Liquid Dynamics: challenges for sustainability in water and sanitation

STEPS Working Paper 6

Correct citation: Mehta, L., Marshall, F., Movik, S., Stirling, A., Shah, E., Smith, A. and Thompson, J. (2007) *Liquid Dynamics: challenges for sustainability in water and sanitation*, STEPS Working Paper 6, Brighton: STEPS Centre

First published in 2007

ISBN – 13: 978 185864 655 3

Thanks to Oliver Burch and Harriet Le Bris for help with copy-editing and to Erik Millstone and Alan Nicol who kindly provided peer reviews.

Design by Wave (www.wave.coop) and Barney Haward

Printed by MCR Print (www.mcrprint.co.uk)

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1. INTRODUCTION

The effects of recurring floods and droughts, the deaths of 6,000 babies daily from waterborne diseases and growing sanitation problems in booming peri-urban and urban centres illustrate the devastating impacts of what the recently launched Human Development Report highlights as the crisis in water and sanitation (UNDP 2006).[1] More than most other resources and services, water and sanitation are essential for all aspects of life, wellbeing and productivity. Water is the lifeblood of ecosystems, essential for many eco-hydrological functions. Water and sanitation are also assets basic, in many ways, to people's livelihoods and wellbeing. Safe water and sanitation improve health and everyday activity. Better and easier access to water and sanitation make more time available for economic activities and keep children in school, thus improving human capital. And water access is essential to building and maintaining many livelihood strategies, whether based on small-scale household cultivation and income generation, irrigated cash crops, livestock production, or livelihoods such as fishing, that are reliant on lakes, rivers and wetlands.

Water and sanitation is therefore recognised as a key Millennium Development Goal[2] with important links to many others. Yet despite the efforts of international organisations, governments, donor agencies and civil society, progress in achieving it has been slow. A billion people still lack access to safe water and 2.6 billion lack access to adequate sanitation, while the so-called problem of water scarcity attracts growing political attention. Concerns with water and sanitation are certainly not new. Indeed they have been a focus of development interventions and international action since the 1977 Mar del Plata UN World

[1] The HDR 2006 essentially argues that the water 'crisis' is rooted in poverty, inequality and unequal power relations and maintains that biophysical scarcity is exacerbated by inadequate management policies.

[2] The MDGs (http://www.un.org/millenniumgoals/) a set of wide-ranging global development goals aiming towards halving world poverty by 2015. Goal 7, target 10 reads 'Reduce by half the proportion of people without sustainable access to safe drinking water'. Access to basic sanitation was added to the target following the 2002 World Summit on Sustainable Development.

Water Conference and the subsequent International Drinking Water Supply and Sanitation Decade (IDWSSD). Today, therefore, the world is full of 'wisdom' on water issues. Markets for ideas are replete, and new markets emerge every year in the form of additional fora, conferences and workshops.[3] Yet much of this debate and the policies and interventions it is linked with fail to address water and sanitation problems in ways that are sustainable and meet the needs of poorer and marginalised people.

Amongst many possible reasons for these failures, in this paper we highlight two pervasive tendencies. First, policy debates and the often generalised, globalised arguments that underpin them often remain disconnected from the everyday experiences of poor and marginalised women and men. In other words, the framings - or understandings and representations - of water and sanitation systems that dominate policy debates often are at odds with the framings held by local water users, so that issues central to poorer people's perspectives and priorities are ignored. Second, current approaches are often not up to the task of addressing emergent challenges associated with contemporary dynamics in water and sanitation systems. This is what, in this paper, we refer to as 'liquid dynamics': the patterns of complexity and interaction between the social, technological and ecological/hydrological dimensions of water and sanitation systems. Today, more than ever, these involve rapid changes and interactions that take place across multiple, interlocking scales, affected by processes such as climate change and rapid urbanisation. They involve many uncertainties and possibilities of surprise. The result is a variety of possible pathways, or particular directions in which water and sanitation systems might develop over time. Yet most analytical and policy debate in relation to water and sanitation has not been geared up to understand such dynamics. Hence, it has not been well

[3] The increasing focus on water and sanitation issues over the last decades has spawned a host of organisations. Examples include the World Water Council (WWC) an international collaboration of NGOs, governments and international organisations founded in 1996. Some 40 per cent of its member organisations are for-profit private companies operating in the water sector which hosts the World Water Forum, a global event that takes place every three years. Others are the Global Water Partnership (GWP), created in 1996 by the World Bank, the United Nations Development Programme and the Swedish International Development Agency in response to the Rio-Dublin principles; the Water Supply and Sanitation Collaborative Council (WSSCC), existing under a mandate of the United Nations, focuses exclusively on people lacking access to water and sanitation; and the International Water Management Institute (IWMI), a non-profit scientific research organization focusing on the sustainable use of water and land resources in agriculture and on the water needs of developing countries and forming part of the Consultative Group on International Agriculture Research (CGIAR) system. Another major organisation is the International Water Resources Association (IWRA) founded in 1972, works to promote 'the sustainable management of water resources around the globe' and was one of the founding members of the World Water Council.

equipped to address which, and how, particular pathways might lead to sustainability, poverty reduction and social justice in relation to water and sanitation.

