, testing and quantifying some of the key relationships observed, the balance of evidence seems to support the

conclusion that mus approaches, by taking poor people's integrated water needs as a starting point and integrating the services that provide water to them, are important forms of IWRM to advance the Millennium Development Goals.

This conclusion also supports a shift in emphasis from documenting and exploring existing examples of mus to a more concerted action aimed at developing properly upscaled examples; together with the evident learning that will need to accompany such efforts. The remainder of the research report presents a conceptual framework within which to develop and document such an effort at upscaling multiple-use water services.

Envisioning Upscaled Multiple-Use Water Services

How would the water sector in poor rural and peri-urban areas look like if it systematically considered people's multiple water needs? What would this imply at community level and among the range of intermediate and national-level water services providers? How to develop an integrated social, economic, institutional, hydrological and technical methodology for water services provision that meets, at least costs, people's multiple water needs in a sustainable way? What action is needed for step-by-step change for realizing that vision—well knowing that once one issue is taken up and worked through, other and new issues will immediately emerge? How feasible is upscaling? What may be key obstacles, including its financial costs?

A method to answer these questions is the compilation of a "Learning Wheel" as a common framework for joint learning, action and knowledge management (Hagmann 2005). Factors that we judge as central to successfully going to scale of multiple-use water services at community, intermediate and national level are clustered into so-called "principles" within three wheels for the three institutional levels. Each of these principles needs to be addressed, if not already in place, as otherwise the weakest one becomes a threat to upscaling as a whole. Representation in wheels underlines that there is no priority or ranking. In this sense the Learning Wheel serves as a "checklist" for the design of massively upscaling of multiple-use water services, and can be used for evaluation after implementation of any step and further learning (Hagmann 2005). In other words, the Learning Wheel and its principles are a set of working hypotheses for action-research that should lead to both better insights and better action (O'Brien 1998). It is as relevant for implementers as for researchers or anyone else interested in realizing the potential of multiple-use water services to advance the Millennium Development Goals. Future learning-by-doing according to this Learning Wheel will also further corroborate, or refute the merits distilled from past experience.

In the visioning of "upscaled multiple-use water services," the concept of "water services" is central. A water service is defined as the provision of water of a given quality and quantity with a given reliability at a given place. This definition emphasizes the outputs—what people receive—rather than the inputs: the hardware (or technology, or scheme; all used interchangeably here) and the software (skills, capacities and institutions required to manage hardware and water resources) that are implied in terms such as "water supply system" or "irrigation scheme." However, a number of important assumptions are included in the use of this term when referring to the vision of upscaled multiple-use water services:

- A service should be reliable and constant or, for seasonal uses, predictable. Therefore, a service implies infinite sustainability. Individual components of the service may need to be replaced or upgraded—but the service itself should remain.
- A service implies the existence of (public, private or, most commonly, combined) service providers, and service users—and of agreed or formalized relationships between them. It also implies specialization and separation of roles, responsibilities and relationships among a range of actors from the national to the local level. There are a wide range of functions necessary to ensure that a service is sustainable, and an equally wide range of actors (governments, NGOs, Community-Based Organizations [CBOs], private companies, ranging from an individual village bailiff to a large water company or utility) who may take on some or all of these roles (Schouten and Moriarty 2003; Lockwood 2002). Only in the very simplest or most traditional cases can a service be maintained entirely at the local level. In all other situations, services are provided by stakeholders at intermediate and national levels.
- Finally, and critically to the purpose here, a service-based approach has inherent within it the means for going to scale. By looking not only at the skills and functions necessary for multiple-use services at the level of an individual project or scheme, but also at the wider enabling environment for service provision from local to national level, some of the most intractable barriers to scaling up are addressed. Upscaling of mus approaches implies supplanting the isolated project-based approaches by intermediate and national-level reform in service delivery. Rural communities and their management and support needs are no longer viewed in isolation but are at the basis of an enabling environment of services management.

A weak intermediate level (local government and line agencies, farmer associations, the private sector, NGOs, and others) will mean that the pattern of adoption of multiple-use services continues to be one of “islands of success in an ocean of misery” —with progress slow and patchy. However, a strengthened and empowered intermediate level consisting of agencies and individuals able to support communities with finance, advice, encouragement, technical backstopping, strategic planning and a range of other services can lead to rapid rollout of improved services to entire populations.

At the national level of central government, private sector, financiers, NGOs, CBOs, educational and research organizations, and representatives of international organizations, policy, legislation and support are able to effectively block most progress, if it is weak. However, good policy, legislation and financing mechanisms have the potential to significantly increase the speed at which successful approaches are identified, developed and upscaled. National-level stakeholders need to support effective intermediate-level service provision to end users, and certainly not interfere with that by imposing unnecessary formalistic requirements.

In figure 1, these different challenges are represented in a three-tier “mus action-research framework.” Ten principles are distinguished, which are valid at one level only or at more levels, as follows.

