Improving Access to Urban Services for the Poor:

Open Issues and a Framework for a Future Research Agenda*

Esther Duflo
MIT and J-PAL

Sebastian Galiani
University of Maryland and J-PAL

Mushfiq Mobarak
Yale University and J-PAL

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ABDUL LATIF JAMEEL
Poverty Action Lab

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About the Urban Services Initiative

Access to safe water and sanitation is essential for health, security, livelihoods, and quality of life. Inadequate access to safe water and exposure to pathogens through the poor treatment of solid waste leads to adverse health consequences, particularly diarrheal diseases. Diarrhoea is responsible for an estimated 21% of under-five mortality in developing countries–2.5 million deaths per year, and over 4% of the world's disease burden. However, the developing world–particularly Asia and Africa–is lagging in water and sanitation coverage. Nearly 2.4 billion people are expected to remain without access to proper sanitation in 2015.

While the problem of inadequate access to water and sanitation exists in both rural and urban areas, the problem is particularly pressing in cities. With internal migration and the "urbanization of poverty," cities are where an increasing proportion of the poor live. In the last three decades, growth in urban populations in developing countries exceeded that of rural areas three-fold. In 2007, there were already more people living in cities than in rural areas.

The water, sanitation, and hygiene infrastructure of many cities is therefore stressed beyond current capacity, and infrastructure investments have not kept pace with rapid and unplanned urbanization. While large infrastructure overhaul–if and when it is possible–has great potential benefits, various public finance, planning, budgetary, and institutional impediments limit how much can be achieved in the short run through large-scale investment alone.

In this context, the strategic focus of J-PAL's Urban Services Initiative (USI) will be to design or identify, and rigorously test innovative micro- and medium-scale solutions to the problem of inadequate access to water, sanitation, and hygiene (WSH) for the urban poor in Asia and Africa. The main goals of USI are:

1. To spur innovative projects that can address the challenge of delivering urban public services, and to use randomized evaluations (REs) to test the effectiveness of those innovations in the field.
2. To form strong research teams (including multidisciplinary teams), and to increase the capacity of researchers based in developing countries to design and conduct REs.
3. To disseminate knowledge gained to policymakers and donors at local, national, and international levels, so that effective solutions are promoted and spread.

While there is a vast literature addressing the impact of access to improved WSH services on health outcomes, there is surprisingly little rigorous evidence on interventions that effectively and sustainably improve access to WSH services for the urban poor. Given this, the emphasis of the research conducted under USI will be on *how*, rather than *whether*; taking the potential impacts of improved WSH access largely as a given, the question that will be asked is: *How can we achieve better urban services outcomes, access, and coverage?*

Barriers Preventing Improvements in Water, Sanitation, and Hygiene

To address the problem of achieving greater coverage, a first step is to identify the barriers to innovation and implementation of improved water and sanitation. USI identifies three key barriers:

1. Insufficient supply: Building water and sanitation infrastructure is costly and may involve numerous technical, bureaucratic, and legal constraints–particularly in the developing world.

There may be smaller-scale, off-grid, innovative supply solutions, but realizing those solutions requires clever innovations in design of contracts, pricing policies, and market development.

2. Insufficient demand: Even in places where a water and sanitation network exists and it is technically feasible to connect to it, there may be limited demand for those services. Willingness-to-pay may be low, different people's demand may be inter-linked, and the presence of transient or migrant populations may not be available as potentially dedicated customers.
3. Institutional constraints: Centralized supply solutions may not be sustainable or even possible at all if regional and local levels of government are not involved to facilitate implementation in the local context. In addition, coordination problems can arise when the sanitation or water infrastructure is shared and must be jointly maintained.

Four Key Areas of Research

This section highlights some open questions within the broader framework of demand, supply, and institutional constraints described above, where USI-funded research might be especially valuable.

1. Consumers' willingness to pay

Improving delivery of WSH services will require identifying the barriers to adopting new products, technologies, and solutions. Estimating the underlying factors that affect demand can inform pricing policy, shed light on the role of credit, information gaps, and other determinants of technology adoption.

So far, the evidence on consumers' willingness to pay is mixed. While some studies show surprisingly low willingness to pay for clean water, there is some evidence that the poor are willing to pay for the convenience of in-home piped water, or to switch from using arsenic-contaminated water, or to travel longer distances to access clean water. More research is needed to identify household characteristics that affect willingness to pay.

It is likely that people exhibit low willingness to pay for WSH services because they do not fully understand its value over their current options, or may underestimate the health costs. Programs such as Community-Led Total Sanitation (CLTS) respond to this perceived lack of information. There is some evidence that households respond to information campaigns on benefits of water quality or hand washing, but more research is needed to understand the conditions in which information really makes a difference.

Recent evidence from studies on improved cookstoves, bednets, and in-home water connections shows that even when households understand the health benefits of a new technology, their primary concerns are more about other attributes of the technology such as convenience or comfort. There may thus be value in better understanding of consumer preferences, and "bundling" product amenities in optimal ways to encourage the take up of new WSH technologies.

Another factor affecting consumer demand may be small bureaucratic hurdles related to accessing WSH services. A study in Morocco suggests that households are much more likely to take up a water connection when they are given at-home administrative assistance. More evidence is needed to understand if bureaucratic hurdles are indeed a significant barrier.

In cases where willingness to pay is still low, it may be cost-effective to subsidize take-up, given the potential negative effects of waterborne diseases on the local community. There is inconclusive

evidence on whether people who are willing to pay less for a service may also be less likely to use it or if not paying for something makes it less desirable. Devising "smart subsidies" that account for economic efficiency and/or psychological considerations is a promising area of research. There is strong evidence from rural Africa that free, point-of-collection chlorine dispenser systems, combined with a local promoter, lead to high rates of sustained take-up. Research is now needed to evaluate such hypotheses in urban settings.

Some WSH products require non-negligible up-front fixed costs for adoption. Studies with bednets and in-home piped water connections have shown that ability to pay may hinge on access to credit or savings. There is room for additional research on these issues, especially in urban settings with very different employment conditions and cash flow situations.

The economics of sanitation and trash management can be very different for business models that rely on revenues from re-use and recycling of waste, as compared to just user charges. There is little evidence on sustainable business models in this realm. More research is needed both on technologies that can more effectively turn waste into something valuable, as well as on innovations in financial, marketing or industrial organization that can better support entrepreneurs in this space.

Finally, willingness to pay may also be affected by disparities between how much the technology is valued by the end user, and how much it is valued by the person in the household in charge of making purchasing decisions. A study from Bangladesh finds that when smoke-reducing cookstoves are offered to women, the take-up rates are higher than when the stoves are offered to men. A growing literature indicates that not only preferences, but tolerance to varying price levels may also vary with gender. More research is required to better understand these mechanisms in the context of WSH services, and to determine the combinations of prices and other interventions that would ensure optimal take-up.

Key Open Questions

- *What are the underlying factors that affect demand of WSH services for the urban poor? How can we use these insights to inform and design pricing policies, discounts or subsidies, and marketing techniques?*
- *What household characteristics affect the willingness to pay for WSH services, especially sanitation services?*
- *Under what conditions do information campaigns that explain the benefits of improved WSH facilities really make a difference?*
- *How can we "bundle" products to encourage take-up of new WSH technologies? What bundles best capture consumer's preferences?*
- *Do bureaucratic hurdles pose a significant barrier to access of WSH services? If so, what exactly is the source of the problem: is the problem real? Or is it only a perception? Do these costs, perceived or real, lead households to procrastinate?*
- *Can "smart subsidies" that account for economic efficiency (including negative effects on others) and/or psychological considerations encourage better take up?*
- *Do subsidized services that have proven to be effective in rural areas (e.g. free, point-of-collection chlorine dispenser systems combined with a local promoter) work in urban areas too?*
- *Does access to credit or savings affect take-up of WSH products with non-negligible up-front fixed costs? How does this relationship vary for urban settings with different employment conditions and cash flow situations?*

- *Are there better technologies to convert trash or solid waste into something valuable that can subsidize the cost of waste management services for consumers? How can we support entrepreneurs to mobilize these technologies, and create sustainable business ventures?*
- *What are the linkages between prices of WSH products, different implicit costs for household members, intra-household resource allocation, and preferences for take up? What combination of prices and other interventions would increase take up?*

2. Coordination failure and collective action problems

Due to strong linkages between different households' decisions, coordination failures pose a serious challenge to implementing community-level solutions such as community sanitation centers, garbage collection or even regular maintenance of drainage. Even when new solutions are implemented, they may not be sustained if no one takes responsibility for maintenance tasks. While there is evidence that community sanitation facilities are usually poorly maintained, very little is known about the specific obstacles to collective action, and how to solve them.

Some interventions, like Community Led Total Sanitation (CLTS), adopt a "big push" approach encompassing the entire community. This gets around the problem of individual households not having an incentive to adopt a WSH solution. But these interventions have so far mostly been confined to rural areas. There are also issues with how knowledge about a technology diffuses through a social network. There is a wide literature on this subject, yet there is no clear answer on the most effective way to create a "big push" for diffusion of innovations through a social network.

What characteristics about a group make them less likely to coordinate? There is some empirical research on the effect of group size, for example; specifically, if large groups are more prone to coordination problems than smaller groups. However, the evidence has been mixed. Another important group characteristic is within-group diversity. New urban areas may be very heterogeneous–both ethnically and in terms of wealth distribution. They may face a constant influx of new migrants. There is some evidence that increased heterogeneity leads to less cooperation, though more research is needed. In particular, it may be useful to test if different kinds of heterogeneity lead to different results.

Solutions to coordination problems require that institutions be designed to incentivize cooperative behavior within that group. While some empirical studies have tried identifying institutional characteristics that are successful in solving coordination failures, by and large, the research in this area is much behind the fieldwork. The "industrial organization" of facilities is a promising area of research, and could cover topics such as optimizing management systems (private versus community managed), pricing schemes, and rules for access.

Finally, if governments opt for the private management of urban services, there is little evidence to guide them. For example, should procurement contracts be auctioned, and if so, through what type of auction? Research is also needed to determine how governments can enhance competition in public procurement auctions in the WSH sector, and whether competition is sufficient for efficiency. For example, one study proposed the division of lot contracts to achieve efficiency, and found that when public procurement of water treatment plant and distribution networks were bundled in a single lot package, competition was significantly reduced, and procurement costs increased.

Key Open Questions

- *What are the specific obstacles to collective action on community-level solutions to WSH services in urban areas? How best can we counter these problems?*
- *What are the most effective ways to diffuse WSH innovations through social networks?*
- *How does group size affect a community's ability to work together?*
- *Do different kinds of within-group diversity affect coordination differently? Do they lead to different outcomes in pubic goods provision?*
- *What characteristics and features of institutions can help or hinder group coordination problems?*
- *What are the optimal mechanisms through which governments can efficiently procure WSH services from the private sector? Should procurement contracts be auctioned, and if so, through what type of auction? How can we enhance competition during procurement?*

3. Institutional and legal issues

Adoption of a new technology for water and sanitation sometimes involves large investments that require local institutional and legal arrangements. Slum dwellers often live in houses with insecure property rights. This could weaken their incentive to make long-term capital investments or to use their property as collateral to secure loans for capital investments. There is some evidence from studies in Latin America validating this hypothesis. Strengthening property rights in urban slums has been shown to have a significant effect on residential investment, primarily due to the threat of eviction being reduced. More research is needed though on the effects of land titling on WSH investments, and the optimal way to provide property rights.

A related issue is that individual recipients of land rights in slums may sell their land rights to more affluent city residents, exacerbating the growth of slums. Policymakers are investigating alternate tenure forms and there are some innovations (such as the Community Land Trust model in Kenya) emerging, but rigorous evidence on their impact is missing.

The sharing of information on service quality is another institutional factor that could encourage providers to improve quality. Current evidence on such programs is mixed, and often depends on the dimensions that the service providers are required to report on. More careful design and research of such programs is needed.

Key Open Questions

- *What are the effects of providing secure property rights (e.g. land titling) to slum dwellers on WSH investments?*
- *Are there any alternative tenure arrangements that are effective in providing secure property rights to slum dwellers while preventing them from selling these rights off in the market?*
- *When and how does sharing information about service quality induce service providers to improve that quality?*

4. Political economy and public finance issues

For larger scale solutions to WSH challenges, local or central government participation is key. This is where issues related to accountability of elected representatives to the urban poor–who often form a sizable voting bloc–and public finance become relevant.

