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BARE KNUCKLE AND BETTER TECHNICS: TRAJECTORIES OF ACCESS TO SAFE WATER IN HISTORY AND IN THE GLOBAL SOUTH

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Abstract: This paper draws lessons from the history of water provision in the industrialised world, and the failure of colonial municipal water utilities, to illuminate the social, political and financial challenges facing improved urban water supply in the global south. It distinguishes four trajectories for water and sanitation access with different records of success. The paper then suggests that engineers, and the communities, NGOs, development agencies and governments for whom they work, could work more effectively if they formulated their work to fit socially, financially and politically feasible trajectories. Copyright © 2007 John Wiley & Sons, Ltd.

Keywords: safe water; sanitation; access; industrial revolution; history; post-colonial utilities; trajectories

1 INTRODUCTION

In this paper, I want to examine three questions about access to water and sanitation in the non-industrialised world. First, what can we learn from the history of the achievement of universal access to safe water and sanitation in the industrialised world? Second, what does the widespread decline of colonial and post-colonial water and sanitation utilities tell us? Third, how can engineers and other specialists restructure their work and their

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organisations to fit the range of scales and social conditions that provide the context for contemporary initiatives in water and sanitation?

To explore these questions, the paper distinguishes four general trajectories or technics¹ for water and sanitation access:

1. Large-scale urban approaches associated with the industrial revolution.
2. Colonial and post-colonial, municipal utilities.
3. Community-driven initiatives.
4. Bare knuckles and high-tech innovations implemented at the household level.

Sections two and three of the paper deal with the first and second questions described in my opening paragraph and the first two trajectories. The fourth section describes community and household level innovations (trajectories 3 and 4) observed recently in Kenya. Section five addresses the third question of how specialists might rethink their work in the light of the social and financial constraints facing this great challenge.

2 ACHIEVING ACCESS TO SAFE WATER IN THE INDUSTRIALISED WORLD

Near-universal access to water and sanitation in North America and Europe was achieved in parallel with the industrial revolution and the social processes it helped to generate (Blake, 1956, 1991; Hassan, 1985; Brown, 1988; Melosi, 2000).

Prior to the mid-19th century, the provision of water in Britain's cities, for example was largely provided by private water companies, with a scattering of poorly run public waterworks, while smaller towns relied on a haphazard combination of sources (Hassan, 1985, p. 532). Hassan argues that a combination of changing ideas and institutional innovations, emerging in the late C19th, motivated municipal efforts to create public utilities, even in the face of strong Parliamentary support for private enterprise (Hassan, 1985, p. 533).

New developments in hydraulic engineering and plumbing made large-scale public water systems more feasible, while cities' ability to raise funds via municipal bonds made it possible to finance construction, purchase and improvement of such infrastructure. By 1907, according to Hassan (1985, p. 544), 'municipal authorities controlled over 81 percent of the net output of British water undertakings'.

In New York, in the 1830s, Gandy (2002, p. 29) reports that a shift in technical and political opinion provided the impetus for large-scale, public water provision. He suggests five factors account for this shift.

1. The increased seriousness of water-related disease outbreaks generated pressure for change. The drop in water-related disease mortality following the installation of a water system in rival city Philadelphia proved a goad to reform in New York.
2. The growing status of engineers enabled them to convince elites that a more ambitious solution was required.
3. Surveys showed that 30 000 owners of building plots were willing to invest sufficient funds to cover the costs of a new water service.

¹I use the term 'technics' (following Mumford 1967) to mean the combination of hardware, practices and institutions that generates collective social outcomes. Thanks to Ronnie Lipschutz, my colleague in the UCSC Water Research Group, for this suggestion.

4. Fire damage was costing the city more than the cost of the water system, and directors of leading insurance companies were represented on the relevant city councils.
5. Industries requiring water, including those using the new energy source, steam power, were engaged in 'increasingly frantic lobbying' for a new water system (Summarised from Gandy, 2002, p. 30).