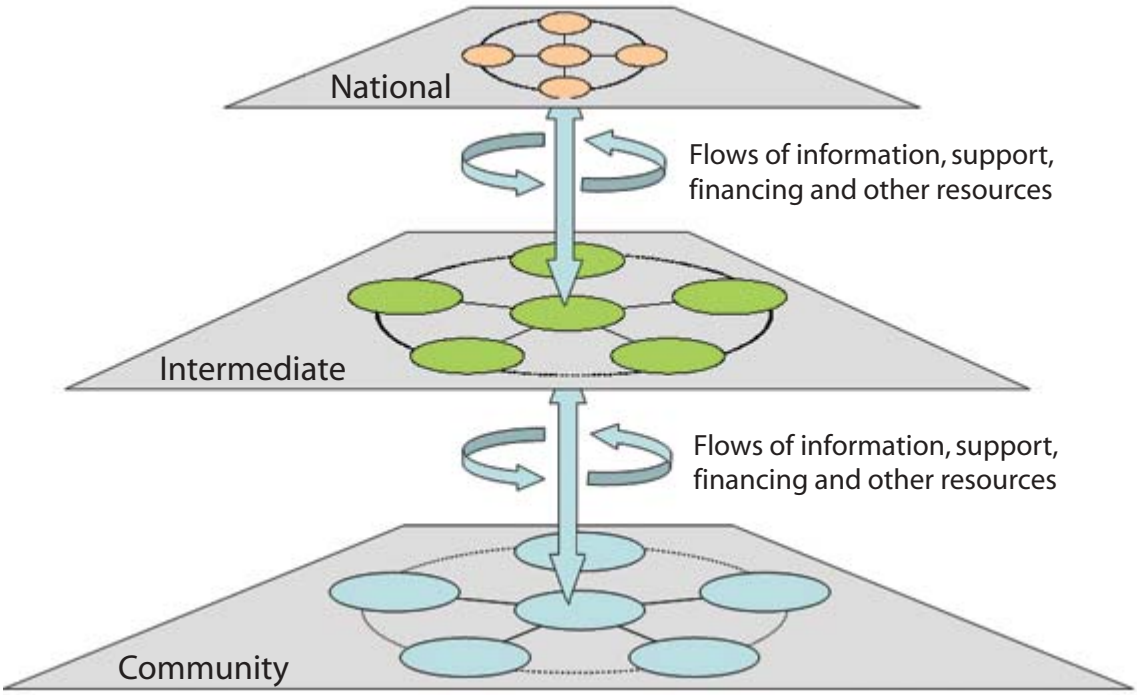
Principles at community-level

- A thorough understanding of water-related livelihoods.
- Efficient, equitable, and sustainable use of water resources.
- Appropriate technologies.
- Inclusive institutions.
- Adequate financing.

Principles at intermediate level

- Coordination amongst sectors and actors.
- Long-term support (to communities).

FIGURE 1.
Three-tiered action-research framework for implementing and upscaling mus approaches.



- Adaptive management.
- Participatory strategic management.
- Adequate financing.

Principles at national level

- Coordination amongst sectors and actors: devolving decision making.
- Long-term support (to intermediate level).
- Adequate financing.
- Enabling policy and legislation.

The following sections discuss these institutional levels and the principles.

Empowering the Poor at Community Level

What Is the Community Level and How Can Water Be Used Most Effectively to Alleviate Poverty and Enhance Gender Equity?

The community level focuses on the end users, living in one or more communities linked through a larger-scale scheme or even a shared watershed. End users' needs, in particular those of poor women and men, are at the basis of integrated needs-based planning processes that are costs-effective, socially equitable and environmentally sustainable, whether in a new collective scheme, an extension, rehabilitation,

individual technologies, or a combination of them. "Community" is the collective noun for often heterogeneous groups and subgroups, who can be divided in different ways according to wealth, gender, and water-using activities—to name the three most important here. As depicted in figure 2, five principles have been identified as important for needs-based planning and design processes that are at the heart of mus:

- A thorough understanding of water-related livelihoods.
- Efficient, equitable and sustainable use of water resources.
- Appropriate technologies.
- Inclusive institutions.
- Adequate financing.

These comprehensive participatory planning and design processes replace conventional practice, in which external agencies bring single-use fixed support packages and work to tight schedules, often only "informing" community (male) leaders, and lacking the time and resources to engage in true consultation and capacity development. Because of the need for widespread involvement, transaction costs for villagers and service providers are likely to be considerably higher, certainly in the initial pioneering stage of methodology and skill development. However, good investment in capacity building at this stage has been widely demonstrated to bring benefits in terms of increased ownership and sustainable management.

FIGURE 2.
Community-level principles.

Livelihoods-Based Services: A Thorough Understanding of the Multiple Roles of Water in People's Livelihoods

This principle emphasizes the need for services and the planning and design of services to be responsive to, and based upon, a thorough understanding of people's livelihoods, in particular poor women's and men's livelihoods. Needs-based planning encompasses the following issues.

- Identifying current and potential water uses and users, ensuring that women's and men's domestic and productive water needs are equally articulated and incorporated into the design.
- Identifying the scope to build upon the local socioeconomic drivers to use water most optimally to create wealth, recognizing that water is only one (critical) input.
- Translating future needs into "water demand characteristics" for technical design: quantity, quality, site (near homestead, in-field, sites for reservoirs, etc.), timing/period (year-round or seasonal), and accompanying demand characteristics (e.g., cattle trampling and pollution of soils and water).
- Understanding and allowing the articulation of different end users' real and perceived benefits, costs and risks.
- Ensuring that service levels are affordable to all and are not too costly for the poorest, or alternatively introducing differential service levels and well-targeted subsidies.

- Identifying potential health risks for users themselves and for others and their causes, and initiating measures for mitigation from the outset.
- Soliciting the support of other relevant stakeholders (health, agriculture and livestock, rural development) to use water more effectively for health, food and income.

Sustainable Water Use: Efficient, Equitable and Sustainable Development and Management of Water Resources

This principle refers to the efficient, equitable and sustainable development and management of naturally available water resources: rainfall, groundwater, surface lakes and streams, ponds, springs, wetlands, and water from man-made storage, reservoirs, conveyance canals, pumps, reticulation networks, abstractions and takeoff points for end uses, drains, return flows and groundwater recharge. Water from multiple and conjunctive sources is used and reused to meet multiple needs.

