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Multiple Use Water Services for the Poor: Assessing the State of Knowledge

Final report

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Winrock International

IRC Water and Sanitation Centre

International Water Management Institute

Research Team and Acknowledgements*

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Multiple-use services

Poor populations need water for a variety of essential uses ranging from drinking, hygiene and sanitation to food production and income generation. Existing approaches to water service delivery typically entail systems that are designed, managed and financed for a single use—for example, drinking or irrigation. But the poor often rely on such single-use systems to meet multiple water needs—needs not considered in the planning or management of the system. An alternative model for water service provision—known as multiple-use approaches to water service delivery—is a consumer-oriented approach that takes people's multiple water needs as a starting point and involves planning, finance and management of integrated water services for multiple domestic and productive uses.

Purpose

The purpose of this study is to guide prospective investments in the water sector by

- assessing the relative costs, benefits and poverty impacts of multiple-use approaches over single-use approaches
- evaluating the potential market for multiple-use approaches focusing on South Asia and sub-Saharan Africa

Executive Summary

1. Background

2. Findings: Costs and benefits

3. Findings: Poverty Impacts

4. Findings: Market Mapping

5. Opportunity Action Areas

6. Strategic considerations for implementation

Executive Summary: Key Findings

The study findings suggest that while multiple-use services cost more than single-use services, they do offer significant advantages in that they have greater potential to:

- **Generate more income and benefits** (health, nutrition, time savings, food security and social empowerment) for a wider range of poor people (including women and the landless) than most single-use services.
- **Decrease vulnerability** by allowing more diversified livelihood strategies.
- **More effectively reduce poverty** by simultaneously addressing multiple dimensions of poverty.
- **Increase sustainability** of services—multiple use services generate enough income to cover on-going operation, maintenance and replacement costs, and, because they better meet the water needs of communities, conflict over water and damage to infrastructure caused by "illegal" or unplanned uses is decreased and community investment is increased.

Potential beneficiaries from multiple use investments: over 1 billion people

Where: in rural South Asia and sub-Saharan Africa, where there are high concentrations of rural poor with inadequate access to water for domestic and productive purposes

How: Through provision of new multiple services to those currently "unserved" and upgrading service levels within existing domestic and irrigation systems. A number of opportunity areas have been identified where we consistently found widespread income generation activities and poverty impacts with incremental benefits sufficient to cover incremental investment costs, frequently in 6-36 months.

Executive Summary: Research Description: Goal, Research Questions, and Methods

Goal and Questions

Study Goal : The goal of this study is to help inform prospective investments in the water sector by assessing the potential of multiple-use water services to sustainably meet the water needs of the poor.

Research Question One: What are the incremental costs and benefits of multiple-use approaches over single-use approaches?

Research Question Two: Where do multiple-use approaches apply and who are the main beneficiaries?

Methods

Develop a framework for multiple use services—defining service levels

Assess incremental costs, benefits and poverty impacts of multiple-use approaches for different market entry points (domestic and irrigation) for commonly observed activities that have a proven potential to generate income and to enhance livelihoods, health, and social equity.

Evaluate the potential market for multiple-use water services by entry points (such as "domestic-plus", "irrigation-plus", multiple-use by design), and number of potential beneficiaries and their socioeconomic characteristics.

Identify potential opportunity areas

Executive Summary: Research Description—Defining a Water Service Level Framework

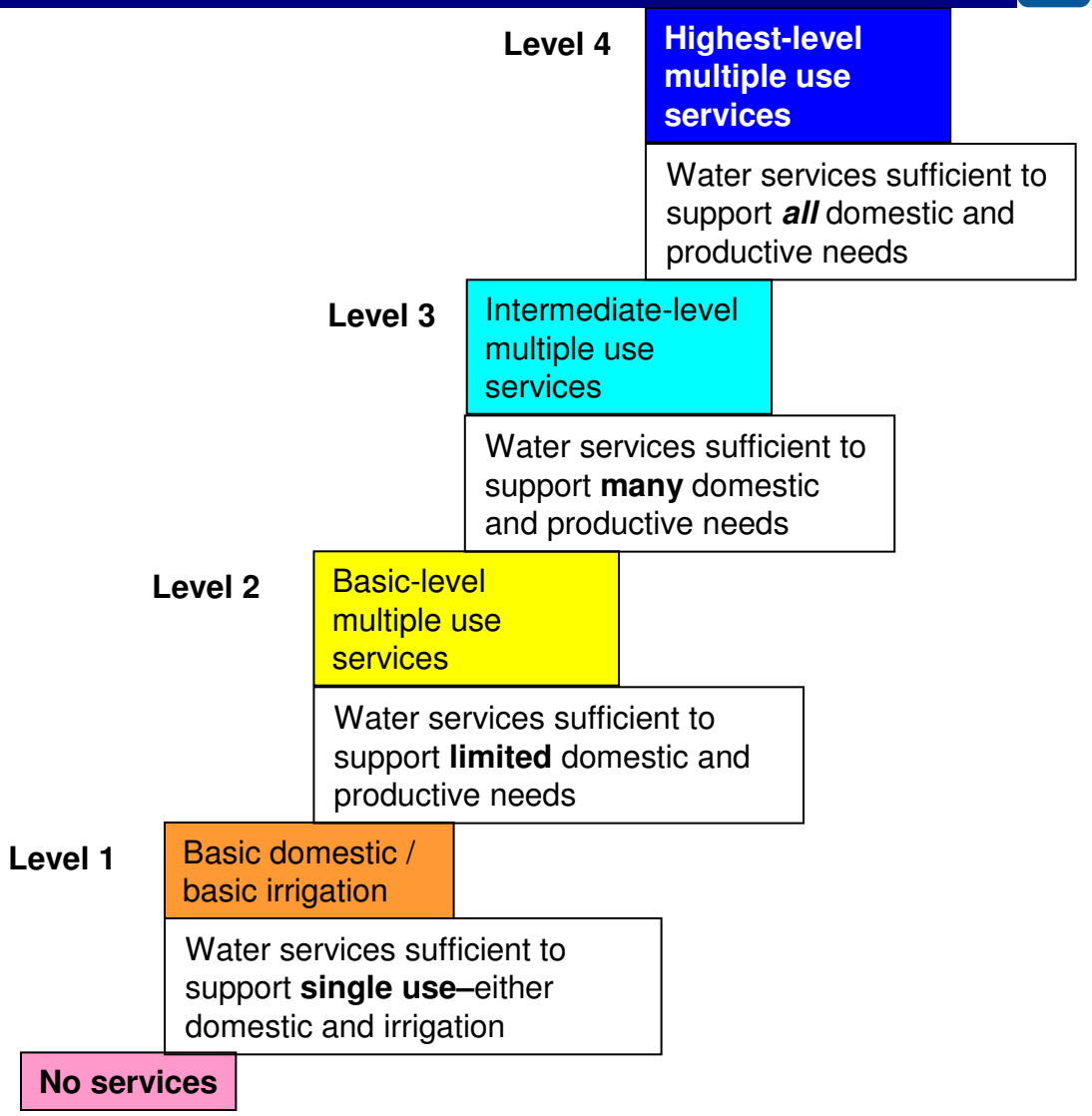
The research team developed a framework of service levels for analyzing the incremental benefits and costs of different water service approaches.

Building on the definitions of "no service" and single-use "basic domestic" and "basic irrigation" services, the research team defined three additional levels of water services required to support varying levels of both domestic and productive uses.

Each different service level represents changes in two or more of four variables: quantity, quality, distance and reliability.

To reflect fundamental differences in water service provision, our typology includes separate service level definitions for "domestic-plus" and "irrigation-plus" approaches. In general, domestic+ approaches involve increasing the quantity and reducing distance between source and homestead. Irrigation+ approaches involve reducing distance between source and homestead and improving quality.

See sections 1.3.3 and 1.3.4 for service level definitions.



Executive Summary: Cost-Benefit Analysis

The study identified and quantified the incremental costs and benefits associated with different water service levels. Benefits were estimated for commonly observed productive uses such as home gardens, livestock and water-dependent small-scale enterprises. Different levels of single-use to multiple-use services were compared to identify optimal service levels. The analysis included benefits and costs for both new domestic+ multiple-use services and upgrades to existing domestic and irrigation services. All benefits and costs are stated in 2004 International Purchasing Power Parity U.S. dollars (PPP I $US). Given the macro-scope of the study, estimates should be considered as “indicative” rather than “universal”.

Key Findings

- **Multiple-use services cost more than single-use services but generate greater income and poverty impacts**.
- **For domestic+, the intermediate multiple-use service level optimizes benefits** (including non-financial poverty benefits) relative to costs for new services and most upgrades. Once basic domestic needs are met (approximately 20 liters per capita per day), each additional liter per capita per day (lpcd) generates an estimated $.5-$1 per year of income. Improving water services from 20 lpcd to 100 lpcd has the potential to generate $40-$80 per capita per year (e.g. for a family of five this would mean an additional $200-$400 per year).
- **For irrigation+, upgrading from the basic irrigation to the basic multiple-use service level optimizes financial benefits relative to costs**, but upgrading to the intermediate multiple-use service level optimizes poverty impacts, including substantial health benefits in areas without domestic water services.
- **Income generated by multiple-use services can enable repayment of initial and ongoing costs for most service levels and technology options**, making multiple-use services more likely to be sustained.

Per capita annual income benefits by service level for domestic+ are:

Highest level multiple uses: $71/capita
Intermediate level multiple uses: $61/capita
Basic level multiple uses: $25/capita

Finding: The largest incremental gains in income are achieved at the intermediate service level.

Average incremental income benefit: $10

Highest level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Average	$64	$87	$19	$71
Range	$4-50	$36-138	$4-35	$4-138

Average incremental income benefit: $36

Intermediate level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Average	$23	$67	$17	$61
Range	$2-43	$14-120	$4-30	$2-120

Average incremental income benefit: $25

Basic level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Average	11	27	17	25
Range	$1-22	$4-50	$4-30	$1-50

Basic Domestic

No Service

Although basic domestic services generate a range of economic benefits related especially to health and time savings, any income generated is through unplanned and often illegal water use, making sustainability uncertain.

Executive Summary:
Summary of Costs and Benefits for **New Domestic+ Multiple-use Services**

Recommendations:

- **Based on the findings, investments in new domestic+ multiple-use services for those currently unserved should focus on the intermediate multiple-use service level, where incremental benefits are sufficient to cover capital investment and annual recurrent cost within 3 years.**
- **A particularly promising option is low-cost piped, gravity-fed spring systems.**

Per capita costs and benefits, repayment periods and benefit-cost ratios of new domestic+ services

Water Service Level	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
Level 1: Basic domestic	**Range**	**$63-$91**	**($9-$13)**		**(negative)**
	Piped systems, dispersed standpipes	$70	($12)		
	Shallow wells w/ hand pumps	$63	($9)		
	Boreholes w/ hand pumps	$91	($13)		
Level 2: Basic multiple uses	**Range**	**$98-$116**	**$8-$9**	**147-155**	**.66-69**
	Piped systems, some standpipes	$98	$8	147	.69
	Boreholes w/ hand pumps & add-ons	$116	$9	155	.66
Level 3: Intermediate multiple use	**Range**	**$56-$105**	**$42-$51**	**13-30**	**3.4-7.8**
	Piped systems, frequent standpipes	$105	$42	30	3.4
	Piped gravity-fed spring systems	$56	$51	13	7.8
	Hand-dug household wells: protecting & adding improved lifting devices	$102	$47	24	3.4
Level 4: Highest multiple uses	**Piped schemes, household connections**	**$140**	**$21**	**80**	**1.28**

Executive Summary:
Summary of Costs and Benefits for **Upgrading Existing Services to Domestic+**

Recommendations:

- **Based on the findings, investments in upgrading to domestic+ multiple-use services should focus on the intermediate multiple-use service level for piped systems and hand-dug wells, where incremental benefits are sufficient to cover incremental capital investment and annual recurrent cost within 7-22 months.**
- **For boreholes fitted with hand pumps, an attractive option involves upgrading to the basic multiple-use service level through in situ add-ons* for domestic and productive activities, with repayment period of 1 year.**

Incremental costs and benefits, repayment periods and benefit-cost ratios of upgrading domestic services

Water Service Level Upgrade	Technology	Capital Investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
		per capita			
Level 1 to Level 2: basic domestic to basic multiple uses	Boreholes w/ hand pumps: in-situ add-ons to support livestock, bathing and community gardens	$25	$22	12	**5.4**
Level 1 to Level 3: basic domestic to intermediate multiple uses	**Range**	**$32-$84**	**$46-$58**	**7-22**	**4.7-8.6**
	Piped systems: increasing quantity and density of standpipes, adding some yard taps	$84	$46	22	4.7
	Hand-dug protected household wells: add improved lifting devices to increase quantity - treadle pump	$32	$58	7	8.6
	- rope pump	$56	$54	13	6.1
Level 2 to Level 3: basic multiple uses to intermediate multiple uses	Piped systems, increasing quantity and adding standpipes & yard taps to expand productive activities	$56	$26	25	3.9

* Livestock troughs, bathing facilities and community gardens added at the source.

Executive Summary:
Per Capita Annual Income Benefits by Service Level for Irrigation+

Per capita annual income benefits by service level are:

Highest level multiple uses:	$71/capita
Intermediate level multiple uses:	$61/capita
Basic level multiple uses:	$52/capita

The greatest incremental income benefits are achieved at the basic multiple-use service level.

Average incremental income benefit: $10

Average incremental income benefit: $9

Average incremental income benefit: $52

Highest level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	$64	$87	$19	$71
Range	$4-124	$36-138	$4-35	$4-138

Intermediate level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	$23	$67	$17	$61
Range	$2-43	$14-120	$4-30	$2-120

Basic MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	-	$52	$17	$52
Range	-	$4-100	$4-30	$4-100

Basic Irrigation

Basic irrigation services generate a range of income and poverty impacts, which are well documented. Given the focus on incremental benefits associated with multiple-use services, these benefits have not been estimated.

Executive Summary: Summary of Costs and Benefits for **Upgrading Existing Irrigation Services to Irrigation+**

Recommendation:

- **Upgrading services from basic irrigation to basic multiple use is the most financially attractive investment option, but higher levels of service are also financially viable and generate more significant poverty impacts including health, time savings and social equity benefits.**

Incremental costs and benefits, repayment periods and benefit-cost ratios of upgrading irrigation services

Water Service Level Upgrade	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
		per capita			
Level 1 to Level 2: Basic Irrigation to Basic Multiple Uses	In situ add-ons to support livestock (drinking troughs and livestock crossings)	$10	$50	3	**27**
Level 1 to Level 2: Basic Irrigation to Intermediate Multiple Uses	Community water storage (including home water treatment and hygiene education) and in situ add-ons for livestock and domestic uses (bathing and laundry)	$50-$110	$51-$57	12-24	**2.9 - 6.8**
Level 1 to Level 3: Basic Irrigation to Highest Multiple Uses	Household water storage (including home water treatment and hygiene education) and in situ add-ons for livestock and domestic uses (bathing and laundry)	$98-$165	$58-$63	19-34	**2.2 - 3.9**

In addition to evaluating the financial costs and benefits, the study also looked at the non-financial benefits derived from multiple-use services and evaluated the potential of multiple-use services to address the multidimensional aspects of poverty.

Key Findings

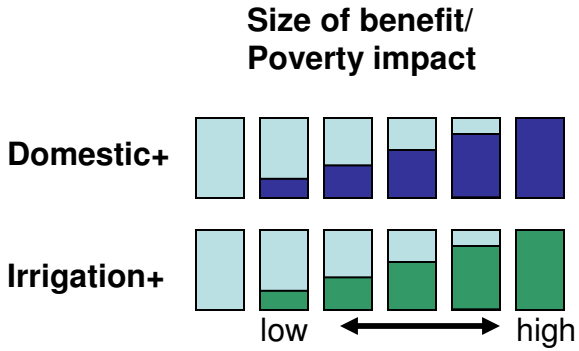
- **Most rural poor have assets necessary to benefit to some extent from multiple-use services.** An estimated 60-70% of the rural poor rear livestock, have access to small cultivable plots (often around their homesteads) and engage in water-dependent small enterprises. Study results suggest that multiple-use services can 'unlock' the productivity of these assets.

- **Improved water services enhance the productivity of these assets**, achieving multiple poverty impacts—income, food security/nutrition, health, reduced vulnerability and livelihoods diversification, and social equity and empowerment (well supported).[1]

- **Communities with high water service levels have more home gardens, higher numbers of livestock, greater numbers of small-scale enterprises and more diversified livelihood activities** therefore reduced vulnerability to shocks (partially supported).[2]

Executive Summary: Illustrative staging of benefits by service level

Domestic+ and Irrigation+ services progressively and synergistically broaden benefits of single-use services and more comprehensively address the multi-dimensional aspects of poverty.



	health	time savings	income	improved food security/ nutrition	diversification of livelihoods; reduced vulnerability	equity and empowerment
Highest-level multiple-use services						
Intermediate-level multiple-use services						
Basic-level multiple-use services						
Basic Domestic/ Basic Irrigation*						

* Assumes no unplanned uses as they cannot assure sustainable generation of benefits.

Executive Summary: Opportunity Action Areas

The study identified 5 high-potential areas for action based on evaluation of: financial sustainability; impact on well-being, health, and social empowerment; scalability; opportunities for leverage, testing and learning.

Opportunity Action Area	**Potential Market & Pilot Locations**	**Capital investment costs per capita** hardware & software	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
Opportunity 1. New piped multiple-use services for currently unserved at the intermediate service level	**137 million** (South Asia: 56 m SS Africa: 81 m) **Pilot: Nepal**	**$56-$105**	**$41-$50**	**3.4-7.8**
Opportunity 2. Upgrading existing domestic piped systems to intermediate multiple-uses service level	**185 million** (South Asia: 144 m SS Africa: 41 m) **Pilot: South Africa**	**$84**	**$45**	**4.7**
Opportunity 3. Boreholes with hand pumps: upgrading services to basic multiple-use service level through communal add-ons to support multiple uses	**280 million** (South Asia: 263m SS Africa: 17m) **Pilots: India and Burkina Faso**	**$25**	**$22**	**5.4**
Opportunity 4. Upgrading existing household hand-dug wells to the intermediate multiple-use service level through well protection and improved lifting devices	**74 million** (South Asia: 43m SS Africa: 31m) **Pilots: Zimbabwe and Mali**	**$39 - $102**	**$47-$55**	**3.4-8.6**
Opportunity 5. Upgrading existing irrigation systems to basic and intermediate service levels through communal add-ons, domestic storage and water treatment	**447 million** (South Asia: 443m SS Africa: 4m) **Pilot: Sri Lanka**	**$10 - $110**	**$50-$57**	**2.9 - 27**

Executive Summary: Criteria for successful implementation

Criteria for successful implementation of multiple-use services:

1. Water availability. Sufficient water must be available to support multiple-use services.

2. Water allocation rules and regulations. Multiple-use services require enforceable formal and informal rules to allocate water among competing uses and users. Regulations must address scarcity, impacts on quality and quantity, and equitable access.

3. Management capabilities. Implementing and maintaining multiple-use services requires sufficient technical, financial, and environmental management capacity. The larger the desired scale of impact, the greater is the need for capacity at intermediate and national levels.

4. Financing. Financial resources and supporting credit institutions must provide adequate credit for system construction and productive activities.

5. Sector and policy coordination. Local actors must work effectively across sectors and stakeholders—both horizontally and vertically– to support to multiple-use activities. The policy and institutional environmental must at least be neutral towards multiple-use approaches.

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Executive Summary

1. Background

2. Findings: Costs and benefits

3. Findings: Poverty Impacts

4. Findings: Market Mapping

5. Opportunity Action Areas

6. Strategic considerations for implementation

1.1 Definitions

1.2 Purpose and Hypotheses

1.3 Research Goal and Methodology

1.4 Caveats and Limitations

1.5 Knowledge Gaps

1.1 Definitions

Water services

Water service is defined as the provision of water of a given quality, quantity and reliability at a specified place. The definition emphasizes outputs—what people receive—rather than infrastructure that are implied by such terms as 'water supply scheme' or irrigation scheme'. In this study, water service levels provide the architecture for evaluating costs and benefits and market opportunities. Different levels of water service support differing levels of domestic and productive activities.

Single-use

Single-use approaches involve design, finance and management of water services for a single intended use, such as for irrigation or domestic purposes. In actuality people often use the water supplied for multiple purposes—with possible consequences for human health and sustainability. Single-use approaches are the standard model of water service delivery.

Multiple-use

Multiple-use approaches involve planning, finance and management of integrated water services for multiple domestic and productive uses based on consumer demand. Recognizing the predominance of sector-based services and differences in service delivery models, our typology includes two types of multiple-use services—domestic+ and irrigation+. Domestic+ approaches involve provision of water services for domestic as well as productive activities. Irrigation+ approaches involve provision of water services for irrigation as well as domestic and non-irrigation productive activities.

1.2 Purpose and Hypotheses

Purpose of the study

The purpose of this study is to help inform prospective investments in the water sector by 1) evaluating whether or not multiple-use water services are a good investment compared to single-use services in terms of poverty impacts, cost-benefit ratios and sustainability, and 2) determining whether there is a potential market for such services in South Asia and sub-Saharan Africa.

Hypotheses

The study tested three basic hypotheses.

Hypothesis 1

Null: The net benefits of multiple-use approaches are greater than those of single-use approaches

Alternative: The net benefits of multiple-use approaches are the same or less than those of single-use approaches.

Hypothesis 2

Null: Multiple-use approaches more comprehensively address the multi-dimensional aspects of poverty than single-use approaches.

Alternative: Multiple-use approaches *do not* more comprehensively address the multi-dimensional aspects of poverty than single-use approaches.

Hypothesis 3

Null: The potential market for multiple-use approaches is large.

Alternative: The potential market for multiple-use approaches is small.

1.3 Research Goal and Methodology

Goal and Questions

Study Goal: The goal of this study is to help inform prospective investments in the water sector by assessing the potential of multiple-use water services to sustainably meet the water needs of the poor.

Research Question One: What are the incremental costs and benefits of multiple-use approaches over single-use approaches?

Research Question Two: Where do multiple-use approaches apply and who are the main beneficiaries?

Methodology

Develop a framework for multiple-use services that defines service levels

Assess incremental costs, benefits and poverty impacts of multiple-use approaches for different market entry points (domestic and irrigation) for commonly observed activities that have a proven potential to generate income and to enhance livelihoods, health and social equity.

Evaluate the potential market for multiple-use water services by entry point (such as domestic+, irrigation+, multiple-use by design) and number of potential beneficiaries and their socioeconomic characteristics.