This paper, one of an initial set of six from the new STEPS Centre at Sussex, reviews past and current debates in the water and sanitation domain and takes initial steps towards developing a framework that might better address the sustainability challenges posed by liquid dynamics. We begin by outlining key strands in the current debate, emphasising the dominance of approaches based on global water assessments, technological fixes, and universalised notions of water scarcity. Each has generated important critiques, giving rise to major fault-lines in analysis and policy. Nevertheless, we suggest that across these debates, there has been insufficient attention to the dynamics and uncertainties that increasingly characterise water and sanitation issues, and how they are experienced by poorer and marginalised people. These liquid dynamics are the subject of the next section, where we trace dynamic processes in social, technological and environmental realms that increasingly impinge on water and sanitation. These interact in ways that give rise to complex, dynamic water and sanitation systems. Moreover, different groups - whether hydrologists or engineers, policy-makers or NGOs, wealthy and poorer water users, or women and men, often understand or frame these dynamics in different ways. We introduce a simple framework for thinking about systems in this way in relation to water and sanitation, and considering the implications for pathways to sustainability.

In this light, the paper then turns to the political and institutional relationships - or governance processes - that shape debates and action in relation to water and sanitation, considering the extent to which they enable or constrain pathways to sustainability. We suggest that while there have been some important moves - for instance in involving communities and in addressing water and sanitation issues across scales through multiple institutions - key challenges remain in fully addressing the need to adapt to dynamics and uncertainties, and to respond to the multiple framings of diverse groups. Governance approaches and practices are in turn linked to appraisal; to how knowledge of water and sanitation is gathered in order to inform decision-making and wider institutional arrangements. Here, as the fourth section shows, moves from narrow, technically-focused approaches such as cost-benefit analysis towards those that broaden out and open up appraisal, allowing a wider range of perspectives to inform policy and political discourse, are crucial if appraisal is to support pathways to sustainability and social justice in water and sanitation. At the same time, keeping the materiality of water and sanitation in sight - the importance of water as a material resource, and the biophysical dimensions of liquid dynamics - is essential. In the final section, we draw the discussion together to indicate essential elements of a STEPS research agenda in the water and sanitation field.

A few words on nomenclature are in order before we proceed. Water issues in this paper encompass both what is commonly known as water supply and water resources management, or as the 2006 Human Development Report puts it, 'water for life' and 'water for production' (UNDP 2006). Water for life is considered to be one of the basic necessities for human functioning. This underlies the notion of a human right to water, usually seen to be between 20 – 100 litres per person per day, largely for domestic purposes (see Mehta 2006). Water for production refers to water in irrigation, industry and small-scale entrepreneurial activities such as e.g. brick-making and beer-brewing, as well as using water to produce food for subsistence. This distinction, however, is highly problematic from the perspective of local users whose subsistence activities encompass both the domestic and productive elements of water and for whom there is little sense in separating water for drinking and washing and water for homegardens or other small-scale productive activities (see e.g. van Koppen 2006, Moriarty 2004, Nicol 2000).[4] Thus in this paper we avoid this discursive divide, while at the same time reflecting on how and why it has come to be so dominant in analysis and policy. We also try to address another malaise in the literature. Water and sanitation are often mentioned in the same breath, even though their logics, politics and disciplinary underpinnings are vastly different. Thus, wherever possible and required, we are careful to spell out where our discussions carry different implications for sanitation and water issues.

2. CURRENT DEBATES: EXAMINING THE FAULTLINES AND BEYOND

WHO IS SHAPING THE DEBATE?

Water and sanitation are multi-faceted issues that can be seen from a multiplicity of perspectives. Water epitomises a natural resource whose state is variable across time and space (Mehta 2006). It fluctuates in availability and is not easily

[4] A multiple-use systems (MUS) project, a partnership between professionals, academics and practitioners within the domestic and productive water use sectors was recently set up to explore frameworks and develop tools to implement multiple use water services that bridge the gap between 'domestic' and 'productive' and are more effective in achieving poverty reduction and gender equity than conventional approaches to water service delivery (see www.musproject.net for more information).

controlled, and it cannot be produced in the true sense of the word. It has different faces and meanings in the everyday contexts within which people live their lives. It can be simultaneously perceived as a free, social, economic, cultural or symbolic resource. People across the globe value water for both its non-economic and economic roles. In addition, water has deep cultural, symbolic and spiritual significance in many settings, ranging from the holy significance of the Rivers Ganga and Narmada in Indian cosmology to the role of the Balinese water temples in irrigation management in Indonesia. Access to water reflects power asymmetries, socioeconomic inequalities, and other distribution factors. Sanitation issues, too, are multi-faceted. They span questions of engineering (e.g. drainage/groundwater contamination), culture (e.g. perceptions and practices around defecation and hygiene), technology (e.g. whether pit or flush latrines and accompanying drainage issues) and the socio-economy (e.g. financing mechanisms and behavioural switches to using toilets).

Nevertheless, official discourses tend to focus on certain aspects of water and sanitation. For example, water debates are frequently dominated by economic and engineering aspects. Since the Dublin Declaration of 1992 (http://www.wmo.ch/web/homs/icwedece.html), characterisation of water as an economic good often overshadows other meanings and roles of water, especially in the socio-cultural and symbolic realms. Sanitation is currently dominated both by engineering issues, and by public health debates concerning the 'behaviour change' necessary to induce people to stop open defecation and use toilets. Again, these projections may obscure other aspects, including wider socio-cultural practices.

As these instances illustrate, there are many conceptual and ideological struggles in the domain of water and sanitation. Yet dominant debates and related policy approaches are largely framed by a few major global players such as the World Bank, the Global Water Partnership, the World Health Organisation, the World Water Council, IWMI and the CGIAR system. As we explore in this section, this gives rise to a set of dominant approaches that emphasise universalised notions more than local and contextual ones, and technical issues more than social ones. Yet these emphases have also been contested and critiqued by other players. Here, we explore these dominant emphases and fault-lines in contemporary debates, moving from those around global water assessments, to those around technological fixes to water and sanitation problems, to debates around water scarcity and access.