Efficient, equitable and sustainable use of water resources entails:

- Exploring the possible synergies for meeting multiple water needs simultaneously by "more use per drop" as well as actively stimulating reuse.
- Incrementally improving communities' and service providers' knowledge about, and monitoring of, water resources: quantity, quality, variability, reliability, sustainable yield, water quality, and the relevant interconnections between different parts of the hydrological system.
- Tapping the comparative suitability of water resources for certain uses (easy accessibility, year-round availability, site, quality or predictability), for example, prioritizing more reliable and higher-quality sources year-round for domestic uses; using roof water and runoff during the rainy season; using slightly organically polluted water for irrigation.
- Identifying sites and periods of competition and negotiating the absolute protection of basic human, domestic and productive needs (50–200 lpd), and ensuring representation at intermediate level decision-making bodies to that end.
- Assessing already prevailing uses, if not at the individual level, at least at the level of the user group and tracing prior claims to access water or to pollute it, whether embedded in traditional legal systems or formal systems, or both, and negotiating new use rights.

Appropriate Technologies: Selection and Use of Technologies Based on People's Needs and Abilities

This principle considers the selection of appropriate technologies and collection of technologies to store, distribute, protect and treat water for multiple uses. It is closely related to the other principles because technology comes with a range of hardware and software requirements for funding, know-how, institutions and environment. The scale of technologies can range from household-level technology to medium-sized dams and systems. The siting of water infrastructure is important: homestead-based technologies tend to be used most intensively for multiple uses. This principle seeks ways to realize improved access to water and lower health risks:

Improved access to water

- Reassembling existing technology components to allow for multiple uses and to mitigate health risks, fitting the locally specific conditions, financial and institutional capacities, ability and willingness to pay and preferences of the end users.

- Ensuring users' participation in finding the best match, building upon local technical expertise and innovation strategies, and stimulating users' own experimentation and field-testing of technologies.
- Paying special attention to storage (surface water reservoirs, groundwater recharge) to enable water use during longer periods of the year.
- Lowering technology costs and ensuring quality-construction implementation so that technologies become more affordable for the poor and the poorest, including women, even though subsidies to reach them are still required.
- Enhancing women's access to technologies and breaking taboos against women's control over water technologies, and therefore over water resources, including basic technologies such as donkey transport, bicycle riding and well digging.
- Under dry-season scarcity, ensuring that technologies allow transparent apportionment and sharing of water resources and protection of basic human water needs (Lankford and Mwaruvanda 2005).

Lower health risks

- Designing systems so as to prevent or minimize breeding of mosquitoes, snails and flies in surface water bodies; ensuring proper drainage and sanitation to avoid unsanitary conditions.
- Protecting water sources from (upstream) pollution and contamination through fencing, shielding, and separating uses (e.g., separate cattle troughs or washing places with independent drains).
- Fencing and covering of small-scale water-storage facilities to prevent pollution and reduce risk of drowning.
- Treating water of unacceptable quality (e.g., arsenic or fluoride, or other pollution), in particular through point-of-use treatment.

Inclusive Institutions: Informed Decision Making and Transparent Management by Institutions That Involve the Poor

This principle highlights the importance of inclusive institutions: sets of structures and rules that arrange informed decision making and enforcement. Internal divisions of roles and responsibilities usually stipulate membership, governance and operational execution (Shah 1996). Integrated community-based water institutions holistically govern conjunctive water resources for the range of water needs of all community members, and build on existing water arrangements. These "unified" water institutions can be either one institution, or different institutions with effective coordination arrangements. Institution building from the planning phase onwards integrates all other principles: livelihoods-based priority water needs, conjunctive water resources, informed technology choices, adapting existing governance structures to new management requirements, and ensuring financial sustainability. Institutions deal with water infrastructural construction, operation and maintenance (O&M) and with water resources management and regulation issues, in particular allocation and pollution from household to basin scales, including the protection of basic livelihood needs. In order to address larger-scale issues nested water governance is required.

Institutions that accommodate people's multiple water needs are characterized by:

- Planning in a participatory way, integrating community-level principles from the outset, with particular measures to include the poor and women.

- Selecting sites and scheme layouts that suit the needs of all, and—in the case of larger schemes—also satisfactorily settling land expropriation and compensation issues.
- Unifying local water governance, while accommodating for different payment and other obligations attached to different uses, with particular consideration of the abilities and needs of the poor.
- Integrating the strengths of existing local integrated water management institutions into new institutions.
- Identifying key gaps in communities' abilities and communicating to intermediate-level service providers for soliciting their support during planning, construction and use phase where necessary and agreed to fill gaps (for example, transparent financial management; managing hydraulic infrastructure; monitoring abstractions and quality; facilitating negotiation over water rights and use within and between communities and user groups).
- Harnessing the higher willingness to pay from the outset through transparency and consultation on important decisions and roles such as tariff setting, arbitration in disputes, and enforcement of regulations and bylaws.
- Dealing effectively with the high transaction costs of participatory planning processes, especially for the poor and women.
- Ensuring effective representation of communities and user groups at higher levels, where necessary, for example, decision making over bulk water allocations.
- Protecting basic human water needs and ensuring equitable allocation across the different uses, from community level to higher aggregate levels.
- Mitigating health and other risks through technological and institutional measures.