Identify potential opportunity areas

1.3.1 Framework: Water Service Levels

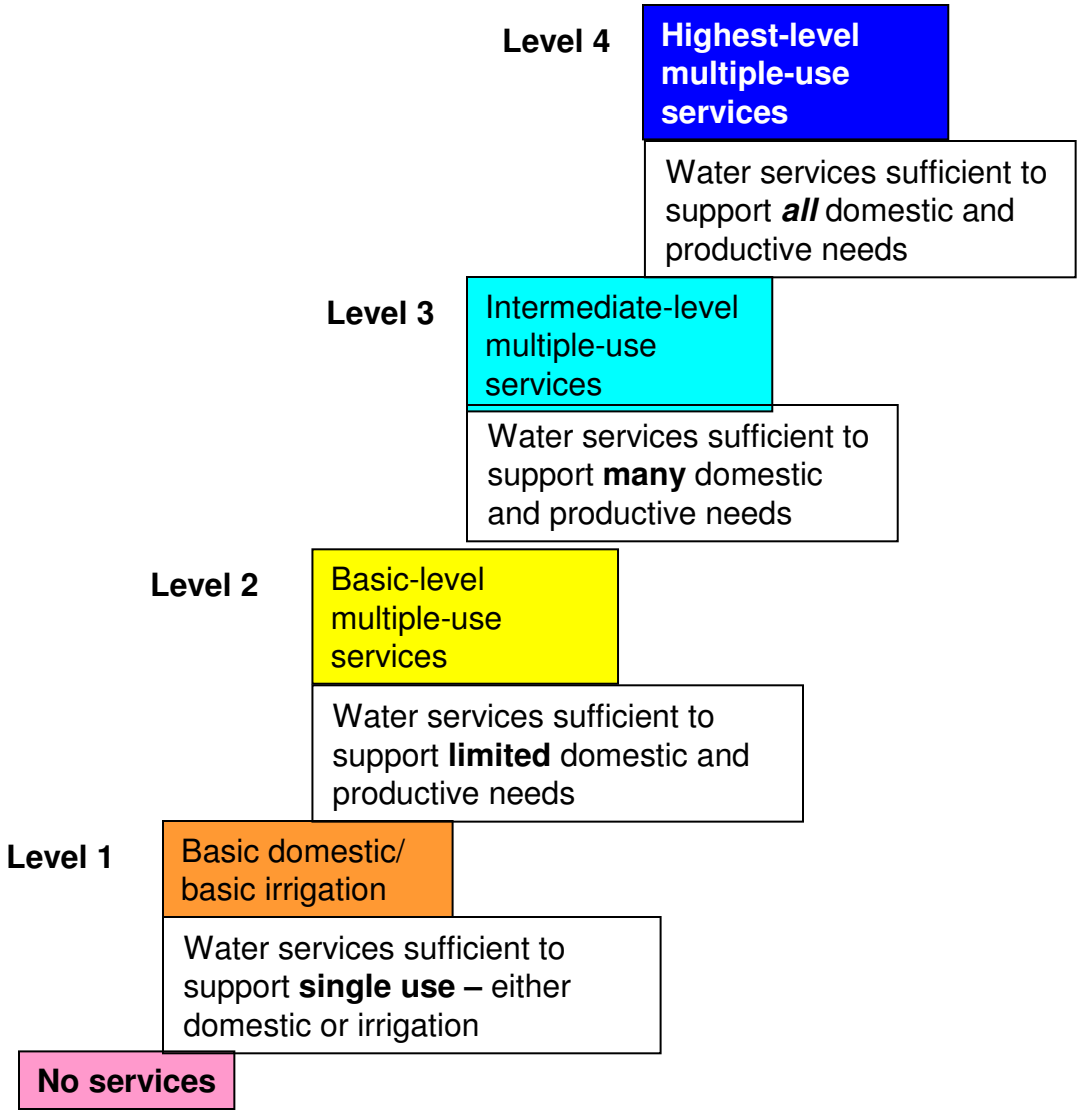
The research team developed a framework of service levels for analyzing the incremental benefits and costs of different water service approaches.

Building on the definitions of "no service" and single-use "basic domestic" and "basic irrigation" services, the research team defined three additional levels of water services required to support varying levels of both domestic and productive uses.

Each different service level represents changes in two or more of four variables: quantity, quality, distance and reliability.

To reflect fundamental differences in water service provision, our typology includes separate service level definitions for "domestic-plus" and "irrigation-plus" approaches. In general, domestic+ approaches involve increasing the quantity and reducing distance between source and homestead. Irrigation+ approaches involve reducing distance between source and homestead and improving quality

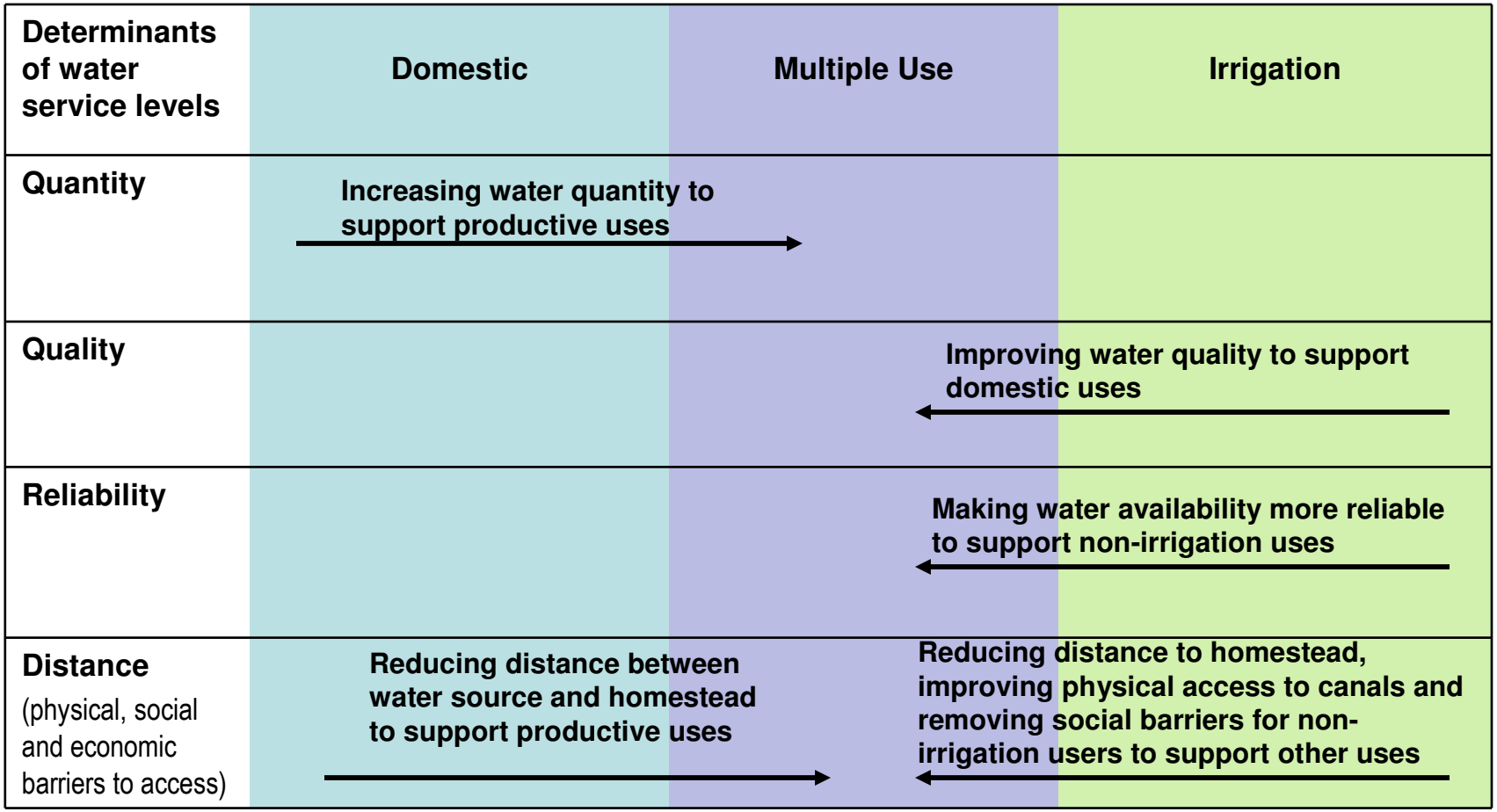
See sections 1.3.3 and 1.3.4 for service level definitions



1.3.2 Water Service Levels Required to Support Multiple Uses

For existing domestic services, supporting multiple uses requires increasing water quantity and reducing the distance to the source.

For existing irrigation services, supporting multiple uses requires improving water quality to support domestic uses, improving reliability, and reducing distance from source to homestead and other access barriers.



1.3.3 Domestic+ Water Service Levels Defined

Service level	Overview	Quantity (lpcd)* *Per capita*	Quantity for productive use at *household* level	Needs met and multiple use potential
Highest-level multiple uses	**House and yard connections** Access: at homestead Quantity: > 100 lpcd Quantity: Improved source Reliability: daily	>100	>475	Sufficient for domestic needs Not all but in some combination: Sufficient for livestock Sufficient for gardening (~50m^2 – >200m^2) Sufficient for many small-scale enterprises
Intermediate-level multiple uses	**Improved source very close to home**. Access: < 5 minutes roundtrip, < 150m Quantity: 40 – 100 lpcd Quality: improved source Reliability: daily	40-100	175 – 475	Sufficient for basic domestic purposes Not all but in some combination: Sufficient for livestock (7 – 17 cows) Sufficient for gardening (~25m^2 – 200m^2) Sufficient for some small-scale enterprises
Basic multiple uses	**Improved source, easily accessible** Access: < 15 minutes roundtrip, < 150-500m; Quantity: 15-50 lpcd Quality: improved source Reliability: daily or storage	15 – 50	50 – 280	Sufficient for basic domestic purposes Not all but in some combination: Sufficient for some livestock (15 goats/8-10 cows) Some gardening, especially with re-use(~10-100m^2) Some small-scale enterprises
Basic domestic	**Improved source** Access: up to 30 minutes roundtrip, < 1km Quantity: 10-25 lpcd Quality: improved source Reliability: daily or storage	10-25	25 - 100	Sufficient drinking and cooking Hardly sufficient for basic hygiene Not all but in some combination: Insufficient for cleaning house Possibility for re-use for horticulture and very limited livestock (chickens or goat)
No service	**Unprotected or distant improved sources** Access: > 30 minutes roundtrip, >1 km Quantity: < 5 lpcd Quality: unimproved source Reliability: daily	< 10	<25	If improved source, may be sufficient for drinking and cooking but too distant Insufficient for basic hygiene

*lpcd = liters per capita per day

1.3.4 Irrigation+ Water Service Levels Defined

Service level	Overview	Quantity (lpcd) *Per capita*	Quantity at homestead for domestic & productive use at *household* level	Needs met and multiple-use potential
Highest-level multiple uses	**Access**: household connections or storage **Quantity**: 50-200 lpcd extra allocation for multiple uses **Quality**: good drinking water (5-10 lpcd) through individual home water treatment **Reliability**: daily	50-200	250-1000	Sufficient for domestic needs Sufficient for livestock Sufficient for home gardening Sufficient for fisheries Sufficient for small-scale enterprises
Intermediate-level multiple use	**Access**: under 150m or 5 minutes roundtrip **Quantity**: 50-200 lpcd extra allocation for multiple uses **Quality**: good drinking water (2-5 lpcd) through individual home water treatment **Reliability**: daily or storage	50-200	250-1000	Sufficient for basic domestic purposes Sufficient for livestock Sufficient for some home gardening Sufficient for fisheries in canals and reservoirs Sufficient for small-scale enterprises
Basic multiple use	**Access**: dependent on infrastructure; under 1 km or <30 minutes roundtrip **Quantity**: 10-100 lpcd extra allocation for multiple uses **Quality**: suitable for irrigation **Reliability**: according to irrigation storage but flexible because of storage	10-100	50-500*	Inadequate quality for drinking Partially sufficient for basic hygiene (canal use) Sufficient for livestock Sufficient for limited home gardening, if water is easily accessible Sufficient for fisheries in canals and reservoirs Sufficient for small-scale enterprise
Basic irrigation	**Access**: dependent on infrastructure **Quantity**: based on crop requirements and plot size **Quality**: suitable for irrigation **Reliability**: access to, and availability for non-irrigation uses not formalized	Per irrigation requirements and plot size	<50	Inadequate quality for drinking, sufficient for cooking Partially sufficient for basic hygiene (canal use) Sufficient for livestock, but access may be difficult Hardly sufficient for small-scale enterprises Non-consumptive uses such as laundry water mills accommodated

*At the Basic Multiple Use service level, additional water is made available at shared communal facilities rather than at the homestead.

1.3.5 Methodology: Analysis of Benefits, Costs and Poverty Impacts

The research team used to the following process to analyze the costs and benefits of multiple-use approaches compared to single-use approaches (see Annex B for further details on the methodology).

Step 1: Assess type and extent of uses supported at each service level. To assess incremental benefits, the research team identified the most common types of uses observed and extent supported at each water level, drawing from existing studies and field observations, which were validated through interviews with experts in the field.

Step 2: Estimate income generated from productive uses by service level. At each service level, the team calculated the potential income generated from home gardens, livestock and small-scale enterprises using the following process:

a) Reviewed literature to identify estimated returns by activity area.
b) Standardized estimates to common units to allow comparison, including currency conversion to 2004 purchasing power parity international dollars (PPP $I).
c) Estimated average returns per activity using standardized estimates gleaned from the literature.
d) Calculated potential income generated from livelihood activities at each service level, estimating mean income generated by the extent of the activity supported at each service level for varying levels of productivity and seasonality of production.
e) Validated income estimates by activity and service level by cross-checking with available estimates from the literature, where possible, and with experts in the field.
f) Converted household-level income estimates to per capita estimates to make comparable to cost data.
g) Estimated incremental income benefits by taking the difference between income generated at each service level.

Step 3: **Estimate costs by service level and technology** using the process outlined below. Estimated costs include hardware, software and annual recurrent costs.

Hardware

- Selected technologies for the cost analysis based on prevalence of use by rural populations in South Asia and sub-Saharan Africa[1], potential to support multiple-use services and availability of data. Domestic+ technologies evaluated include: Networked piped systems, communal boreholes with hand pumps, hand-dug wells, and infrastructure add-ons such as livestock troughs, lifting devices and community gardens. Irrigation+ technologies include: large-scale irrigation systems and infrastructure add-ons to support domestic and productive activities such as livestock troughs, cattle crossings, bathing facilities, canal steps, communal and household storage, home water treatment.

[1]The rationale for selection is described in annex B.

1.3.5 Methodology: Analysis of Benefits, Costs and Poverty Impacts (cont.)

Step 3: **Estimate costs by service level and technology, cont.**

- Identified per capita hardware costs for selected technologies in rural South Asia and sub-Saharan Africa for both new services and incremental upgrades based on literature review supplemented with limited primary data collection and expert consultations.
- Standardized estimates to common units to allow comparison, including currency conversion to 2004 purchasing power parity international dollars (PPP $I).

Software costs

- Software costs for domestic systems are typically on the order of 10% of hardware costs. Based on the ongoing multiple-uses research, the International Water and Sanitation Centre estimates that total software cost (technical assistance and program support costs) for multiple- use approaches could be on the order of 30-50% of hardware costs. This estimate is corroborated by evidence from Winrock and IDE's implementation of over 60 multiple-use by design systems in Nepal where total software were on the order of 40-50%. For the purposes of the financial analysis, we assume 40%.[1]

Recurrent annual costs:

- Recurrent annual costs include operation and maintenance, source water protection and capital maintenance fund. (See Annex B for details on recurrent cost calculations)

Step 4: Calculate cost-benefit ratios

- Cost-benefit ratios for new services and incremental upgrades were calculated assuming a discount rate of 10% where costs equal the per capita hardware and software investment costs in year 1 less the present value of the stream of annual per capita mean income benefits net of annual per capita recurrent costs (operation and maintenance, source water protection and capital maintenance fund) over the useful lifetime of the infrastructure.

Step 5: Calculate repayment periods

- Repayment periods were calculated based on the period of time it would take to cover hardware and software costs based on estimated average annual financial benefits less annual recurrent costs.

Step 6: Conduct sensitivity analysis

- To evaluate how variations in net returns might influence the results, benefit-cost analysis was conducted under four net income scenarios ranging from conservative (25% of potential income) to optimistic (100% of potential income).

1.3.6 Methodology: Analysis of Non-financial Benefits, Costs and Poverty Impacts

Poverty Impacts

To capture non-financial benefits and impacts on poverty of improvements in water services, the study analyzed a series of global poverty surveys and approximately 40 credible research studies. Drawing on the sustainable livelihoods framework, assessments were made of the non-financial incremental benefits and poverty impacts of multiple-use water services vs. single-use services in terms of four key factors known to impact poverty: food security, health and nutrition, vulnerability/ livelihoods diversification, and social equity and empowerment (Ravnborg et al. 2007). The potential poverty impacts of home gardens, livestock, small-scale enterprises and domestic uses of irrigation water for each factor were qualitatively ranked (low, medium, high). To accurately reflect the incomplete nature of the available evidence, the research team utilized a ranking system for key findings based on the quality, quantity and consistency of available supporting data:

- **Well supported**: significant number of high quality studies that consistently provide corroborating evidence
- **Partially supported**: number of high quality studies, or numerous studies with partial data, which provide consistent but only partially corroborating evidence
- **Inconsistent evidence**: inconsistent findings from studies
- **Anecdotal evidence**: observed but not well studied or documented

1.3.7 Methodology: Evaluation of the Potential Market for Multiple-use Services

The research team used to the following process to estimate the potential market for multiple use services (see annex B for further details on methodology)

Market entry points—domestic and irrigation systems. The research team identified and evaluated two market entry points for reaching the rural poor in sub-Saharan Africa and South Asia**:**

Domestic+. The study evaluated the potential for providing multiple-use water services through domestic water service models, either by providing new services for a portion of the **440 million people** without services or by upgrading existing systems for a portion of the **1 billion people** with services.

Irrigation+. The research evaluated the potential for upgrading existing irrigation systems to support multiple uses through incremental improvements for a portion of the **450 million people** living in irrigated areas of South Asia and sub-Saharan Africa.

Identifying high potential markets. The research team used the following process to identify high potential markets for multiple-use services:

Step 1: Assess potential markets based on existing service levels using available global data sets, including remote sensing, to identify attributes of water services (quantity, quality and distance) for populations by country based on market entry point (irrigation or domestic) and current service level.

Step 2: Disaggregate potential markets by technology/water source for water service levels using available global data sets.

Step 3: Identify markets with highest potential using results from cost and benefits analysis.

Step 4: Assess socioeconomic characteristics of households in these markets to determine if they could benefit from multiple-use services (e.g., characterized by poverty and malnutrition but with the necessary assets (land and livestock) to make productive use of water. This analysis relies on Demographic Health Survey Wealth Indices data for 23 countries in South Asia and sub-Saharan Africa, which provided information on sources of household water (by technology), sanitation facilities, household assets (such as livestock and land), health indicators and gender equity.

1.4 Caveats and Study Limitations

Scope of the study

- This study is the result of a four-month intensive effort aimed at conducting a broad scoping exercise for South Asia and sub-Saharan Africa focused on: (1) the incremental costs and benefits of single- vs. multiple-use services, and (2) the potential size of the market. Given the macro scope, results should be considered as "indicative" rather than "universal."

Analysis of costs and benefits

- Benefits and costs were calculated based on observations from the field, and were conservatively estimated, which may result in a slight bias towards over-estimating costs and under-estimating financial benefits. As indicated above, the International Water and Sanitation Centre estimates that supporting software costs for multiple-use approaches, to achieve impact at scale, will range from 30-50% of hardware costs, in comparison to 10% typically estimated for single-use systems. In this study, software costs were estimated at 40%. All financial costs and benefits are stated in **per capita** 2004 International PPP $I.
- Within a particular location, benefits and costs depend on a range of context-specific factors. For example, financial benefits vary based on household assets, complementary inputs, know-how, access to finance and markets as well as supporting local, intermediate and national institutional environment. Even within a given location, these factors also influence the distribution of benefits across different types of households. As with benefits, actual costs for services, both hardware and software, vary based on context-specific factors, including water availability, type of technology, cost of materials, level of services, population served, implementation and management capacity, and institutional environment.
- The study focuses largely on the financial (rather than economic) costs and benefits of single-use and multiple-use approaches. Valuation of economic benefits and costs, such as those related to health, food security and nutrition, labor and social equity were beyond the scope of the study. However, the analysis of poverty impacts does provide an indication of economic and other non-financial benefits and costs and can serve as a foundation for future research.

Technology choices

- The study included only single-source technology options. In reality, the poor often use multiple sources for multiple uses. However, estimating the incremental costs associated with an amalgamation of technology packages was beyond the scope of the current study. Further research is needed to identify the most promising bundles of technologies/systems that could cost-effectively meet the poor's demand for multiple-use services and more efficiently leverage available developed and undeveloped water supplies. This research should include analysis of surface and rooftop rainwater harvesting as well as options for utilizing nearby unprotected sources for productive activities such as with treadle pumps.

1.4 Caveats and Study Limitations, cont.

Poverty impacts

- The analysis of poverty impacts relies on the best available evidence that the team was able to locate and includes a mix of macro-, meso- and micro-level studies. Macro-level studies include data analysis and policy and institutional evidence, especially related to land and livestock, by reputed research institutions such as the International Water Management Institute and the International Livestock Research Institute. Approximately 40 micro- and meso-level credible research studies provide the basis for much poverty impact analysis. Many of these studies are site specific. Where possible, we attempted to find a range of corroborating evidence for and against poverty impacts. Given the incomplete nature of the available evidence, the research team utilized a ranking system for key findings based on the quality, quantity and consistency of available supporting data (as described above).

- Poverty impacts are expected to vary among different household types based on assets; socioeconomic, cultural and structural characteristics; and other context-specific factors. However, due to data limitations and the macro scope of the study, an analysis of the distribution of benefits and costs among different households has not been conducted.

Market analysis

- The analysis of potential opportunities relies on best available macro data sets, including data from the Joint Monitoring Program (JMP), World Health Organization Health Survey and Demographic Health Survey, and Global Irrigated Area Mapping Project.

- The JMP data on coverage estimates rely, in part, on national surveys that have varying definitions of access to safe drinking water. As a result, JMP data on coverage rates for safe drinking water have been criticized for being too low, in some cases, and too high in others. Country-level statistics do not capture data on reliability of sources; they fail to account accurately for non-functionality. In addition, they provide little information about quality at source or quality consumed, which means the “improved” water may not actually be safe for human consumption. Given inherent limitations of such macro data, the size of potential markets should be considered as “order of magnitude” estimates. Detailed country and local-level studies are needed to further these estimates

- In addition, the Global Irrigated Area Mapping data do not capture small-scale irrigation systems, which are most prevalent in sub-Saharan. Further research is needed to identify the extent of small-scale irrigation systems in sub-Saharan Africa and opportunities for multiple-use services.

- The report outlines key enabling factors to achieve the market potential. Given the macro focus of the study and data limitations, an analysis of these enabling conditions was beyond the scope of the study. Investment decisions should carefully consider the enabling environmental and how it may influence outcomes.