Despite its long history, very little is known about either the mechanisms of vote buying or its implications for the quality of urban public goods, particularly WSH services. Another issue is that voters are not always well-informed about the responsibilities of their representatives or those representatives' performance in office. Evidence shows that voter mobilization and information campaigns can potentially solve this problem, but little is known on how politicians respond in return. Further, there is some evidence from rural India showing that rules that affect the identity of elected representatives (e.g. quotas) also affect what they choose to invest in. There is no corresponding evidence for urban areas.

Building centralized water and sanitation infrastructure is costly, further complicated by the complementary nature of water and sanitation provision: many of the safest sanitation improvements require adequate water supply. How to mobilize public resources (through revenue generation, taxation, innovations in pricing, cross-subsidization, and so forth) to overcome the public finance challenges may be a fruitful area of inquiry for USI-funded projects.

Key Open Questions

- *What are the mechanisms of vote buying and its implications for the quality of publicly-provided WSH services?*
- *How can urban voters in poor neighborhoods be effectively mobilized to demand accountability of their representatives, and how do the representatives respond in return?*
- *Do rules that affect the identity of elected representatives (e.g. quotas) in poor urban areas also affect what they choose to invest in?*
- *How can government programs, budgets, and taxation systems be adapted to overcome public finance challenges and enable better provision of WSH services?*

Introduction

In 1977, the international community declared the 1980s the "International Drinking Water Supply and Sanitation Decade" in the context of the United Nations Water Conference. The goal was that, by the end of the decade, all people worldwide would have access to clean water and sanitation. More than 30 years later, almost 40 percent of the world's population remains without improved sanitation. Furthermore, even facilities characterized as "improved" are not always safe: In urban areas, the waste of 2.1 billion people is captured and stored in latrines, with no systematic way to ensure extraction, transport, treatment and disposal, or recycling (Bill & Melinda Gates Foundation 2010). Although the world is on schedule to meet the drinking water target of the Millennium Development Goals (MDGs) ("Less than 12 percent of the world's population without improved drinking water by 2015"), the goal on sanitation ("Less than 23 percent of the world's population without improved sanitation by 2015") will likely be missed. And that too by a wide margin: More than half a billion people (WHO 2012).

Access to safe water and sanitation is believed to be essential for health, security, livelihood, and quality of life, and is especially critical for women and children. Improved water supply and sanitation interventions could thus provide a wide range of benefits: longer lifespan, reduced morbidity and mortality from various diseases, higher school attendance, lower health costs, and less time and effort devoted to managing water and waste (see, for example, Evans 2005; Fewtrell and Colfrod 2004; Galiani et al. 2005; and Jalan and Ravallion 2003). The time saved could allow women to engage in other productive tasks. It could provide more time for childcare, socialization, and educational activities.

The problem of inadequate access to water and sanitation exists both in rural and urban areas. However, for several reasons, the problem is particularly pressing in cities: Increasingly, this is where a large proportion of the poor live. Migration, both temporary and permanent, from impoverished rural areas to larger urban centers has usually promised large improvements in welfare (Chowdhury et al. 2009), but these increases may be mitigated by poor urban infrastructure. Furthermore, the crowded conditions of urban settlements in theory heighten the health risks associated with poor sanitation and its negative externalities.

Against this backdrop, the Abdul Latif Jameel Poverty Action Lab (J-PAL) has launched a research initiative called the *Urban Services Initiative* (USI), which focuses on *identifying, designing, and rigorously testing innovative micro- and medium-scale solutions to the problems of inadequate access to water, sanitation, and hygiene in urban areas of developing countries*. The primary purpose of USI is to (a) match researchers and practitioners working in this area to collaboratively develop field-based research projects that address the challenges of providing the urban poor with access to water and sanitation services, and (b) facilitate the implementation of the most promising projects by providing research funding and other research support services. The purpose of this document is two-fold. The narrow purpose is to describe the scope of USI and its research priority areas, as a resource for researchers and practitioners who have been invited to apply for funding for their collaborative projects. The broader purpose is to describe the most promising and valuable

open areas of inquiry in the field of access to urban services, in order to provide a guide for a future research agenda.

Section 1 of this review paper will define urban public services for the purposes of this initiative, and the types of services USI seeks to prioritize. Section 2 provides some general background on the state of the provision of these services worldwide, specifically in Asia and Africa. It also explains USI's focus on microsolutions. We discuss the supply, demand, and institutional barriers to the adoption of adequate urban services in section 3. In section 4, we detail the specific barriers that USI plans to target, together with some suggestions regarding approaches to overcome them. Those barriers include: low willingness to pay, collective action problems, institutional and legal constraints, and other political economy issues (such as corruption). Finally, section 5 concludes with the main recommendations on the types of interventions most suitable to address the problems described, and that will be encouraged by USI in the next stage of the project.

1. The Scope of USI

USI is primarily focused on water, sanitation, and hygiene services (WSH), though other services of relevance to the urban poor will be considered as well. Furthermore, the emphasis will be on *how*, rather than *whether*; taking the potential welfare effects of improved WSH access largely as a given, the question that will be asked is: *How can we achieve better urban services outcomes, access, and coverage?* Within this framework, we have prioritized innovative micro- and medium-scale solutions rather than large-scale investments, because the structure and scope of this initiative suggests that we can have a greater research and policy impact at this scale. Inadequate infrastructure is certainly at the core of many challenges to urban service delivery, but various public finance, planning, budgetary, and institutional impediments limit how much can be achieved in the short run through large-scale investment alone. Thus, while the broader infrastructural challenges may take years to be satisfactorily solved, there is scope for developing interventions that can improve access to WSH services quickly, efficiently, and cheaply in the short run.[1]

The definition of urban services is very broad and includes the following three tiers:

Tier 1: Sanitation, Solid Waste, and Drainage
Tier 2: Water, Security, Electricity, and Housing
Tier 3: Education and Health

The tiered definition reflects the ranking and prioritization of the broad set of urban services for the purposes of this initiative. USI will focus on the delivery of Tier 1 and Tier 2 services, with an emphasis on WSH services. Other complementary interventions that can facilitate enhanced delivery of or access to WSH services (such as titling, improved political or bureaucratic

[1] A project on promising microlevel interventions that can improve access to large-scale infrastructure (either pre-existing, or newly planned) would fall within the purview of USI. Similarly, if there are other opportunities to conduct new and interesting research which leverages new infrastructure investment (such as different designs, or pricing schemes that can be studied with statistical precision), such projects will be considered.

accountability, managed demand through pricing policy or migration policy) also fall under the purview of USI. To define WSH services, we follow Evans (2005):

Sanitation: i) Safe "on-site" collection, storage, treatment and disposal/re-use/recycling of human excreta; ii) Connection to sewage systems; iii) Management/re-use/recycling of solid waste; iv) Collection and management of industrial waste products; v) Management of hazardous wastes (hospital wastes, chemical/radioactive and other dangerous substances).

Water Provision and Management: i) Access to water network–at household, neighborhood, or local level; ii) Drainage and disposal/re-use/recycling of household waste water ("grey water"); iii) Drainage of storm water; iv) Treatment and disposal/re-use/recycling of sewage effluents.

Hygiene: i) Safe storage of water; ii) Safe treatment of foodstuffs; iii) Safe handwashing practices. In the next section, we review the current state of service delivery and access for the urban poor, and lay out some stylized facts about poverty, urbanization, water, and sanitation. These facts motivated our prioritization of urban services and WSH for this initiative, and focus on evaluating micro- and medium-scale solutions that do not involve major infrastructural investments. The descriptive evidence helped define the parameters and boundaries of this initiative laid out above.

2. Current Situation in Urban Services

2.1 The Urbanization of Poverty

Migration from rural to urban areas has increased in the last few decades, especially in the developing world. The rural poor usually come to large cities to take advantage of job opportunities and improved living standards not available in their previous areas of residence (Glaeser 2011). Moving to cities is also often the primary method of income diversification for rural agricultural workers (Banerjee & Duflo 2006). Indeed, it can be a very productive move, even for temporary migrants (Bryan, Chowdhury and Mobarak 2011).

However, cities and peri-urban centers have often been unprepared to absorb expanding populations and provide adequate urban services--housing, sanitation, health, and education, among others–to meet the needs of these rapidly growing new populations. Consequently, migration has shifted the locus of global poverty to the cities, a process now recognized as the "urbanization of poverty" (UN-Habitat 2003a).

In many cities, water, sanitation, and hygiene infrastructure is stressed beyond current capacity, and infrastructure investment has not kept pace with rapid and unplanned urbanization (WaterAid 2007). Temporary and seasonal migrants can exacerbate the service provision challenge, as these migrants often live in temporary shelters without improved sanitation, waste disposal or water facilities. They introduce volatility in the slum populations, and are not integrated into pre-existing social networks, making it more difficult to introduce community solutions to institutional problems (UN-Habitat 2003a).

Furthermore, this problem of overcrowded cities with inadequate urban services is getting more serious. From 1975 to 2007, the growth rate of urban populations in the developing world was 3.35 percent annually--more than three times larger than the growth of the rural population. In 2007, the world's urban population surpassed the rural population. Figure 1 shows the growth in urban populations by region. In Africa and Asia, over 2 billion people live in cities, and this number is expected to increase by 150 percent by 2025 (United Nations 2008).

The urban poor face enormous challenges in their daily lives. Almost a billion people (more than one-third of the urban population), primarily in the developing world, live in slums.[2] Living conditions in slums are characterized by overcrowding, high levels of unemployment or underemployment, deficient urban services (water, sanitation, education, and health), and widespread insecurity, including violence against women (UN-Habitat 2003b).

Figure 2 shows that rapid urbanization is common in the developing world. The progress achieved in urban service provision has allowed around 200 million people living in cities to gain access to water, sanitation facilities, and durable housing. As a consequence, from 2000 to 2010, the proportion of urban residents in developing countries living in slums decreased from 46 percent to 36 percent. However, the progress is still not enough as the number of people moving to slums is increasing: the proportion of slum dwellers decreased because the growth of the urban population more than compensated the growth of the slum dwellers. This is especially true in sub-Saharan Africa, and Western and Southeastern Asia (see Figures 3 and 4).

2.2 Two key Deficiencies: Sanitation and Water Provision

Access to water and sanitation among the urban poor: A snapshot

Sanitation coverage is especially low in cities. Despite the fairly flexible and expansive definition of improved sanitation,[3] such facilities are used by less than two-thirds of the world population. Goal 7 of the MDGs (environmental sustainability) includes halving, by 2015, the proportion of people without access to improved sanitation and water facilities as measured in 1990. Figure 5 shows that during the period from 1990 to 2008 (the last official figures), the proportion of the population using unimproved sanitation facilities decreased from 46 percent to 39 percent. The projected proportion for 2015 is 36 percent, far from the MDG target of 23 percent.

[2] A slum dweller is defined as someone who lives in housing with at least one of the following characteristics: i) lack of improved sanitation; ii) lack of improved water supply; iii) lack of durable housing; iv) lack of security of tenure, and v) lack of sufficient living area (UN-Habitat 2003b).

[3] WHO (2011) defines a sanitation facility as "improved" if the facility is one that is likely to hygienically separate human excreta from human contact. Improved sanitation facilities include: flush or pour-flush to piped sewer system, septic tank or pit latrine, ventilated improved pit latrine, and pit latrine with slab and composting toilet. However, sanitation facilities are not considered improved when shared with other households, or open to public use.

There are great disparities across regions regarding sanitation coverage. Map 1 shows that in the developed world, access to improved facilities is essentially universal, while in the developing regions, only around half of the population has access to them. Among the 2.6 billion people in the world who do not use improved sanitation facilities, the greatest numbers are in Southern Asia, but there are also large numbers in Eastern Asia and sub-Saharan Africa. Significant progress has been made since 1990 in Northern Africa, Southeastern Asia, and Eastern Asia. Partly inspired by the spatial distribution of these challenges, the Urban Services Initiative has prioritized Asia (especially South Asia) and sub-Saharan Africa as the two geographic areas where we intend to focus our resources.