Adequate Financing: Matched to People's Ability and Willingness to Pay

The principle of adequate financing refers to the challenge to enhance cost recovery by end users, without excluding the poor from improved access to water. As partly already mentioned before, adequate financing encompasses:

- Harnessing the higher willingness to pay from the outset through transparency and consultation on important decisions and roles such as tariff setting, arbitration in disputes, and enforcement of regulations and bylaws.
- Ensuring that improved access to infrastructure is not too costly for the poor and poorest or, otherwise, introducing differential service levels and well-targeted subsidies.
- Adjusting current and introducing new subsidization and credit models that are more appropriate for communities' and individuals' self- or co-financing of water systems.
- Soliciting the support of other relevant stakeholders (agriculture and livestock, rural development) to use water more effectively for food and income.

A more general issue is the overall cost-benefit analysis at community level. The benefits and technology costs envisioned in this section seem similar to those identified in the section under "Merits and Drawbacks...." However, the transaction costs for villagers (and service providers) for participatory planning processes are higher compared to conventional approaches, especially those typically used by government. The required skills also need to be developed. This implies the need for:

- Further assessing and quantifying the benefits and costs of mus systems.
- Exploring ways to further augment the benefits and reduce the costs for users (and public- and private-service providers), in particular, transaction costs.

Enhancing Service Delivery at Intermediate Level

What Is the Intermediate Level, and What Is an Enabling Environment for Service Delivery and Upscaling of MUS?

Figure 3 illustrates the five principles identified at the intermediate level that allow achieving the objective of an enabling environment for supporting the implementation of multiple-use water services. But what is meant by the "intermediate level?" While both "national" and "community" levels are fairly clear, intermediate is less so. This is because it is something of a catch-all phrase intended to identify a set of actors, functions and required capacity that do not exist at either the community or national level, but somewhere in between. These are the service providers who construct and maintain systems; who provide finance; who train communities; and who carry out audits. Whether there are one or several intermediate levels, the particular roles and responsibilities of different actors at each level depend on the context in a particular area.

FIGURE 3.
Principles at intermediate level.

Key sets of intermediate-level actors include local government, sectoral line departments, local public and private service providers, irrigation committees of larger schemes, donors, financiers, local NGOs and CBOs like associations or farmer networks. Particularly important is the district or municipality level at which local civil servants and elected officials work and plan together (Schouten and Moriarty 2004).

The intermediate level is also crucial for water resources management. It is an aggregating level that allows for planning, priority setting, and resource identification at a scale that will capture many of the externalities missed when concentrating on individual villages alone, but that remains close enough to the community to allow for meaningful participation in planning and management, as well as the local adaptation essential for sustainability. The establishment of subnational catchment or watershed coordination or decision-making bodies in some countries is important within this context, as these are by mandate empowered to coordinate and negotiate between agricultural, industrial and municipal or domestic sectors. Typically, this level corresponds to a population of some hundreds of thousands of people.

The importance of the intermediate level cannot be overemphasized. The reason that, at any one time in much of the developing world, a large proportion of domestic water supply infrastructure is out of order (WHO/UNICEF 2000) has much to do with the problems at the intermediate level (Schouten and Moriarty 2003). Similarly, many smallholder irrigation schemes collapsed after the sudden withdrawal of intermediate-level public support under the name of "irrigation management transfer." Although the irrigation bureaucracies had many weaknesses, the absence of any support for institution building, refurbishing infrastructure, facilitating input provision or ensuring market channels is worse (Shah et al. 2002).

Decentralization to the intermediate level offers an opening to systematize service delivery—moving away from many scattered individual projects delivered by different agencies, and to provide an overall environment for strategic management of human and natural resources at scale. Within the new understanding of the role of local governments that are being developed as part of wider decentralization policies, it is perhaps this role of strategic planner and regulator that is most critical for both sustainability and scaling up—also with respect to multiple-use water services. This also gives the opportunity to break through rigid sectoral boundaries and to achieve integrated water development at the district level.

Within any district or village there will typically be a range of needs for water, and also a range of resource options, and a range of infrastructure and institutional choices. A critical function is to ensure integration of management (strategic planning and action) of the human, financial, physical and natural resources in the optimum way to meet people's needs for water services. It requires a unique mixture of hardware, software and financial solutions. The intermediate level has an important role to play in supporting this integration within communities, but it has a crucial and irreplaceable role to play in doing so between communities. In practice, this role means having the capacity to pose and answer a range of questions, such as: What mix of boreholes, small dams and roof-top water harvesting is most appropriate to the needs of a community? Does it make most sense to meet all needs from a single borehole and electric pump? Does it make more sense to use hand-pumps for domestic purposes and roof-top rainwater harvesting for productive uses? At the scale of the district, it means answering questions such as: Should domestic needs be met by a large reticulation system, while productive use is catered to by village-level boreholes and dams? Is there an impact on downstream users of large-scale adoption of rainwater harvesting technologies by upstream communities? An enabling environment at this level means the ability to support strategic planning, negotiation and decision making in the essentially political processes that surround water resources management and water service delivery. What is more, resources to meet huge demands are extremely scarce, so intermediate-level actors need the tools (policies, legislation, enforcement tools, decision-making framework) and skills (facilitation, planning, negotiation) to effectively prioritize investment and water resources allocation in a way that is equitable and transparent.

A first step in supporting multiple-use water services is simply avoiding intermediate-level stakeholders acting as a barrier, so allowing local-level experimentation by NGOs, donor projects and communities. However, on its own this is not enough to lead to upscaled service delivery. Without an effective intermediate-level of government, the private sector, associations of communities and, most likely combinations of all these, there is no prospect of significantly and sustainably upscaling of multiple-use water services or of dealing with scale-related externalities.