Gandy concludes, however, that the needs of industrial capitalism were given greater priority than those of the urban poor:

'The modernisation of nineteenth-century cities was not carried out in order to improve the conditions of the poor but to enhance the economic efficiency of urban space for capital investment. In this sense, the scale of new public works and the pace of technological change masked the persistence of social and political inequalities that would not be tackled in any systematic way until many decades later. Advances in public health were an ambiguous byproduct of the bourgeois rationalisation of cities' (Gandy, 2002, p. 37).

A knowledgeable 1884 commentator made a similar point about water and sanitation advance in British cities:

'The hygienic view is invariably put forward to support schemes which aim at obtaining supplies...from distant watersheds...it may be depended upon that the real and less apparent object is to obtain soft waters suited to the manufacturing interests' (Silverthorne, 1884, p. 31, cited in Hamlin, 1988, p. 79).

Hamlin's careful study (1988) of the expansion of water supply and water treatment in four British cities paints a similar if more complicated picture. In Wakefield, for example a centre of the spinning industry with a large population of poor people, the prime movers of an expansion and public takeover of water supply were the proprietors of large woollen mills needing soft water. Public ownership of water undertakings, amongst other objects, allowed the opposition of landowners and manufacturers in other towns, often expressed through parliament, to be overcome. By contrast, the need for an image of clean water was a key factor in the takeover of the private water supply company in Cheltenham, known for its health spa. The water company proposed to get new water from the River Severn, a source 'repugnant' to the Town's elite which backed supply from springs (Hamlin, 1988, pp. 70–8).

We can abstract from these narratives at least six processes connecting the industrial revolution and widespread access to water and sanitation:

- New industries needed more water.
- Technological and manufacturing innovation lowered the costs of producing and distributing safe water and sanitation.
- Large-scale urban industries provided demand for a healthy work force.
- Conceptual advances in urban design, for example Chadwick's sanitary idea (water transport of human waste, piped access to filtered water), were made possible by new technology, by emerging ideas about bacteria and disease causation, and by growing public concern about health issues.
- New sources of finance, on a scale previously unthinkable, were made possible by industrial accumulation. Then legal, fiscal and political innovations, forming what Gandy terms the 'nascent civil realm', connected private finance to municipal ends.

- Social movements and ideas of public health were encouraged by the rise of collective work and city living.

These processes may be related in the manner sketched in Figure 1.

Figure 1. Catalytic effects of Industrial Revolution on urban infrastructure.

Technological innovation opened new possibilities for cheap water supply and sanitation. Public health movements, coinciding with the material interests of factory employers, generated political support for improvements in urban living conditions. New opportunities and social support made feasible cross-class (worker–employer) political alliances which could arrange municipal and financial institutions, investment in, and manufacture of, the new urban infrastructures, particularly water supply and sewage treatment.

These social changes came to fruition in the period from the 1840s to 1910 when municipal utilities took over fragmented private enterprises and made access to water and sanitation nearly universal in most major cities of the industrialised world.

Hamlin (1988, 2001), however, cautions against too simple a reading of history. With hindsight, the choices made in the introduction of large water and sanitation systems may seem more obvious than they were for contemporary decision-makers:

‘To improve a community’s water and wastes systems may seem a straightforward matter requiring only a minimally competent civil engineer. . . In fact, even with

unimpeachable expertise, very modest improvements in public hygiene arrangements can be enormously difficult to achieve...What seem to outsiders like straightforward solutions to clear-cut technical problems involve changes not only in daily life and habits, but in standards of public behaviour, familial, gender, political and economic relations, and even personal identity' (Hamlin, 2001).

In reality, local stakeholders with uncertain information, and particular interests made choices amongst a range of options now largely forgotten. Hamlin again:

'While the public reasons for improvement of water tend to focus on health, need and amenity, other factors often count more, such as who owns what land, which areas will be served, what labor will be employed and whose political power will be enhanced by a water project' (Hamlin, 2001).

Technical complexities and the diversity of motives notwithstanding, it is clear that the industrial revolution provided key resources and impetus for large-scale water infrastructure in the industrialised world. In the early twenty-first century, by contrast, most cities and rural areas where water and sanitation is absent are located in countries either in the early stages of industrialisation or those lacking significant industries. The task of providing water and sanitation thus has to be attempted largely without the resources and impetus provided by later stages of industrialisation.