Maps 2 and 3 show the evolution of the proportion of urban population with improved sanitation between 1990 and 2008. We can see that most of the progress was concentrated in Asian countries. In fact, in Southeast Asia, the proportion of people without access to improved sanitation fell by almost half, from 54 percent to 32 percent (WHO and UNICEF 2011). Figure 6 shows the evolution of the proportion of population with unimproved sanitation facilities by region, and the corresponding world MDG target (under the assumption that it applies to every region). According to the figure, the regions that are farthest from the target are sub-Saharan Africa (with an incidence of unimproved sanitation at 69 percent in 2008; the target is 37 percent for 2015), Southern Asia (65 percent in 2008 versus A target of 38 percent), Oceania (50 percent versus 24 percent), and Eastern Asia (44 percent vs. 29 percent) (WHO and UNICEF 2011). Only three countries in sub-Saharan Africa are expected to reach the target of reducing by half the proportion of the population without sustainable access to basic sanitation by 2015 (UNEP 2011; WHO and UNICEF, 2011).

Figure 7 shows the proportion of the urban population using each type of sanitation facility for 2008, by region. Sub-Saharan Africa is the region with the smallest proportion which has access to improved sanitation (44 percent), followed by Southern Asia (57 percent), and Eastern Asia (61 percent). In those three regions, the second most popular type of facility is shared sanitation (between 20 to 30 percent). The proportion of urban population practicing open defecation is still high in Southern Asia (14 percent), sub-Saharan Africa (8 percent), Southeastern Asia (8 percent), and Eastern Asia (6 percent) (WHO and UNICEF 2011). Sanitation is thus a key priority for USI.

The other priority within the USI is the provision of safe water. Globally, the use of improved sources of drinking water[4] is high, with 87 percent of the world population and 84 percent of the people in developing regions getting their drinking water from such sources (see Map 4). Figure 8 shows that, globally, the world is on track to achieve the MDG for water. In 1990, the proportion of the population without improved water was 23 percent, and in 2008, it was only 13 percent. Figure 9 disaggregates the evolution of this indicator by region. We can see that some regions have already reached and exceeded this target for 2015 (Eastern Asia, Southeastern Asia, Latin America, and the

[4] WHO (2011) defines a drinking water source as "improved" if, by nature of its construction and design, it is likely to protect the source from outside contamination, in particular from fecal matter. Improved drinking water sources include: piped water into a dwelling, plot or yard, public tap/stand pipe, tube well/borehole, protected dug well, protected spring, and rainwater collection. On the other hand, unimproved drinking water sources are: an unprotected drug well, unprotected spring, cart with small tank/drum, tanker truck, surface water (from a river, dam, lake, pond, stream, canal, irrigation channel and any other surface water), and bottled water (if it is not accompanied by another improved source).

Caribbean). However, other regions are still far from the target and it is unlikely that they will achieve it by 2015. In particular, the proportion of people with unimproved water in sub-Saharan Africa was 40 percent in 2008, while the target for 2015 is 26 percent. Africa has experienced some progress in this indicator since 1990, reducing by 11 percentage points the proportion of people without improved water. But the pace of improvements is very slow compared to the needs: 40 percent of the sub-Saharan African population still uses unsafe water (WHO and UNICEF 2011). Only 26 of the continent's 53 countries are currently on track to reach their targets (WHO 2010; UNEP 2011).

For urban populations, Maps 5 and 6 show the progress in provision of improved water for urban Africa and Asia. While there were improvements in some countries, urban African populations are lagging behind. Overall, taking into account both migration and the progress in infrastructure, the urban population without access to safe drinking water in Africa increased from approximately 30 million in 1990 to more than 55 million in 2008 (WHO and UNICEF 2011).

Figure 10 shows the proportion of the urban Asian and African population per water facility type for 2008. While improved water sources are fairly common, as mentioned, access to piped water is quite limited in sub-Saharan Africa (35 percent), Southern Asia (51 percent) and Southeastern Asia (52 percent) (WHO and UNICEF, 2011). The availability and quality of water at improved access points varies greatly. Water from standpipes and kiosks, key sources of access for the poor, is not always available 24 hours a day. As a result, people (often women) spend hours fetching water, and must frequently adjust their work and rest schedules to get water. Intermittent service, which results in unreliable availability and inadequate volumes of often contaminated water, causes a large number of households to store water in household reservoirs, and supplement piped water with water from tanker operators and water vendors (Water and Sanitation Program 2007).

The findings of a survey conducted by J-PAL researchers with over 5,000 slum dwellers in Delhi (Banerjee et al., 2011) shed light on this point. The respondents highlighted the following deficiencies: 44 percent faced water scarcity, 90 percent reported that the drains were overflowing, and 99 percent reported that the nearby dumpsters were emptied less than once a month. A comprehensive toilet audit in these same communities found that 83 percent of toilets had fecal or significant amounts of other waste matter lying around the facilities, and only 16 percent had soap or other sanitary fluid for washing. When asked about priorities regarding urban facilities, slum dwellers identified water as the most problematic issue (50 percent of respondents), followed by sewage and drainage (20 percent), and garbage (15 percent).

The health impacts

A substantial literature seeks to establish the deleterious effects of lack of access to water and sanitation on health outcomes, particularly in urban areas.

Inadequate access to safe water and exposure to pathogens through the poor treatment of solid waste leads to adverse health consequences, particularly diarrheal diseases. Diarrhea is responsible for an estimated 21 percent of under-five mortality in developing countries--2.5 million deaths per

year (Kosek et al. 2003), and over 4 percent of the world's disease burden (WHO, 2011). Approximately 88 percent of all diarrhea infections worldwide are attributed to unsafe water supply, the lack of safe hygiene practices, and basic sanitation infrastructure (Evans 2005). Consequently, interventions that improve sanitation, water, and hygiene are of first order importance to achieve a better quality of life.

Densely populated environments are particularly prone to the diffusion of pathogens, and these problems affect the urban poor in particular. The urban poor have a lower life expectancy at birth, and a higher infant mortality rate than both the rural poor and the urban nonpoor (Bradley et al.,1992). Recent cholera outbreaks in Zimbabwe, Senegal, Zambia, and Ghana were linked to unhygienic and unsanitary urban conditions (Sasaki et al. 2008; Drechsel et al. 2010). Furthermore, inadequate disposal of solid waste is also a threat to the natural environment (and indirectly to health), as it can contaminate surface and groundwater with organics, nutrients, and solids (Hogrewe et al., 1993). It is estimated that by piping uncontaminated, chlorinated water to households, it would be possible to reduce diarrheal disease by up to 95 percent (Fewtrell and Colford 2004).

Safe hygiene practices and improved sanitation can have a large impact on health threats for children under five (Hutton and Haller 2004; Waddington and Snilstveit 2009). The lack of proper sanitation (defecation in plastic bags, buckets, open pits, and public areas) in crowded slums contributes to serious health and environmental risks for entire populations, and the poor are particularly vulnerable to infection from contaminated water and other disease vectors.
Given this vast literature, USI will not focus primarily on the impact of access to WSH and other urban services on downstream outcomes (although new evidence on this could be a by-product of other research project), but instead on innovative solutions to *improve* this access. This is where the knowledge gap seems larger, and where the initiative has a greater chance of creating a more substantive impact on research and policy discussions, given the scale of our operations.

2.3 Improving access: A focus on microsolutions

The enormity of the public health and development challenges associated with low-quality urban services may suggest that problems of this scale require large-scale, infrastructure-based solutions. Although macro infrastructure solutions must indeed be part of the solution in the long run, new infrastructure may not always be feasible, affordable, or cost-effective for the immediate WSH or other urban infrastructure needs of many cities in developing countries. Specifically, three constraints limit the possible speed of progress in reaching the poor with large-scale urban infrastructure projects.

I. *Logistical Feasibility*: Extending large-scale network-based solutions may not be immediately feasible for economic and logistical reasons. Adding new infrastructure or extending existing infrastructure is complex and expensive, especially in the marginal areas of cities. The poor are often forced to live in areas that are undesirable for formal

development. These settlements can be very dense, leaving little space for sewer lines (Hogrewe et al. 1993).

II. *The Public Finance Challenge*: In large cities in the poorest countries, governments may not have the funds to finance the large fixed-investment costs needed to connect an increasing number of urban poor to existing water, sanitation, and electricity networks. Even without budget constraints, building large-scale infrastructure can involve insurmountable bureaucratic challenges that USI would not be well-positioned either to analyze or overcome (for example, poor management, delays, cost overruns, and project selection).

III. *Legal Uncertainties*: Large-scale upgrading may require the regularization of the legal status of many informal settlements. For example, the Delhi Jal Board, which has been assigned the responsibility for water supply and drainage in New Delhi, is only allowed to make private in-house connections in legal settlements, though it is required to provide communal supplies (from public taps) to all citizens (Banerjee et al. 2011).

Given these limitations, there is scope for improvement in access within the constraints set by the existing network infrastructure: access to or quality of existing or newly planned infrastructure can be improved through more inclusive pricing, information, credit policies (e.g. Devoto et al. 2011); lighter infrastructure, such as community toilets, can be developed and maintained better; markets can be developed for the recycling of trash or human waste, creating a way to pay for the maintenance of first class services. The urban services challenge is not purely a technical one: while there is scope for improving transport and recycling technologies, there is also considerable scope for better understanding pricing and revenue models, incentives for politicians to direct adequate resources and provide services, and barriers to public action at the community level.

3. Barriers Preventing Improvements in Water, Sanitation, and Hygiene

In this section, we identify the key sets of barriers to innovation and implementation of improved water and sanitation, elaborating broadly on the demand, supply, and institutional constraints. This section only provides a brief overview: in the next section, we detail the specific barriers in which we believe there is scope for developing and testing new micro- and medium-scale solutions.

3.1 Supply Constraints

The first barrier to improvement of urban services is insufficient supply, especially of networked services. As mentioned earlier, a high percentage of the urban poor remain excluded from water and sanitation networks. In fact, less than 15 percent of those living in Asia and Africa have access to sewer sanitation (Bill & Melinda Gates Foundation 2011). Less than 50 percent of the poorest urban residents in Africa, and less than 40 percent in Asia have access to piped water (WHO and UN-Habitat 2010).

A number of explanations have been proposed for the inadequate supply of safe water, and especially, sanitation. Building water and sanitation infrastructure is costly and may involve numerous technical, bureaucratic, and legal constraints (Water and Sanitation Program 2007). Overcoming these constraints is further complicated by the complementarities in water and sanitation provision: many of the safest sanitation improvements require adequate water supply, and modern sanitation solutions without water may actually be counterproductive for health. Water infrastructure must, therefore, be provided either before sanitation infrastructure is built, or ideally as a joint project, which in turn increases the costs of service provision. Improvements in the planning and delivery of services are essential to promote more efficient use of water resources. However, overcoming technical supply problems must be complemented by a resource management framework involving national, regional, and local authorities (UN Millennium Project 2005). How to mobilize public resources (through revenue generation, taxation, innovations in pricing, cross-subsidization, etc.) to overcome the public finance challenges may be a fruitful area of inquiry for USI-funded projects.

In addition to these, climate change is altering the availability and quantity of water throughout the world. Furthermore, the "urbanization of poverty" and the massive internal migration of people from rural areas to cities are placing growing pressure on increasingly scarce water resources (UNEP 2011). Both these trends increase the threats to public health posed by poor WSH services in densely populated areas. Thus, moving forward, it is critical that policymakers and researchers search for ways to overcome not just current constraints to adequate water supply, but develop possibly pre-emptive responses to evolving challenges. For example, if the infrastructure is indeed stressed beyond carrying capacity, can public policies or other innovative interventions affect the quantity or composition of the population that needs to be served? Because of the links between water and sanitation, such research has the potential to impact water supply, sanitation, and other urban services all at once.