An effective enabling environment at intermediate level is difficult and time-consuming to create and requires new skills, even if the national-level stakeholders fully support systematic decentralization, which they often do not as yet. The efforts required will be centered on the following five principles:

- Coordination amongst sectors and actors.
- Long-term support to communities.
- Adaptive management.
- Adequate financing.
- Participatory strategic management.

Coordination amongst Sectors and Actors: Integrated Service Delivery

The principle of coordination between the wide range of stakeholders at the intermediate level addresses the problem that, regardless of how

much communities may want multiple use services, they are unlikely to get those services if intermediate-level stakeholders have to work within the organizational limits of vertical-sector agencies. In many districts in the developing world three or four NGOs will be working side by side providing services to different villages using different approaches, with different hardware and software and financial approaches. In addition, and despite decentralization of power to local governments, at least in theory, there still tends to be a split between elected representatives whose focus really is at their own level; and civil servants who often nominally serve the local government but, in fact, report to and get financing from national ministries. NGOs are often more flexible but their failure to coordinate with the local and national governments and their sometimes relatively costly interventions lead to systems that are often not officially recognized—and therefore these systems remain islands of success. Even if "best practice" planning frameworks exist, such as South Africa's above-mentioned Integrated Development Plans, which bring together not only water services but also electricity, transport, health, etc., (RSA 2000a, b) implementation is often slow and plagued by lack of capacity.

Against this background, key issues for better coordinating sectors and actors towards an enabling environment include:

- Removing sector-based limitations and restrictions from above and encouraging existing multiple-water use initiatives.
- Facilitating effective communication and sharing of information and skills, not only between government actors from different sectors but between all actors involved in local water service delivery or resources management.
- Gradually moving to common vision building, integrated planning, implementation, and joint management of finances by those involved in water-related service provision.
- Forging effective links between (sub-) catchment agencies and sectoral service providers and local governments to implement sustainable mus.

Adaptive Management: Capacity and "Space" to Follow a Learning-Based Approach

The ability to learn and adapt based on experience is key to developing locally appropriate models for service provision including mus. Rapid and effective piloting and upscaling of multiple-use water services require a flexible and pragmatic "learning by doing" environment (sometimes called adaptive management), in which approaches can be developed and tailored to local reality, based on participatory experimentation. In a sense, that is all there is to mus—the tailoring of services provision to meet the real needs of people, and to take into account the real constraints they face—natural and human.

The amount of information required to plan fully integrated resources and services from scratch is typically far beyond the means of local government or other intermediate actors. Therefore, an adaptive "learning by doing" approach is normally the best way forward. So, for example, farm-ponds may be an approach that has been tried elsewhere in a country with good success. Should they now be adopted in another district? Classic planning approaches would call for hydrological, social and financial studies, supported by data-gathering and modeling. Such planning requirements may even be imposed through policies and legal frameworks. However, a learning approach would involve identifying two or three "pilot" sites within a district, implementing some ponds, and then critically examining the results. Only when all involved are convinced as to the utility of the approach should it be scaled up within the district. "Learning by doing" can also be based on communities' own knowledge,

experimentation and networking as, for example, implemented by the Local Wisdom Network in Thailand (Ruaysoongnern and Penning de Vries 2005). Evidently, learning-by-doing requires very different attitudes and skills.

Issues to focus on through action-research relating to this principle include:

- Using the opportunities provided by decentralization processes to create the policy and legal space for intermediate actors to adopt an adaptive management approach for implementing multiple-use water services while maintaining controls on quality, transparency and equity.
- Developing the skills, capacity and attitude amongst intermediate actors to plan, implement, monitor, analyze, document, draw lessons, and build upon these lessons.
- Using the skills of existing actors, e.g., from national level, NGOs, and CBOs to support other intermediate-level actors in adopting adaptive management-based approaches for implementing and upscaling of mus.

Participatory Strategic Management: Involving Stakeholders and End Users in Strategic Management

This principle articulates two linked concerns. First, that management (the programming and the implementation of services) follows a strategic approach (such as a program cycle)[3] and second, that such approaches are participatory—that is based on the inputs of all stakeholders including communities. In this way, communities' specific multiple water needs can be channeled into broader planning processes which also regard the many other needs like housing, education, electricity, etc. Neither assumption can be taken for granted. The extent to which most local authorities really engage in a structured or strategic management is minimal. The reality is more often one of annual planning based on troubleshooting and unintegrated, uncoordinated implementation of once-off projects. Often, these are driven by donors or international NGOs with the acquiescence rather than collaboration of the government (see for example Moriarty et al. 2005). Adopting a structured and strategic approach assumes that, while not losing sight of their essentially political nature, planning and decision making are: objective and logical; proceed on the basis of an assessment of needs and resources; and take a medium- (or long-) term and integrated approach.

Similarly, while there is reasonable acceptance of participation in the implementation of projects at the grass roots in NGO-funded projects, this may not be the case within larger programs. Improving participation has at least four aspects, whether concerning the broader needs or focusing on multiple-use water services, which would be based on a thorough understanding of people's livelihoods and which would use water resources equitably and sustainably, select appropriate technologies, build inclusive institutions and ensure adequate financing. The first, and most obvious, is capacity at the intermediate level to interact with stakeholders and to facilitate their involvement. Providing this capacity can be an appropriate role for NGOs and CBOs to fulfill. The second dimension regards clear and transparent decision-making procedures, preferably backed up by policy or legal requirements for stakeholder involvement. The sort of mechanism that can be useful in this regard is a requirement to develop long-term village, town or district water development plans that user groups and other key stakeholders explicitly sign up to. The third is that, better legal recognition given to stakeholder groups, such as CBOs or water user associations, makes it more difficult to exclude them from decision-making processes. Last, the

[3]By cycle we mean a set of linked activities, typically involving planning, implementation, monitoring and lesson learning, leading to adjusted planning.

most important challenge to participation is the transaction cost related to it. To involve communities either you have to travel to them, or they have to come to you. This costs money, time and effort, and needs both facilitation, in terms of providing the time, transport and offering the skills of facilitation, etc., and incentives.