There is corroboration for the connection between the industrial revolution and water and sanitation provision in the record of municipal failure and success in the global south. There is a clear distinction between the significant achievements of municipalities located in rapidly industrialising countries compared to the decline of utilities in non-industrialised, or only very recently industrialising countries.

3 THE DECLINE OF COLONIAL AND POSTCOLONIAL WATER UTILITIES

Not long after municipal utilities in the industrialised world took over the work of private water enterprises, colonial governments began to consolidate utilities in the colonies under their control. And after independence from colonial rule, many newly independent governments introduced or extended piped water and sanitation in the major cities within their domain. This was one way for new governments to fulfill the promises they had made that life would be better after colonial rule.

Many of the water supply and sanitation systems introduced at that time have subsequently declined. In piped water systems, water flows for a few hours a day, and water is supplied to a much smaller proportion of the urban population than was the case when the systems were constructed. Sanitation and treatment systems are often derelict. But this pattern of declining service is not replicated in the newly industrialised countries of Asia.

A 1997 survey (McIntosh and Yñiguez, 1997) of 50 municipal utilities in Asia estimated² that the proportion of the population served by either a household connection or a public tap varied from 23% (Cebu), 27% (Jakarta) and 42% (Bandung and Dhaka) up to

²Calculated from estimates of city population, numbers of household and public tap connections, and average numbers of users for each. It is not clear if informal settlements and peri-urban slums are included in the estimates. This form of estimate is also open to errors of self-reporting.

Table 1. Percent consumers reporting 24 h access to urban water supply by country category

	Non-Industrial	Part-industrial (excl. China and India)	Industrial	China (Beijing, Hong Kong, Tianjin, Shanghai)	India (Calcutta, Chennai, Delhi, Faisalabad, Mumbai)
Consumers reporting 24 h water in selected cities	56	74	87	97	23

Calculated from Table 3, p. 18 of McIntosh and Yñiguez, 1997.

Non-Industrial: Kazakhstan, Samoa, Kyrgyzstan, Bangladesh, Maldives, Vietnam, Solomon Is, Nepal, PNG, Tonga, Fiji, Cambodia, Vanuatu, Cook Islands, Bhutan, Mongolia, Laos, Burma. Uzbekistan.

Part-Industrial: Indonesia, Sri Lanka, Pakistan, Philippines.

Industrialised: Thailand, S Korea, Malaysia, Singapore, Taiwan.

100% (Beijing, Hong Kong, Kuala Lumpur, Singapore, Shanghai). Least industrialised countries have the lowest coverage. The most industrialised report complete coverage.

The percentage of consumers reporting that they have water 24 h a day provides one measure of the efficacy of the utility in supplying water to those customers it covers. Table 1 shows the percentage of consumers reporting that they have 24-h access to water in the 50 cities included in the Asian Development Bank study of urban utilities.

Industrialised countries and China have much higher levels of water provision than non-industrialised countries and India. If the tourist-oriented capitals of small island nations are excluded from the service levels of the urban areas of non-industrial nations, then the proportion of consumers reporting 24-h service falls to 50%.

Table 1 provides support for the idea that large urban areas in industrialised countries have better access to water than similar areas in non-industrialised countries. This is partial support for the general thesis of this paper that industrialisation provides the possibility of better access to water.

That the historical conditions of particular cities need further examination is underlined by the anomalous positions of the Chinese and Indian cities. Though both countries fit most easily in the partly industrialised category, the evidence from this survey shows very different outcomes. The Chinese cities have high levels of service, for those customers with water access, whereas the Indian cities show low levels of service. This contrast begs for additional research. It is possible that widespread energy crises in Indian cities, with electricity available for only a few hours a day, provides the main explanation for poor service to those with household water supply. The substantial industrial development of, and corporate demands in, Chinese cities such as Shanghai and Hong Kong, may illuminate the high levels of service characteristic of the Chinese cities.

The Asian Development Bank report notes that many utilities provide service for only a few hours: 'A number of city utilities are in a very bad way and these include Karachi (4 h), Delhi (4 h), Chennai (4 h), Bandung (6 h), Katmandu (6 h) and Faisalabad (7 h)' (McIntosh and Yñiguez, 1997, p. 13).