Despite the centrality of these issues to human welfare, the provision of water and sanitation services has not been a priority in the allocation of funds by governments and other stakeholders (UN Millennium Project 2005). Activities with a more visible and transparent link to economic productivity have been prioritized over sanitation, as has the provision of other types of infrastructure.[5] There are several reasons for this. First, large-scale public works to improve sanitation are more time-consuming and expensive than other types of urban services, including extensions to the water network (UN Millennium Project 2005). Second, local and national governments respond to priorities set by international donors and policymakers, but sanitation was not considered a priority by international institutions until recently. While access to clean water was in the original MDGs, sanitation was not added until 2002. Since its inclusion, it has become a greater policy priority for governments in different parts of the world.[6]

[5] According to the Development Cooperation Directorate (DCD-DAC) of the OECD, aid for water supply and sanitation has increased since 2001 following a temporary decline in the 1990s. The combined annual bilateral and multilateral support to water supply and sanitation in 2007 was US$ 6.2 billion, with approximately 26 percent for support to Sub-Saharan Africa.

[6] See, for example, India's Total Sanitation Campaign, among others.

Furthermore, the beneficial effects of sanitation and hygiene interventions take longer to materialize because they usually require behavioural changes in addition to the infrastructure improvements (Kar and Chambers, 2008). Access to roads, electricity or health-care professionals often have self-evident benefits, while improving sanitation in a community might require convincing the population to change an intimate behaviour. This may discourage governments from allocating funds to these types of investments. This line of argument also implies for USI researchers and practitioners that the urban services challenge is multidimensional, and that the provision of services cannot be analyzed in isolation. Demand, political economy, or other behavioral issues can usually not be ignored.

A closely related point is that governments may not have the incentives to allocate resources to sectors that they perceive as suffering from low demand by their constituents. After decades of large-scale information and public awareness campaigns, it is now well known that contaminated drinking water is responsible for waterborne diseases. However, the transmission of waterborne diseases through exposure to fecal material, and other sanitation-related disease pathways (flies, groundwater) is less well known. As a result, developing country citizens often inaccurately assess the environmental and health burdens of inadequate sanitation facilities (UN Millennium Project 2005). The multiple pathways of contamination complicate efforts to quantify the effects of poor sanitation and make it difficult to infer cause and effect, leading to low demand for, and subsequent underinvestment in, sanitation infrastructure.

Lastly, the insufficient public attention to WSH facilities might be due to a view of water and sanitation as household amenities, and consequently as household responsibilities (UN Millenium Project 2005). In this view, public agencies should concentrate only on the public aspects of sanitation, such as public networks for storm-water drainage and other large-scale public works projects. However, given the positive health and environmental externalities generated through common access to WSH, its provision is a clear public good, which should be an object of public policy. Economic theory suggests that it is in the interest of public institutions, both central and decentralized, to allocate public resources toward household- and community-level sanitation improvements (Tearfund 2007). Appropriate public service delivery models in an area where researchers and projects with an interest in public-finance issues could address with USI funds.

3.2 Demand Constraints

Even in places where a sewage system or piped water network exists, and where it would, in principle, be possible to connect households to it, there may be demand constraints that limit people's access to these services.

There are various potential reasons for limited demand. The primary constraint may be low willingness to pay. Randomized experiments in Zambia (Ashraf et al. 2010) and Kenya (Kremer et al. 2009; Kremer et al. 2011) suggest that the willingness to pay for improved water quality is low (in terms of money spent on chlorine or time allocated to water collection). Yet, given that investing in improved water and sanitation services is believed to provide high returns to health outcomes, the

reasons for such low uptake are difficult to rationalize. The poor may be liquidity constrained, they may not fully understand the benefits of the new technologies, have a wrong assessment of its costs, or there may be other behavioral or institutional constraints.

If liquidity constraints are the main barrier to uptake of WSH services, then there is an argument to be made for public subsidies for such services, given the positive health and environmental externalities associated with increased use of water and sanitation systems. Moreover, aid in kind (in the form of reduced prices for water) could theoretically be justified in light of paternalism, imperfect information or interdependent preferences (Currie and Gahvari 2008). Regardless of the type of subsidy used, the subsidy should be designed to provide an efficient allocation of services and ensure sustainability. The standard subsidy for water, however, hardly covers the cost involved in giving someone access to the network, but does provide for continuous supply of very cheap water. This may be regressive (as the poor are most likely to be unable to pay for the fixed investment costs) and inefficient (as it leads to waste of water). Recent work suggests that helping the poor borrow for the fixed cost of connection, and then charging a more reasonable price for water may increase both access and satisfaction (Devoto et al. 2011). Additional research on efficient ways to permit the poor to better access existing infrastructure is likely to be valuable.

Lack of demand for these urban services may stem from the fact that slum dwellers often live in housing without registration or titling, which discourages them from investing in new services (see Field 2005; S. Galiani and Schargrodsky 2010). Transient migrants are very common in fast growing slums, and usually come to urban areas during off-seasons in rural agricultural work in order to diversify their income sources (Banerjee and Duflo 2006, Bryan et al. 2011). They lack incentives to invest in urban services, and it is difficult to integrate them into existing networks.

3.3 Institutional Constraints

There are also institutional constraints that prevent the poor from accessing adequate urban services. For example, centralized supply solutions may not be sustainable or even work at all if regional and local levels of government are not involved to adapt the solutions to specific local needs (Tearfund 2007). Mismatches between demand for improved sanitation and the type of services provided often results in unused or underused sanitation infrastructure.

In addition to these, moral hazard and free-riding problems typical of collective action can arise when the sanitation or water infrastructure is shared, and must be jointly maintained. Although examples of communal solutions to these coordination problems exist (see, for example, communal sanitary facilities, garbage collection, or maintenance of drainage), they must be structured carefully to ensure that incentives are correctly aligned, the institutions (i.e. rules of the game) are well-designed, and that the community can successfully monitor its members.

Finally, not all individuals in the community may approve the development of water and sanitation services. For example, small, private, water-service providers–tanker operators, private kiosk operators, household resellers, door-to-door vendors, and operators of small boreholes and private

piped networks–have a vested interest in preventing the construction of formal network-based services. Some of these provide good quality service under competitive conditions, but the price of water is usually much higher than that of the main water utility, and they are most often informal and unregulated providers. Any novel interventions must account for the pre-existing market conditions.

On the flip side, such small-scale providers may be an important part of the solution. Addressing market failures may require innovations that fill important gaps in current provision. It might involve innovations in contracting, in labor supply, in logistics, or in new technologies. The Urban Services Initiative is very interested in projects that field test promising technological, institutional or economic innovations that have the potential to improve service delivery.

4. Four key areas for further research

This section highlights some open questions where USI-funded research might be especially valuable, within the context of demand, supply, and institutional constraints described above. These areas of research include: (1) consumers' willingness to pay; (2) collective action problems (such as coordination failure); (3) institutional and legal constraints, and (4) other political economy issues (such as a lack of incentives for politicians to provide these services). While there exists some research in each of these areas, there are, nevertheless, interesting avenues for future research.

4.1 Willingness to pay for improved services and other demand-side issues

Improving delivery of sanitation and other public services will require us to identify key sources of aversion to the adoption of new products, technologies, and solutions. Estimating demand functions for these services can inform pricing policy, guide the magnitude and targeting of discounts or subsidies, and also provide insights on novel marketing techniques. Demand estimation may shed light on the role of credit and liquidity constraints, information deficiencies and social learning, and other determinants of technology adoption, including intra-household decision making, risk aversion, ambiguity aversion, or price anchoring (Ashraf et al. 2010; Ashraf, Field, and Lee 2010; Miller and Mobarak 2011).

As noted above, some studies have found surprisingly low willingness to pay for clean water. It is unlikely that this reveals a blanket lack of interest in water quality or quantity, but it does indicate that diarrhea risk may not be the household's only concern. In Morocco, Devoto et al. (2011) found high willingness to pay for the convenience of in-home piped water, when people already had access to clean water from public taps. In Bangladesh, households switched taps in response to warnings about arsenic at the cost of collecting much dirtier water (Field et al. 2011; Madajewicz et al. 2007), and in Kenya, households exhibit a willingness to travel longer distances to access a cleaner source of water (Kremer, Leino, Miguel, and Zwane 2011).

Understanding the underlying factors that affect demand for urban services is a necessary first step in the design of the most suitable incentive mechanisms to improve access. An interesting subject

for further research, given the range of estimates, is to better understand what household characteristics affect the willingness to pay for services. There is more pre-existing research on this for other products and services (including water) than there is for sanitation.

Many factors could explain a low willingness to pay for clean water and sanitation. In some cases, people may not be willing to pay for a new technology because they do not fully understand its use or value. They may not be aware of the benefits to those services (for example, they may not realize that their current water is contaminated), or because they underestimate the health costs. Policymakers have long considered lack of information to be a central barrier. For example, the Community-Led Total Sanitation (CLTS) program takes as given the fact that people do not understand the pathways of disease transmission between fecal matter and food and water sources. Making these disease pathways salient through demonstration events is therefore a key component of the CLTS intervention (Kar and Chambers, 2008). Some research on the impact of information about water quality on household behaviour suggests that households are responsive to information campaigns (Jalan and Somanathan, 2004; Madajewicz et al. 2007). A campaign promoting handwashing in Pakistan (which also provided soap) resulted in a reduction in diarrheal disease among children younger than five (Luby et al. 2004). But more research is needed to understand the conditions in which information really makes a difference.

Even when households understand the health benefits of a technology, that may not be their primary consideration; they may care more about other attributes of the technology. For example, the Mobarak et al. (2012) study of demand for improved cookstove technologies finds that even though people are aware that indoor air pollution has negative health impacts, they place a higher priority on other needs, and are therefore unwilling to invest in pollution-reducing stoves. The authors conclude that packaging stoves with other features that align more closely with households' non-health-related priorities (e.g., reduced fuel consumption) may be more effective in increasing uptake. Dupas (2010) argues that households, in order to be willing to pay for bednets, mainly need to learn whether a bednet will be comfortable to sleep under. Pour-flush latrines require additional water collection, as water must be poured down the latrine after each use. People may be unwilling to pay for the installation of latrines if the maintenance of the latrine increases the already high costs of water collection. Devoto et al. (2011) find that households have high willingness to pay for the convenience of a water connection in their home, even if the quality of the water is not improved. Such considerations may change the cost benefit calculations for some facility improvements; for example, households may well be willing to pay a part of the “last mile” cost to be connected to a network when the grid is already present. In such cases, adding features such as a credit facility to help people pay may better leverage investment costs incurred previously. There is scope to better understand the value of “bundling” product amenities in optimal ways to encourage the take-up of health-improving products. This involves both technological solutions (e.g., toilets that require less or no water), as well as an understanding of consumer preferences.

A third factor affecting demand may be that small bureaucratic hurdles may play a larger role than is generally acknowledged. In Tangiers, 80 percent of households agreed to pay the full cost of a connection to the water network when they were informed that credit was available, and when they received help in obtaining it (Devoto et al. 2011). Households that were neither informed nor helped

were much less likely to apply for the existing credit opportunity. And after these households were informed, they remained less likely to take it up than those that were also helped at home. This study was not specifically designed to test the impact of bureaucratic hurdles, but the results are suggestive that they may matter, and it would be an interesting topic to study further. Since WSH services often involve interaction with a local bureaucracy, addressing hurdles may be an effective way to improve access. If bureaucratic hurdles to access these services are indeed a significant barrier, it would be important not only to try to lower them, but also to understand what the source of the problem is: is it that households exaggerate the difficulty of dealing with the bureaucracy? Or that dealing with the bureaucracy is genuinely difficult? Or is it that these costs, perceived or real, lead households to procrastinate?

When willingness (or ability) to pay is low despite these kinds of interventions, it may be cost effective to subsidize take-up, given the potential externality of waterborne diseases, especially in urban environments. Concerns have been raised that such subsidies would discourage effective use and lead to waste through screening effects (people with low willingness to pay for a product may also be those less likely to use it) and/or a psychological sunk cost effect (e.g., the very fact of not having to pay for something makes it less desirable). These considerations, as well as externality-based pricing, suggest that "smart subsidies" that account for economic efficiency and/or psychological considerations may be a useful avenue for research.