Key issues to enhance strategic and participatory management, also with regard to integrated water services, include:

- Encouraging managers and decision makers at the intermediate level to adopt a more strategic approach to management of services and resources (as opposed to current fire-fighting) and developing their capacity to that end in the short and longer term.
- Ensuring that (genuine representatives of) end users, including the poor and women, are actively involved in planning processes at both the community and the intermediate level, and that their opinions on mus approaches are taken into account when making decisions.

Long-Term Support: To Community Multiple Use Systems

The principle of long-term support addresses perhaps the most important lesson of the last decade of “community management” and “management transfer” of collective schemes. This is that most community- or farmer-managed systems that are not provided with adequate external support are no more sustainable than those without community involvement (Shah et al. 2002; Schouten and Moriarty 2004). Communities require long-term support for sustainable multiple-use water systems and this support needs to be conceived holistically, without sector-based restrictions attached to them.

Technical capacity needs to be built; manufacturing or importation and dissemination of technologies and spare parts to reassemble for multiple uses need to be facilitated and promoted; regular refresher trainings organized; or help given in negotiation contracts with the private sector. Less visible tasks include maintaining institutional capacity (chairpersons, treasurers, pump-mechanics, water bailiffs) in the face of constant turnover of the people who fulfill these posts; backstopping to communities on how to handle the finances for construction, O&M and how to handle public subsidies and grants; auditing; or mid-term loan facilities, and so on.

Regulatory support may be needed, particularly with regards to water resources management, where it is crucial to have some mechanism for ensuring that allocations are respected and that the poor and marginalized are not discriminated against. Support may also be needed for other factors that determine the ultimate benefits of using water for multiple purposes, for example, market development, agricultural training or sanitation and hygiene campaigns. Regulation can avoid the health risks of water development.

Issues that need special attention to develop support to communities by intermediate-level stakeholders include:

- Developing the capacity and means of intermediate-level stakeholders to fulfill key support roles.
- Removing existing sector-based restrictions and limitations so that the support provided stimulates multiple-use systems.

Adequate Financing: Access to Financing to Fund Integrated Multiple-Use Services

This principle seeks to meet the requirement of decentralized service provision: to provide sufficient financial support and services in the appropriate form to communities. External injections of finance, in the form of grants and subsidies and soft loans from government or donors, or commercial banking are essential, in particular for infrastructural construction or repair costs. However, financing facilities for rural mid-term loans are almost absent. Moreover, the various small funding streams available,

especially subsidies, are typically earmarked for one single water use and have other conditions which hinder the financing of integrated activities such as multiple-use systems. This implies that communities that want to pool different income sources have to worry about different budgets, reporting rules and auditing requirements from different government and non-government agencies. Financing is also required for intermediate-level institutions to fund planning and support functions. In many cases, this will be through government or donor subsidies. Many limiting conditions are the result of national-level decision making, but there is room for maneuver and piloting.

Key issues related to supporting this principle include:

- Negotiating and piloting with national-level stakeholders to adapt their financing models to the integrated needs and activities at intermediate and community level, for example, based on integrated planning of multiple-use water systems through "village water development plans."
- Developing lending and other financing models so that they become more appropriate to fund intermediate-level actors, especially local governments and the local private sector and local groups in undertaking mid-term integrated activities such as developing mus systems.
- Developing appropriate revenue-collection mechanisms, tariff setting, also for cross-subsidization.
- Developing transparent, accountable models to speed up disbursement of financing for service provision.

Ensuring an Enabling Environment at National Level

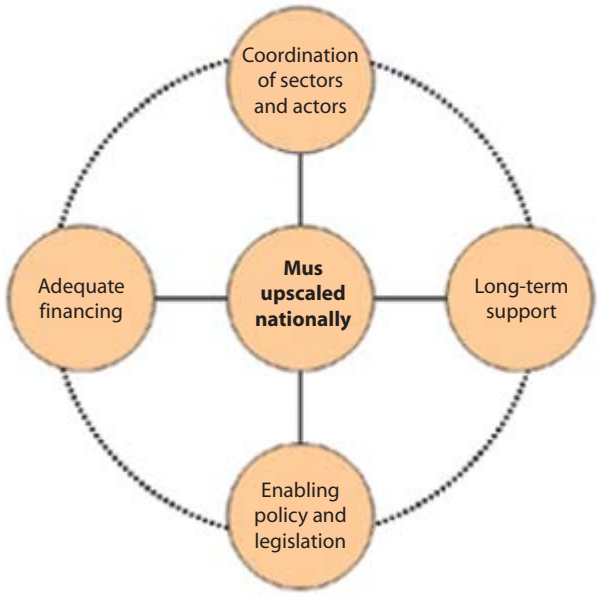
National-level players create the enabling environment and are the "gatekeepers" for implementing mus approaches at any significant scale. Government departments and national programs, private-sector companies, banks, national NGOs, universities and research institutes, media, political parties, and country delegations of international governmental and nongovermental organizations decide over internal structuring and important resources. Resources are financial (treasury, national banking, corporate sector, and international grant and loan provision); technical know-how, (e.g., through the nation's education and training systems and public and private sectors); and institutional knowledge and skills.