Other indications of malfunctioning utilities include: between 1% and 88% (average 33%) of consumers were willing to drink tap water without further processing; between 16% and 100% (average 72%) reported no interruption in supply during the previous month; in 15 of the 50 utilities operation and maintenance costs exceeded revenues (McIntosh and Yñiguez, 1997, p. Tables 3 and 9).

Another study (Nickson and Franceys, 2003) evaluated the efficiency, effectiveness and equity of water utilities in four case study countries. These cases include two countries, Ghana and Zimbabwe, that can best be categorised as non-industrialised and two, India and Sri Lanka, partly-industrialised. That study concluded:

‘Individual country [water utility] performance may be summarised as follows: Ghana (very poor, with upward trend), India (very poor, with downward trend), Sri Lanka (poor, with slight upward trend) and Zimbabwe (satisfactory, with slight downward trend)’

(Nickson and Franceys, 2003, p. 32).

These snapshots can be put into historical perspective by one of the most detailed studies of long-term changes in access to water. Thompson *et al.* (2001) revisited a set of households in East Africa first visited by Gilbert White (White *et al.*, 1972) 30 years earlier. Their study provides longitudinal data on a set of non-industrialised African countries. On the question of urban water utilities, they report a general decline throughout East Africa in both the proportion of the population with piped water and, for those with piped water, in the hours of water provision per day.

One case they describe concerns Iganga, an urban site in central Uganda. In the 1960s, 100% of households surveyed reported access to piped water 24 h a day. By the 1990s, the proportion of households with piped water had declined to 13%. And this small proportion received water only for a few hours a day.

One resident of Iganga explained the decline in these words:

During the ‘60s and early ‘70s the situation was good, but from the late ‘70s the water services began to deteriorate. The situation worsened in the ‘80s when the water pumps and most of the distribution lines broke down. Of the four pumps operating in the ‘60s, only one was still working by 1980’ (Thompson *et al.*, 2001, p. 55).

Leaks were also reported in the storage tanks and pipes of the system, and one official reported:

Most of the revenue collected from water bills is spent on repairing the pipes and pumps. Moreover, since the water pumps run off electricity sources that are subject to frequent power cuts, water supply is unreliable. It is really beyond our control (Thompson *et al.*, 2001, p. 55).

In the late 1980s, piped municipal sources were supplemented by private boreholes and then by commercial water kiosks selling water. Why did this decline occur?

3.1 Why Did Utilities Decline in Non-Industrialised Countries?

There are at least two elements of a theory of what happened. As in many development questions, one explanation comes from the World Bank, and a more politically contextualised account comes from others. The World Bank research says that municipal utilities provide poor service because they suffer from weak operational procedures and poor financial accountability (Haarmeyer and Mody, 1997). The alternative account

suggests that utilities have been captured by one of a number of possible groups from politicians to engineers (Nickson and Franceys, 2003).

This is how Haarmeyer and Mody (1997) of the World Bank summarise a version of the first line of thinking:

'The water and sewage sector in developing countries is generally financially and operationally weak. A World Bank study... found that revenues collected by utility companies in the Third World cover only 35% of the cost of water... Yet the sector's fundamental problem arises less from the shortage of financial capital than from the lack of accountability in managing financial and operational resources. Water enterprises generally face weak internal (organisational) and external (regulatory) incentives to perform' (Haarmeyer and Mody, 1997. p. 34).

This suggests that revenues of water utilities cover only a third of the cost of water, and that even this little expenditure may be not be accountable. This neoliberal explanation leads to the suggestion that improved incentives, through privatisation, will make the utility more responsive and efficient.

This first line of thinking is not incompatible with the second, broader line. Nickson and Franceys (2003, p. 48) write:

'The key reason for poor performance [of water utilities owned and operated directly by the state] is that the existing institutional arrangements fail to protect these utilities from capture by powerful stakeholders (politicians, public sector unions and the 'professional hobbyism' [*interest in technical innovation-bc*] of water engineers) whose objectives (low tariffs, job creation and large-scale capital investment respectively) are opposed to the water needs of its citizens, especially the poorest.'