GLOBAL ASSESSMENTS AND THEIR PROBLEMS

There are many recent examples of global assessments of water scarcity and related issues. Often created and disseminated by influential international organisations, these have become highly influential in policy debates about addressing water-related problems. However, there is a range of problems with the ways such assessments are framed, and the assumptions they make.

First, their portrayals of scarcity largely focus on the physical and volumetric aspects of water scarcity, as opposed to considering disparities in distribution. An example is the Water Poverty Index, compiled by UK researchers in 2003. This represents a data set that explores the relationship between water scarcity and water poverty (Lawrence, Meigh and Sullivan 2003). The data represent an interdisciplinary attempt to indicate the degree to which water scarcity impacts on human populations (Shah and van Koppen 2006). By correlating the data in this manner, the researchers reveal that they subscribe to the hypothesis that water scarcity determines water poverty (ibid).

Second, there is usually a primacy of 'first world' definitions which make it difficult to monitor sustainability of use and impacts on the poorest at local and national levels. For example, the MDG targets refer to 'safe' drinking water. The Joint Monitoring Programmes of the World Health Organisation refer to 'improved' water types (WaterAid 2003). What constitutes 'improved' is contentious (e.g. a borehole, a protected spring). These definitions often have little to do with local understandings of what constitutes 'improved' water supply. In Merka, western India, for example, villagers prefer local sources of water (e.g. the local tank and wells) to government supplied piped water which is ostensibly an 'improved' supply. They find the taste and quality of government supplied water suspect (Mehta 2005).

Third, there is often confusion between different global agencies regarding how to define water and sanitation targets, indicators for assessing progress and financial estimates to achieve the goal. Thus the ways in which the problems and goals are presented and interpreted, their solutions and the financing required to achieve them vary across the different agencies. Take the example of financing. The World Water Council estimates that an additional US$100-110 billion a year is required to reach the goal of full global service coverage and other aspects of global water security, including irrigation, industrial effluent, wastewater treatment, water resource and environmental management. By contrast, the Water Supply and Sanitation Collaborative Council (WSSCC) also aims at universal coverage for 2025 but focuses on safe drinking water and sanitation and estimates an additional $9 billion a year (Mehta 2004). Further variation occurs

because the calculations are complex and affect many variables for which there is no reliable or comparable information among countries. This implies that even the levels of current spending on which future projections are based are uncertain and varying (Mirosa 2004). Moreover, the results of the projections themselves depend on the assumptions made about factors such as levels of current access, choice of technology and cost per unit (Terry and Calaguas 2003). As argued by Mirosa (2004) there is also much confusion regarding what some of the estimates refer to and what they include. This sometimes leads to the use of the same figure by different institutions to refer to different goals. Not least, there are two official sets of international water goals: 1) halving the proportion of people without access to sanitation and safe drinking water by 2015 (part of the Millennium Development Goals); and 2) achieving full global service coverage, which includes all aspects of water security, by 2025. Table 1 summarises how various estimates and projections relate to these different goals.

Table 1: Summary of financial estimates for reaching water and sanitation goals.

Organisation / researcher	**Estimates**
World Water Council and Global Water Partnership	Additional US$100-110 billion a year to reach the 2025 goal (US$16 billion of these additional resources for drinking water and sanitation)
WSSCC	Additional US$9 billion a year for the 2025 goal for drinking water and sanitation
World Bank	Additional US$15 billion a year for drinking water and sanitation for the 2015 goal
Averous (cited in Winpenny 2003 and in Guerquin and others 2003)	US$49 billion a year for the 2015 goal (incorporates full water and sewerage connections and primary wastewater treatment to the urban populations)

Source: Mehta with Mirosa Canal (2004).

Clearly a key issue is the standard and level of service and technology. Many open-ended issues emerge as problems or questions. Critics argue that many of the high-cost, capital intensive solutions may not be appropriate, and need to be compared and put together with a range of low-cost technologies that may

be more suited to the demands that will be placed on them (Terry and Calaguas 2003). Such critiques have become part of a high-profile attack on the World Water Council, Global Water Partnership and other organisations. Civil society groups (for example at the Mumbai World Social Forum of 2004) argued that the emerging imperative for additional water financing was the result of a collusion between the international financial institutions and large water corporations - even though the latter's current lack of interest in the international market would appear to dispute this claim. Furthermore, there is little doubt that high-powered financing initiatives initiated by the World Water Council, Michel Camdessus,[5] former Managing Director of the International Monetary Fund (IMF), and others have been bereft of wider consultation and participation. They have taken place with little or no participation from developing country governments or NGOs, let alone the 'end users', namely the world's poorest people. The extent to which they represent the needs and perspectives of poor people is therefore questionable.

Thus, such global assessments tend to be framed in particular ways that obscure questions of distribution and access. They also show little evidence of reflexivity, i.e. an awareness of how such assessments reflect, at least in part, the social, economic and political positions of the individuals and organisations that produce them. Not surprisingly, then, water and sanitation are sites for contentious politics. At the 2nd World Water Forum in the Hague in 2000, the inaugural meeting was stormed by naked demonstrators protesting against large dams and water privatisation which they saw as pushed by powerful actors. Indeed global assessments, and the particular problem-framings and solutions that they justify, such as large dams, are bitter sites of struggle in the water domain. Conca (2006) draws on the social movement theory of Tarrow et al (1998) to argue that anti-dam movements involve a multiplicity of organisational forms and coalitions that make use of a wealth of tactics, from conventional lobbying to direct confrontation, calling for a more 'open-ended, process-oriented perspective on contentious politics' (McAdam et al. 2001 quoted in Conca 2006, p. 174). As political ecologists remind us, this struggle in the water and sanitation domain is both over access and meaning (Peet and Watts 1996). Both are key in determining whether water debates and policies lead to sustainability and social justice.