As is the case for the intermediate level, the first step in creating a more enabling environment is a passive one: dissolving barriers to local initiative and experimentation in multiple-use water services. However, for mainstreaming and upscaling of multiple-use water services countrywide, pro-active national support is pivotal.

The enabling national environment envisioned is based on four principles (see figure 4). Three principles are shared with the intermediate level and address national-level stakeholders' roles in enabling the intermediate-level stakeholders to effectively address the same principles. The fourth principle, policy and legislation, is typical for the national government:

- Coordination amongst sectors and actors: devolving decision making.
- Long-term support.
- Adequate financing.
- Enabling policy and legislation.

FIGURE 4.
Principles at national level.



Coordination amongst Sectors and Actors: Devolving Decision Making

The principle "coordination amongst sectors and actors" for mus echoes international and national initiatives towards IWRM, which aim at better horizontal and vertical integration while devolving decision making to the lowest appropriate levels. Institutional innovation is necessary to overcome the multiplicity of uncoordinated actions for water services provision by national and international actors, each with its own particular take on how development should be approached and usually also promoting top-down single-use water services delivery. The structuring into "silos" is manifest in sector-based mandates and job descriptions; in upward reporting requirements; in parallel planning cycles; in rigid one-size-fits-all technical standards; or in single-use earmarking of financing streams. The design of systems that meets the locally specific multiple water-related needs of the poor, in ways that are least costly, socially equitable and environmentally sustainable, requires a bottom-up integrated approach across all levels, in which decision making on integrated priorities is to take place at the community and intermediate levels, not at the national level.

Important coordinating roles for national-level players are: to devolve integrative decision making to intermediate and community levels; coordinate the support and backstopping required, as discussed in the next principles; and coordinate with international donors, NGOs and financiers so that they harmonize their support according to these decentralized services. Key issues for coordination and devolution are:

- Enabling coordination at intermediate and community levels by devolving decision making for integrated planning of water services provision to the lowest appropriate level, including basin and watershed level decision-making fora.
- Loosening or removing elements of national planning that tend towards top-down single-use or otherwise fragmentary planning (e.g., earmarked financing streams, upward reporting and accountability, narrow mandates and job descriptions).
- Sharing of information and expertise both horizontally and vertically.
- Coordinating with international rural development, water, and financing agencies to pool and channel support for multiple-use water services that are needs-driven, sustainable, replicable, and embedded in the country's planning processes, so that they can be taken to scale.

Long-Term Support: To Intermediate-Level Players

The principle of substantive and well-coordinated national support expresses that decentralization can only work if it comes with the required resources and capacity building—otherwise "decentralization" translates into little more than weakening of central government's functions while shifting their obligations to unprepared or even nonexistent intermediate-level stakeholders: a mismatch between functional responsibility and financial discretion. Technical public- and private-sector support to the intermediate and community

levels can entail the promotion of appropriate micro-scale, medium-scale and sometimes nation-scale infrastructure from both within and outside the country—requiring entrepreneurs, engineers, researchers, social scientists, economists and others to work together in an open and learning mode to identify appropriate models and to support intermediate and community-level actors in implementing and modifying them.

Key to developing a supportive national environment is:

- Identifying and building new competencies and mind-sets required among national-level individuals to support needs-based approaches.
- Enhancing the availability of appropriate individual and collective technologies and building the capacity to reassemble these in innovative ways to support mus.
- Designing innovative institutions for bottom-up nested integrated water management that is needs-based and inclusive, and building the capacities for intermediate- and community-level stakeholders to implement those.
- Adopting multidisciplinary curricula that integrate domestic and productive water uses.

Adequate Financing: To Upscale MUS Nationwide

The principle of "adequate financing" addresses the need for adequate financing through national budgeting of large-scale investments as loans and subsidies or grants (budget-support; sectoral programs, projects), and has the same two aspects as at intermediate level: the overall amount available and the models by which it is made available. Even if the total sum of the various sector-based investments remained the same, multiple-use water services are already promoted by relaxing or removing single-use tags of financing streams and allowing for pooling of grants and loans by local governments and other intermediate-level service providers and communities. Proactive redesign of financing structures, including commercial banking, that empower the intermediate levels can do more, and is also needed to ensure that the poorest get access to minimum levels of water for basic domestic and productive needs.

Key issues related to meeting these challenges are:

- In setting the conditions of subsidies and grants: relaxing or removing labels or binding priorities or restrictions focusing on one water use only.
- Devolving authority by public (and private) financing agencies to intermediate- and community-level stakeholders to enable them to coordinate between, and pool financing sources from, "domestic" and "productive" sectors, while maintaining sufficient accountability and transparency.
- Devolving authority for revenue collection, and otherwise assisting in cost-recovery at community and intermediate level.
- Designing, piloting and upscaling innovative mid-term loan facilities (soft; equity; partial grants) by government and banks that will encourage intermediate-level players and communities to invest in mus schemes.
- Designing a financial strategy that combines the goals of economic efficiency and social equity and designing (cross-) subsidy schemes that better reach the poorest and poor.

Taking mus to scale will involve investments to meet transaction and technology costs at community level and especially the building of an effective intermediate level. The costs will largely depend on the success of decentralization in general. However, if the promotion of multiple-use water services is accompanied by more rigorous cost-recovery from the income gained from the productive activities and more opportunities for self-financing through loans, funds would be freed

up at the medium term that could specifically be used for subsidized targeting of the poor. The real question is therefore whether these short-term investments are worth the expected longer-term benefits.