Nickson and Franceys argue that the high capital investment required for urban water supply, and the inability of the consumer to determine potability, conceal under-performance: '...once the initial capital investment has been made, it is possible for an apparently functioning system to degrade over a very long time without that failure becoming too obvious' (Nickson and Franceys, 2003, p. 33).

McGranahan, Satterthwaite and Thompson (2003) combine elements of these two perspectives to summarise the prevailing narrative of public sector crisis as follows:

'The basic message is that public utilities are under-funded, inefficient, overstaffed, unresponsive to their customers, easily manipulated by politicians to serve short-term political ends and, in low-income settings, are often providing subsidised services to the relatively well off while the poorest go without' (McGranahan, Satterthwaite, and Thompson, 2003, p. 2).

Why then do municipal utilities in recently industrialised or rapidly industrialising countries not suffer from these failings? Capitalist industrialisation, as Max Weber suggested, brings with it a diffusion of modes of thought lumped together as rationality (including calculability, efficiency, empiricism, predictability) which would be likely to address the failings described by the first line of explanation (weak institutions and poor financial accountability) of municipal failure. If higher levels of industrialisation are also associated with expectations of public accountability, and more effective democratic

representation, then fewer utilities may fail because they are captured by special interests (the second line of explanation).

The more specific, and historical, argument of the first section of this paper may also be used to illuminate the widespread failure of municipal utilities in the non-industrial world. Corporate demands for industrial water and the demands of social movements, around public health and urban improvement, may not yet have generated compelling political alliances and discourses providing support for effective expansion of municipal water and sanitation. Sources of finance and technological adaptation have not yet been deployed in support of such expansion.

Two lessons can then be drawn from historical experience in industrialised and non-industrialised countries. First, large-scale water and sanitation provision in the industrialised world was associated with the coming together of a range of innovations including industrial (demand for water), social (discourse and coalitions), technological and financial (sources of accumulation as well as institutions to tap them) innovations. Hindsight tends to provide too straightforward and technological view of what happened. Second, attempts to create institutions for water and sanitation provision in non-industrialised countries have been disappointing. There appears to be an association between the level of industrial development and the effectiveness of municipal provision.

In the next section, I turn to what happens when municipal provision is inadequate. The inability of municipal utilities to provide water and sanitation in large parts of cities and rural areas in the non-industrialised world encourages the rise of 'bare knuckle' technologies adapted to the needs of the poorest and their survival strategies.

4 BARE KNUCKLE, HOUSEHOLD AND COMMUNITY TECHNOLOGIES

The 'flying toilets' of Kibera, Nairobi, said to be the largest slum in sub-Saharan Africa, provide an iconic example of a bare-knuckle technology. In this case, poor people live in crowded conditions in what is thought to be the largest slum in sub-saharan Africa. Without access to organised sanitation, many have no option but to defecate into a plastic or paper bag and throw the bag onto a garbage heap. Since Kibera has only the narrowest of mud paths between houses and no organised garbage collection, heaps of garbage accumulate. I term this a bare knuckles technology because it constitutes an individualised, impoverished and bruising encounter with nature, much as bare knuckle fighting represents a crude and desperate negotiation or sport. Other examples of bare knuckle technologies of water and sanitation access include: access to water from unprotected springs, seeps and rivers, defecation in fields and forests.

There is a gap-toothed continuum of water and sanitation technologies and trajectories ranging from the most individualised and bruising to more collective actions involving several households or a community and on to the large-scale approaches which brought universal access in the cities of industrial countries.

The social dynamics of these variegated trajectories are complex and poorly understood. Contemporary discourse on markets, public private partnerships and privatisation often overlooks this variety of scales, politics and efficacy. Examination of the characteristics of different examples of access to water and sanitation illustrates some dimensions of the continuum.

In Kibera, another technology, slightly less bruising than the flying toilet, is being widely disseminated. This is solar disinfection of contaminated water, termed SODIS. Households obtain standard, clear plastic (PET) bottles and fill them with contaminated water. They then place them in the sun for 6 or more hours and drink the water. Both local experience of illness inferred from school attendance records (personal communication KWAHO 2005) and epidemiological studies of disease reduction with intervention (Sobsey, 2002, Thompson, 2003) suggest that this simple technology does disinfect the water and reduce disease prevalence. This SODIS ultra violet disinfection program used in Kibera costs one or two dollars per re-usable bottle and can use water from any source.