1.5 Key Knowledge Gaps

The research team a number of key knowledge gaps through the research process, including:

For cost and benefit analysis

- Reliable data on software costs for multiple uses.
- Identification of the most promising bundles of technologies/systems that could cost-effectively meet the poor's demand for multiple-use services and associated costs

For poverty impact analysis

- Consistent and specific data on the range of non-financial benefits and costs of multiple-use water services.
- Data on the differential poverty impacts for different household types based on assets; socioeconomic, cultural and structural characteristics; and other context-specific factors

For market analysis

- Extent, location and characteristics of small-scale irrigation systems (<1000 hectares) in sub-Saharan Africa.
- Information on demand for multiple-use services and willingness of the poor to pay for such services.

For implementation

- Country- and district-level information on wider enabling environment for South Asia and sub-Saharan Africa, including policies, institutional abilities, local water governance, investment potentials and poverty priorities.
- High quality data and analysis from a number of locations on the sustainability of multiple-use services
- Appropriate financing models to make services affordable and feasible for poor households, with the poorest households likely to require subsidies. More research is needed to identify appropriate financing models—at both the community and household levels.

Executive Summary

1. Background

2. Findings: Costs and benefits

3. Findings: Poverty Impacts

4. Findings: Market Mapping

5. Opportunity Action Areas

6. Strategic considerations for implementation

2.1 Overview and Key Findings
2.2 Domestic: Benefits and Costs
2.3 Irrigation: Benefits and Costs

2.1 Costs and Benefits: Overview

While there is growing interest in multiple-use services, a key knowledge gap has been lack of information on the costs and benefits of multiple-use services in comparison to single-use services. Some studies and anecdotal evidences have suggested the net financial benefits of multiple-use approaches are greater than single-use approaches.

To test this hypothesis, the study made the following calculations for new domestic and domestic+ services and for upgrading existing services to domestic+ and irrigation+

- The potential income generated from the most commonly observed productive activities—home gardens, livestock and small-scale enterprises—supported at each service level.
- The costs by service level for new domestic+ services and for upgrading existing domestic and irrigation services, including hardware, software and annual recurrent costs.
- Repayment periods for hardware and software based on average annual financial benefits less annual recurrent costs.
- Cost-benefit ratios with sensitivity analysis to evaluate how variations in net income might influence the results.

Key Findings

- **Multiple-use services cost more than single-use services but generate greater income and poverty impacts** (see section 4 for more details on poverty impacts).
- **For domestic+, the intermediate multiple-use service level optimizes benefits** (including poverty impacts) relative to costs for new services and most upgrades.
- **For irrigation+, upgrading from the basic irrigation to the basic multiple-use service level optimizes financial benefits relative to costs**, but upgrading to the intermediate multiple-use service level optimizes poverty impacts, including substantial health benefits in areas without domestic water services (see section 4).
- **Income generated by multiple-use services can enable repayment of initial and ongoing costs for some service levels and technology options**, making multiple-use services more likely to be sustained.
    - Incremental income benefits are sufficient to cover the costs of new piped domestic+ multiple-use services at the intermediate multiple-use service level. Repayment periods for systems at this level of service are between 6-36 months under typical microfinance conditions.
    - Upgrading existing domestic and irrigation services to the basic and intermediate multiple-use service levels can result in sufficient income to repay full investment costs and recurrent annual costs within 3-30 months.
    - Appropriate finance models, including possible subsidies for poorest households, will be required to ensure affordability and equitable access to services.

2.2 Domestic+: Income Benefits

Key findings

- **Once basic domestic needs are met (approximately 20 lpcd), each additional lpcd of water generates approximately $.5-$1/year of income**. Based on this analysis, improving water service levels from 20 to 100 lpcd has the potential to generate $40-$80 per capita per year. For a family of five this translates to an additional $200-$400 in income per year.
- Several factors cause variations in income benefits:
    - Differences in the asset base of households (different plot sizes, livestock types and numbers, and opportunities for small-scale enterprises) and extent of home consumption.*
    - Differences in the nature and intensity of production (access to inputs, technologies, know-how, credit) and climatic factors.
    - Market prices and access, and financial, technical and managerial support.

*For example, lower income estimates for home gardens assume small plots, seasonal production, traditional garden (low intensity production) with nearly all produce consumed.

2.2.1 Domestic+: Income Benefits by Service Level

Per capita annual income benefits by service level for domestic+ are:

Highest level multiple uses:	$71/capita
Intermediate level multiple uses:	$61/capita
Basic level multiple uses:	$25/capita[1]

Finding: The largest incremental gains in income are achieved at the intermediate service level.

Average incremental income benefit: $10

Average incremental income benefit: $36

Average incremental income benefit: $25

Highest level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Average	$64	$87	$19	$71
Range	$4-50	$36-138	$4-35	$4-138

Intermediate level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Average	$23	$67	$17	$61
Range	$2-43	$14-120	$4-30	$2-120

Basic level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Average	11	27	17	25
Range	$1-22	$4-50	$4-30	$1-50

Basic Domestic

No Service

Although basic domestic services generate a range of non-financial economic benefits related especially to health and time savings, any income generated is through unplanned and often illegal activities, making sustainability uncertain.

2.2.2 Domestic+: Costs

Key findings

- For new services, the intermediate multiple-use service level optimizes income benefits (and poverty impacts) relative to costs. Income benefits are sufficient to cover the costs of new piped domestic+ multiple-use services with repayment periods of 6-36 months.

- For upgrades to existing services, the intermediate multiple-use service level optimizes income benefits relative to costs for piped systems and hand-dug household wells. For these two technologies, repayment periods for incremental upgrades range from 7-25 months, depending on the extent of the service upgrade and technology. For boreholes with hand pumps, the basic multiple-use service level optimizes income benefits with repayment periods averaging 12 months.

Factors influencing the cost and ease of moving up the water service ladder

- **Population density and economies of scale of water supply**: The higher the population density, the smaller the per capita incremental costs of moving to a higher level of service.

- **Water availability**: Shallow groundwater sources cost less to develop; sources that are less distant are less costly to develop for networked systems.

- **Technology**: Technology choice is an important determinant of costs for both new services and incremental upgrades. For example, the initial costs of gravity-fed piped systems are significantly less than those for deep boreholes. For upgrades, the incremental costs are determined by existing technology and upgrade options.

- **Institutional readiness and implementation capacity**: As institutional readiness and implementation capacity increase, incremental costs (initial and recurrent) decrease.

2.2.3 Domestic+: Per Capita Costs and Income Benefits of New Multiple-Use Services

The intermediate service level is the most promising option for NEW domestic+ services.

Incremental income benefits are most likely to cover capital investment and annual recurrent costs at the intermediate multiple-use service level. Average repayment periods range from 6-30 months. A particularly promising option is low-cost gravity-fed spring systems.

Appropriate finance models, including possible subsidies for poorest households, will be required to ensure affordability and equitable access to services.

Units: US$/per capita

Capital investment = Average hardware and software costs in year 1

Recurrent costs = Average annual costs for operation and maintenance, source protection, and capital maintenance fund

Income = Average annual income due to incremental upgrade to higher service level

Highest level MUS

Piped scheme, individual HH connections	
Capital investment	140
Recurrent cost/yr	50
Annual income	71

Intermediate level MUS

	Piped scheme, frequent standpipes	Piped spring systems close to households
Capital investment	105	19
Recurrent cost/yr	19	10
Annual income	61	61

Basic MUS

	Piped scheme, some standpipes	Borehole w/ hand pump & communal add-on
Capital investment	98	116
Recurrent cost/yr	18	17
Annual income	25	25

Basic Domestic

	Community shallow well w/ hand pump	Borehole w/ hand pump	Piped scheme w/ few & dispersed standpipes
Capital investment	63	91	70
Recurrent cost/yr	9	13	13
Annual income	0	0	0

No Service

2.2.4 Domestic+: Sensitivity Analysis of Benefits and Costs for **New Multiple-use Services** for Those Currently Unserved

To evaluate how variations in net returns might influence the results, the research team conducted benefit-cost analyses under four net income scenarios:

- Conservative: 25% of estimated net income potential achieved
- Moderately conservative: 50% of estimated net income potential achieved (base case)
- Moderately optimistic: 75% of net income potential achieved
- Optimistic: 100% of income potential achieved

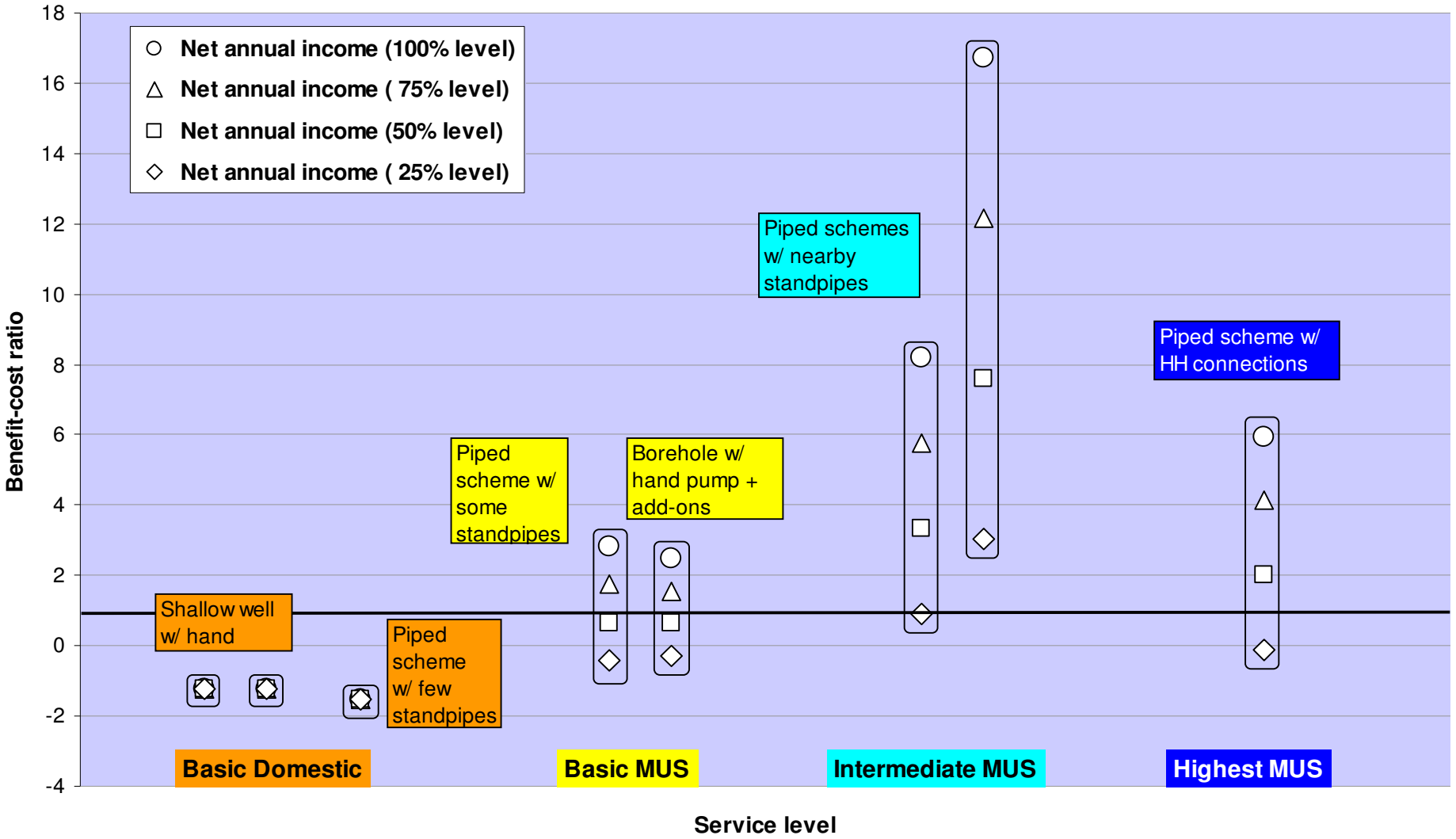
Key Findings

- At the **intermediate** multiple-use service level, the benefit-cost ratios exceed 1 for all income scenarios, indicating that potential investments in multiple-use water services at the intermediate service level are likely to be financially viable even when income returns are modest.

- The **highest** multiple-use service level offers a relatively attractive investment opportunity. Achieving impact at scale, however, could be challenging given the relatively high costs of household connections and competing demands for water services for those currently without services.

- The **basic** multiple-use service level is a viable investment option under two scenarios:
  - Capital investment costs are subsidized. Under this scenario, the income generated should be sufficient to cover recurrent annual costs, including capital maintenance funds for infrastructure replacement at the end of its useful life.
  - Users achieve higher income levels. This is an optimistic, risky assumption.

Baseline used for analysis is 50% level



2.2.6 Summary of Domestic+: Financial Analysis for New Domestic+ Services

Investments in new domestic+ multiple-use services should focus on the intermediate multiple-use service level, where incremental benefits are sufficient to cover full investment and annual recurrent costs within 3 years and achieve significant poverty impacts. A particularly promising option is low-cost piped, gravity-fed spring systems.

Incremental costs and benefits, repayment periods and benefit-cost ratios of new domestic+ services

Water services systems	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
Level 1: Basic domestic	**Range**	**$63-$91**	**($9-$13)**		**(negative)**
	Piped systems, dispersed standpipes	$70	($12)		
	Shallow wells w/ hand pumps	$63	($9)		
	Boreholes w/ hand pumps	$91	($13)		
Level 2: Basic multiple uses	**Range**	**$98-$116**	**$8-$9**	**147-155**	**.66-69**
	Piped systems, some standpipes	$98	$8	147	.69
	Boreholes w/ hand pumps & in situ add-ons	$116	$9	155	.66
Level 3: Intermediate multiple use	**Range**	**$56-$105**	**$42-$51**	**13-30**	**3.4-7.8**
	Piped systems, frequent standpipes	$105	$42	30	3.4
	Piped gravity-fed spring systems	$56	$51	13	7.8
	Hand-dug household wells: protecting & adding improved lifting devices	$102	$47	24	3.4
Level 4: Highest multiple uses	**Piped schemes, household connections**	**$140**	**$21**	**80**	**1.28**

2.2.7 Domestic+: Per Capita Benefits & Costs of **Upgrading Existing Systems** to Multiple-Use Systems

The best option is upgrading from the basic domestic to intermediate multiple-use service level. Repayment periods range from 20-24 months.

Highest level MUS

	Piped system upgrade
Capital investment	56
Recurrent cost/yr	10
Annual income	10

Intermediate level MUS

	Piped system upgrade
Capital investment	56
Recurrent cost/yr	10
Annual income	36

Intermediate level MUS

	Piped system upgrade
Capital investment	84
Annual recurrent	15
Annual income	62

Costs and benefits are for stepwise incremental upgrades from one service level to the next, except for upgrades from basic domestic directly to intermediate multiple use level.

Going from basic domestic to intermediate multiple use

Basic MUS

	Piped system upgrade
Capital investment	56
Recurrent cost/yr	10
Annual income	25

Basic Domestic

	Piped system upgrade
Capital investment	70
Recurrent cost/yr	13
Annual income	0

No Service

Units: US$/per capita

Capital investment = Average hardware and software costs in year 1

Recurrent costs = Average annual costs for operation and maintenance, source protection, and capital maintenance fund

Income = Average annual income due to incremental upgrade to higher service level

2.2.8 Domestic+: Per capita Benefits and Costs of **Upgrading** Boreholes with Hand Pumps

The best option is upgrading basic domestic services to basic multiple-use services by adding communal infrastructure to support livestock and communal gardens. The repayment period averages 12-14 months.

Costs and benefits are for stepwise incremental upgrades from one service level to the next

Highest level MUS

	Increasing pumping, storage capacity and piped distribution network
Capital investment	67
Annual recurrent	10
Annual income	10

Intermediate level MUS

	Network: Adding pump, storage and pipes
Capital investment	67
Annual recurrent	10
Annual income	36

Basic MUS

	Communal add-ons (livestock, bathing and community gardens)
Capital investment	25
Annual recurrent	4
Annual income	25

Basic Domestic

	Borehole with hand pump
Capital investment	91
Annual recurrent	13
Annual income	0

No Service

Units: US$/per capita

Capital investment = Average hardware and software costs in year 1

Recurrent costs = Average annual costs for operation and maintenance, source protection and capital maintenance fund

Income = Average annual income due to incremental upgrade to higher service level

2.2.9 Domestic+: Per Capita Benefits and Costs of **Upgrading** Household Hand-Dug Wells

The best option is upgrading from the basic domestic service level to the intermediate multiple-use level by installing improved lifting devices for protected wells. Repayment periods range from 6-12 months. To achieve health benefits as part of the upgrade, however, well protection/lining is essential. For households without protected wells, well lining coupled with improved lifting devices is a promising upgrade; repayment periods average 24 months.

Intermediate level MUS

	Lining/protecting and improved lifting
Capital investment	$102
Annual recurrent	$15
Annual income	$61

Going from "no service" to intermediate multiple use service level though well protection and by improved lifting devices

Going from basic domestic to intermediate multiple use by adding improved lifting devices to protected wells

Intermediate level MUS

	Treadle pump	Rope pump
Capital investment	$32	$56
Annual recurrent	$5	$8
Annual income	$61	$61

Basic MUS

Basic Domestic

	Lining/protecting
Capital investment	$63
Annual recurrent	$9
Annual income	$0

No Service

Unprotected hand–dug wells; unimproved source

Units: US$/per capita

Capital investment = Average hardware and software costs in year 1

Recurrent costs = Average annual costs for operation and maintenance, source protection, and capital maintenance fund

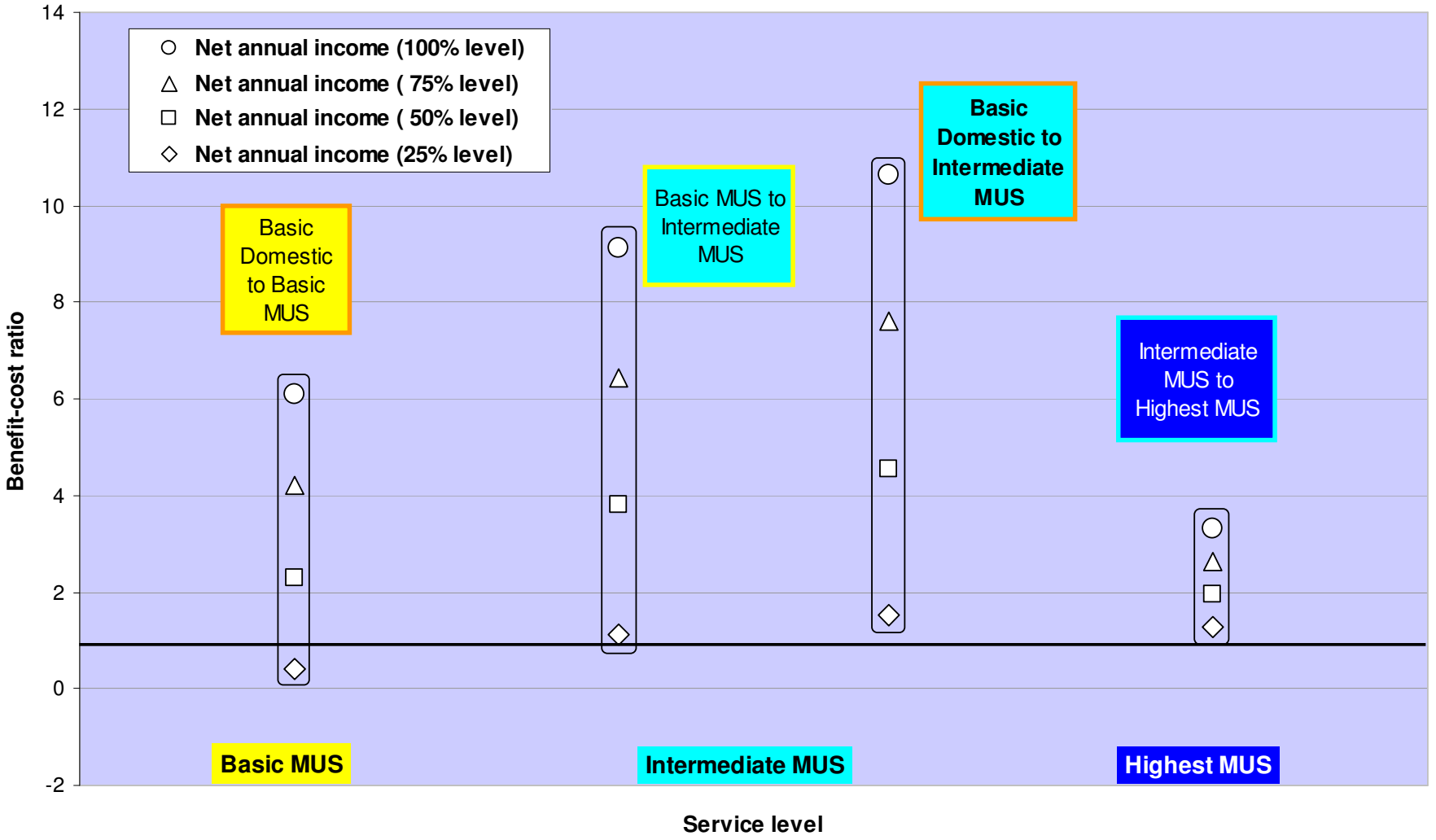
Income = Average annual income due to incremental upgrade to higher service level

2.2.10 Domestic+: Sensitivity Analysis of Benefits and Costs of **Upgrading** Existing Systems

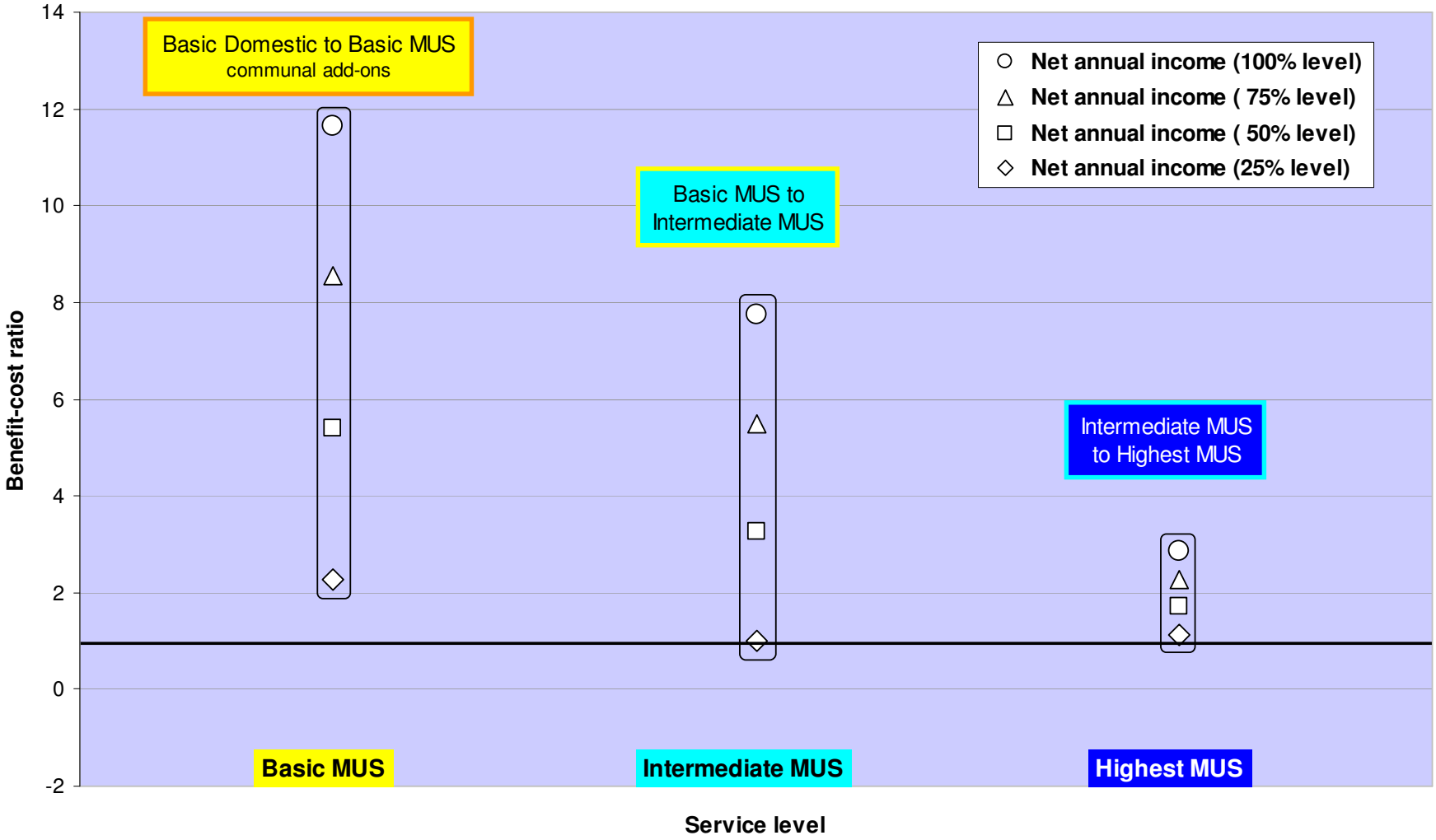
Key Findings

- **For piped systems**, the benefit-cost ratios exceed 1 at all income levels for upgrades that result in water service levels at the intermediate multiple-use level and higher. The highest benefit-cost ratios are achieved when upgrading from the basic domestic to intermediate multiple-use service level.
- **For communal boreholes with hand pumps**, the benefit-cost ratios for all upgrades exceeded 1 for all income scenarios. The highest benefit-cost ratio under all scenarios resulted from upgrading from the basic domestic to basic multiple-use service levels.
- **For household hand-dug wells**, the benefit-cost ratios exceeded 1 for all options evaluated. The largest benefit cost ratios resulted from improved lifting devices for protected wells that increased service levels from basic domestic to intermediate multiple-use level.