[5] The controversial Camdessus Report (referenced here as (Winpenny 2003) can be accessed online at: http://www.worldwatercouncil.org/download/CamdessusReport.pdf.

TECHNOLOGY AS THE FIX

Technology is commonly evoked as a means to assure long-run resource abundance in many arenas (e.g. Norgaard 1994). In the water domain, recent 'technological optimist' policies range from the search for the new 'blue revolution' and more irrigation systems for Africa (Movik et al. 2005) and the crop biotechnology revolution to solve problems of water scarcity, to - at their most far-fetched - expansion into space to mine Mars for water. There is no doubt that technologies have key roles to play in addressing water and sanitation problems. Yet driven by conventional engineering paradigms, technological choices in water and sanitation are often portrayed as existing outside politics, with technology expected to provide solutions that transcend politics. Technology is thus made out to be an anti-political instrument – with scientific committees and experts sought as 'arbiters' (Barry 2001) - around which scarce resources are managed and allocated. However, technologies and techniques are of course often deeply political. Contestations around technological solutions, be it large dams, India's fantastical river interlinking project, or the Integrated Water Resources Management approaches now written into water policies and institutions across sub-Saharan Africa, have become sites of politics, questioning both their cultural and material implications.

In the 1980s, technology was seen as the 'solution' when the focus in water and sanitation was largely on hardware solutions. Due to the controversies around them (for example, with large dams, see WCD 2000 and Goldsmith and Hildyard 1984, 1992) and an acknowledgement of the failures of the supply oriented mode (due to the litany of broken down handpumps and unused toilets) there was then a shift towards software models. These focused on gender, institutional and governance issues (see Mehta 2004). Despite some increased attention to distributional and demand management issues, technology continues often to be seen as the universal fix for scarcity (e.g. in arguments for augmenting supply through storage and reservoirs).

Furthermore, the relationships between technology and socio-cultural issues are often overlooked. Necessity is not always the mother of invention. Instead, culture and meaning can also drive a society's technological development (see Pfaffenberger 1992). For example, large water structures embody power and prestige in many ancient hydraulic societies. Emotions such as shaming, cleanliness and disgust are today often drawn upon by sanitation specialists to encourage toilet use. Indeed, in many rural areas the key sanitation challenge has to do with cultural practices and perceptions, alongside issues such as environmental

impacts. Thus, it is necessary to understand the dynamic interplay between society, technology and ecology - something which rarely comes to the fore in conventional analyses.

RECONCEPTUALISING SCARCITY AND ACCESS

It is estimated that 2.7 billion people will face water scarcity by 2025 (UN 2003). Orthodox commentators such as the World Water Commission, the World Bank and others have been warning us of a 'global water crisis' for a while, often drawing on the Malthus-influenced 'gloomy arithmetic of water' to highlight that half the world's population will live under conditions of severe water stress by 2025. Moreover, conflicts and growing competition over water allocation are anticipated to lead to 'water wars' at the regional or continental level.

But what is scarcity? How has it been conceptualised? Does the way the 'problem' is constructed, shape the proposed solutions? And do global or theoretical portrayals of scarcity match up to the way the issue is experienced locally or is there sometimes a disconnect between global and local solutions? There is no dearth of research on water scarcity. Since the 1990s, there has been an impressive flurry of reports, papers and global assessments of water scarcity. Most of this literature looks at either the finite nature of global water supplies (e.g. Shiklomanov 1998); classifies countries according to a 'water stress index' on the basis of their annual water resources and population (see Falkenmark and Widstrand 1992), or creates water scarcity scenarios for groupings of countries or regions based on projections of future water demands and needs (e.g. Seckler et al. 1998; WRI 2003; Rosegrant et al. 2002). While there is some acknowledgement of the differences between water shortages - which refer to physical amounts - and water scarcity - which could be a social construct or the result of affluence, lifestyle choices and expectations (see for example Winpenny in FAO, n.d.), - most of the literature focuses on volumetric and physical measures.

More nuances are provided by a political science and international relations literature that teases out differences in the 'orders' of scarcity, ranging from physical (first order scarcity) to second order or socio-economic scarcity (referring to the lack of ability to adapt to the problem of physical scarcity), to third order scarcity that refers to the socio-political, technological and cultural changes that a society must undertake to deal with scarcity (Allan 1998; Ohlsson and Turton 1999; Wolfe and Brooks 2003). But even these debates fail to distinguish adequately between the socially constructed and biophysical aspects of scarcity. They lack a focus on how the problem of scarcity is constructed and how problematic framings in policy discourse can actually lead to a

worsening of scarcity conditions. They tend not to disaggregate users and their entitlements or to look at the politics of distribution in the context of political economy. Nor do they focus upfront on the social relations underlying how technology choices are made, and their embeddedness in diverse governance and institutional arrangements. Finally, most global portrayals of water scarcity see it as something natural and inevitable, instead of something that is either exacerbated or caused as a result of socio-political processes. Instead, empirical work has demonstrated that water 'crises' are more often the result of struggles over access to and control over water resources than a natural condition (see Jairath forthcoming and Mehta 2005) . Indeed, scarcity can be manufactured in certain ways to legitimise interventions and controversial schemes such as large dams that can serve the interests of powerful actors and may not end up benefiting the water-poor (ibid).