A growing literature examines the impact of prices of preventive health products (including chlorination of water) on both take-up and effective use (see J-PAL, 2011, and Glennerster and Kremer 2011, for reviews). Several studies are specifically concerned about water treatment: Ashraf et al. (2010) design an experiment involving door-to-door sale of Clorin, a disinfectant commonly use to purify water supplies. Households were randomly selected to receive a take-it-or-leave-it offer of the product at the retail price or at a discounted price. Then, among those that were offered a retail-price product and agreed to purchase it, some were offered an unanticipated discount. In the short run, households with a greater willingness to pay for the good were also more likely to use it, supporting the hypothesis of screening effects. However, there was no evidence of a sunk cost effect. Yet another study (Berry, Fischer, and Guiteras 2011) estimated the willingness to pay for household water filters in rural northern Ghana using an alternative approach: the Becker-DeGroot-Marschak mechanism, in which individuals are asked to bid for the item, and then a random price is drawn from a distribution. If the price drawn is smaller or equal than the price offered, they receive the water filter at the price drawn; otherwise, they do not pay and do not receive the filter. The authors were able to separately identify the extent to which usage of the filter varied by willingness to pay independent of the actual price paid (i.e., a screening effect), and also by price paid independent of willingness to pay (i.e., a sunk cost effect) because the mechanism employed elicited willingness to pay before randomly assigning the actual price paid. The study results did not support the existence of either effect. Work by Kremer et al. (2009; 2011) demonstrates that free, point-of-collection chlorine dispenser systems combined with a local promoter leads to high rates of sustained take-up for chlorine water treatments. Understanding whether such strategies would work in urban environment is another potentially fruitful avenue for research.

The same kinds of questions arise in the case of other WSH services, and there is no experimental evidence for those: should soap be provided free or subsidized or should it be sold at market price? From the point of view of demand, how should one charge for public or community toilets, the usage of which carry clear epidemiological externalities?

Some WSH products require non-negligible up-front fixed costs for adoption. In that situation, the ability to pay for the product may be influenced by access to credit or savings. Dupas (2009) finds that the demand for insecticide-treated bednets is less price elastic when people have more time to make a purchase decision, as they can save for the product in advance. Similarly, Tarozzi et al. (2011) find a much lower elasticity of demand among the poor than that found in other studies when potential users are offered a microcredit contract with which to purchase the new technology. Devoto et al. (2011) find very high take-up of an expensive water contract when it is coupled with credit. There is clearly room for additional research addressing the links between price, demand, and liquidity constraints in urban settings with very different employment conditions and cash flow situations.

The economics of both sanitation facilities and trash management may become entirely different with a modification in the business model. Reusing and recycling offer the opportunity to generate revenues, which can substitute for fees (both on the markets, and using mechanisms such as carbon credits for electricity generated), but a sustainable business model is yet to be developed. This involves research both on technologies (the microbiological process by which certain types of trash or solid waste can be turned into something valuable needs further research), but also on ways to support entrepreneurs who can mobilize these technologies, and create a profitable business venture out of that technological breakthrough. Promising innovations in engineering, financing, marketing, or industrial organizations may need to be field-tested. Effective projects in this area would not only have the potential to improve urban services, but would also create better livelihoods for poor urban residents, many of whom are already involved in these activities.

Willingness to pay may be affected by positive and negative externalities. Foster and Rosenzweig (2010) discuss two types of externalities that influence technology uptake: learning externalities, and technological externalities. When there are learning externalities, one's neighbor's experimentation with the use of a new technology may increase one's own productivity with the technology, which increases returns to investing in the technology, assuming one can observe and learn from neighbors. However, given that there are costs to experimentation, there may be inefficiently low levels of experimentation if first adopters believe that others are likely to free ride on what they have invested in learning (Foster and Rosenzweig, 1995). Technological externalities occur when one person is made better or worse off by another's use--or lack of use--of a new technology. This may affect take up in either direction. The existing experiments that allow for clean identification of spillovers in the take-up of preventative goods with externalities (e.g., Kremer and Miguel 2007; Dupas 2010) were not specifically designed to separate learning from technology externalities, and more research is needed. These externalities are closely linked to collective action problems and coordination failures, which we discuss in the next section.

Finally, willingness to pay may also be affected by disparities between how much the technology is valued by the end user, and how much it is valued by the person in the household in charge of making purchasing decisions. A growing literature indicates that intra-household variance in preferences can lead to inefficiencies (Udry et al. 1995; Udry 1996; Anderson and Baland 2002; Ashraf 2009; de Mel et al. 2009; Ashraf et al. 2010; Fafchamps et al. 2011; Köhlin et al. 2011; Miller and Mobarak 2011). Specifically, women and children may disproportionately bear the health costs of exposure to waterborne illnesses or may be primarily in charge of collecting water, and thus may place a high value on technologies that reduce water contamination or reduce the amount of time spent in water collection. However, because it is typically men who make the purchasing decisions, households may not purchase these technologies because men do not fully take into account the costs imposed on their wives and children. Miller and Mobarak (2011) find that when smoke-reducing cookstoves are offered to women, the take-up rates are higher than when the stoves are offered to men, which is consistent with this theory. Some evidence from a more general economics literature indicates that not only preferences but price elasticities may vary by gender. Hersch (2000) finds that both men and women are more price inelastic when they have access to their own income, and that women in particular have a smaller earnings elasticity when the earnings are their own (that is, not pooled into the overall household income). Experiments should investigate the linkages between product prices and externalities, different implicit costs, and intra-household resource allocation. Examples could include co-varying price with group incentives, or investigating gender differentials in price elasticity of demand, to determine the combinations of prices and other interventions that would bring about optimal levels of uptake.

4.2 Coordination failure and collective action problems preventing shared, community solutions

Due to strong interdependencies between different households' decisions, the provision of most WSH services may be hindered by collective action issues. Coordination failures and free riding are a serious challenge to implementing community-level solutions--such as community sanitation centers, garbage collection, or even regular maintenance of drainage. For example, the health benefits from adopting improved latrines may be minimal so long as other people in the community continue open defecation practices, as rates of fecal-oral contamination would remain high (Kar and Chambers, 2008). Thus, the individual benefits to adoption may not outweigh the costs until a certain threshold is crossed in terms of the percentage of community members who also adopt.

Coordination failures sometimes prevent technological solutions from being put into practice. Even when solutions are implemented, they may not be sustained because no individual takes responsibility for maintenance tasks. In a study of community toilets in Bhubaneshwar, India, one in six toilet seats were observed to be entirely nonfunctional, and 74 percent of users characterized community and public toilets as bad-smelling (J-PAL 2012). However, very little is known about the specific obstacles to collective action in urban areas, and how to solve them. We need to produce research on individual and group decision making in the context of urban WSH in order to learn how best to counter these collective action problems.

Plan International's CLTS campaign seeks to eliminate this coordination failure by collectively "shaming" villages into ending open defecation practices en masse. Another NGO, Gram Vikas, requires the contribution of every single household to a financial pool before construction of the water and sanitation infrastructure is started. This is analogous to the "big push" approach first outlined (in a more macroeconomic context) by Rosenstein-Rodan in 1943: nonindustrial economies can be moved from suboptimal to optimal equilibria through rapid industrialization across sectors, even when externalities (and complementarities) mean that no individual firm has the incentive to industrialize on its own (Rosenstein-Rodan 1943; Murphy et al. 1989; Ray 1998).

In addition to these externalities, there are also learning diffusion issues. While much work has been done on the diffusion of innovations through the social networks (see, for example, Banerjee 1992; Rogers 2003; Bandiera and Rasul 2006; BenYishay and Mobarak 2012, among others), questions remain open on the most effective way to create this dynamic. Questions also remain on how these externalities interact with price, and whether pricing can help create a "big push." For example, Dupas (2010) finds that offering bednets for free to some individuals increases the purchase rates of their neighbors. Studies here could leverage (and help further) new research in the economics of social networks. The question is particularly interesting from a social network point of view, since water and sanitation both involve standard externalities and, potentially, learning externalities.

To address collective action and coordination failures, it is also important to identify which characteristics of groups can aggravate the problem. Group size has been proposed as one of the main factors affecting collective action. If a group is very large, individual effort becomes diluted and, given that an individual will have no discernible impact on the probability of provision of the public good, nor would she derive any great marginal benefit from the good, the classic free-rider problem may result. In order to solve this dilemma, some sort of organization must be created to change the incentives faced by group members and coordinate total effort. Theoretically, large groups will face more free riding problems (Olson 1965), while small groups would have fewer organizational costs and each member would receive a more substantial portion of the good (Banerjee et al. 2008). Iyer (2008) points out that the net result of these opposite forces will depend on the nature of benefits of the public good: on the one hand, if individual benefits do not depend on the number of users of the good, the level of provision will likely increase with the size of the group; on the other hand, if the good is subject to congestion, the free rider will be stronger. Empirical literature, however, has found mixed results in the effect of group size on coordination (Bandiera et al. 2005).

Another group characteristic that affects coordination is group heterogeneity. In contrast to rural areas, neo-urban settlements are often quite heterogeneous–both ethnically and in terms of wealth distribution–and this may hinder collective action (Alesina, Baqir, and Easterly 1999). These issues are potentially exacerbated by the influx of recent migrants: it is difficult for stationary slum residents to hold the transient population accountable to their rules, and this can lead to internal conflicts. Socially heterogeneous groups may also increase communication costs, lower the degree of trust and altruism, and increase the difficulty of monitoring members and applying social sanctions to those that do not participate (Iyer, 2008; and Banerjee et al. 2008).

Similarly, Bandiera et al. (2005), using individual-level panel data of Eastern European rural workers in the UK, find heterogeneity along the lines of ethnicity, religion and social class to be negatively associated with cooperation. Jackson (2007) uses household surveys covering 15 countries and concludes that poor piped water provision in ethnically fragmented groups is due to the lack of institutions that manage interethnic relations properly. Finally, Balasubramaniam et al. (2011) study two dimensions of within-community heterogeneity (caste and religion) to assess the correlation between within-group heterogeneity and tap water access in India.

In addition to the empirical literature, theory suggests that different kinds of heterogeneity may lead to very different results in public good provision. For example, low benefit heterogeneity may lead to lower coordination due to differences in preferred production level. High benefit heterogeneity, on the other hand, may imply that few people receive the lion's share of the benefits. These individuals will be willing to pay for the provision of the good by themselves, and let other group members free ride.

Solutions to collective action problems and coordination failures require that institutions be well designed--taking into account context and characteristics of groups--to incentivize cooperative behavior. Bandiera et al. (2005) review field studies and laboratory experiments in order to determine which institutions are more successful in solving coordination failures. They conclude that well-defined rules, monitoring technologies, the ability to punish deviators, and the existence of well-functioning conflict resolution mechanisms, as well as a forum for discussion, are typically associated with successful communities. Similarly, Khwaja (2009) finds that inequality, social fragmentation, and lack of leadership in community have adverse consequences on coordination, but these problems can be addressed with better project design.

More research is needed on the type of institutions that are effective in solving coordination failures. This is an area in which fieldwork is ahead of research, as many organizations worldwide are actively seeking to solve collective action problems, and install facilities. For example, the international NGO, WaterAid, in cooperation with the Tiruchi City Corporation, and Gramalaya, a local NGO operating in Tamil Nadu, India, created a community-based management system to maintain public latrines. Each user of the latrines pays 50 paise (approximately US$0.01) for each use, and the money is used to stock the latrines with cleaning supplies, as well as to pay the salaries of the facility staff (who clean and collect fees). While qualitative evidence indicates that this project has been successful, to our knowledge, no quantitatively rigorous work has been done to determine whether such toilets are better maintained than they would be under alternative models, or whether this is the optimal price in terms of balancing financial sustainability with providing all members of the community access to improved sanitation facilities. The "industrial organization" of such facilities could be useful fodder for research, covering topics such as the optimal management system for the facility (private sector versus community-managed?), evaluation of alternative institutional rules supporting that management structure, pricing schemes, and access rules.

Consideration of public versus private management of urban services yields a rich set of analytical, policy-relevant questions. Government procurement from the private sector is complicated by

asymmetric information on costs, which may lead to distortions of outputs (see, for example, Laffont and Martimort, 2002). Mechanism design for efficient service provision and the firm selection process in a procurement auction are important areas for future research. There is not much work on this in the context of urban services. Should procurement contracts be auctioned, and if so, through what type of auction? Ajayi et al. (2012) and Jack (2012) study different auction designs for environmental services in developing countries. The analytics get even richer when the possibilities of renegotiation or add-ons to procurement contracts are considered (e.g., if the networks need to be expanded or the service upgraded).