Enabling Policy and Legislation

Policy and legislation reflect the nation's priority in allocating scarce resources and support provision and entail the cross-linkages between international Millennium Development Goals and national poverty reduction and gender equity strategies and mus approaches as forms of IWRM to achieve those goals. Good policy and legislation not only enable the upscaling of multiple-use water services by removing current restrictive elements but are also an important stimulus for all parties concerned to take responsibility for new approaches. However, formal policy and legislative frameworks tend to work best for the formal urbanized and industrialized segments of societies, which often also become the reference points for uniformity and standardization. National policy and legislation often lack the flexibility to accommodate the very different and intrinsically informal settings found in rural and peri-urban poor areas. Norms and procedural requirements for business plans, environmental impact assessments, or registration and fee payment of water uses are hardly ever a local priority, or indeed even realistic. Bureaucracy without effective enforcement even leads to bribery and corruption by "street-level" bureaucrats. Formalization can easily create more problems than it can solve in the informal economies of the rural and peri-urban poor (Shah 2005; Van Koppen et al. 2005). Indeed, various current formal norms and standards contribute to the shortcomings of single-use planning and design.

On the other hand, bottom-up planning and decision making on public resources require clear, transparent and enforceable division of responsibilities and rules with regard to financial management and auditing of public funds, election and representation, procurement and tendering procedures, quality delivery, legal status of groupings in their interactions with third parties, rules to adhere to during conflict resolution at the different levels, measures to deal with externalities, to name a few.

Policies and legislation to enable mus approaches revolve around the following issues:

- Highlighting multiple-use water services provision as practical forms of IWRM suitable for advancing the Millennium Development Goals in national-poverty reduction and gender-equity strategies and in national water-efficiency strategies and plans, called for by the World Summit of Sustainable Development 2002.
- In particular, by law, prioritizing basic human water needs that include both domestic and productive uses by the poor (50-200 lpd) in national water policy, water strategies and allocation plans.
- Loosening, removing or replacing current restrictions in policies and laws that, in practice, discourage the adoption of mus approaches in rural and peri-urban areas, such as "one-size-fits-all" norms for construction, dam safety, spare parts and technical expertise.
- Designing policies and laws that enable transparent, participatory and accountable planning and public-fund management by communities and intermediate-level service providers.
- Testing draft legislations in informal settings before promulgation.

Conclusions

Multiple-use water services provision in poor rural and peri-urban areas, in which water is better used to reduce poverty and enhance gender equity, was presented from three angles in this research report.

First, we presented empirical evidence from a range of sources, dating back to the 1980s, describing efforts to overcome the shortcomings of conventional single-use planning and design. These shortcomings were, above all, manifest in the universal transformation of single-use planned schemes, whether domestic or productive schemes, into de facto multiple-use water schemes. Worldwide, "domestic-plus," "productive-plus" and "multiple-use" water services provision showed effective solutions, which are gaining momentum and align well with global efforts to decentralize decision making to the lowest appropriate levels, in particular local governments, and with more holistic thinking in the water sector through IWRM.

Second, generic merits and drawbacks of these past efforts towards multiple-use water services provision were identified. At low incremental costs, the benefits include, in brief:

- Addressing simultaneously a broader set of dimensions of well-being than conventional approaches.
- Offering a more gender-equitable approach to service provision.
- Enhancing both ability and willingness to pay for water services.
- Increasing water productivity through "more use per drop."
- Enabling integrated water management institutions owned by communities.
- Enabling design of services that will be more sustainable and less prone to illegal overuse.
- Holistically addressing the various health risks associated with water.
- Allowing for more equitable and environmentally sustainable water allocation and protection of people's basic multiple water needs.

This confirmed what GWP already stated: mus approaches are appropriate forms of implementing IWRM in poor areas with a backlog of infrastructural development and of advancing the Millennium Development Goals (GWP 2004), Upscaling of mus approaches promises proportionate multiplication of the benefits.

Third, therefore, a framework was provided, based on principles grouped in "Learning Wheels" at three different institutional levels to guide future implementation and investigation of upscaled mus. Ten principles were briefly elaborated: service provision based on a thorough understanding of water-related livelihoods; sustainable, equitable and efficient use of water resources; appropriate technologies; inclusive institutions (at community level); adequate financing (crosscutting all levels); adaptive and learning-based management (at intermediate level); coordination between sectors and actors; long-term support; participatory planning (at the intermediate and national levels); and enabling policies and legislation (by governments at the national level).

To conclude, this vision and action plan of upscaling multiple-use water services suggests four increasingly transformative ways to promote multiple-use services provision.

- Formally recognizing existing de facto multiple-uses of single-use planned systems as contributions to achieving the Millennium Development Goals.
- Relaxing or removing current blockages in national policies, laws and programs that hinder intermediate level service providers and communities to implement multiple-use services (single-use mandates, financing

earmarking, upward accountability, definitions of basic human needs and minimum survival norms, one-size-fits-all norms, bureaucratic requirements, unrealistic water-quality requirements, etc.).

- Taking poor people's multiple water needs (quantities, qualities) as a starting point in new public or private project-based domestic-plus, productive-plus, or multiple use schemes, rehabilitations, extensions and new technologies.
- Conducting pilots that can be replicated at large scale at intermediate and national level (integration of needs-based water services in local government planning processes in synergy with intermediate-level capacity building through general decentralization processes; innovative loan facilities for mid-term investments in water schemes; upscaling of farmer-led experimentation at intermediate and national levels, etc.).

The documentation and critical evaluation of these and other future actions will further improve insights and action with regard to the many still outstanding questions with regard to needs-based integrated water services provision.

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