The 2006 UNDP Human Development Report, 'Beyond Scarcity: Power, Poverty and the Global Water Crisis' either rejects or nuances most of these conventional views. It contends that water scarcity is not due to physical shortages of water. Instead, it emerges due to inequality of access, power, poverty and institutional and policy failures. Through detailed analysis, it argues that there is more than enough water in the world for domestic purposes, for agriculture, and for industry. It urges governments and donors to wake up to the 1.8 million child deaths each year related to dirty water and poor sanitation that dwarf the casualties associated with violent conflict (UNDP 2006). Thus, water shortages are the result of a combination of institutional, ecological and socio-political factors. Solutions, therefore, cannot be simplistic. Our starting point, thus, is that scarcity is not a natural condition. It is not something that is inherently in the nature of things. It does not arise because there is too little water or food to go around. Instead, the problem lies in how we see scarcity and the ways in which it is socially generated. Conventional visions of scarcity that focus on aggregate numbers and physical quantities are privileged over local knowledges and experiences of scarcity that identify problems in very different ways.

Simplistic notions of scarcity often lead to simplistic solutions which can intensify problems of access and exclusion. These range from enhancing water supplies, increasing and improving existing infrastructure and technologies to bringing in markets through cost recovery principles and privatising scarce water supplies.[6] Since the Dublin Declaration of 1992 (http://www.wmo.ch/web/homs/icwedece.html), water is increasingly seen as having economic value in all its

[6] However, the declaration of water as an economic good often robs water of its multiple meanings and roles, especially in the socio-cultural and symbolic realms. .

competing uses. By implication it is being argued that the basic human need for safe drinking water can no longer be regarded as a sufficient criterion for providing an engineered supply free of charge (Black 1998, p. 55). Because water is scarce, goes the logic, it must be used judiciously and its demand managed. Free water is considered wasted. Accordingly, efficient resource management is equated with water having a price. The price signal is thus evoked as a way to solve water scarcity problems. Around the turn of the century, the World Bank, the World Water Council and others advocated privatization models as the best way to manage 'scarce' goods and services efficiently. However others questioned their impacts on human wellbeing and people's basic rights, especially in the world's poorest countries (Bayliss 2002; Gleick, Wolff et al. 2002; Budds and McGranahan 2003; Mehta 2004).

More recently, rights-based approaches and notions of entitlement to water and sanitation have been evoked as ways to enhance access. For instance in 2002 the United Nations Committee on Social and Economic Rights explicitly recognised the right to water as a human right and stressed its importance in realising other human rights.[7] It also stressed the role of states in progressively realising the right to water, determining this to entail the provision of sufficient, safe, affordable water to everyone. There is, however, still much resistance on the part of donors and powerful players in the water domain to accepting water as a human right. An exception is South Africa whose constitution explicitly recognises the right to water, and where its Free Basic Water policy provides a basic level of water (25 litres per capita per day based on a household size of eight people) free to all citizens This goes against the grain of most donor discourses that shy away from explicitly recognising the human right to water. However, implementation has been a problem. For instance, it is difficult to stipulate how much water should constitute the basic right, and many critics feel that 25 litres is too low to meet basic and subsistence needs, especially if one rejects a distinction between water for life and water for production. Furthermore, alongside the remarkable commitments to providing free water, South Africa has experienced several World Bank-influenced policy changes that have led to poor households being disconnected from water supplies, contravening their basic rights. Privatisation contracts with international firms have also led to water becoming very expensive for many poor people. Thus in dancing to the two tunes of markets and rights, equity considerations are being compromised (Bond 2003).

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[7] General comment E/C.12/2002/11, dated 26 November 2002, accessed 29 December 2002 at: http://www.waterobservatory.org/library/uploadedfiles/right_to_water_Articles_11_and_12_of_the_Inter.pdf.

Thus different approaches to conceptualising scarcity, access, distribution and allocation are part of the framing of international and national debates around water and sanitation. These framings, in turn, have implications for governance processes and institutional arrangements. Despite the continued prevalence of approaches focused on aggregate, technical aspects of water supply, as we have traced there have been important moves towards a greater recognition of distributional issues. For example, the need to use scarce water supplies equitably is the logic behind the water allocation reform processes underway in many parts of the world. These are leading to institutional reforms and programme approaches designed around water rights, aimed both at enhancing equity and efficiently managing water (see Section 4).

But merely enhancing access is not enough. Even recent debates have paid insufficient attention to what we might term the 'functionality' of water access, i.e. the particular services that people derive from water and sanitation and which they value, in the context of their livelihoods and social and cultural values. This requires greater attention to diverse local settings and the meanings and values that people attach to water and sanitation in their everyday lives than is found in much contemporary analysis and policy discourse. At the same time, the sustainable development of that functionality is key, referring to the extent to which water and sanitation access enables people, communities and regions to develop the personal, social and economic dimensions of their livelihoods and uses of water and sanitation (on top of their basic needs for water for survival) in a way that is resilient and robust over time and in the face of shocks and stresses (see STEPS Working Paper 1 on Dynamics).