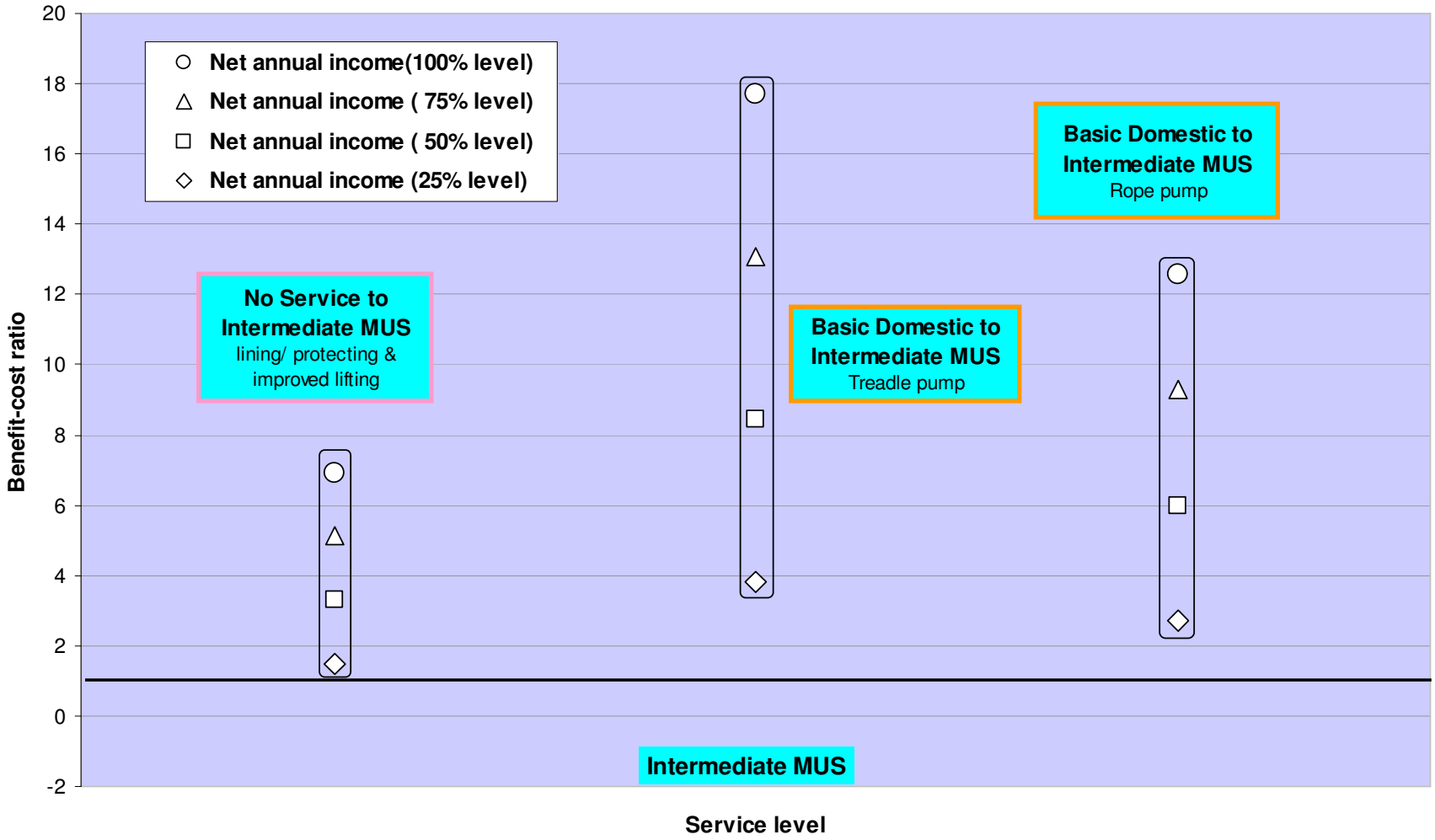
Baseline used for analysis is 50% level



Baseline used for analysis is 50% level



Baseline used for analysis is 50% level



2.2.14 Summary of Domestic+: Financial Analysis for **Upgrading** Existing Domestic Services

Investments in upgrading domestic multiple-use services should focus on the intermediate multiple-use service level for piped systems and hand-dug wells, where incremental benefits are sufficient to cover capital investment and annual recurrent cost within 7-22 months. An attractive option for boreholes fitted with hand pumps is upgrading to the basic multiple-use service level through in situ add-ons for domestic and productive activities, with repayment period of 1 year.

Incremental costs and benefits, repayment periods and benefit-cost ratios of upgrading domestic services

Water services systems	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
Level 1 to Level 2: Basic Domestic to Basic Multiple Uses	Boreholes w/ hand pumps: in situ add-ons to support livestock, bathing and community gardens	$25	$22	12	5.4
Level 1 to Level 3: Basic Domestic to Intermediate Multiple Uses	**Range**	**$32-$84**	**$46-$58**	**7-25**	**4.7-8.6**
	Piped systems: increasing quantity and density of standpipes, adding some yard taps	$84	$46	22	4.7
	Hand-dug protected household wells: add improved lifting devices to increase quantity - treadle pump	$32	$58	7	8.6
	- rope pump	$56	$54	13	6.1
Level 2 to Level 3: Basic Multiple Uses to Intermediate Multiple Uses	Piped systems, increasing quantity and adding standpipes & yard taps to expand productive activities	$56	$26	25	3.9

Key Findings

- **The income generated by irrigation+ multiple use services can enable repayment of initial and ongoing incremental costs for irrigation+ multiple-use service upgrades, particularly at the basic and intermediate multiple-use service levels.**
    - Upgrading services from the basic irrigation to **basic multiple-use service level is the most financially attractive** upgrade investment option, with an average repayment period of 3 months.
    - **Poverty impacts are maximized at the intermediate service level**, where water services near the homestead provide for drinking and domestic needs, as well as productive needs. This service level is also an attractive investment option, with income benefits sufficient to cover investment costs in 12-24 months.
- Cost-benefit ratios exceeded 1 for all sensitivity analysis scenarios, indicating that potential investments in irrigation+ multiple-use services are likely to be financially viable, even if income returns are modest, particularly at the basic multiple-use service level.

2.3.1 Irrigation+: Per Capita Annual Income Benefits by Service Level

Per capita annual income benefits by service level are:

Highest level multiple uses:	$71/capita
Intermediate level multiple uses:	$61/capita
Basic level multiple uses:	$52/capita

The greatest incremental income benefits are achieved at the basic multiple-use service level.

Average incremental income benefit: $10

Average incremental income benefit: $9

Average incremental income benefit: $52

Highest level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	$64	$87	$19	$71
Range	$4-124	$36-138	$4-35	$4-138

Intermediate level MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	$23	$67	$17	$61
Range	$2-43	$14-120	$4-30	$2-120

Basic MUS

	Home gardens	Livestock	Small-scale enterprises	Total
Midpoint	-	$52	$17	$52
Range	-	$4-100	$4-30	$4-100

Basic Irrigation

Basic irrigation services generate a range of income and poverty impacts, which are well documented. Given the focus on incremental benefits associated with multiple-use services, these benefits have not been estimated.

Two financially viable options:

- Upgrading from the basic irrigation service level to the basic multiple-use service level through communal add-ons to support livestock.[1] The average repayment period is 3 months.
- Upgrading from the basic irrigation level to the intermediate multiple-use service level by adding communal water storage, home water treatment, and in situ add-ons. The repayment periods average 12-24 months.

At the intermediate and highest multiple-use service levels, increasing domestic and some non-irrigation productive needs are met .

At the basic multiple-use service level, domestic needs are *not* addressed.

Basic Irrigation

Highest level MUS

	Individual household water storage w/ taps	Multi-household water storage w/ taps
	In situ add-ons for livestock and domestic uses, plus household storage, hygiene education and home water treatment	
Capital investment	98	165
Recurrent cost/yr	8	13
Annual income	71	71

Intermediate level MUS

	Community water storage w/ electric pump	Community water storage w/ electric pump & generator
	In situ add-ons for livestock and domestic uses, plus community water storage, hygiene education and home water treatment	
Capital investment	56	110
Recurrent cost/yr	6	9
Annual income	61	61

Basic MUS

	In situ add-ons for livestock (drinking troughs and cattle crossings)
Capital investment	11
Recurrent cost/yr	1
Annual income	52

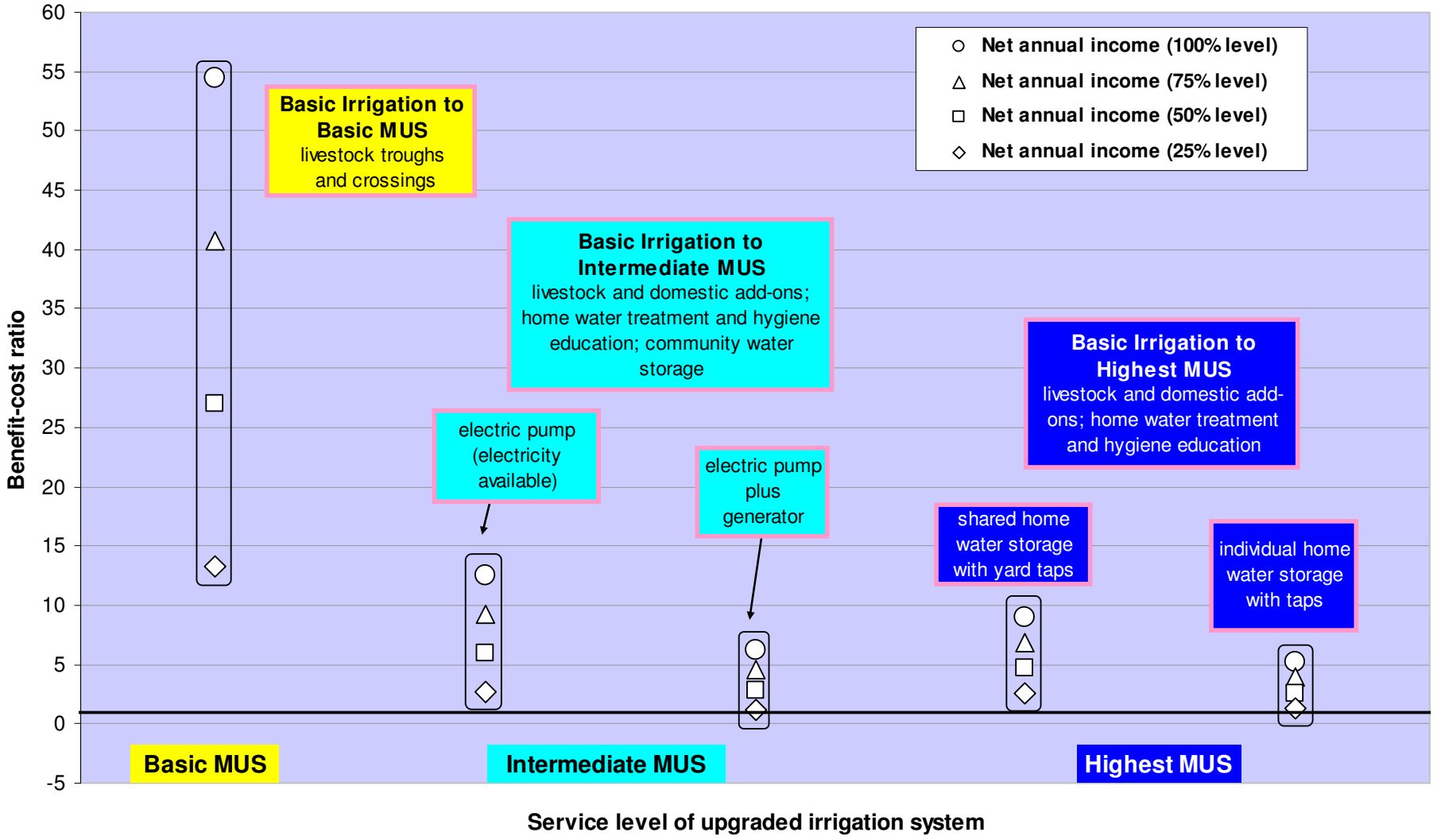
Units: US$/per capita

Capital investment = Average hardware and software costs in year 1

Recurrent costs = Average annual costs for operation and maintenance, source protection and capital maintenance fund

Income = Average annual income due to incremental upgrade to higher service level

Baseline used for analysis is 50% level



2.3.5 Irrigation+: Summary of Costs and Benefits for **Upgrading** Existing Irrigation Services to Irrigation+

The results suggest there are significant investment opportunities for upgrading existing irrigation systems to support multiple-use services to improve productivity of sunk investments and enhance poverty impacts, including health benefits. Upgrading services from basic irrigation to basic multiple-use is the most financially attractive investment option, but higher levels of service are also financially viable and generate more significant poverty impacts (including health and social equity benefits).

Incremental costs and benefits, repayment periods and benefit-cost ratios of upgrading irrigation services

Water services systems	Technology	Capital investment costs (hardware plus software)	Annual income net of recurrent costs	Repayment period (months)	Benefit-cost ratio (10% discount rate)
		per capita			
Level 1 to Level 2: Basic Irrigation to Basic Multiple Uses	In situ add-ons* to support livestock (drinking troughs and livestock crossings)	$10	$50	3	**27**
Level 1 to Level 2: Basic Irrigation to Intermediate Multiple Uses	Community water storage (including home water treatment and hygiene education) and in situ add-ons for livestock and domestic uses (bathing and laundry)*	$50-$110	$51-$57	12-24	**2.9 - 6.8**
Level 1 to Level 3: Basic Irrigation to Highest Multiple Uses	Household water storage (including home water treatment and hygiene education) and in situ add-ons for livestock and domestic uses (bathing and laundry)*	$98-$165	$58-$63	19-34	**2.2 - 3.9**

* In situ add-ons include infrastructure that is added at the source to support domestic and productive activities. The add-ons proposed at the basic multiple–use service level include livestock troughs near canals and livestock canals crossings. At the intermediate multiple-use services level, in situ add-ons include communal facilities near canals for bathing and laundry.

Executive Summary

1. Background

2. Findings: Costs and benefits

3. Findings: Poverty reduction potential

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6. Strategic considerations for implementation

3.1 Overview and Key Findings

3.2 Poverty Impacts by Use

3.3 Summary: Single –vs –Multiple-Use Services

3.1 Poverty Impacts: Overview

Poverty is multi-dimensional and the poor experience deprivation at many levels

"…poverty is typically characterized not only by low income and assets, but also by hunger and under-nutrition, illiteracy, the lack of access to basic necessities such as safe drinking water and health services, and social isolation and exploitation" (CPRC, 2007).

How single-use services impact poverty is fairly well understood. Domestic services improve health and free up time for productive activities. Irrigation services increase income and food security for those with irrigated land. In theory, multiple-use services can provide a broader range of benefits to a broader range of poor people (women, children, the landless), and thus more comprehensively address the multi-dimensional aspects of poverty.

To test this hypothesis, the study evaluated:

- The ability of poor people to engage in productive activities enabled by multiple-use services and the non-financial benefits—such as improved health, food security and nutrition, time savings, livelihoods diversification, and social empowerment—accruing from these activities and from domestic use of irrigation water.
- The direct and indirect poverty impacts from multiple-use as compared to single-use services.
- The incremental staging of benefits based on water service level.
- The potential of multiple-use services to provide "pathways" out of poverty for those with different levels of assets.
- The sustainability of water services

Findings are based on analysis of approximately 40 credible case studies. Detailed analysis of 11 of these case studies is provided in Annex A.

3.1 Poverty Impacts: Key Findings

Key Findings

- **Most rural poor have assets necessary to benefit to some extent from multiple-use services.** An estimated 60-70% of the rural poor rear livestock, have access to small cultivable plots (often around their homesteads) and engage in water-dependent small enterprises.

- Evidence suggests that **improved water services enhance the productivity of these assets**, **achieving multiple poverty impacts**—income, food security/nutrition, health, reduced vulnerability and livelihoods diversification, and social equity and empowerment (well supported).[1]

- **Communities with high water service levels have more home gardens, higher numbers of livestock, greater numbers of small-scale enterprises and more diversified livelihood activities** and therefore reduced vulnerability to shocks (partially supported).[2]

[1] Poverty impacts are maximized when improved water supplies are complemented by access to markets, credit, improved and sustained technical support, and redistribution of assets to the poorest (well supported).

[2] Given the heterogeneity in household poverty levels within any community, a reliable capital asset base or the lack of it and several other factors, including affordability and access to available water, determine the livelihood activity of particular households (well-supported).

3.2.1 Poverty Reduction Potential: Home gardens

Key findings

- Most of the rural poor own or have access to small cultivable plots, including communal cultivation schemes for the absolute landless (partially supported).
- Improvements in water supply are critical to enabling home gardening and have spin-off social equity and empowerment benefits, particularly for women (well supported).
- Improved water supplies result in year-round improved productivity, improved food security and nutrition (well supported).
- Subsistence benefits from improved gardens are highest for the poorest (well supported).
- Complemented by improved technologies, water services, and credit, home gardens can be upgraded from subsistence to marketing, giving women a source of income, which is often re-invested in food, education and health care, improving social equity and empowerment (inconsistent evidence).

Non financial benefits →	Food security and nutrition	Health	Reduced vulnerability and diversification	Social equity and empowerment
Potential for impact from MUS	medium to high	medium	low to medium	medium

3.2.1 Home gardens: Examples of Supporting Evidence

- In South Africa, 45% of households with intermediate multiple-use services had cultivated home gardens, compared with 14% of those with basic domestic services. In Vietnam, 48% of households with intermediate service levels had home gardens, compared with 11% of those with no (improved) services (Perez de Mendiguren, 2003; Noel et. al., 2007). (see Annex A.2)
- In Nepal, daily vegetable consumption increased by 70% in poorest households with less than 0.5 ha of land through multiple-use service schemes (Pant, 2005). (see Annex A.1)
- In Nicaragua, households with the smallest plots and lowest incomes achieved the highest (comparatively) food security and nutrition benefits from improved water service levels (Alberts and van der Zee, 2003). (see Annex A.2)
- In Bangladesh, a survey of 45,000 households found that intake of Vitamin A and C was higher among households with home gardens, with quantifiable impacts on night blindness and diarrhea (Helen Keller Worldwide, 2001).

Women watering home gardens in Bolivia, South Africa and India.

Photo credits: Ronald Rospigliosi, Umgeni Water, and Accion Fraterna.

- During the recent droughts in Zimbabwe, small multiple-use productive water points allowed small-scale garden production when the major crops failed reducing vulnerability (Robinson et al 2004). (see Annex A.1)

Key findings

- Livestock serve as the most common asset base of the poor; around 70% of the world's rural poor own livestock, including some landless (well-supported).
- Livestock enhance ability to meet food security and protein needs, even with small numbers of animals (well supported).
- Additional benefits from livestock include transport, fertilizer, fuel and a reliable source of bankable credit (well supported).
- Providing adequate quality drinking water in sufficient quantities greatly increases livestock health and productivity and reduces morbidity (well supported).
- Women and children are most often responsible for watering and feeding livestock (well-supported); providing readily accessible water for livestock generates time savings and reduces drudgery for women and children and improves social equity.
- Higher level multiple-use services have additional social benefits (reduced time and labor) and environmental and human health impacts (controlled grazing and reduced pollution of human water sources) (partially supported).