4.1 High Technology Applied to Bare-Knuckles Self-Provisioning

Both changes in technology and recent studies have encouraged increased interest in water treatment at the level of the household, or point-of-use treatment. Clasen and Cairncross (2004) caught the spirit of renewed interest when they termed household water management a 'refinement' of the dominant paradigm. Previously, it had been held that 'to achieve broad health impact, proper attention should be given to safe excreta disposal and proper use of water for personal and domestic hygiene, rather than to drinking water quality. . . interventions aimed solely at improving drinking water quality would have little impact in reducing diarrhoeal disease' (Clasen and Cairncross, 2004, p. 188).

Their review of epidemiological studies suggested that the influence of interventions just improving water quality had been underestimated in earlier public health reviews. They also quoted the conclusion of a WHO report (Sobsey, 2002) that 'simple, acceptable, low-cost interventions at the household and community level are capable of dramatically improving the microbial quality of household stored water and reducing the attendant risks of diarrhoeal disease and death' (quoted in Clasen and Cairncross, 2004, p. 188). So, the refined paradigm Clasen and Cairncross were supporting is household, or point of use, water treatment.

Table 2. Health impact of improvements in water and sanitation provision—based on review of studies

Water and sanitation improvement	Median reduction in diarrhoeal morbidity %		
	1985 review	1991 review	
		Overall	Rigorous*
Improved water quality	22	17	15
Improved excreta disposal	22	22	36
Improved availability of water	25	27	20
Improved quality and quantity of water	37	16	17
Improvements in both water and sanitation	—	33	33
Hygiene	—	33	33

Source: Data cited in Clasen and Cairncross (2004: 187–88) from Esrey *et al.* (1985) which reviewed 67 studies and Esrey *et al.* (1991) reviewing 144 studies.

*Deemed methodologically rigorous by Esrey *et al.* (1991).

Table 2 provides a summary of reviews undertaken in 1985 and 1991. This suggests that improvements in water quality alone may reduce diarrhoeal disease less than combined water quality and quantity improvements (1985 study), improvements in sanitation, and in hygiene (1991 study).

These results support the 'dominant paradigm' that improvements in water quality alone were less effective than other measures. A new study by Clasen (2003), of 21 controlled field trials over the preceding two decades, suggested:

'interventions designed to enhance the microbiological quality of drinking water at the household level showed a median reduction in endemic diarrhoeal disease of 42% compared with control groups' (Clasen and Cairncross, 2004, p. 188).

Clasen and Cairncross examined reasons for the discrepancy between Esrey *et al.*'s review (summarised in Table 2) and the new finding. Various methodological differences, they suggest, provide a plausible explanation.

So, there are public health findings justifying new interest in household interventions to improve water quality. At the same time, technological innovations have also encouraged interest in point-of-use purification devices. For example, readers from the industrialised world will be aware of the rise of simple, commercial filtration devices for improving drinking water quality and enabling campers to drink from polluted sources. Some NGOs are beginning to distribute household purification devices, and the World Health Organization (WHO) has established an international network to promote household water treatment and safe storage (http://www.who.int/household_water/en/). The WHO claims 'our insight' is as follows:

'Household water treatment and safe storage (HWTS) interventions can lead to dramatic improvements in drinking water quality and reductions in diarrhoeal disease—making an immediate difference to the lives of those who rely on water from polluted rivers, lakes and, in some cases, unsafe wells or piped water supplies.'

An award winning technology developed at UC Berkeley and the Lawrence Livermore Laboratory by Ashok Gadgil and others (Gadgil *et al.*, 1998) is one of several new technologies proposed for household disinfection. The Smithsonian, the World Bank, the Tech Museum of San Jose and others have awarded prizes for this relatively simple UV disinfection system. This device costs about \$600 and presumes a system with gravity pressure. The application of such a device to the varied water sources and limited resources of urban slum households would require ingenuity and collective action on a large scale. One presentation of this technology (Drescher, 2003) suggests that it would require collective action by 2000 people.