In water and sanitation processes and interventions, analysts have argued that it has not been easy to assess whether something is sustainable or not due to the difficulty of defining sustainability in operational and quantitative terms (Figueres, Rockström et al. 2003). In part this is due to questions concerning the adequacy of assessments and designs to gauge social and environmental costs (see Section 6). These could include: natural resource depletion; compensation to future generations for social and cultural costs as well as the depletion of natural resources; impacts on health, or financial and institutional costs. Engineers such as Mihelcic et al. (2003) have stressed the importance of bringing together three dimensions when viewing sustainability in water and sanitation. These include societal sustainability (social justice, equity), environmental sustainability (human and ecosystem health, natural resource protection and restoration) and economic sustainability (productivity, employment, growth, etc.). Watkins, McConville and Barkdoll (2004) build on these to identify and explore

several metrics for water use sustainability. These include: (1) the ratio of water withdrawal to total supply; (2) the percentage of income spent on water and sanitation; (3) the incidence of waterborne diseases and (4) the indices related to a managed system's ability to cope with extreme events. They also consider the temporal and spatial scales over which such metrics can be calculated.

These are valuable indices. Overall though, current approaches lack adequate criteria to judge sustainability or pro-poor development in water and sanitation (Figueres, Rockström et al. 2003). Most indices tell us little regarding whether water and sanitation use is enhancing equity or contributing to poverty reduction in a dynamic world. Furthermore, sustainability could also be directly linked to the level of local participation. There is growing evidence that when intense community mobilisation allows local people to play a key role in project design and execution, sustainability is enhanced and there is an incentive to make the system more resilient. The rapid spread of community-led total sanitation initiatives in Bangladesh is a good case in point. Here community members, encouraged by external actors such as NGOs, collectively decide to stop open defecation, construct low-cost latrines and continue to maintain them even after floods and other shocks (Kar and Pasteur 2005).

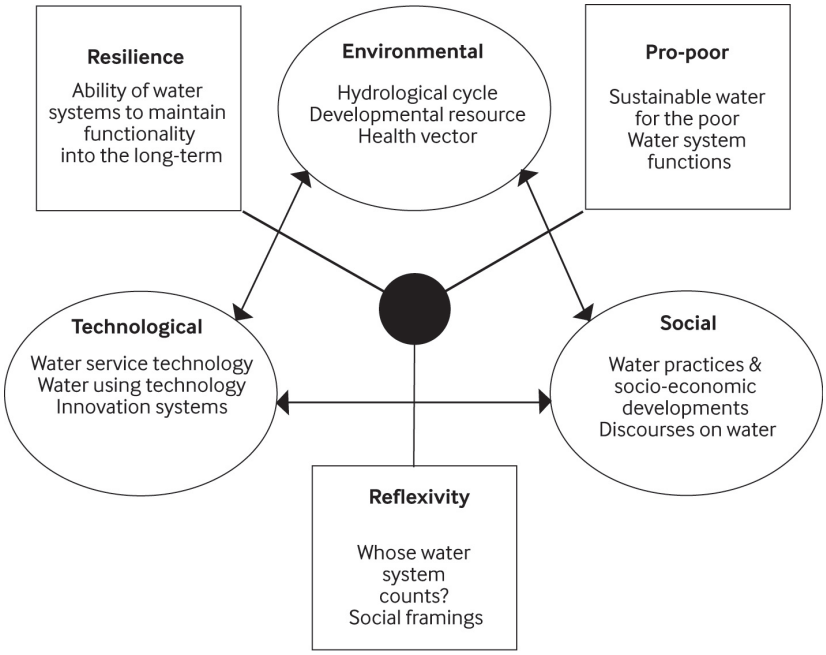
What then constitutes pro-poor sustainability with respect to water and sanitation systems, their governance and institutional designs? An approach is needed that comprehends the interaction of social, technological and ecological dimensions of complex, dynamic water and sanitation systems, and addresses whether they are sustainable in terms that poorer and marginalised people value, and which enable them to exercise agency in water and sanitation services provision. Yet as this section has argued, dominant water debates - and the approaches to sustainability they give rise to - take insufficient account of these questions of dynamics and of poorer people's values. In the next section, we offer some first steps towards an alternative framework.

3. ADDRESSING SUSTAINABILITY IN DYNAMIC WATER AND SANITATION SYSTEMS

In today's dynamic world, water and sanitation systems involve rapidly-changing social, technical and ecological processes. In this section, we discuss these liquid dynamics and introduce a perspective on sustainability in a water and sanitation context that takes them into account. Furthermore, we suggest that

how water and sanitation systems are understood - or 'framed' - differs according to the individual or group concerned and their social, political or disciplinary positioning. Different framings may represent systems dynamics in different ways, and will vary in how far they acknowledge and understand the many uncertainties involved. Particular framings in turn justify particular approaches to water and sanitation governance. We are interested in the interaction between how water and sanitation systems are framed, the interventions that result, and their outcomes - for poor people and for complex ecologies and hydrologies. Figure 1 illustrates these concerns. Our own 'meta-framing' of water and sanitation system analysis is shaped by our interest in the resilience of these systems in relation to the functions valued by poor people, and a concern for greater reflexivity - or recognition that framings of a system are partly constituted by the observer's own circumstances.

Figure 1: Dimensions of concern with water and sanitation dynamics



As pointed out earlier, the functionality that people derive from water and sanitation systems is determined by the interactions between complex social, technological and environmental processes. Whilst each of these is discussed in turn below, it is important to bear in mind, and will soon become apparent, how

each implicates and is implicated by the other. It can be difficult to tease apart one set of processes from another. Indeed, such separations can be deeply contested. Social activities do not simply impact upon the physical flows and operation of hydrological cycles (cf. Oki and Kanae 2006). Rather, the meaning societies invest in water, both culturally and economically, influences how they frame and understand hydrological cycles, interpret data, read in between gaps in the data, and as such socially construct water cycles. This can subsequently lead to interventions that affect the water system and its services for the poor (sometimes in unanticipated ways).