Enhancing competition for procurement can save public resources. In auctions with private values (i.e., each firm knows its own costs, and this is private information), firms are induced to bid their true cost in equilibrium when there are a large number of bidders, and this leads to the efficient (lowest cost) outcome (Gupta 2002). However, competition in public procurement auctions in the water supply and sanitation sector is often very limited due to technical complexity and flaws in auction design (Estache and Iimi 2009). How to enhance competition, and whether competition is sufficient for efficiency are open questions. For instance, Estache and Iimi (2009) propose the division of lot contracts as a policy choice for auctioneers to achieve efficiency. They use data from public procurement auctions for water and sewage projects in developing countries to show that bidder entry is endogenous, especially because it is determined by the auctioneer's bundling and unbundling strategy. For example, they propose that when public procurement of water treatment plant and distribution networks are bundled in a single lot package, competition is significantly reduced, and this in turn increases procurement costs.

4.3 Institutional and Legal constraints

The adoption of new technology regarding water and sanitation sometimes involves large investments (whether they be time, money or other resources) that are irreversible. For example, connecting a house to the water or sewage network, or building a safe latrine, are investments requiring the consideration of the support structure, such as the local institutional and legal arrangements.

Slum dwellers often live in houses with insecure property rights where a legal title is lacking.[7] De Soto (2000) describes the channels through which insecure and poorly defined property rights stifle economic development. Insecure property rights weaken the incentive for owners to make long-term capital investments, and hinder the ability of owners to use their property as collateral to secure loans to finance capital investment. There is not much evidence on the effects of property rights, since the institutions develop endogenously, posing challenges for empirical work. To overcome this identification problem, Galiani and Schargrodsky (2010) exploit a natural experiment

[7] Besley and Ghatak (2009) define property right as an owner's right to use a good or asset for consumption and/or income generation (referred to as "use rights"). It can also include the right to transfer it to another party, in the form of a sale, gift, or bequest (referred to as "transfer rights"). A property right also typically conveys the right to contract with other parties by renting, pledging, or mortgaging a good or asset, or by allowing other parties to use it, for example, in an employment relationship.

in the allocation of land titles. In 1981, squatters occupied a piece of land in a poor suburban area of Buenos Aires. In 1984, a law was passed expropriating the former owners' land to entitle the occupants. Some original owners accepted the government compensation, while others disputed the compensation payment in the slow Argentine courts. These different reactions by the former owners generated an exogenous allocation of property rights across squatters. The authors find that entitled families substantially increased housing investment, reduced household size, and invested in their children's education relative to the comparison group. Slow-moving investments in physical and human capital led to these changes rather than improvements in credit access. Field (2005) addresses a similar question in Peru using variation in ownership status induced by a nationwide titling program, in which 1.2 million property titles were distributed to urban squatters on public land. She performs a difference-in-difference analysis to compare the change in housing investment before and after the program among participating households, to the change in investment among nonparticipants. Her results indicate that strengthening property rights in urban slums has a significant effect on residential investment: the rate of housing renovation rose by more than two-thirds of the baseline level. The greater incentives to invest are not associated with an improvement in credit access due to the titling program, but to the lower threat of eviction. In particular, there is also a significant increase in renovations financed out-of-pocket, and in total investment among nonborrowing households.

More studies are needed on the effects of institutional factors (including land titling) on sanitation investments, and on the optimal way to provide property rights. For example, one issue arising in sub-Saharan Africa is that the individual recipients of land rights often sell their land rights to more affluent city dwellers, exacerbating the growth of slums (Bassett 2007). Policymakers are investigating alternative tenure forms. One example is the Community Land Trust model in Kenya, which is a community based institution used to provide tenure security as part of a settlement improvement project. Rigorous evidence on the effects of such programs are still needed.

Market information is another aspect of the institutional environment that matters for urban service delivery. In theory, disclosure of information about service quality should increase the returns to quality, which in turn incentivizes service providers to improve quality (see Dranove and Zhe Jin 2010 for a comprehensive review). An information disclosure program could be a cost-effective intervention that improves the quality of urban services, but such programs will need to be field-tested. Evidence on the effects of such programs in other contexts is mixed. Bennear and Olmstead (2008) examined how Massachusetts drinking water suppliers react to a new mandatory disclosure requirement for water contamination levels. They find that larger utilities required to mail consumer confidence reports directly to customers reduced total violations by 30–44 percent. On the other hand, Bar-Isaac et al. (2012) and Lu (2012) find that firms allocate more effort to improve quality in the dimensions that they are required to report on, but compensate by shirking in other dimensions. Net benefit to consumers of this behavior is potentially nil.

4.4 Political Economy issues

For larger scale solutions to urban WSH challenges beyond the household or community level, local or central government participation is necessary. Issues surrounding the accountability of elected

representatives to poor neighbourhoods then become very relevant. And when the constituents are residents of urban slums, it leads to an unusually rich and interesting set of research questions. Despite the urban poor forming a sizable proportion of the population, this voting bloc has often been unable to leverage their political weight to gain improved public service delivery. There appears to be little disciplining of elected representative through the voting booths, and this has contributed to the low quality of public good provisions in urban areas.

There are several strands of possible research areas. First, there is a long tradition, mostly in developed countries, of studying urban politics through the lens of political "machines." The basic idea is that new immigrants seeking integration into the political system are a natural target for political parties, which offer them some degree of protection and help in return for votes. More generally, vote buying in poor neighborhoods of cities might be particularly easy given that these neighborhoods are densely populated, with extensive information networks. Despite its long history, there is very little known about either the mechanisms of vote buying (public goods, private goods, threats, etc.)[8] or its implications for the quality of urban public good provision, particularly WSH.

A second issue is that part of the problem is driven by the fact that voters are not always very well-informed about who is responsible for various types of infrastructure, and hence who should be punished for what. In a survey conducted by Abhijit Banerjee and Rohini Pande in Delhi, only 36 percent of respondents knew that the municipal councilor, the elected representative most responsible for funding local public goods, had money to spend in the ward; of those, over 85 percent thought that the councilor had less to spend than they actually do. Voters may not even know the proper person to contact: only 28 percent of the Delhi respondents could correctly name their councilor. A survey of the leaders of Resident Welfare Associations, organizations that aid their members in obtaining better services, found similarly low rates of knowledge. Voters may also not know what their representative actually did while in power (how they chose to spend their budget, for example). Voter mobilization and information campaigns can potentially solve this problem. This is a recent and very active area of research (Ferraz and Finan 2011; Banerjee et al. 2010; Banerjee et al. 2011; see Olken and Pande 2012, for a review). While these studies generally find that voters are responsive to information, very little is known about whether politicians in turn respond to the altered political environment. Urban WSH services may provide a great context in which to examine these questions, since they are local public goods whose quality can be affected by individual politicians. This is an area for which cofunding for research projects from J-PAL's Governance Initiative and the Urban Services Initiative may be feasible.

Finally, even if the politicians are partly responsive to voters' incentives, elected representatives may act according to their own preferences (as in Besley and Coate 1997; or Osborne and Slivinski 1996). In this case, rules that affect the politicians' identity (such as quotas) may affect what they chose to invest in. In rural areas, there is evidence that women pay more attention to water infrastructure (Chattopadhyay and Duflo 2004). There is no corresponding evidence for urban areas.

[8] Exceptions are Banerjee et al. (2011) for Delhi, and Finan and Schechter (2012).

Conclusion

In the last three decades, the population growth rate in urban areas of developing countries was three times that in rural areas. In 2007, there were already more people living in cities than in rural areas. Consequently, in many cities, water, sanitation, and hygiene infrastructure is stressed beyond current capacity, and infrastructure investment has not kept pace with rapid and unplanned urbanization (WaterAid 2007).

Access to safe water and sanitation is essential for health, security, livelihood, and quality of life, and is especially critical to women and children. However, the developing world--particularly Asia and Africa--is lagging behind in water and, even more so, in sanitation coverage. Close to 2.4 billion people are expected to still be lacking access to proper sanitation in 2015 (WHO 2012). In this context, the strategic focus of the Urban Services Initiative (USI) of the Abdul Latif Jameel Poverty Action Lab (J-PAL), an initiative funded by the Bill & Melinda Gates Foundation, will be to identify, design, and rigorously test innovative micro- and medium-scale solutions to the problems of inadequate access to water, sanitation, and hygiene in urban neighborhoods of developing countries.

Due to the balance in the existing literature, the emphasis of the research conducted under USI will be mainly placed on *how*, rather than *whether* (although the question of impact may be a useful by-product), to provide better public services to the urban poor.

Building large-scale infrastructure will be an important part of the long-term solution. However, new infrastructure may not always be feasible, affordable, or cost-effective for the immediate WSH or other public service needs of many cities in developing countries. Hence, there is scope for developing interventions that can improve access to WSH services quickly, efficiently, and cheaply, either by improving access to existing (or newly planned) large-scale infrastructure or by providing smaller scale investment at the individual or the community level. USI will mainly conduct research on these topics.

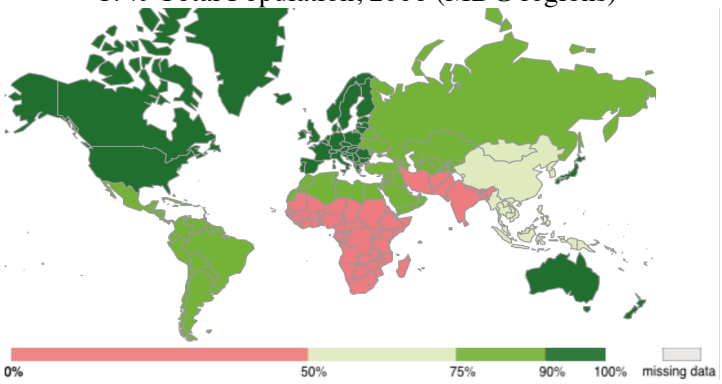
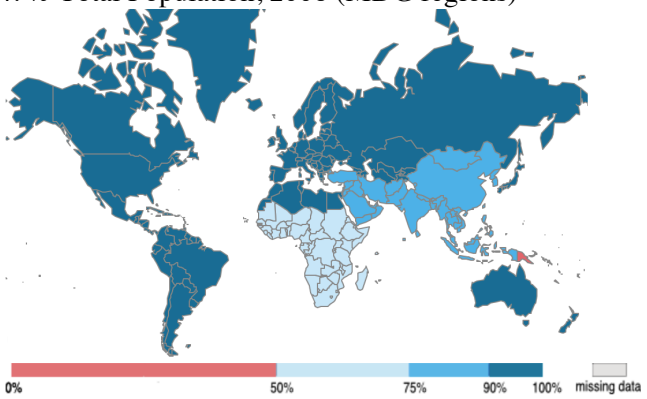
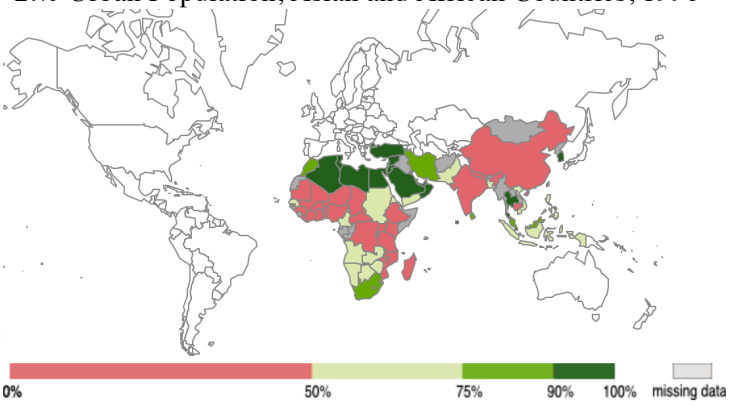
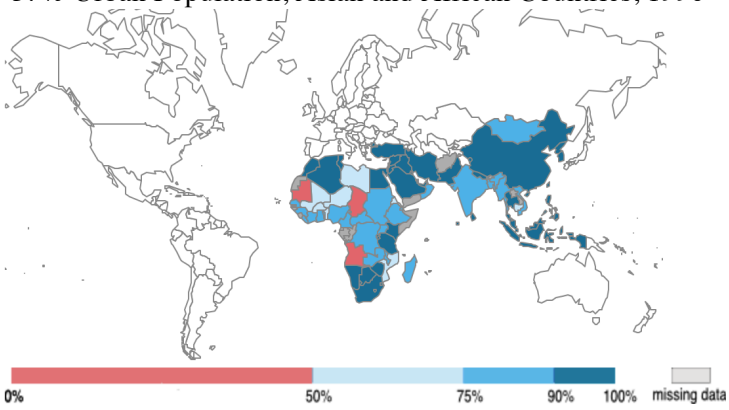
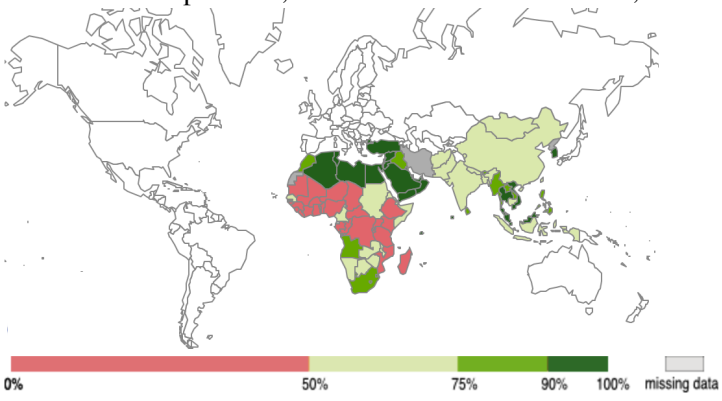
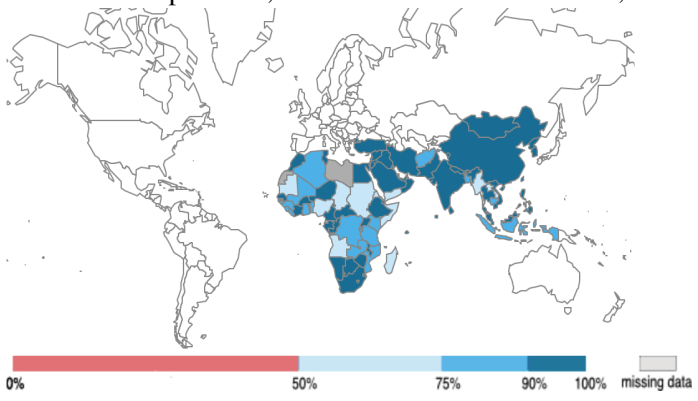
To assess the problem of achieving greater coverage, a first step is to identify the barriers to innovation and implementation of improved water and sanitation. The first one is clearly insufficient supply. Building water and sanitation infrastructure is costly and may involve numerous technical, bureaucratic, and legal constraints–particularly in the developing world. Even in places where the water and sanitation network exists and it is technically feasible to connect to it, there may be demand constraints that limit people's access to these services. The third type of constraints is institutional. For example, centralized supply solutions may not be sustainable or even work at all if regional and local levels of government are not involved to adapt the solutions to the local context.