Point-of-use water disinfection technologies, in general, face at least two problems, those of cost and those of collective action. Since improved drinking water access provides only indirect financial benefits for a household, through reduced morbidity and greater productivity, household water systems cannot normally be financed by even micro-credit loans. Even the \$1–2 cost of SODIS, solar disinfection bottles being promoted by NGOs in Kibera, represents a significant expense for poor households. Most high technology point-of-use water systems cost more than a few dollars. Once systems require significant investment and collective action by many households, then the questions of political support, institutions, finance and technology choice, outlined in Figure 1, come into play.

Engineers, public health professionals, municipal politicians and others trying to address the water and sanitation needs of people living in urban slums have to face a complex range of existing technologies and social trajectories situated in particular local conditions.

5 ENGINEERING ACROSS SCALES, CIRCUMSTANCES AND CONSTITUENCIES

Engineers and public health workers in non-industrialised countries should think twice about focusing on a fashionable new water technology, like UV filtration. However small and cheap such a technology may be, questions of water supply and effluent treatment require a broader perspective encompassing the spatial distribution of water sources, the constraints of bare knuckle technics, the existing sanitary politics, social movements and cross-class coalitions of a particular locale.

If the connections between industrialisation and urban infrastructure suggested in Figure 1 are broadly correct, then addressing these questions is more likely to be productive than seeking new small-scale technologies:

1. What industries need more, cleaner water? Do they have the political influence and financial means to change the water supply situation?
2. Are there public health or environmental movements, which could contribute to the generation of a new discourse about urban water and sanitation?
3. Are there new technologies, not just at the household scale, which could lower the social and economic costs of water and sanitation access?
4. Are there points where the interests of the rich and influential can be aligned with those of the poor?
5. What new financial sources (middle class, tourism, environmental service payments, export agriculture) could provide funding for the expansion of urban infrastructure?
6. What financial and institutional innovations could mobilise political and economic support for collective action to improve water access?

What new opportunities could reflexive engineers, development agencies and financing institutions use? An engineering and development team able to reflect upon its own influence on social conditions might attempt to facilitate innovative political coalitions, take advantage of local industrial and financial opportunities and collaborate with nascent social movements to create a new discourse recognising the collective need for water in a neoliberal era.

This possibility may be constrained by professional mores and education, and by the inflexibility of aid agencies:

‘Many professionals object to [community-driven] solutions because their own role and importance is diminished - and because their professional training did not equip them to know how to work with urban poor groups and to support their initiatives. Almost all the official development assistance agencies find it difficult to support community-driven development because their structures and procedures were never designed to do so (Satterthwaite, McGranahan and Mitlin, 2005, p. 27).

These authors argue that a critical block to more flexible intervention arises from the attitudes of many of the professionals and agencies that consider themselves to be pro-poor.

The time pressures facing many development agencies, including those trying to meet Millennium Development Goals, may also restrict their ability to identify and use local social and political trajectories.

Historian Hamlin suggests that a detailed knowledge of local sanitary politics, and the realities of local decision-making could greatly improve external efforts to promote water supply and sanitation:

‘If there is a lesson from history, it is that we should not idealise community decision-making and that there is no role which is not partisan in some way. In any community, there will already be a sanitary politics, a distribution of power. Often hygienic improvement required appealing to many constituencies with many diverse reasons. The intervener with a sense of the complex history of sanitary improvement, as well as a sense of local social structure, and some appreciation of ethnographic theories and methods, will be much better positioned to intervene effectively to improve water quality’ (Hamlin, 2001).

In the early days of the industrial revolution, entrepreneurial engineers helped build political coalitions and rustle up finance. Since then professional specialisation has narrowed the focus of engineering.

These roles hardly figure in contemporary engineer’s training. It is possible that engineering teams could work, for example with community-based organisations to build coalitions between the peri-urban poor and those who employ them. This seems like an organic alliance.