Scientific and technological development is an important form of intervention. Technologies help people exploit and manage water resources, and mediate relationships between the social and the hydrological in important ways. But knowledge about water/sanitation and their technologies are the products of social processes interacting with the material world. The same processes give those technologies their meanings. A good example is the contrast between water-intense flushing toilets, and the cultural notions of development attached to this technology, compared to dry latrines, and cultural associations with them, and the natural and social climates in which each is deemed to be appropriate.

SOCIAL DYNAMICS

Social processes play into the dynamics of water and sanitation systems in a number of important ways. First, processes such as demographic change, the concentration of populations in urban centres, patterns of agricultural practice, socio-economic development, and changes in livelihoods and lifestyles affect demands upon water resources, sanitation and the use of water in productive sectors. Thus for example, rising norms of 'cleanliness' in affluent societies (Shove 2003) are leading to changes in water and sanitation practices, while in terms of food consumption, the growing presence of meat in daily diets is also impacting heavily on water demand.

Second, social processes and relations around caste, gender, ethnicity, race and so on often shape who gains access to water and sanitation services and whose perspective counts while allocating 'scarce' resources. Third, social processes underpin the development of governance arrangements for meeting demand and arbitrating between conflicting demands - as will be discussed in more detail in the section on governance below. Frequently, such socially-shaped governance arrangements are at odds with the allocation arrangements that emerge from local social relations and practices, sometimes resulting in disso-

nance and conflict. A final set of social processes influencing water systems and their functionality are cognitive processes, or relations of power and knowledge. Thus scientific, cultural and economic institutions (such as the World Bank and CGIAR system) frame complex water systems, appraise options, form water values, and inform the development of water systems. But of course, there are inevitably knowledge gaps and uncertainties. One example is the incomplete monitoring of complex hydrological cycles, whose patterns are strongly influenced by poorly-understood climatic shifts (UNW/UNESCO 2004). Yet powerful institutions rarely admit to such uncertainties and knowledge gaps, whether out of haste or because their own power is tied up with an image of a more stable, certain water world that they can shape in predictable ways - even though in practice such views often prove illusory.

Thus, the social processes that affect water and sanitation systems include the power/knowledge relations that affect how water issues and dynamics are framed. These in turn shape the interventions made into hydrological cycles, their material effects, and the consequent form those cycles take. Social processes affecting framing, in this way, can have real hydrological impacts.

TECHNOLOGICAL DYNAMICS

Technologies are produced by social processes, whilst also transforming materials for human benefit. They consequently play an important mediating role between the social and the environmental dimensions of systems. Water and sanitation-using technologies simultaneously presume a particular view of the system, place demands on it, and shape it; in effect, they co-construct the system. Such technologies include agricultural techniques; industrial processes, and household technologies for washing, bathing and flushing. Explicit and implicit presumptions about water availability built into such technological developments, compared to actual water systems, will have profound impacts on the resilience of the systems. For example, dam engineers may miscalculate the volume of water in the river or encourage the boom of water-guzzling industries in the command area, thus leading to a reduction in the life or benefits of the project.

Affluent societies have long-established and standard water and sanitation technologies. In many cases these are little altered from the capital-intense, hydraulic civil engineering technologies first introduced by the Victorians (Hamlin, 1992). This is the technological paradigm that most utility companies entering into developing country markets inhabit. But such capital and (water/energy)

resource intensive technologies can be ill-suited to other environmental contexts, such as providing services to populations in arid regions. The dominant technological paradigm has overcome this through the extra-basin transfer of water through large irrigation projects, large dams and so on. While benefits have been accrued, there have also been major social and environmental costs (WCD 2000) as well as unintended consequences such as disease outbreaks. This has resulted in a renewed interest in alternative and/or updated traditional technologies more appropriate for specific situations, to complement or substitute traditional civil engineering solutions (Gleick 2003). Examples include rainfed or trickle irrigation for agriculture, rainwater harvesting techniques, reed bed wastewater treatment, and community-led total sanitation. But here the challenges concern equity and going to scale - can these systems serve large populations? - as well as questions around productivity and markets in a context where these are often isolated small-scale initiatives amidst globally-connected food and industrial systems. Some therefore argue that there is a 'crisis of innovation' in the water and sanitation industry, and troubling complacency around current, long-standing technology solutions that simply will not work for the majority world (Thomas and Ford, 2005). In other cases, as with community-led initiatives in sanitation, strong arguments are being made for greater attention to processes of participation and facilitation to enable the adoption of new toilet systems, so going to scale sensitively and equitably (Kar and Pasteur 2005).

Thus different technological developments have different implications for the long-term resilience of water and sanitation systems, and for the livelihoods and wellbeing of the poor. This raises crucial questions in liquid dynamics: which trajectories of technology development improve resilience in ways that suit the poor, and which undermine it? How far, in different settings, are the technology strategies of donors, governments and global utility companies inclined towards appropriate water service technology solutions for the poor, and where is more attention needed to develop participatory innovation systems?