USI will seek to promote innovative research on these three topics. While USI is open to any research on these issues, within those broad topics, we have identified some key areas where additional research would be highly productive. The first area of research, or barrier to access of

urban public services, is consumers' willingness to pay. Understanding the demand functions for WSH services is crucial to design the most suitable incentive mechanisms to improve the coverage. There are many open questions along this line, such as what households are willing (and unwilling) to pay for, how to make the consumers aware of the benefits of those services, or what the optimal "bundling" strategies to encourage take-up are.

The second barrier has to do with collective action problems. Moral hazard and free riding problems typically arise when the sanitation or water infrastructure is shared, and must be jointly maintained. There is limited knowledge about how to manage pricing in the context of positive and negative externalities, the specific obstacles to collective action in urban areas, and about individual and group decision making in the context of urban WSH. Thirdly, there are institutional and legal constraints. A common case is that slum dwellers do not have legal property rights for their dwellings, so would not embark in major improvements of them. More studies are needed on the effects of land titling on sanitation investments, and on the optimal way to provide property rights. Also further investigation is required on the organization of the supply of urban services, via regulatory frameworks that would lead to the efficient outcomes. Finally, there are other political economy factors affecting the coverage of WSH services. Avenues for future research in this field include voter mobilization and how politicians respond to voters' incentives, the mechanisms of vote buying and its implications for the quality of urban public good provision, particularly WSH.

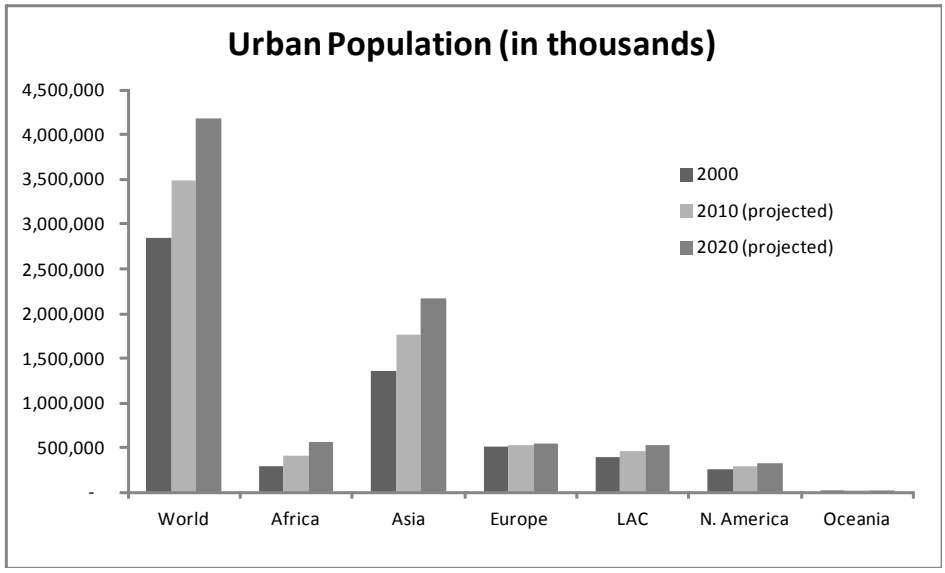
Annex I. Maps

Improved Sanitation	Improved Sources of Water
1. % Total Population, 2008 (MDG regions) 	4. % Total Population, 2008 (MDG regions) 
2.% Urban Population, Asian and African Countries, 1990 	5. % Urban Population, Asian and African Countries, 1990 
3. % Urban Population, Asian and African Countries, 2008 	6. % Urban Population, Asian and African Countries, 2008 

Source: (WHO and UNICEF 2011)

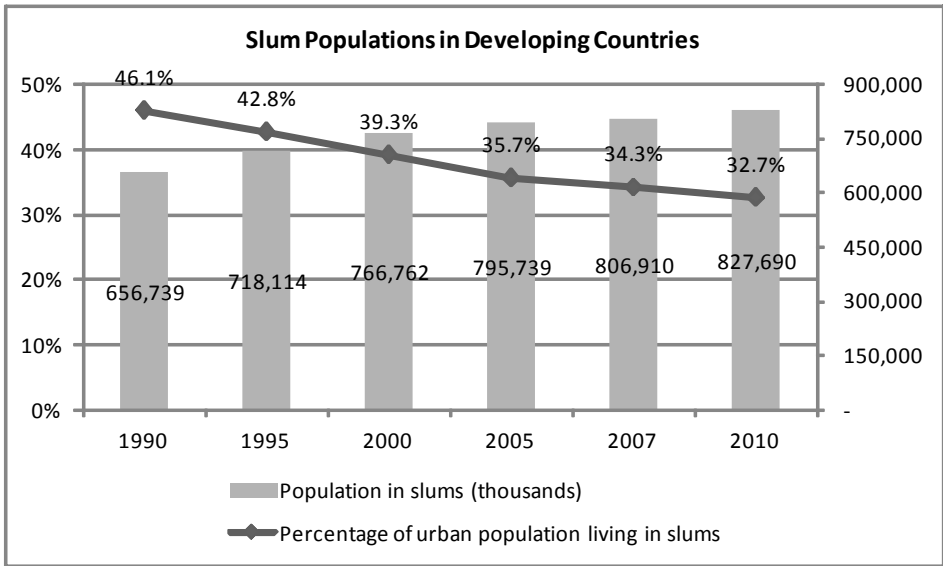
Annex II. Tables and Figures

Figure 1



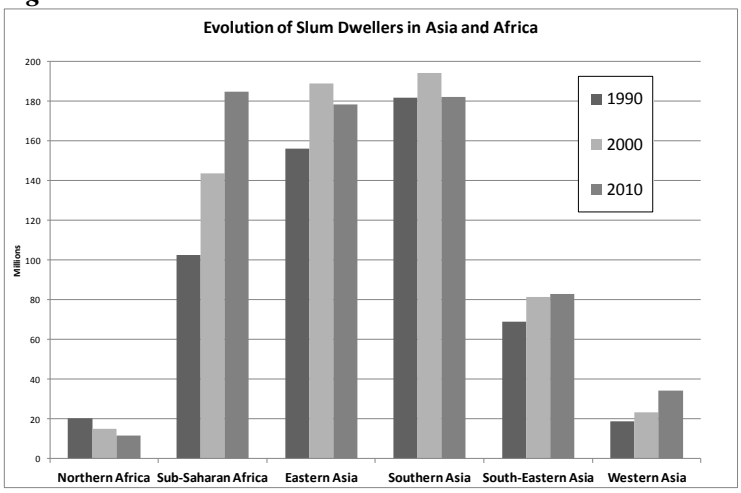
Source: (United Nations, 2010)

Figure 2



Source: (UN-Habitat 2008)

Figure 3



Source: (UN-Habitat, 2008)