There is evidence of some predisposition for this sort of coalition in Nairobi, Kenya. An international Bank and a Kenyan cement company have recently begun to support some NGO water and sanitation operations in Kibera, Nairobi (Odaba and Otieno, 2005). At present, these monetary contributions are much too small for the scale of issues. NGO workers point out ‘small uncoordinated donations will have only a limited effect’ when basic needs for infrastructure, coordination and affordable homes are not being addressed (Odaba and Otieno, 2005). A reflexive, entrepreneurial engineering team with sociological and historical understanding might be able to provide the coordination required to build these prefigurative gestures into a coalition.

It is possible that middle-class employers of domestic labour, a second important occupation of Kibera residents, could also be mobilised to support improvement of the living conditions of their employees. Existing engineering institutions, municipal and state engineering departments, national and international consultancies, are not currently configured to construct these coalitions. That capacity presumes a set of interdisciplinary and political skills.

What opportunities do new technologies (and technics) present? It is possible that distributed information technologies could be deployed to improve the efficiency and accountability of municipal utilities. I am working with an engineer and entrepreneur to pilot test a new set of technologies, based on a cheap wireless water meter and valve, and an innovative business plan. This new technology may make it feasible for small traders, perhaps the existing meter readers employed by utilities, to sell quantities of water using scratch-cards similar to those used to sell mobile phone time in many cities of the global south. The seller provides a card, which enables a specified quantity of water to be supplied through a water meter. The losses of revenue and water that currently disable municipal utilities could then be avoided. This wireless metering technology could be more effective

Table 3. Four technics for urban water and sanitation

Technic	Economic actors	Social actors	Financing	Technology
Flying toilet (crude waste disposal)	Household	Household	Household	Plastic bag and wasteland
SODIS (solar H ₂ O disinfection in plastic bottle)	Indigenous development NGO	NGO	NGO/Household	Plastic bottle, roof and sunlight
Point-of-use filtration	Transnational corporations	WHO, International NGOs	Household plus subsidy?	High tech filtration: UV, membrane, ceramic and others
Wireless information technology	Small and large enterprise	Municipality	Business accumulation and municipality	Wireless water meters and valves, pipes

at providing improved access to water than point-of-use filtration technologies because it has a business plan with a social dynamic that rewards efficient expansion.

The question of household and community level treatment may open another set of options. Somewhere between bare knuckles technologies and the high tech, expensive filtration systems currently being proposed may lie undiscovered technics for access to safe water. The key to these pathways is unlikely to be simply technological. Institutional innovation and transformed social contexts are also required. How could these technologies contribute to a new discourse of citizenship and access for the rural and urban poor? Not by commoditisation alone.

Table 3 lists the economic and social actors, and the financing and technology associated with four of the technics I have described. What it suggests is that more sophisticated technics are associated with a wider range of actors and may draw upon more substantial sources of finance. Evaluation of the feasibility of these proposals is often best considered in the specific circumstances of a particular community. This is an obvious task for reflexive engineers, community organisers and public health experts in collaboration.

6 CONCLUSION

This paper has described different trajectories of water and sanitation provision. First, it has described some key social, financial and technical aspects of the history of large-scale water and sanitation provision in the industrialised west. Second, it has examined the patchy record of provision by colonial and post-colonial municipal utilities in the Third World. As in the west, effective urban water provision in the developing world seems to be associated with industrialisation. That, in itself, is not enough. Industrialisation and organisation seem to be essential. Third, the paper has tried, with the idea of bare knuckle technics, to capture the reality of water and sanitation provision for many millions of poor people lacking both industrialisation and organisation. For these people, water and sanitation provision requires a bruising encounter with the natural and social worlds in which they live. Finally, the paper suggests that reflexive engineers, and the range of organizations with which and for whom

they work, could be more effective if they situated their work in relation to the social, financial and political challenges of water and sanitation provision.

I turn to Hamlin again for a closing point:

'If public health experts in the North are to contribute to [the solution of water and sanitation problems], they should draw on parts of their history and professional identity that have been suppressed: their ability to engage in politics, not to circumvent it with scientific authority. What is now necessary is to recover these lost strains of professional heritage, bring them back into professional education, and rethink the identity of the professional sanitarian in a postcolonial age' (Hamlin, 2001).

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