Non financial benefits →	Food security & nutrition	Health	Reduced vulnerability	Social equity & empowerment
Potential for impact from MUS	medium to high	medium to high	high	medium to high

3.2.2 Livestock: Examples of Supporting Evidence

- In Vietnam, 56% of households with intermediate multiple-use services had livestock, compared with 22% of those with no (improved) sources (Noel et. al., 2007). (see Annex A.2)
- In India, households with basic multiple-use services reported an income 300% higher from livestock than households with no (improved) services (Upadhyay, 2004). (see Annex A.2)
- In Mauritania, households with intermediate multiple-use services had more livestock, more diverse nutritional diets and more reliable income compared to households with basic multiple-use services (Bingham, 2007). (see Annex A.2)
- In India and Ethiopia, women saved between 4-6 hours of walking time per day, as a result of improved livestock drinking water facilities (Upadhyay, 2004; van Hoeve and van Koppen, 2004).

Woman watering livestock with communal hand pump, India.

Photo credit: IRC

Key findings:

- An estimated 5-15% of poor households undertake water-dependent, informal, small-scale enterprises (anecdotal evidence).
- Small-scale enterprises provide valuable cash income to households, help tide families over during lean agricultural periods and enable an efficient barter of local produce, skills and benefits (well-supported).
- Small-scale enterprises are often owned by women, who operate them in or around the home (anecdotal evidence).
- Cash earned by women is often used to meet household food, education and health needs (anecdotal evidence).
- Along with demand for products and services, and human and financial capabilities, access to water is a key factor in promoting small scale-enterprises (anecdotal evidence).

Non financial benefits →	Food security & nutrition	Health	Reduced vulnerability	Social equity & empowerment
Potential for impact from MUS	low to medium	low to medium	medium to high	medium to high

3.2.3 Small-scale Enterprises: Examples of Supporting Evidence

- In Uganda, a study of 95% of the enterprises in 2 small peri-urban towns found that areas with low water service levels identified water as a key constraint to enterprise scale and productivity. Study results indicated small-scale enterprises require modest amounts of water—between 20-40 liters/water/day (Davis et. al., 2001).
- In South Africa, 60% of households with higher level multiple-use services engaged in 2 water-dependent enterprises, compared with only 38% of those with lower level services (Perez de Mendiguren, 2003). (see Annex A.2)
- In India, women gain social equity and empowerment from home-based enterprises. Income is re-invested in household food needs and children's education and health (James, 2003).

Woman making bricks, India.

Photo credit: Charles Batchelor

Woman brewing sorghum beer, South Africa

Photo credit: Stef Smits

Key findings

- Domestic use of irrigation water is prevalent in areas without potable groundwater or access to basic domestic water services (well supported).
- While the quality of drinking water is an important health issue, research shows that having water available in sufficient *quantities* for drinking and hygiene is equally important in preventing diarrheal diseases, especially when combined with improved hygiene (well supported).
- Providing irrigation water for domestic uses, coupled with home water treatment, may improve health more quickly and cost-effectively than piped domestic schemes (inconsistent evidence).
- Alterations in the design of irrigation systems to support water collection for domestic use can help prevent drownings and reduce schistosomiasis (partially supported).

Man bathing in irrigation canal, Sri Lanka

Photo Credit: Ronald Loeve

- In Pakistan and Morocco, many communities rely on communal storage reservoirs that are regularly filled with irrigation releases to meet their domestic needs (Boelee and Lamraani, 2003). (see Annex A.3)
- In Sri Lanka, shallow wells used to collect irrigation seepage water from canals and fields proved to be the best source of drinking water available, as deeper groundwater was contaminated by fluoride and surface canal water was contaminated by bacteria (Shortt et al., 2003).
- A study of domestic use of irrigation water in Pakistan showed that people in houses with their own water connection and a water-storage facility (even if the water supplied was irrigation water) suffered less often from diarrhea--mainly because of higher standards of hygiene and better sanitation enabled by a more readily available water supply (van der Hoek et al 2001).

Children collecting water for household use from irrigation canal, Morocco

Photo credit: Menno Houtstra

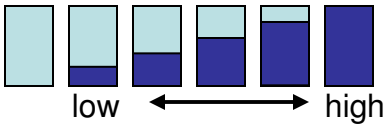
Community storage tank for domestic use of irrigation water, Pakistan.

Photo credit: Jeroen Ensink

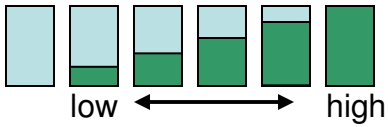
Poverty dimension	Potential Impacts	
	Domestic	**Irrigation**
Low income	- Indirect impact through increased time for productive activities **Domestic+ adds:** - Direct impact through marketed production from gardens, livestock, other enterprises	Direct impact for those with irrigated land Indirect impact on landless through labor opportunities **Irrigation+ adds:** - Direct impact on landless through marketed production from communal gardens, livestock, other activities - Indirect impact through increased time for productive activities
Poor food security/ nutrition	- Indirect impact on nutrition through better absorption of nutrients due to less diarrheal disease **Domestic+ adds:** - Direct impact through household consumption of vegetables, fruits, livestock products	- Direct impact for those with land - Indirect benefit through increased purchasing power/bartering **Irrigation+ adds:** - Direct impact though better food security & more diversified diets - Indirect impact on nutrition through less diarrheal disease
Poor health	- Direct impact through reduced water-related disease **Domestic+ adds:** - Indirect health improvement through better nutrition	- Indirect impact through improved nutrition **Irrigation+ adds**: - Direct impact through reduced water-related disease
Vulnerability	- Direct impact on to vulnerability natural conditions (drought) **Domestic+ adds:** - Reduced economic & health vulnerability (home gardens & livestock made less vulnerable to drought - ensuring food security & income) - Reduced vulnerability to water-related disease & physical vulnerability for women and girls when fetching water - Reduced social vulnerability (especially for women)	- Direct impact on vulnerability to natural conditions (drought) **Irrigation+ adds:** - Reduced economic vulnerability by enabling diversified livelihood strategies - Reduced health vulnerability (see above) & physical vulnerability for women and girls when fetching water - Reduced social vulnerability (especially for women)
Social inequity, disempowerment& exclusion	- Direct impact if access to water equitable **Domestic+ adds:** Indirect impact through improved bargaining/purchasing power (often for women)	- Direct impact on those with title to irrigated land and enforceable water rights (often men only) **Irrigation+ adds:** Direct impact on women and landless

Degree of impact on poverty dimension:

Domestic+



Irrigation+



Illustrative progressive staging of benefits with improvements in service levels

Poverty dimension →	health	time savings	income	improved food security/ nutrition	diversification of livelihoods; reduced vulnerability	equity and empowerment
Highest-level multiple-use services						
Intermediate-level multiple-use services						
Basic-level multiple-use services						
Basic domestic/ Basic irrigation*						

* Assumes no unplanned uses as they cannot assure sustainable generation of benefits.

3.3.2 Supporting Pathways Out of Poverty

Both single and multiple-use services contribute to poverty reduction, but services that impact on a wider range of aspects of poverty have a greater scope for enabling pathways out of poverty by reducing vulnerability and supporting asset accumulation.

	Single-Use		Multiple-use	
	Domestic	Irrigation	Domestic+	Irrigation+
1. Enabling basic subsistence: Reducing chronic poverty for resource-poor households				
Improving health through safe drinking water, reducing time and labor burdens, especially for women and occasionally for children	✓		✓	✓
Improving food security and nutrition from productive subsistence livelihoods		✓	✓	✓
Enhancing social equity, empowerment and social cohesion through meeting both domestic and productive needs, possibly enabling equitable access, use and management of available water	**Partially**	**Partially**	✓	✓
2. Enabling simple-accumulation livelihoods: Allowing households with some resources to increase secure assets				
Reducing time and labor fetching water thereby freeing time for additional productive activities	✓		✓	**Partially**
Reducing uncertainty and risks relating to existing livelihoods (cultivation and livestock rearing)		**Partially**	✓	✓
Enabling food security and nutrition through consumption *and* sale of produce (income often used to supplement household food security and diet diversity and to upgrade existing livelihood practices)		✓	✓	✓
Improving social standing in the community as a result of increased ability to trade labor and goods		✓	✓	✓
3. Enabling higher-return livelihoods: Allowing households with more secure assets to move out of poverty				
Enabling investments and risks in new livelihood opportunities, offering potential for home –based enterprises, often undertaken by women	**Partially**	**Partially**	✓	✓
Enabling start-up of informal small-scale enterprises that have higher rates of return and generate cash incomes (often used for household food, health and education needs or reinvested in new enterprises) and which generally require relatively little water compared to livestock and gardens		**Partially**	✓	✓

3.3.3 Sustainability Considerations: Key Findings

Key Findings

- **Sustained access to water services is critical to achieving poverty impacts**.

- **Unplanned multiple uses of single-use domestic and irrigation systems** are widespread and these unplanned uses **threaten sustainability of water services** (well supported). Unplanned uses frequently result in system breakdowns, resource inefficiencies, poor cost-recovery and conflicts.

- **Explicitly catering to multiple uses enhances sustainability of water services** by better addressing needs for domestic and productive uses leading, generating financial and non-financial benefits and increasing ability and willingness to pay for improved services (partial evidence).

    - Due to relatively limited documentation available on long-term sustainability of multiple-use services due to the prevalence of single-use approaches, pilot implementation activities should include carefully designed monitoring and evaluation programs to further assess sustainability of multiple-use services.

Findings from the Multiple Use Systems project, part of the Challenge Program on Water and Food. Data gathered from over 25 multiple-use sites in 8 countries in Latin America, Asia and sub-Saharan Africa found evidence that not explicitly planning for multiple uses in water services resulted in sustainability problems of the services (van Koppen, et al. 2008 forthcoming).

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2. Findings: Poverty impacts

3. Findings: Incremental costs and benefits

4. Findings: Market Mapping

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4.1 Overview and Key Findings
4.2 Domestic+—market mapping
4.3 Irrigation+—market mapping

4.1 Market Mapping: Overview

A key knowledge gap has been lack of information on potential markets for multiple-use approaches. Based on observed widespread uses of domestic and irrigation systems for unplanned domestic and productive uses and low rates of coverage for basic access, some sector experts have suggested the potential market for multiple-use approaches is large.

To test this hypothesis for domestic+ services, the study estimated:

- The number of estimated rural populations by service level in South Asia and sub-Saharan Africa (see 1.3.3 and 1.3.4 for service level definitions) disaggregated by technology/water source.
- Markets with the highest potential based on results of cost-benefit analysis for different technologies and service levels.
- The socioeconomic characteristics of households in these markets to determine if they could benefit from domestic+ multiple-use services.

For irrigation+, the study estimated:

- The number of people living in irrigation command areas, and of those, the number without access to basic domestic water services.
- Markets with highest potential based on results of cost-benefit analysis for different service levels.
- The socioeconomic characteristics of households in these markets.

See background section for details on methodology (1.3.7) and study limitations (1.4).

Key Findings

The potential market for multiple-use approaches is large (> 1 billion): Based on an analysis of current service levels, technologies, benefits and costs, a number of high potential markets (opportunity action areas) have been identified in South Asia and sub-Saharan Africa:

Domestic+ market:

- **New piped multiple-use water services—137 million**, South Asia (56m) and sub-Saharan Africa (81m)
- **Upgrading existing services—539 million**, South Asia (450m) and sub-Saharan Africa (89m)
  - upgrading services for those relying on piped systems—public standpipes (185m)
  - upgrading household dug wells through protection and improved lifting devices (74m)
  - in situ add-ons for those relying on boreholes, which are mostly fitted with hand pumps (280m).

Irrigation+ market:

- **Upgrading existing services—447 million**, South Asia (443m) and sub-Saharan Africa (4m)
  - incremental add-ons to support livestock (290m)
  - communal water storage, home water treatment to support domestic uses (112-225m)

Achieving potential at scale will depend on an enabling environment, including adequate water resources, political willingness reflected in enabling policies and potential investments, entry points for implementation approaches to scale-up, and institutional readiness at local, intermediate and national levels.

4.2 Domestic+ Market: Key Findings

Key Findings:

- The potential market for domestic+ multiple use approaches is substantial—over 800 million.
- In sub-Saharan Africa, the largest potential domestic+ market is for rural populations currently without services—267 million. The potential market for upgrading existing services is also substantial—111 million.
- In South Asia, the largest potential domestic+ market is for rural populations with water services at the domestic/basic multiple-uses level—328 million. The market for those currently without services is substantial—184 million, offering opportunities for significant impact at scale.

Estimated population (millions) by current water service levels

Region	Highest MUS	Intermediate MUS	Domestic/ Basic MUS*	No Services	Total
South Asia	81	453	328	184	1,047
Sub-Saharan Africa	20	60	111	267	458
Total	101	513	439	451	1,505

Estimated using JMP (2004) and WHO Health Survey (2003) data.

*Note: Due to data limitations we were not able to disaggregate those with water services at the domestic vs. basic multiple-uses service levels

4.2.1 Domestic+ Market: Disaggregation by Technology in Sub-Saharan Africa

Key Findings:

- Potential is significant for new domestic+ services, which will likely follow existing technology trends. Piped systems serve the largest rural populations in sub-Saharan Africa (37% from public standpipes and 10% from household connections), followed by boreholes (31%) and protected dug wells and springs (21%).[1]
- Potential is also significant for upgrading existing domestic services to the intermediate multiple-use service level (and higher), including: domestic piped systems (41 million), nearby protected dug wells/springs (14 million),[2] and boreholes (60 million) from the basic domestic/basic multiple-use service level to the intermediate multiple-uses service level.

Estimated population (millions) by service level and technology/source: sub-Saharan Africa

Service level	Piped water to house/ yard	Public standpipe	Protected tube well or borehole	Protected dug well or spring	Unprotected dug well or spring	Rainwater (into tank or cistern)	Water from pond or stream	Tanker -truck, vendor	Total
Highest MUS	20								20
Intermediate MUS		29	17	14					60
Basic Domestic/ Basic MUS		41	43	27					111
No Services		19	11	10	112	13	83	19	268
Total	20	89	71	51	112	13	83	19	458

An estimated 25% of this population—28 million—relies on unprotected household dug wells, which could be upgraded through well-protection and improved lifting devices such as treadle and rope pumps.

Estimated using JMP (2004) and WHO Health Survey (2003) data.

4.2.2 Domestic+ Market: Disaggregation by Technology in South Asia

Key Findings:

- Potential is significant for upgrading existing domestic services to the intermediate multiple-uses service level (and higher), including piped systems (144 million), boreholes (407 million), and nearby protected dug wells/springs (94 million).[3] Significant potential also exists to upgrade services from household hand-dug wells through well protection and improved lifting.
- Potential is significant for new services, which will likely follow existing technology trends. Boreholes serve the largest rural populations in South Asia (47%), followed by piped systems (32% from public standpipes[4] and 9% from household connections) and protected dug wells and springs (11%).

Table 8. Estimated population (millions) by service level and technology/source : South Asia

Service level	Piped water to house/ yard	Public standpipe	Protected tube well or borehole	Protected dug well or spring	Unprotected dug well or spring	Rainwater (into tank or cistern)	Water from pond or stream	Tanker-truck, vendor	Total
Highest MUS	81								81
Intermediate MUS		136	263	54					453
Basic Domestic/ Basic MUS		144	144	40					328
No Services		28	20	7	68	17	35	9	184
Total	81	308	427	101	68	17	35	9	1,047

An estimated 25% of this population—17 million—relies on unprotected household dug wells, which could be upgraded through well-protection and improved lifting devices such as treadle and rope pumps.

Estimated using JMP (2004) and WHO Health Survey (2003) data.

4.2.3 Domestic+ Market in sub-Saharan Africa and South Asia Based on Economic Feasibility

Key Findings: Linking cost and benefit analysis with populations by technology and service level reveals 4 high-potential domestic+ markets:

1) **Providing new piped services at the intermediate multiple-uses service level for those with "no services"—137 million**
(sub-Saharan Africa—81 million, South Asia—56 million).
   - Based on current technology trends, we estimate 30% of the those currently without services will receive new piped services.

2) **Upgrading existing piped systems at the basic domestic/basic multiple-uses level to the intermediate multiple-uses service level—185 million**
(sub-Saharan Africa—41 million, South Asia—144 million)

3) **Upgrading boreholes w/ hand pumps w/ in situ add-ons to basic multiple-uses service level—280 million**
(sub-Saharan Africa—17 million and South Asia—263 million)[5]

4) **Upgrading hand-dug wells to the intermediate multiple-uses service level —74 million**
(sub-Saharan Africa—31 million, South Asia—43 million)
   - Based on WHO Health Survey data, which contain information on proximity to source, we estimated that 25% (14 million) of the population in the "protected dug well or spring" at the intermediate multiple-use service level, and 25% of the population (17 million) in the "unprotected dug well or spring" at the "no service" level, have household/multi-household wells that could be upgraded to the intermediate service level through improved lifting and well-protection.

Maps with estimates of populations by country are presented in the Opportunities for Action section

Key Findings

- **Wealth – Households in potential markets tend to be in the lower wealth quintiles.**
  - Poorer households are more likely to have no water services or to rely on communal shared sources compared to wealthier households. Countries with very low safe drinking water coverage rates, such as Ethiopia, are exceptions--here reliance on public standpipes is positively correlated with wealth.

- **Assets – Poor households do have the assets (land and livestock) to make productive use of domestic+ water services**
  - Households in the lower wealth quintiles are more likely to have livestock and either own or have access to land, suggesting they are able to benefit from productive water. This data corroborated evidence from global poverty surveys and case studies that ~70 percent of rural poor own livestock or have access to small cultivable plots, often near the homestead, that could be used for productive activities.

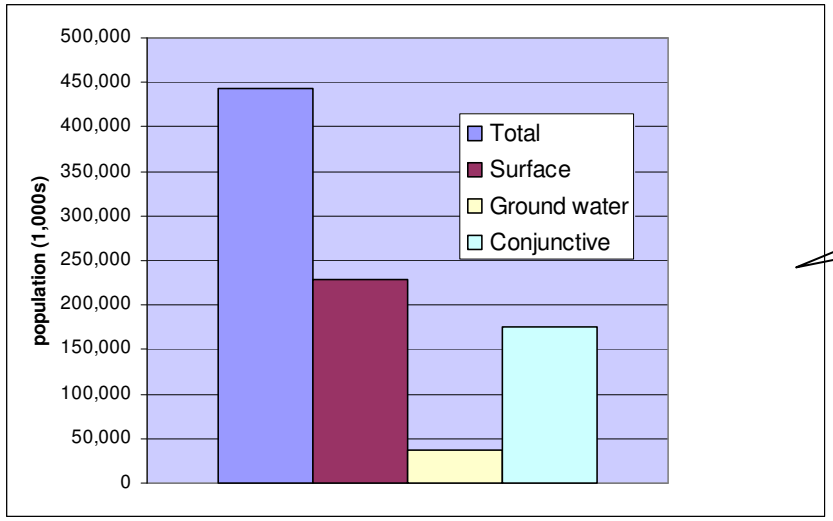
- **Health – Poor households especially can benefit from improved food security and nutrition**
  - Lower wealth quintiles were associated with higher food insecurity and greater deficiencies of protein, vitamins A and C, suggesting that home gardens and livestock could positively impact these households.

4.3 Irrigation+: Key Findings

Key Findings:

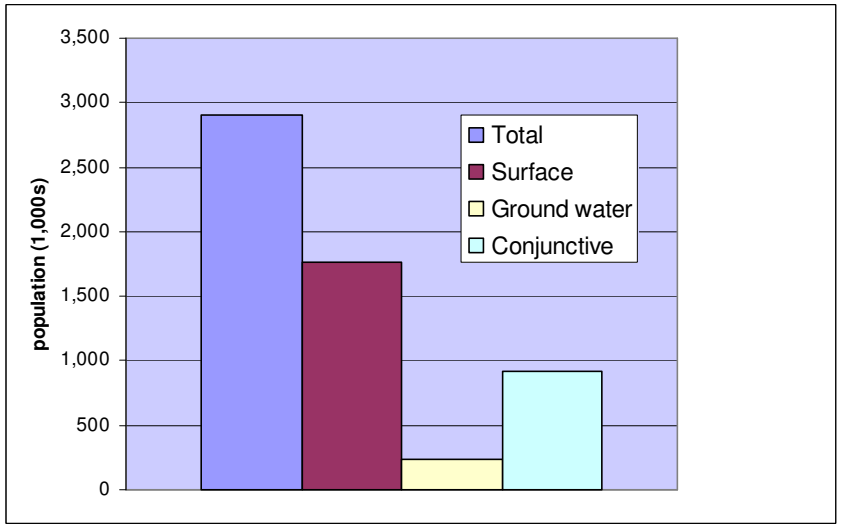
- **The potential irrigation+ market for multiple uses is substantial (~ 450 million)**
- The largest potential market is in **South Asia,** where an **estimated 447 million** people live within irrigation command areas.
- In **sub-Saharan Africa, the numbers are much smaller—3.5 million**. However, these numbers do not capture small-scale systems, which are much more prevalent in sub-Saharan Africa.
- For large-scale irrigation systems, there is greater potential for multiple-use approaches based on total number of potential beneficiaries living in areas with irrigation facilities and relatively easy access to centrally managed large systems.

South Asia: Estimated Population in Irrigation Areas



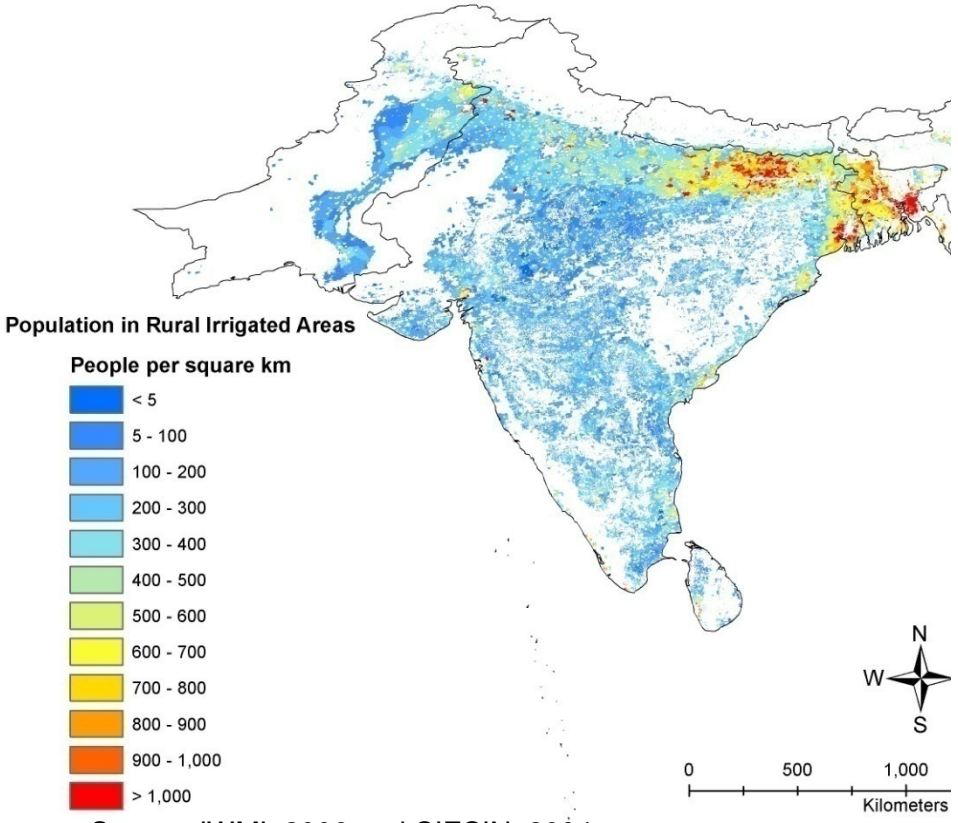
The largest potential market for irrigation+ is in South Asia

Sub-Saharan Africa: Estimated Population in Irrigation Areas



Source: IWMI, 2006 and CIESIN, 2004.