Figure 4

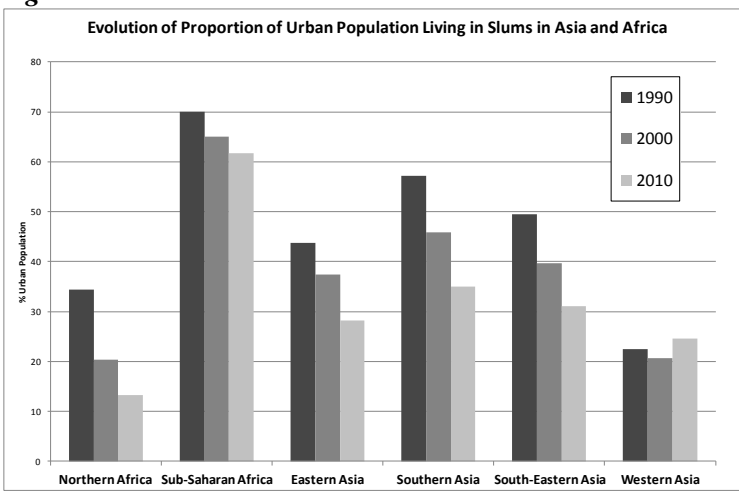
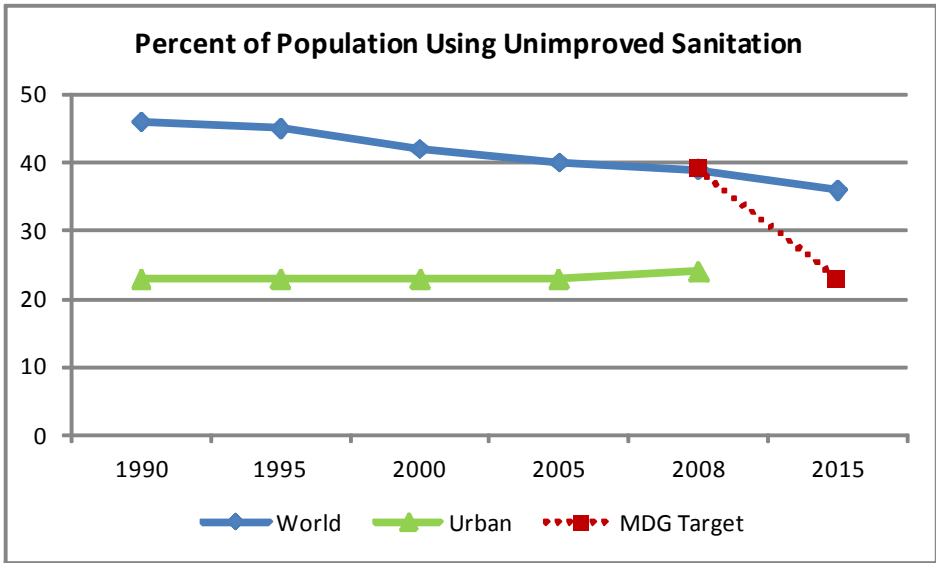
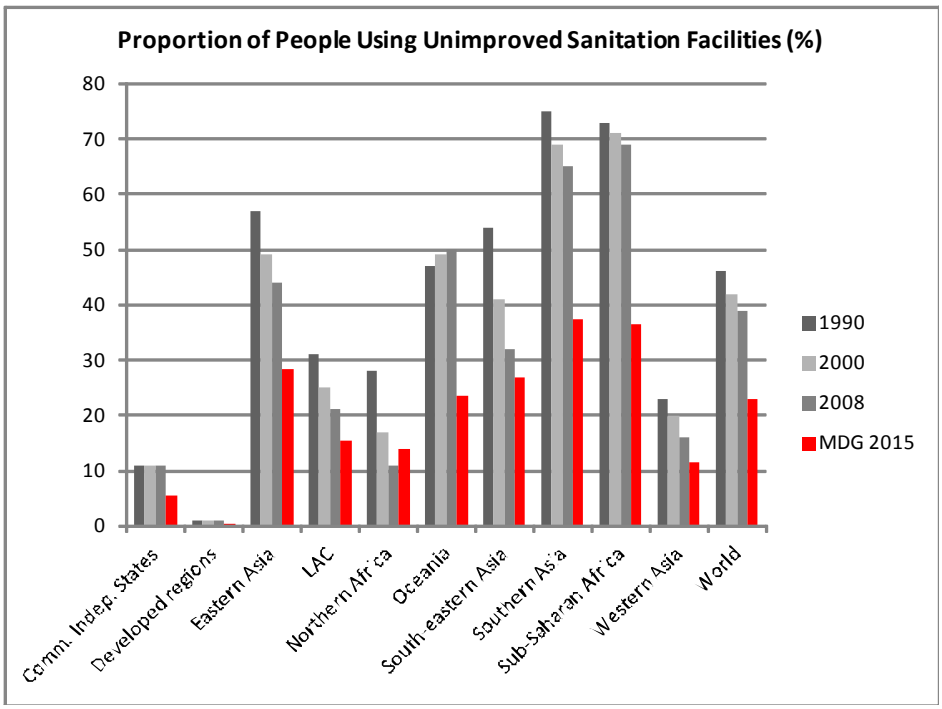


Figure 5: World OFF track for MDG



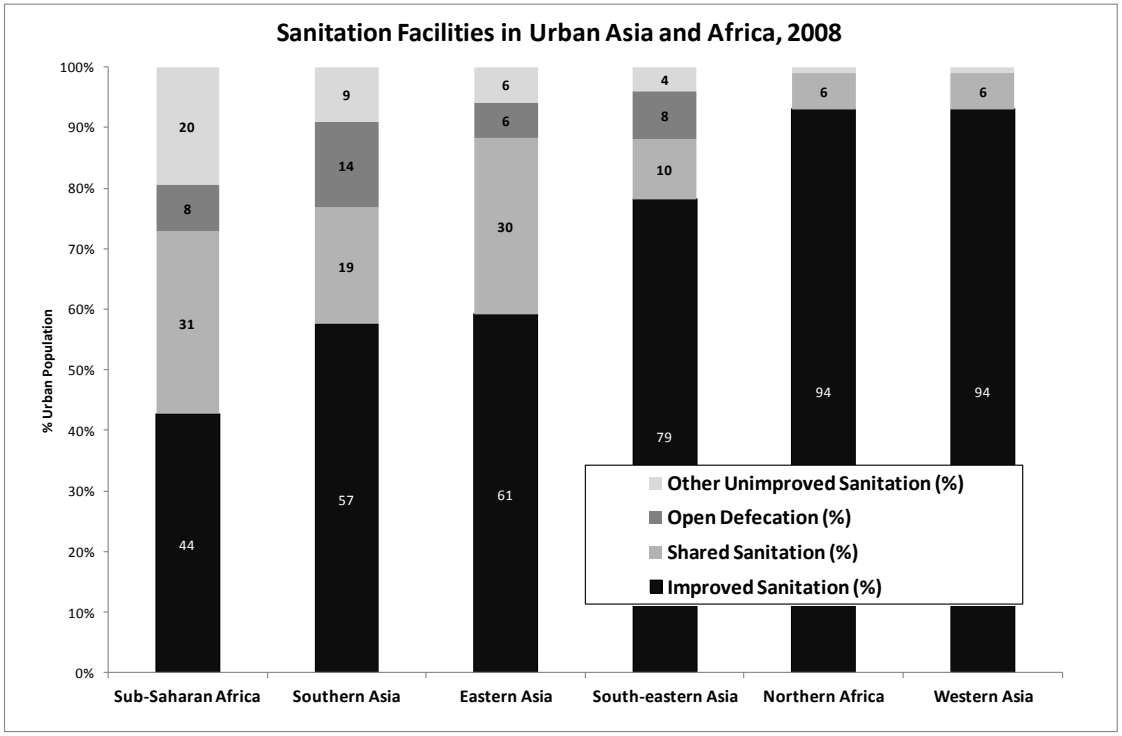
Source: (WHO 2010; WHO and UNICEF 2011)

Figure 6



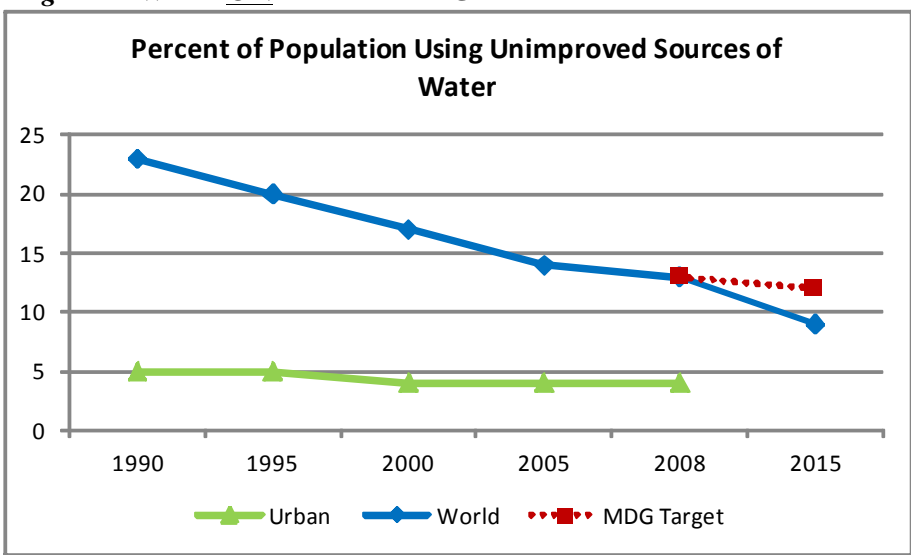
Source: (WHO and UNICEF 2011)

Figure 7



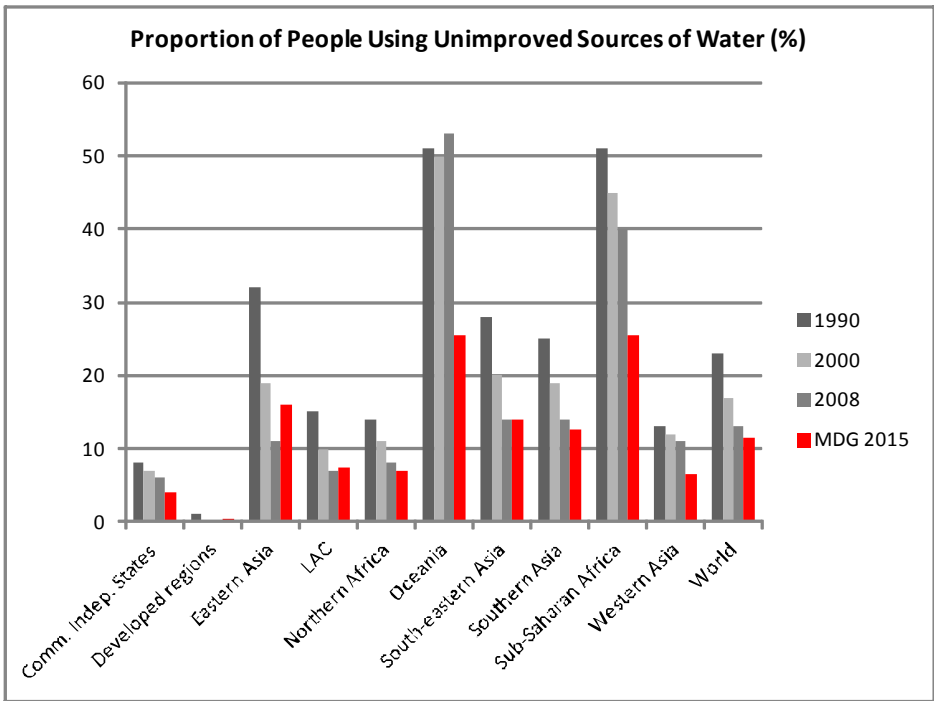
Source: (WHO and UNICEF 2011)

Figure 8: World ON track for MDG



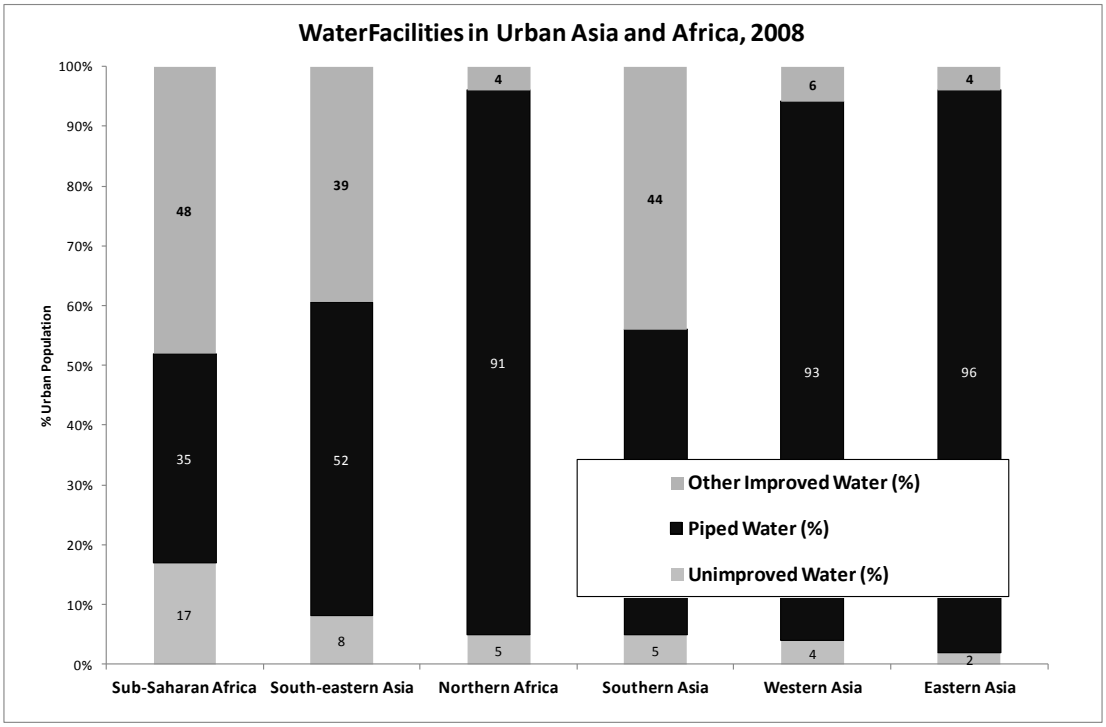
Source: (WHO 2010; WHO and UNICEF 2011)

Figure 9



Source: (WHO and UNICEF 2011)

Figure 10



Source: (WHO and UNICEF 2011)

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