Spatial distribution of estimated rural populations living in irrigated areas in South Asia



Source: IWMI, 2006 and CIESIN, 2004.

4.3.2 Irrigation+ Market Based on Economic Feasibility

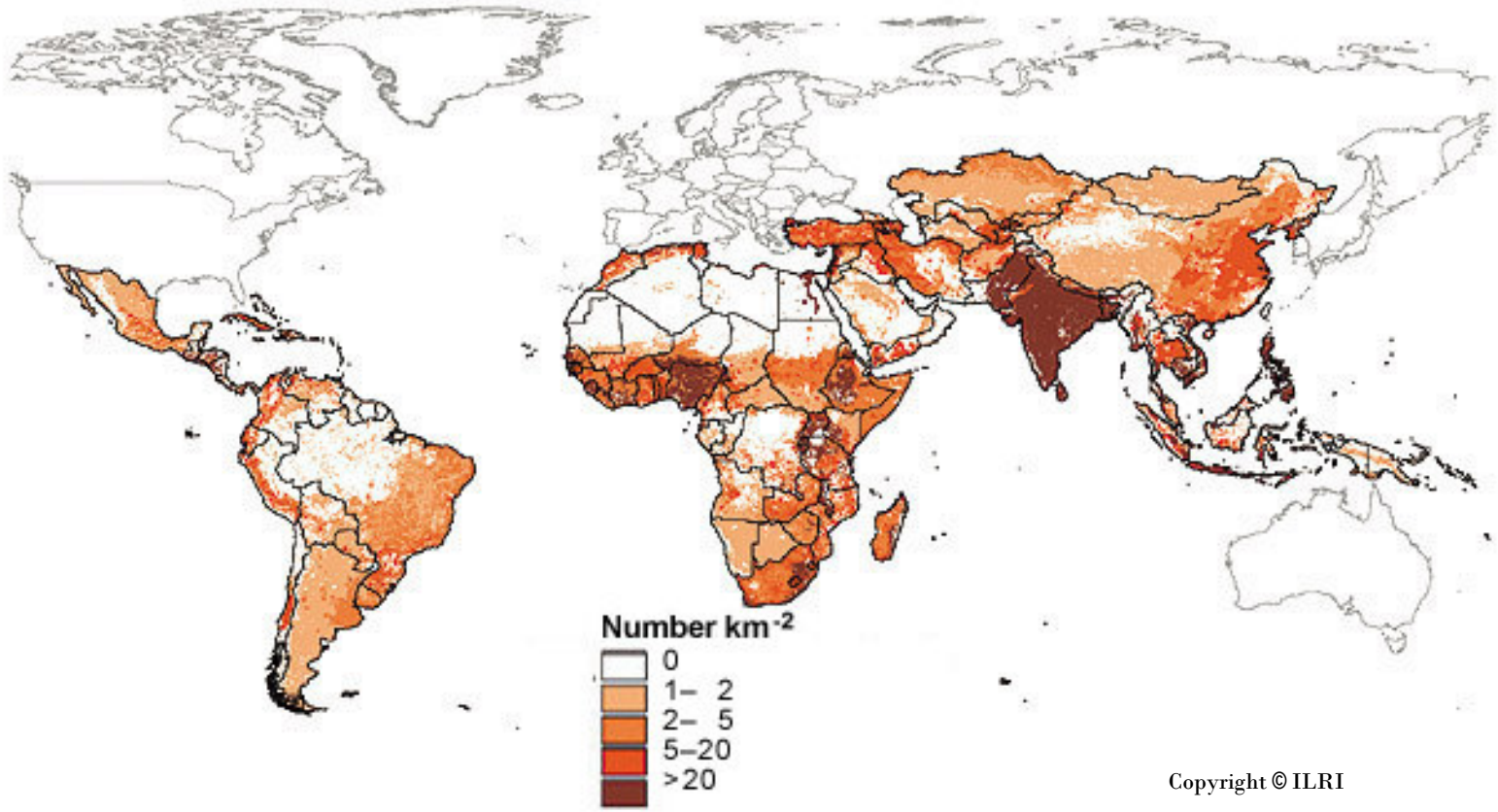
Key Findings: Linking cost and benefit analysis with populations in irrigated areas reveals 2 high potential markets that are concentrated in South Asia:

1) **Upgrading existing basic irrigation services to the basic multiple-use service level through communal add-ons to support livestock—290 million (mostly South Asia)**
   - An estimated 60-70% of households in rural areas have livestock holdings. Within irrigation command areas, the density of livestock holdings is higher (Molden et al., 2007; Peden et al., 2007). In this study, we estimate that 65% of those living in irrigated areas have livestock and can benefit from formal allocations of irrigation water for livestock drinking needs, including technical improvements to facilitate use.

2) **Upgrading existing basic irrigation services to the intermediate multiple-uses service level through improved communal and home water storage to support domestic and non-irrigation productive uses—112-225 million (mostly South Asia).**
   - An estimated 25-50% of the population in irrigation command areas could benefit from improved communal and household water storage. Further research is needed to refine this estimate. Of this population, an estimated 81 million could benefit from home water treatment and hygiene education. The latter estimate is based on current rural water supply coverage rates in South Asia, where an estimated 18% of the population living in irrigation command areas lack access to safe drinking water. Although specific evidence is lacking, irrigation+ case studies reviewed in this study suggest that health benefits are significant in formal allocation of surface irrigation water for domestic purposes, especially in areas where ground water quality or quantity is a key constraint.

Key Finding: In addition to the data on socioeconomic characteristics of the potential markets based on the Demographic Health Survey Wealth Indices above, data on density of poor livestock holders (those living on less than $1/day) shows very high concentrations poor livestock holders in irrigated areas of South Asia who could potentially benefit from multiple use services.

Population densities of poor livestock holders



Endnotes for market mapping

1) For the purposes of the analysis, we assumed that approximately 30% of those without services (81 million) will receive new piped services based on current trends in technology for improved services.
2) Based on WHO Health Survey data, which contains information on proximity to source, we estimated that 25% of the population (3.5 million) in the “protected dug well or spring” at the intermediate multiple use service level and 25% of population (28 million) in the “unprotected dug well or spring” at the “no service” level, are household wells that could be upgraded to the intermediate service level through improved lifting and well-protection.
3) For the purposes of the analysis, we assumed that approximately 30% of those without services (56 million) will receive new piped services based on current trends in technology for improved services.
4) Based on WHO Health Survey data, which contains information on proximity to source, we estimated that 25% (14 million) of the population in the “protected dug well or spring” at the intermediate multiple use service level and 25% of population (17 million) in the “unprotected dug well or spring” at the “no service” level, are household wells that could be upgraded to the intermediate service level through improved lifting and well-protection.
5) To estimate populations who could benefit from upgrades to existing boreholes with hand pumps we used populations estimated at the “intermediate multiple –use service level”. We opted for nearby boreholes (those less than 150 m from point of use) because more distant boreholes are frequently face high demands on usage and may be unable to support productive uses. As a result, these population estimates should be considered as conservative as they likely under-estimate the total population who could potentially benefit.

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5.2 Opportunity 1: New piped systems for the currently unserved
5.3 Opportunity 2: Upgrading existing piped systems to multiple-use systems
5.4 Opportunity 3: Upgrading boreholes with hand pumps to support multiple uses
5.5 Opportunity 4: Upgrading existing household hand-dug wells to support multiple uses
5.6 Opportunity 5: Upgrading existing irrigation systems to support multiple uses

5.1 Overview of Opportunity Action Areas

Five high-potential areas for action have been selected based on financial sustainability; impact on well-being, health, and social empowerment; scalability; opportunities for leverage; and testing and learning opportunities.

Opportunity Action Area	**Potential Market & Pilot Locations**	**Capital investment costs/capita** hardware and software (per capita)	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
Opportunity 1. New piped multiple-use services for currently unserved at the intermediate service level	**137 million** (South Asia: 56 m SS Africa: 81 m) **Pilot: Nepal**	**$56-$105**	**$41-$50**	**3.4-7.8**
Opportunity 2. Upgrading existing domestic piped systems to intermediate multiple-uses service level	**185 million** (South Asia: 144 m SS Africa: 41 m) **Pilot: South Africa**	**$84**	**$45**	**4.7**
Opportunity 3. Boreholes with hand pumps: upgrading services to basic multiple-use service level through communal add-ons to support multiple uses	**280 million** (South Asia: 263m SS Africa: 17m) **Pilots: India and Burkina Faso**	**$25**	**$22**	**5.4**
Opportunity 4. Upgrading existing household hand-dug wells to the intermediate multiple-use service level through well protection and improved lifting devices	**74 million** (South Asia: 43m SS Africa: 31m) **Pilots: Zimbabwe and Mali**	**$39 - $102**	**$47-$55**	**3.4-8.6**
Opportunity 5. Upgrading existing irrigation systems to basic and intermediate service levels through communal add-ons, domestic storage and water treatment	**447 million** (South Asia: 443m SS Africa: 4m) **Pilot: Sri Lanka**	**$10 - $110**	**$50-$57**	**2.9 - 27**

5.2 Opportunity 1. New piped systems for the currently unserved: from no services to intermediate multiple-use services

What's involved:

Based on current trends, an estimated 30% (137 million) of those without services in South Asia and sub-Saharan Africa will receive water from networked piped systems over the next 20-30 years. An opportunity exists to leverage planned investments and enhance financial, technical and social sustainability through provision of multiple-use services. This opportunity involves provision of water services at the intermediate multiple-use service level with communal standposts (< 150m, <5 minutes roundtrip, 40-100 lpcd).

Types of uses supported: All drinking and domestic needs met, plus a combination of the following: home gardens (25-200m^2), livestock, and many small-scale enterprises (food processing, construction, etc.).

Selected learning opportunity area:

Nepal

- Potential for low-cost gravity-fed spring systems, which means lower investment costs (<$20/capita)
- Good water availability
- Capacity to scale up MUS: critical mass of aware NGOs, established models of MUS in operation, intermediate level organizations endorse MUS approach, relatively high level of institutional readiness
- Opportunities to leverage existing and planned investment
- Existing micro-credit facilities
- High potential to scale-up

Potential Market	**Capital investment costs/capita** hardware and software (per capita)	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
137 million (South Asia: 56 m SS Africa: 81 m)	**$56-$105**	**$41-$50**	**3.4-7.8**

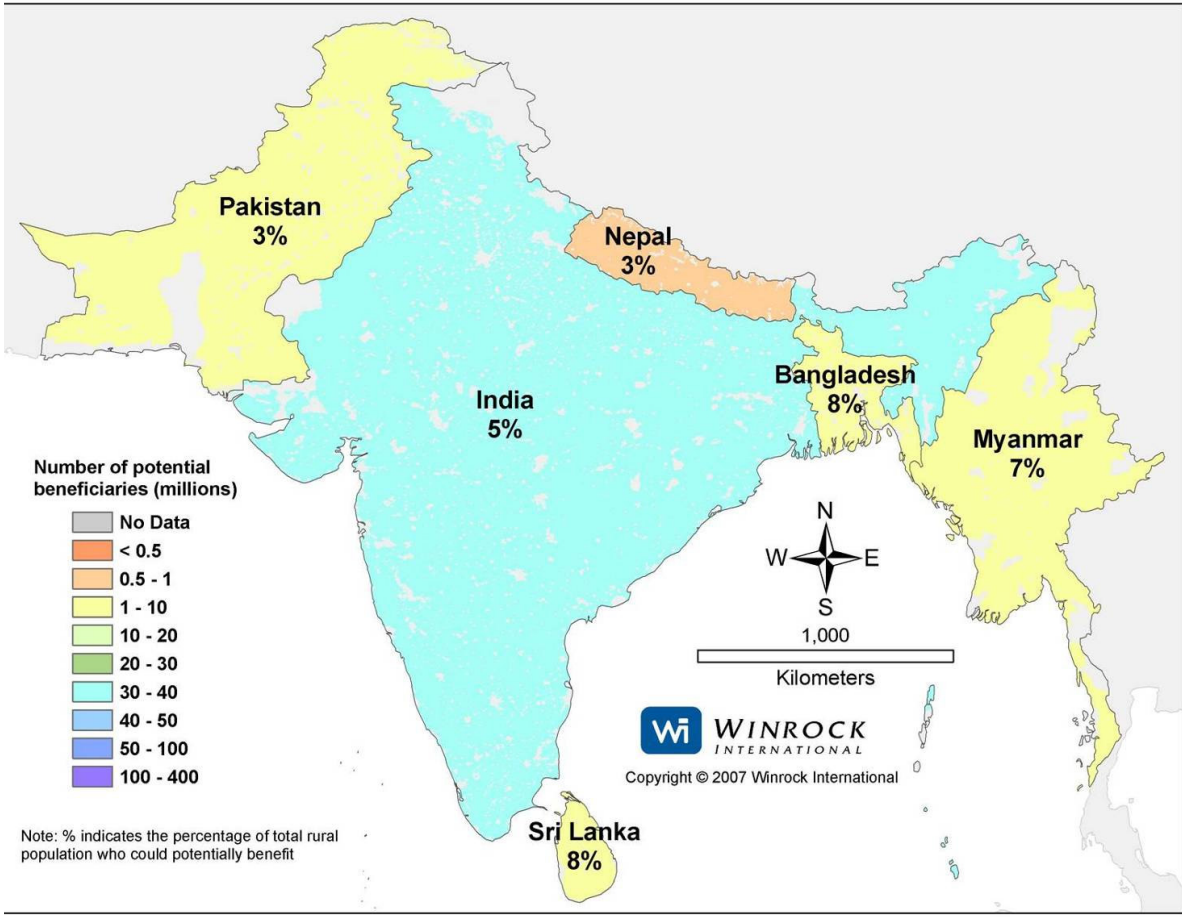
5.2.1 Opportunity 1. South Asia

Potential South Asia market: 56 million

In terms of absolute number of potential beneficiaries: Largest market is India

In terms of percentage of rural population that could be reached: Bangladesh and Sri Lanka are largest

Pilot: Nepal is a smaller market but offers the opportunity to reach > 500,000 rural beneficiaries with a proven low-cost service model; enabling conditions are good and potential for scaling up is high.

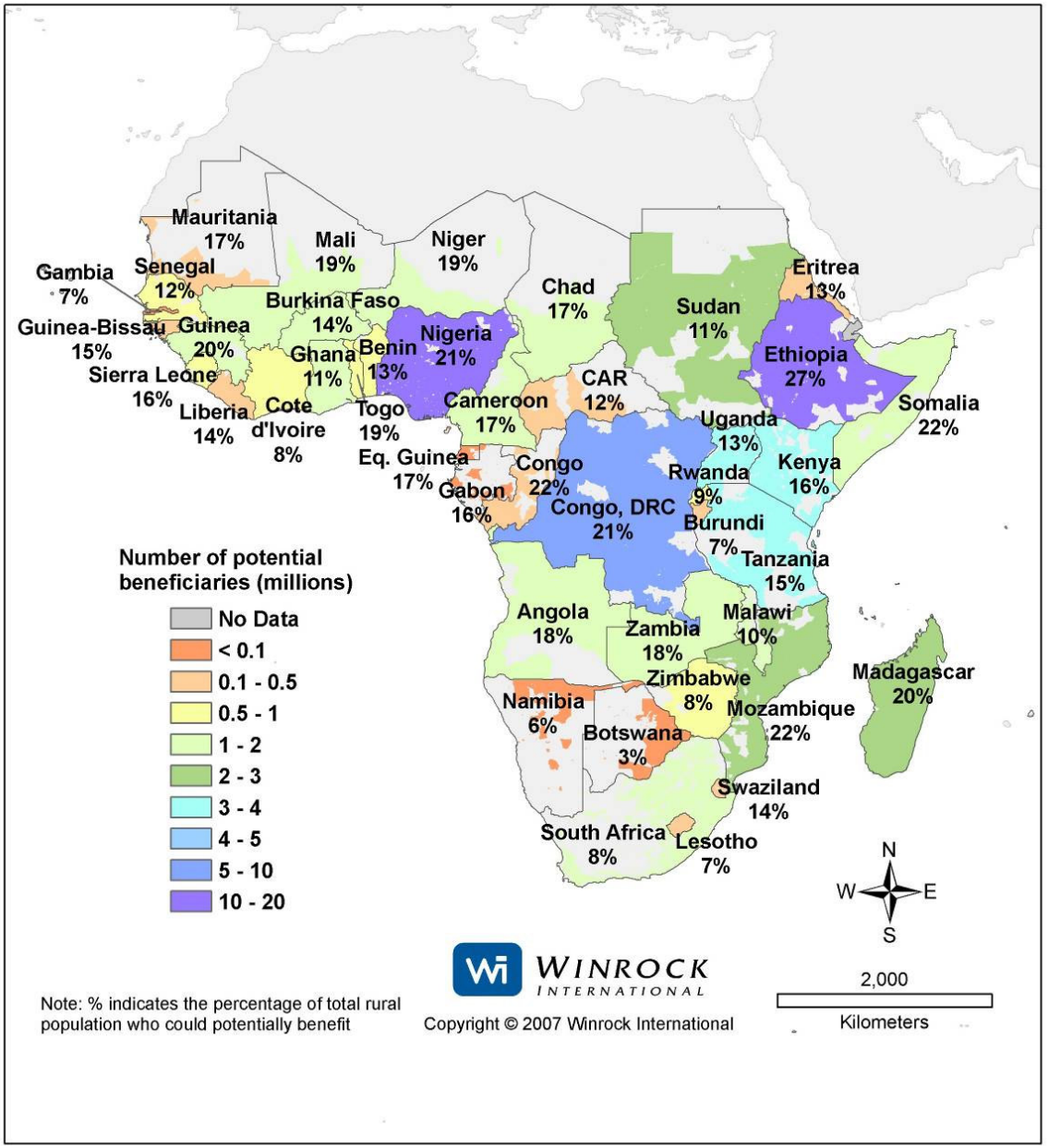


Potential sub-Saharan Africa market: 81 million

In terms of absolute number of potential beneficiaries: Largest markets are Nigeria, Ethiopia, DRC Congo, Kenya, Tanzania and Uganda

In terms of percentages of rural population that could be reached: Largest markets are Ethiopia, Mozambique, Somalia, Nigeria, DCR Congo, Madagascar and Guinea

Markets are sufficiently large and concentrated to achieve significant impact at scale. They offer opportunities to reduce costs through economies of scale and potential to accelerate and even "leap-frog" costs associated with enabling environment due to "critical mass" effects and learning.



What's involved:

An estimated 390 million people in rural areas of sub-Saharan Africa and South Asia rely on communal piped systems to meet their water needs. This opportunity action area targets about 40% of this population by increasing the density of communal standposts from an improved source to within <150m of households (5 minutes roundtrip); adding some yard taps and increasing quantity to provide reliable access to 40-100 lpcd. Technical and managerial support is provided for improved community management and productive activities.

Types of uses supported: All drinking and domestic needs met and a combination of the following: home gardens (25-200m^2), livestock and most small-scale enterprises.

Selected learning opportunity area:

South Africa

- Explicit government policies, norms and standards supportive of multiple uses
- Significant knowledge base on multiple uses in South Africa
- Some international and local NGOs implementing multiple uses
- Iintermediate level organizations endorse the MUS approach
- Significant potential for implementing intermediate and highest level multiple uses, particularly in small rural towns and peri-urban areas
- High potential to scale up

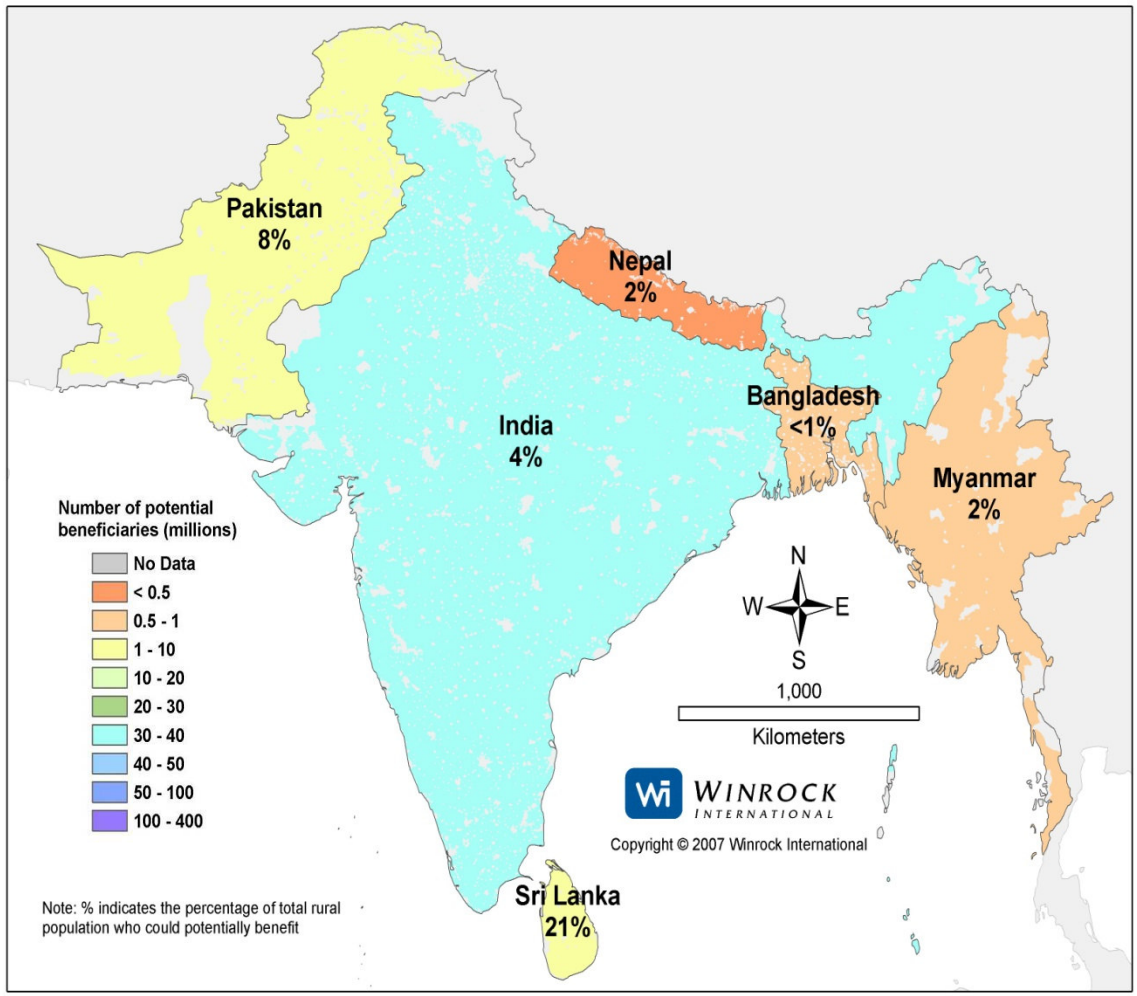
Potential Market	**Capital investment costs/capita** hardware and software (per capita)	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
185 million (South Asia: 144 m SS Africa: 41 m)	**$84**	**$45**	**4.7**

Potential South Asia market: 144 million

In terms of absolute number of potential beneficiaries: Largest markets are India and Pakistan

In terms of percentages of rural population that could be reached: Largest markets are Sri Lanka and Pakistan

Further scoping work should examine opportunities for upgrading piped systems, particularly in Pakistan and India



5.3.2 Opportunity 2. sub-Saharan Africa

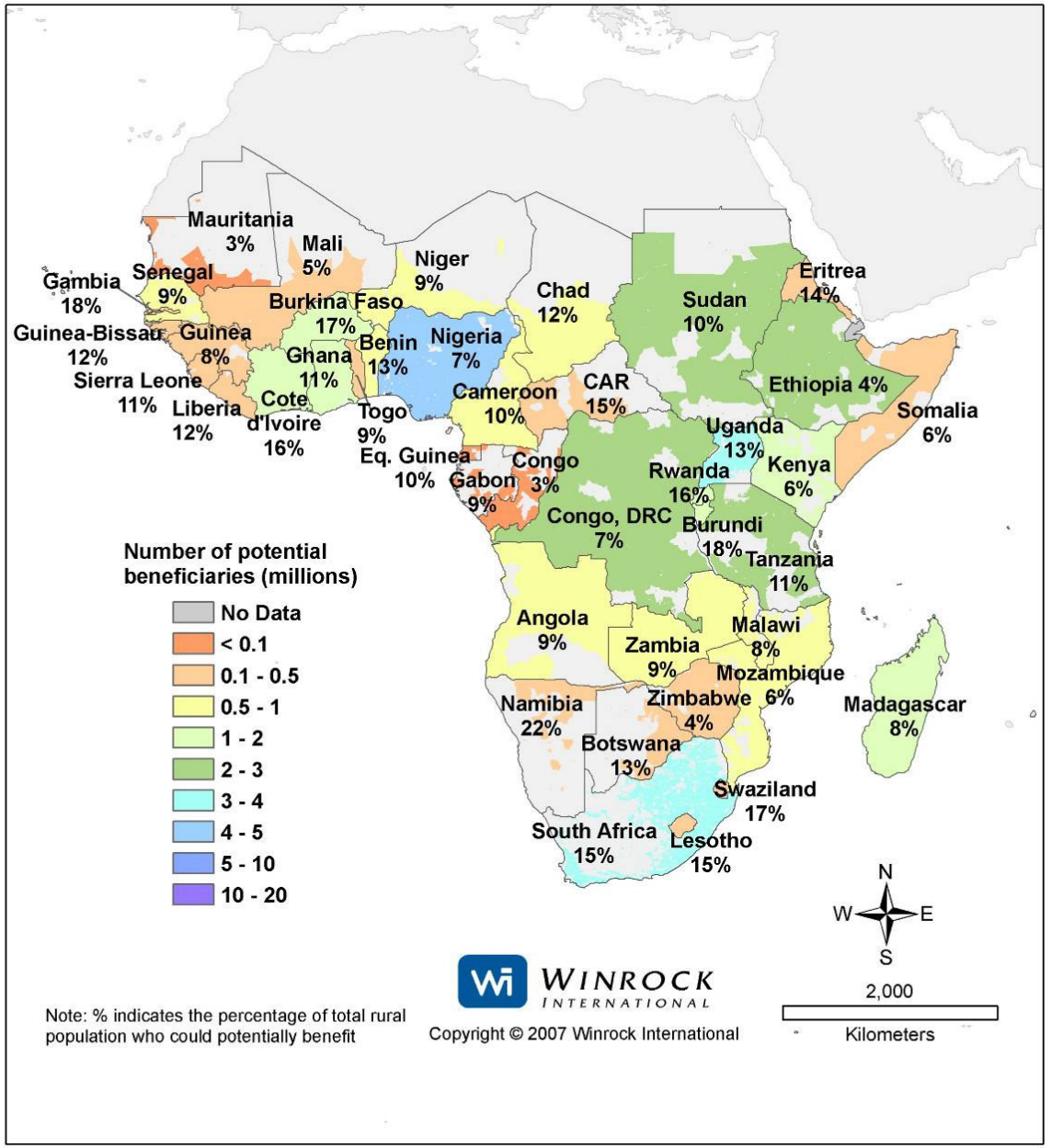
Potential market: 41 million

Absolute number of potential beneficiaries: Largest markets are Nigeria, South Africa, Uganda, Tanzania, Sudan, Ethiopia, DCR Congo and Burundi

Percentages of rural population that could be reached: Largest markets include: Namibia, Burundi, Gambia, Swaziland, Burkina Faso, South Africa and Lesotho

Pilot: South Africa offers the potential to reach more than 3 million people and has a good enabling environment and high potential for scale-up.

Further scoping work should examine opportunities and enabling environments throughout sub-Saharan Africa, with a focus on areas where 10% or more of the rural population could potentially be reached



What's involved:

Communal boreholes with hand pumps provide water for an estimated 30-40% of rural populations (~500 million) in South Asia and sub-Saharan Africa. As a point-source, with limited opportunities for incrementally expanding services (except moving to network systems, which involve significant lumpy investments), incremental add-ons (such as cattle troughs) and community gardens can be provided to support multiple uses *in situ.* The level of service provision, in terms of quantity, depends on demands and pump capacity. Water can generally be transported to the garden plots manually and can be combined with low cost drip systems to increase efficiency.

Types of uses supported: Domestic uses plus livestock and community gardens of various sizes (w/ member plot size ranging from 20m^2 on up)

Selected learning opportunity areas:

India:

- Opportunity to scale up segregated ad hoc efforts by local and international NGOs that currently implement MUS approaches
- Adequate water in many areas
- Good management capacity, financing and credit facilities
- Leader in livestock and garden cooperative activities for poor households, but efforts limited to some states only

Burkina Faso:

- High-level of institutional readiness; government policy promoting and supporting multiple uses
- Good capacity to implement among government line agencies and local and international NGOs
- Established credit facilities

Potential Market	**Capital investment costs/capita** hardware and software (per capita)	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
280 million (South Asia: 263m SS Africa: 17m)	**$25**	**$22**	**5.4**

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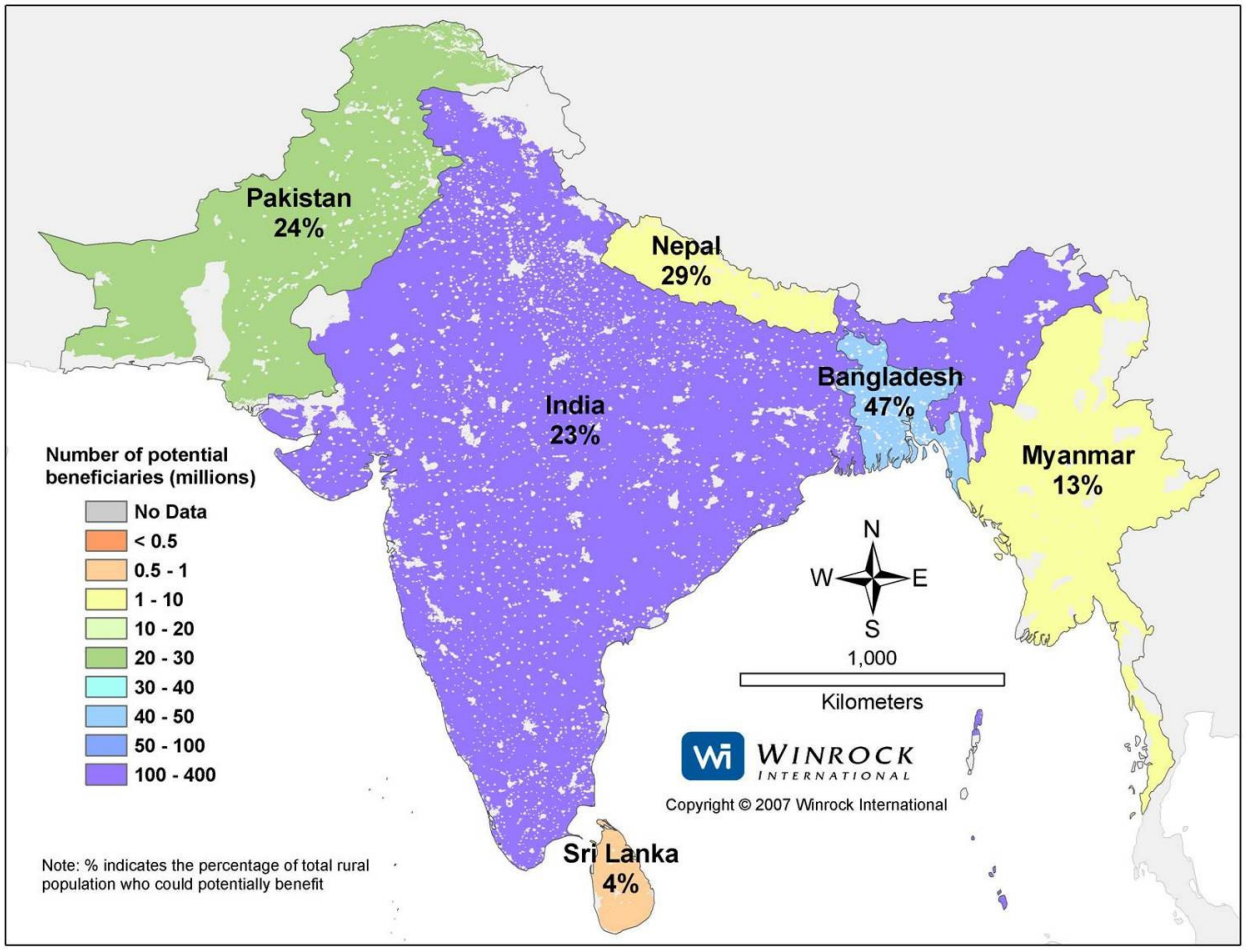
Potential South Asia market: 263 million

In terms of absolute number of potential beneficiaries: Markets are large in all of South Asia, but especially in India with an estimated market of 180 million

In terms of percentage of rural population that could be reached: Largest markets are Bangladesh, Nepal, Pakistan and India

Pilot: India offers significant opportunities for piloting. Given its size, efforts should focus on piloting-at-scale by clustering activities, possibly in 2-3 locations, to test scale-up models.

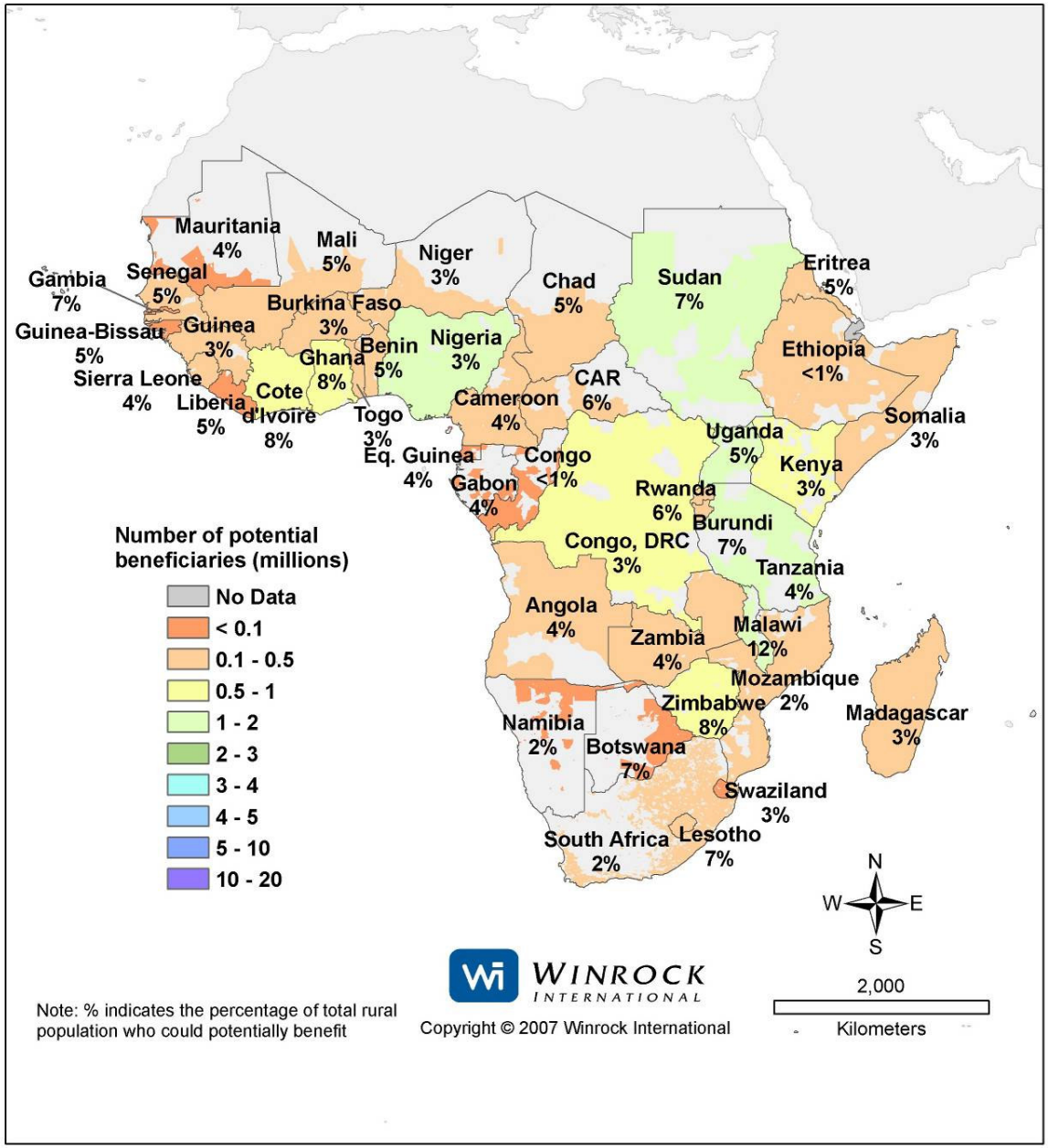


Potential sub-Saharan Africa market: 17 million

In terms of absolute number of potential beneficiaries: Largest markets are Malawi, Sudan, Tanzania, Burundi, Nigeria, Kenya, Zimbabwe, DRC Congo, Cote d'Ivoire and Ghana

In terms of percentage of rural population that could be reached: Largest are Malawi, Ghana and Zimbabwe

Further scoping work should examine opportunities for boreholes that are more distant. To be conservative, this analysis included only populations with boreholes less than 150 meters from point-of-use. Multiple-use services could potentially reach an additional 43 million people who receive water from borehole sources <1 km from point-of-use.



What's involved: Over 150 million people in rural South Asia and sub-Saharan Africa rely on hand-dug wells to meet their water needs. Approximately one-half of these wells are estimated to be household/multi-household wells. Upgrading wells to support multiple uses involves well protection, if necessary, to improve water quality for drinking and domestic needs and improved lifting devices to increase the quantity available for productive uses. This opportunity for action offers significant potential for private sector involvement by supporting value-chains that produce and market low-cost pumps and drip kits.

Types of uses supported: All drinking and domestic needs met, plus a combination of the following: home gardens (25-200m^2), livestock and many small-scale enterprises (food processing, construction, etc.).

Selected Learning Opportunity Areas:

Zimbabwe:

- Significant scope for upgrading hand-dug wells with proven low-cost strategies for multiple uses, particularly for improved lifting devices such as the rope pump. Typical cost for protection and improved lifting devices is $225/well, often shared by a couple of households.
- High capacity among international and local NGOs implementing MUS.
- Relatively high level of institutional readiness—government policy, norms and standards conducive/supportive of MUS approaches.

Mali:

- Significant scope for upgrading hand-dug wells with proven low-cost strategies.
- Growing private sector markets and value-chains to provide improved lifting devices.
- Good capacity among local and international NGOs implementing multiple-use approaches.

Potential Market	**Capital investment costs/capita** hardware and software (per capita)	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
74 million (South Asia: 43m SS Africa: 31m)	**$39 - $102**	**$47-$55**	**3.4-8.6**

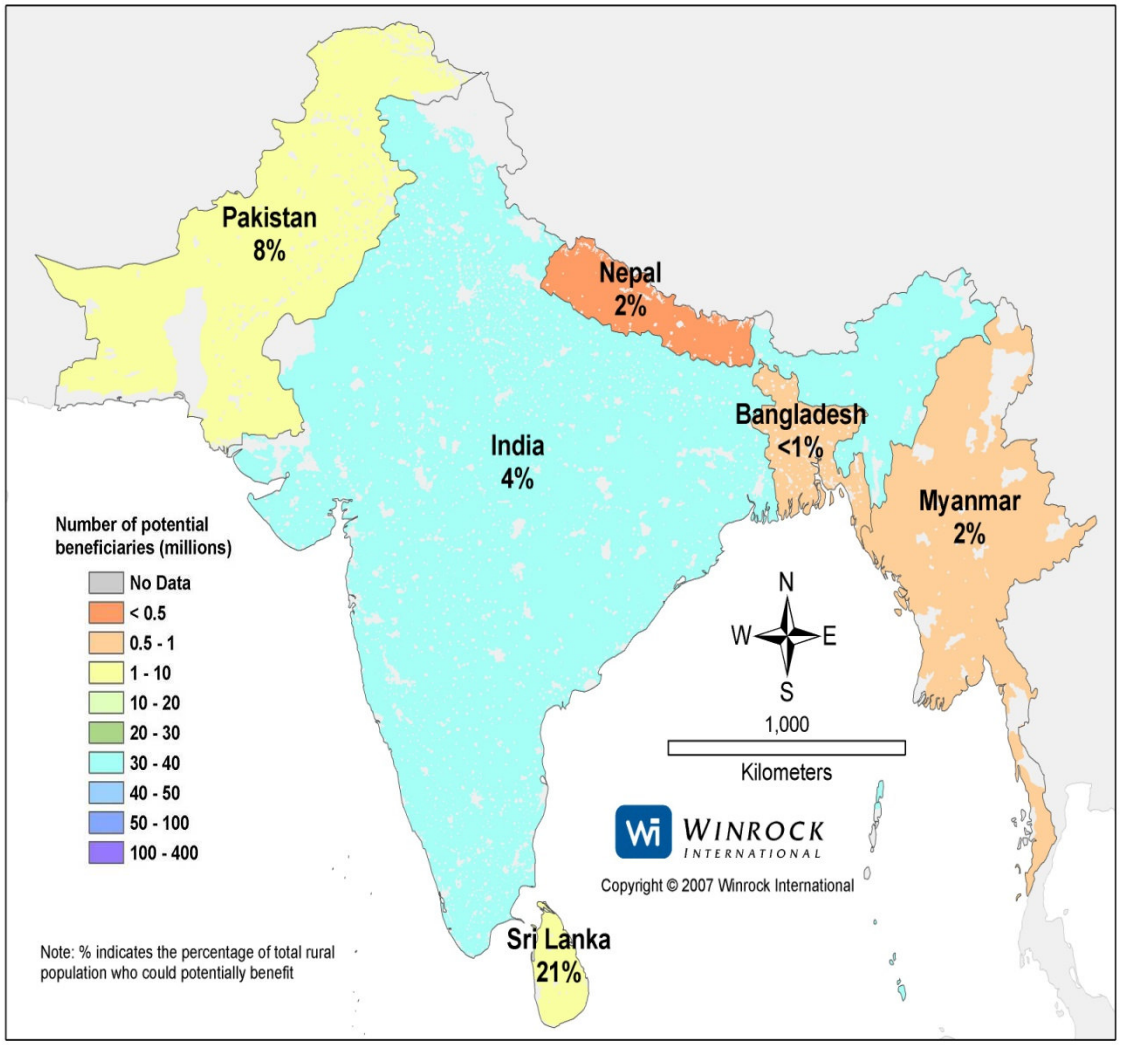
5.5.1 Opportunity 4. South Asia

Potential South Asia market: 43 million

In terms of absolute number of potential beneficiaries: Largest markets are India and Pakistan

In terms of percentage of rural population that could be reached: Largest markets are Sri Lanka and Pakistan

Further scoping work is needed in Pakistan to identify the potential of value-chain approaches and evaluate the opportunities for the private sector to address this market. In India, population concentrations need to be assessed to identify whether strategies should target this market or include it as part of larger market opportunities, for example, for integrating low-cost manual lifting devices within well-developed motorized pump value-chains.



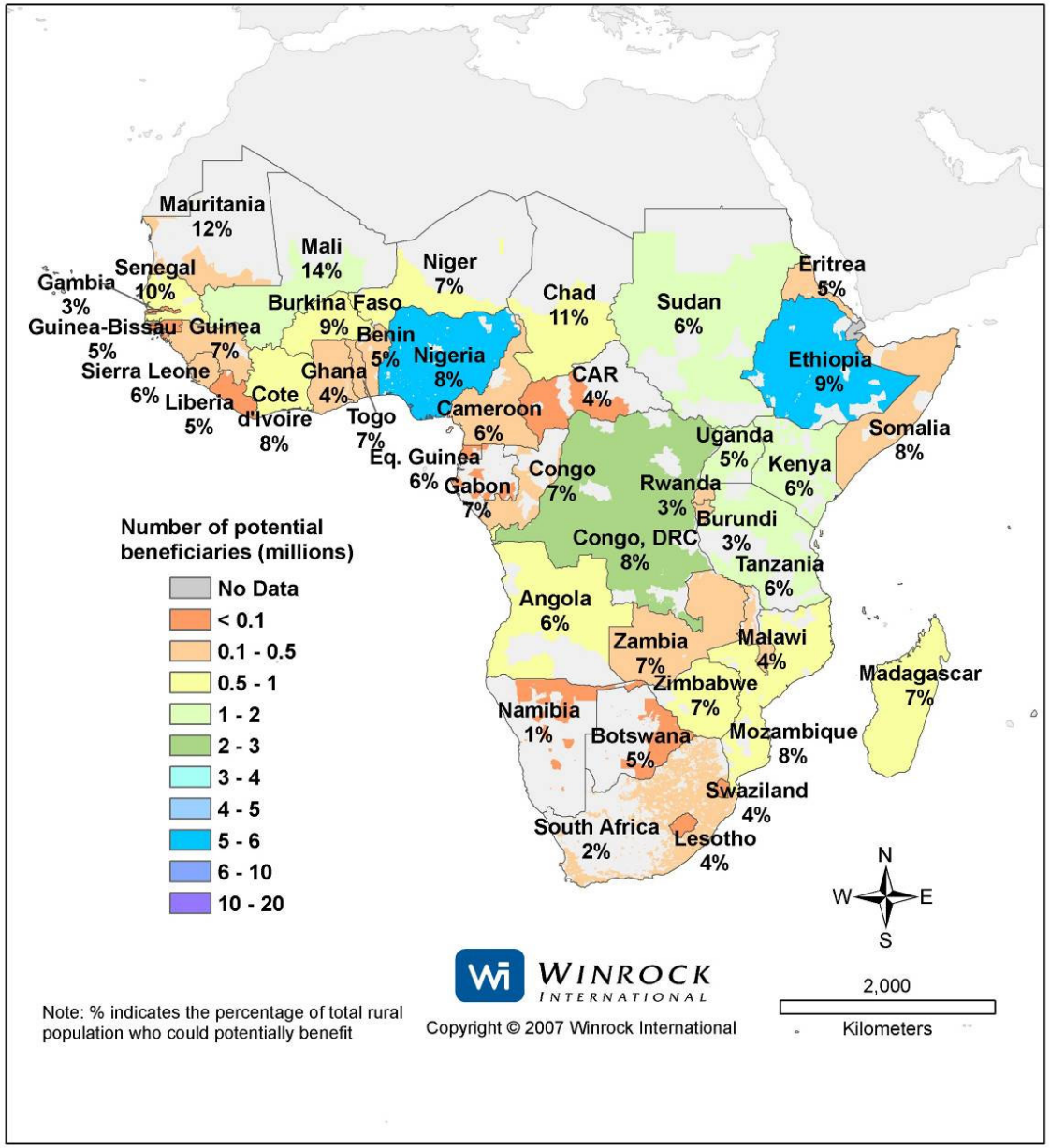
5.5.2 Opportunity 4. sub-Saharan Africa

Potential sub-Saharan Africa market: 31 million

In terms of absolute number of potential beneficiaries: Largest markets are Ethiopia, Nigeria, DCR Congo, Mali, Kenya, Tanzania, Sudan, Uganda

In terms of percentage of rural population that could be reached: Largest markets are Mali, Mauritania, Chad, Senegal

Pilots: Mali offers significant opportunities for piloting based on potential populations and enabling conditions. To support private-sector value-chain opportunities, efforts should focus on piloting-at-scale by clustering activities, possibly in 2-3 locations, to test scale-up models. Zimbabwe has significant opportunities and proven models; however, the scope of private sector approaches is not well-understood, especially given the current political climate and disincentives for market-based approaches.



What's involved:

Over 400 million people live within irrigation command areas in South Asia and sub-Saharan Africa. A range of options is available for improving water services to support multiple uses, including communal add-ons to accommodate livestock (cattle troughs and crossings) and domestic uses (laundry slabs and washing rooms), improved communal water supply to provide domestic water with home water treatment as well as to support home gardens, livestock and small-scale enterprises.

Selected learning opportunity area:

Sri Lanka:

- Significant knowledge base on multiple uses within irrigation systems in Sri Lanka.
- Moderate level of institutional readiness with irrigation authorities.
- Capacity to implement as demonstrated by some large irrigation systems already accommodating domestic uses, livestock and fisheries.
- Moderate to high potential for scale-up and impact.
- Potential to leverage anticipated investments in rehabilitation and modernization of irrigation systems.

Potential Market	**Capital investment costs/capita** hardware and software (per capita)	**Annual income net of recurrent costs** (per capita)	**Benefit-cost ratio** (10% discount rate)
447 million (South Asia: 443m SS Africa: 4m)	**$10 - $110**	**$50-$57**	**2.9 - 27**

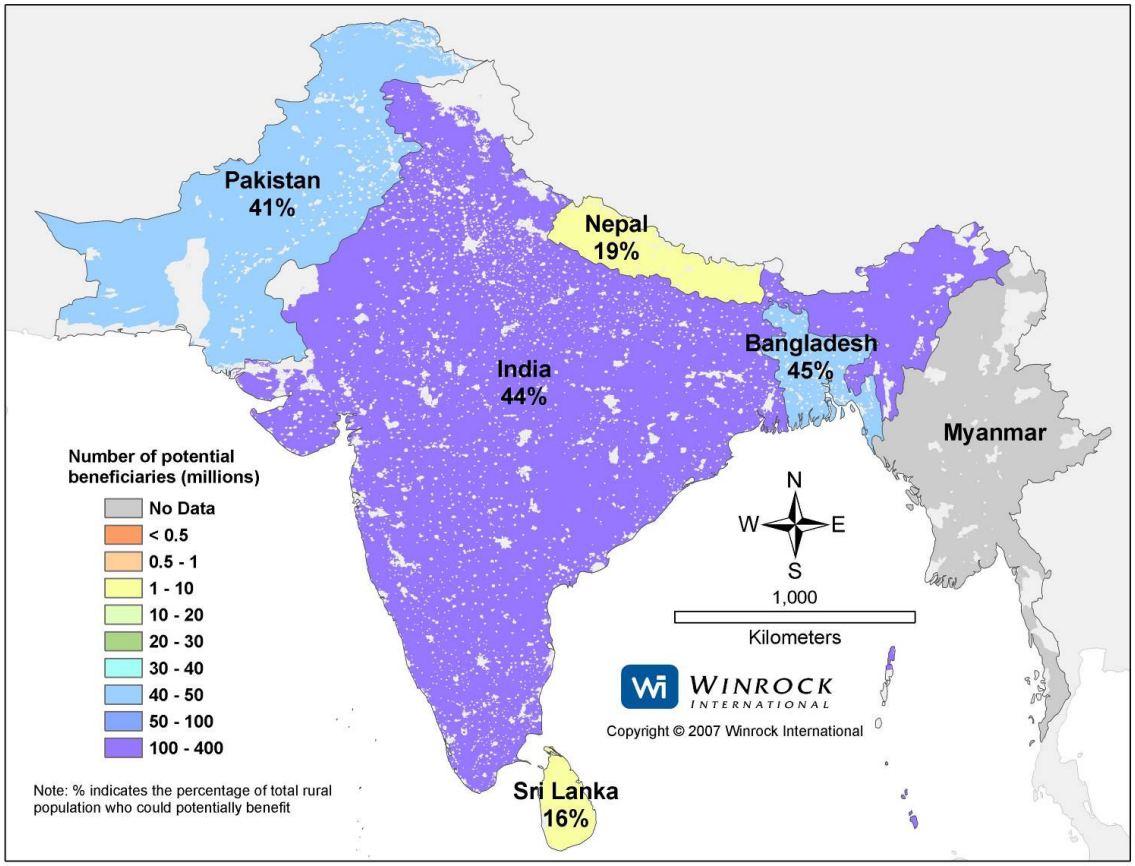
Potential South Asia market: 443 million

In terms of absolute number of potential beneficiaries: Largest markets are India, Pakistan and Bangladesh

In terms of percentage of rural population that could be reached: Bangladesh, India and Pakistan

Pilot: Sri Lanka, although a relatively smaller market, offers the potential to reach more than 2.5 million people. With a relatively good enabling environment, centralized management (through the Mahaweli Authority) and existing experience with supporting multiple-use approaches (formally and informally), potential is significant in Sri Lanka to successfully pilot-at-scale on various sized systems.

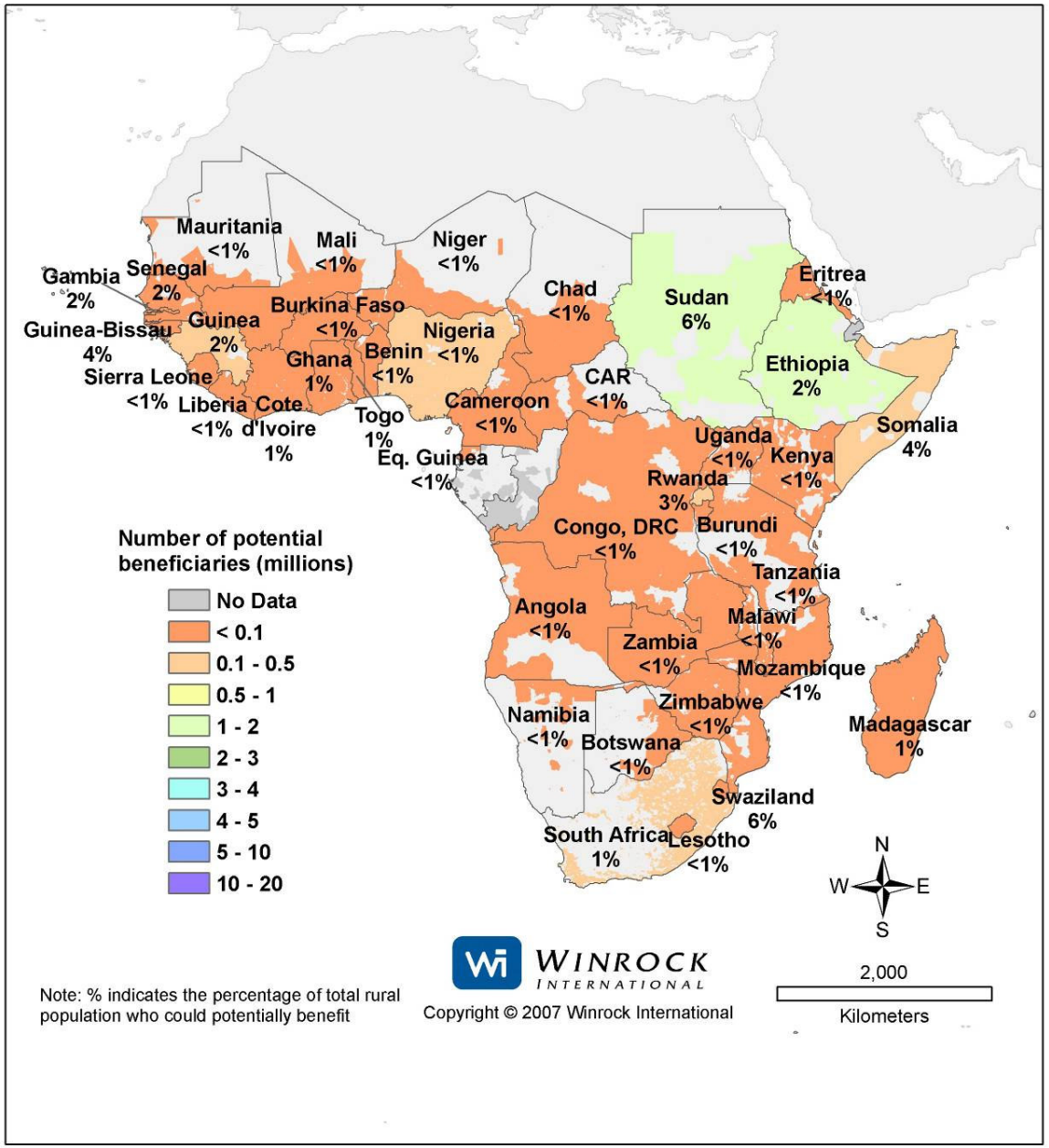
Further scoping work is needed in South Asia to identify entry points and evaluate enabling conditions.



5.6.2 Opportunity 5. sub-Saharan Africa

Potential sub-Saharan Africa Market: Aside from Sudan and Ethiopia, the market opportunities for large-scale irrigation systems appear limited. However, the majority of systems in sub-Saharan Africa, which are small-scale (<1000 hectares), were not captured in the remote sensing maps used to estimate populations.

Further scoping work is needed to identify the extent, location and characteristics of small-scale irrigation systems in sub-Saharan Africa to evaluate potential opportunities for multiple-use approaches. Anecdotal evidence suggests this is a potentially significant market, especially given the trend towards investments in new small-scale irrigation systems.



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2. Findings: Costs and benefits

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6.1 Overview
6.2 Criteria for successful implementation
6.3 Potential risks and mitigation measures
6.4 Scaling-up

6.1 Strategic considerations for implementation: Overview

The results of study suggest that multiple-use services can cost-effectively maximize poverty impacts of water services while enhancing sustainability with the potential to improve the lives of over 1 billion rural poor in South Asia and sub-Saharan Africa. Achieving this potential will depend on ability to implement sustainable multiple-use services at scale. Concrete action towards achieving the potential of multiple-use services raises some important questions:

- What needs to be in place for successful implementation of multiple-use services?
- What are the risks of implementing multiple-use services and what measures can mitigate them?
- How can multiple-use services be scaled up?
  - What are the key enabling conditions and capacity for scale-up?
  - What are alternative approaches to implementation and scale-up processes?
- How to assess readiness for implementation and scale-up?

This section provides some initial answers to these questions by:

- Identifying key criteria for successful implementation
- Pinpointing potential risks that may influence sustainability of multiple-use services and mitigation measures
- Identifying enabling conditions and capacity at the intermediate level and alternative approaches to catalyze for scale-up processes
- Providing a rapid assessment tool for evaluating readiness for implementation and scale-up

6.2 Criteria for successful implementation of multiple-use services

With the exception of water availability, all criteria can be addressed through carefully designed projects and programs. However, the more criteria that are met at the outset, the greater the speed and lower the costs and risks of implementing and scaling-up multiple use approaches. Pilot sites identified for each opportunity area meet most, if not all, of the criteria.

Water availability

Sufficient water available to support domestic and productive uses. Alternative sources can be utilized to support different uses, based on service level requirements

Management capacity

Technical and financial management capacity at local, intermediate and national scales. The larger the scale of impact, the greater the need for capacity at the intermediate and national levels (discussed further on next slides).

Technical

- Plan, design and construct appropriate multiple use systems, including system upgrades, to support domestic and productive activities
- Operation and maintenance—technical capacity to ensure long-term capability to operate, maintain and repair the system, including access to spare parts, capability in water quality monitoring.
- Capacity to monitor, anticipate and adapt water management practices to ensure long-term sustainability, including hydrological interconnections between different parts of the hydrological system

Financial

- Sound and transparent fiscal management capacity, including appropriate cost-recovery mechanisms, tariffs, incentives for wise-use and sufficient capital reserves for maintenance, repairs and replacement infrastructure.

6.2 Criteria for successful implementation of multiple-use services cont

Water rights

- Informal and formal enforceable rules and regulations for determining how water is developed, allocated and used
- Water allocation mechanisms that explicitly address competing uses and users, particularly addressing issues of scarcity, quality-quantity and equitable access.

Financing and credit

Sufficient financial resources and supporting credit institutions to ensure access to adequate credit for system construction and to support productive activities.

Sector and policy coordination

- Ability to work effectively across sectors and stakeholders—both horizontally and vertically
- Policy and institutional environmental that is conducive, or at least neutral, to multiple use approaches

While the evidence suggests that provision of multiple-use services enhances sustainability, potential risks exist. The risks presented below represent a compilation of common concerns and suggested mitigation measured by sector experts.

Risk	**Mitigation measures**
Multiple-use services require technical systems that provide more water closer to households, implying higher capital investment and operational costs. Poor communities may not be **able to pay** for and maintain these systems.	Evidence suggests that incremental income and non-financial benefits from multiple-use services should sufficient to cover incremental costs for appropriately designed and managed multiple-use services However, planning activities must include a detailed financial analysis of the requirements for capital investment, recurrent costs for maintaining the service versus user affordability, and scope for equitable allocation to users with varying abilities to pay.
Even when individual households receive additional benefits from water for multiple uses, they may not show increased ***willingness to pay*** for the service and reinvest in its functioning.	Evidence shows that people are willing to pay and re-invest in systems that better meet their range of needs, but this is also related to other system performance indicators. Further research is needed on willingness-to-pay for multiple use services so that possible mitigation measures can be defined.
Water for multiple uses will be used mainly by the better-off who have access to other assets (land, credit, etc.), ***aggravating differences and tensions*** within the community.	Water scarcity and the political control of water resources and systems suggest that this risk will persist and requires attention to social, economic and political heterogeneity within a community and approaches that target the needs and limitations of the poorest. Evidence shows that even the poorest have access to some assets, and that water interventions in the past have not targeted the productive water needs of poorer households.

Risk	Mitigation measures
Providing water for multiple uses may result in ***inequitable distribution*** within a community with particular concern that basic drinking and domestic supplies for all may be encroached upon.	In most conventional domestic systems, services are designed to ensure at least basic access for all. A range of measures can help ensure the multiple-use systems provide basic access for all, including: • Technical measures to control distribution of water such as in-flow control devices and small diameter taps. • Institutional measures such as establishing rules regarding types of use that are allowed and distribution in times of scarcity • Financial measures such as payment based on actual use and incentives for efficient use In practice, a combination of all of these is needed.
Providing water for multiple uses results in additional ***stress on scarce water resources***, compromising resource sustainability.	While multiple-use services involve provision of greater quantities of water, evidence suggests that the total amounts required will remain small when compared to other uses on a catchment basis, even when scaled up (well-established). However, multiple-use approaches may increase local competition over water resources reinforcing the need for integrated local-level water resources management.
Providing water for multiple uses may result in ***health and environmental risks***, especially when drainage is not properly addressed.	Some anecdotal evidence exists on potential health and environmental risks associated with drainage water. For example, pooling of drainage water may provide breeding sites for malarial mosquitoes may breed or contaminated drainage may pollute nearby water and land). Multiple-use systems must consider return flows in both infrastructure designs and water management.

Key Findings:

Readiness for implementation and scaling-up depends on:

- **Enabling conditions and capacity at the intermediate level.** Intermediate level organizations and government agencies are those operating between communities and the national level (Schouten and Moriarty, 2004). Intermediate level organizations play a critical role in sustaining and supporting the community management of multiple-use services.

- **Strength of existing implementation approaches, including self-initiated, project-led, and government-led approaches.** Different approaches can be used to catalyze scaling up processes. Scale-up strategies in each country should build upon the strengths and capacities of existing approaches, and how they can work together synergistically.

Drawing on Van Koppen et al. (2008 forthcoming) key considerations for scaling-up are presented, including: key enabling conditions and capacity at the intermediate level, implementation approaches, and considerations for assessing overall readiness for implementation and scale-up processes.

Note: This section is biased toward domestic+ approaches. Scaling-up irrigation+ approaches may require other considerations for scaling up but to date these have not been well researched.

6.4.1 Scaling Up: Enabling Conditions at the Intermediate Level

As with scaling up single-use services, multiple-use services require that a number of enabling conditions and functions be fulfilled at the intermediate level. For intermediate level organizations to fulfill these functions, sufficient resources (human, financial), mandate (policy and legislation) and political willingness (institutional motivation and support) are required.

The following three conditions in particular must be met and are often shaped by national policy frameworks :

- **Participatory planning**. Multiple-use services requires planning for diverse water needs. Participatory planning ensures that needs are met and minimizes inequity and conflicts regarding water allocations. Planning activities should pay particular attention to heterogeneity in poverty, livelihoods and political capital (the ability to voice needs and exercise demand) within a community. This requires a number of realistic options and strategies to meet specific needs.
- **Broadening 'narrow' institutional mandates** of domestic and irrigation agencies. The water sector is highly segmented for provision of single-use services. Scaling up of multiple-use services requires relevant agencies to broaden their mandate to provide for multiple-use services. Experience suggests that changes in mandates should focus on scaling up efforts within the domestic and irrigation sectors, rather than merging sectoral institutions. Experience shows that cross-sectoral initiatives are unlikely to occur, at least initially, due to high transaction costs of institutional coordination between agencies.
- **Loosening sector-based financing models**. Current financing models for water services are based on single-service provision models and often tied to technical norms and standards for either domestic or irrigation services. Scaling up multiple-use services will require additional financing with more flexible rules for provision of multiple-use services. Along with institutional mandates, agencies need to clearly define the spread of additional investment costs among agencies and plan cost-sharing strategically.

6.4.2 Scaling Up: Three Entry Approaches to Catalyze Scaling Up Processes

There are three primary approaches to implementing water services; each of these approaches should be considered a potential initial entry point to catalyze scaling-up processes for multiple-use services. Each approach differs in strengths, weaknesses and needed support from the enabling environment. Achieving impact at scale will require a combination of approaches that work together synergistically over time.

1. **Self-initiated approaches**. Households and communities do the majority of the investments themselves; community (or household) ownership is genuine; development of services is based on actual needs; demand is illustrated by willingness and ability to meet costs. Government programs can support self-initiated supply and achieve impact at moderate scales; however, full coverage and sustainability will not be achieved without support programs and special attention on the poorest households, which do not have the resources to make investments in their own water services.

2. **Project approaches**. Donor and NGO driven approaches can catalyze scaling-up of multiple-use services through innovation, demonstration, learning by doing and leadership. However, important donor and NGO approaches have important limitations in terms of sustainability and coverage. Intermediate level agencies, especially local government, need to be actively engaged with appropriate mandates and sufficient capacity and resources to ensure long-term support for sustainability.

3. **Formalized, programmatic government led-approaches**. These approaches have the potential for scale in terms of coverage and sustainability. However, they are often characterized by rigid norms and frameworks, which may not be conducive to multiple-use without sufficient momentum and demand for change.

6.4.3 Considerations for Assessing Implementation and Scaling Up Readiness: **existing approaches, intermediate level capacity, and overall readiness**

Government-led approach	
Low	Water services and water resources policy, norms and standards may restrict MUS approaches.
Medium	Water services and water resources policy, norms and standards are neutral vis-à-vis MUS.
High	Water services and water resources policy, norms and standards are promoting or conducive to MUS approaches.
Project-led approach	
Low	None of the larger implementing NGOs or projects are following an explicit MUS approach.
Medium	Some of the larger implementing NGOs and projects are following a MUS approach, but in an ad hoc manner.
High	A number of major implementing NGOs or projects are following an explicit MUS approach.
Self-initiated approach	
Low	Communities and households are not developing and investing in their own services.
Medium	Communities and households are developing and investing in their own services with a MUS focus, but not seeking intermediate level support.
High	Communities and households are developing their own MUS services, and seek intermediate level support.
Intermediate level enabling environment and capacity to support multiple-use services	
Low	Intermediate level organizations (local government, local NGOs, and private sector) are not aware of the MUS approach, and are not able to support communities.
Medium	Intermediate level organizations are aware of and endorse the MUS approach, but do not have the capacity to actively support it.
High	Intermediate level organizations actively support communities in MUS services delivery.
Overall readiness and potential scale-up	
Low	There is no clear entry point for MUS yet; these need to be developed first through awareness and advocacy.
Medium	There is at least one clearly identified entry point for MUS in a country; but capacity is not sufficient at all levels to take it forward. This needs to be strengthened prior to the scaling up process.
High	There is at least one clearly identified entry point for MUS in a country, and some capacity at all levels to take it forward. Potential exists to start working at scale, but further strengthening of capacities is needed.