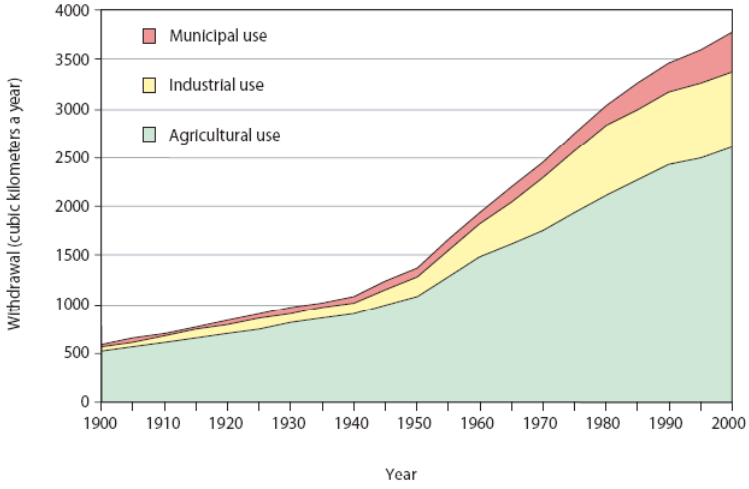
ENVIRONMENTAL PROCESSES

Geo-hydrological conditions are an obvious and key factor in water systems. Water cycles, consisting of interacting processes of evapotranspiration, climate, precipitation, land cover, water courses, water uses and so on inform basic hydrology (Chow and Maidment, 1988). Hydrological processes determine the physical availability of water flows. Oki and Kanae (2006) estimate that in aggregate people around the world currently withdraw around 3800 cubic kilometres of circulating renewable freshwater resources, or about 10 per cent of the maximum available globally. However, this masks stark distributional

inequalities and high stress in specific regions (UNDP 2006). Moreover, water resource datasets can be incomplete: the UN World Water Development Report in 2006 (UN 2006) pointed out how information about the state of aquifers, especially in developing countries, was especially inadequate. Climate change is introducing new uncertainties to these flows. Growing recognition of the environmental services derived from ecosystems, and the water needs of those systems, is adding another dimension and demand to environmental processes in water systems. Agriculture is the dominant water user, but the part diverted for domestic and industrial use is growing rapidly. Withdrawals for agriculture represent the bulk of water use (74 per cent), with industry (18 per cent) and municipalities (8 per cent) consuming significant, but smaller proportions (Shiklomanov 2000).

Total global 'blue' water (i. e. freshwater available from surface sources such as rivers and lakes, as well as underground sources such as aquifers), withdrawals are estimated at 3,390 km3, with 2,490 km3 (or 74 per cent) for agriculture, mostly irrigation (Figure 2). About 20 per cent comes from groundwater, mostly for drinking water and irrigation. Industrial and domestic use is growing relative to that for agriculture. And water use for energy generation – hydropower and thermo cooling – is growing rapidly. Of course, not all water withdrawn is 'lost.' Much is available for reuse in river basins, but often at degraded quality which requires some reprocessing before it can be used again.

Figure 2: Withdrawal of 'Blue Water' for Human Use – 1900-2000



Source: Shiklomanov (2000)

On average about 60 per cent of rainfall does not reach rivers or aquifers, but remains in the soil. This soil moisture, or 'green water', represents a potential in terms of increasing agricultural productivity, in combination with supplemental irrigation such as rainwater harvesting or microirrigation. Studies have shown that providing an additional 100 mm of blue water to rainfed agricultural systems during dry spells can increase productivity from 1 to 2 tonnes of cereals per hectare (source: http://www.iwmi.cgiar.org/WWF4/html/action_2.htm).

Physical scarcity occurs when available resources are insufficient to meet all demands, including minimum environmental flow requirements. Arid regions are most often associated with physical water scarcity. But an emerging, alarming trend is an artificially created scarcity, even in situations where water is apparently abundant. This is due to the overdevelopment of hydraulic infrastructure, most often for irrigation. Water resources are overcommitted to various users, and there are often competing pressures to meet human demands and environmental flow needs.

Many hydrologists accept that the social is a major intervening factor. And not just at local or regional scales, but across the global scale too. For example Oki and Kanae have argued that:

> ....it no longer makes sense to study only natural hydrological cycles. For this reason, some studies have started to consider the impact of human interventions on the hydrological cycles, thereby simulating more realistically the hydrological cycles on a global scale. In such studies, human withdrawals are subtracted from the river flow, and the regulation of flow regime by major reservoirs is incorporated' (Oki and Kanae, 2006: 1069).

River basin approaches and Integrated Water Resource Management (IWRM) similarly try to take a more socially-aware perspective on the hydrological cycle at different scales (settlements, watersheds, rivers), but also over different timescales (short-term needs; seasonal demands; medium-term developments in demand; long-term availability of water).

Whilst the integration of social impacts into hydrological studies has been widely accepted for some time now, much of the work continues to be based on an equilibrium model of water systems. Thus water users' social practices are understood as intervening in and disrupting hydrological cycles, and as needing to be brought back into line to restore hydrological balance. Such narratives often justify policy processes aimed at restoring such balance. However, such notions overlook the more dynamic, sometimes non-equilibrial ways that social and hydrological processes interact.

ADDRESSING SUSTAINABILITY

In multiple ways then, dynamic environmental, social and technological processes co-construct water and sanitation systems and the distribution of functions that people derive from those systems. Shifting demographics, technological innovation, economic development, land use patterns, climate change, prevailing social values, new institutional arrangements, and other factors obviously affect the operation of water and sanitation systems (although the precise influence of each can be far from obvious, see also Moench et al. 2003; 2004). Some factors can be internal to the water system itself, in the sense that they are an explicit and dynamic social, technological or ecological component of the water system. Other factors are more contextual. A sustainable water and sanitation system can be understood as one that can maintain a level of service provision over the long-term by adapting and coping with these dynamic components and contexts. Yet while sustainability refers to maintaining services in a general sense, we also need to recognise Sustainability, referring to the services valued by a particular social group (such as the poor), or to meet particular, normatively-defined goals such as poverty reduction or social justice (see STEPS Working Paper 1 on Dynamics).

System properties contributing to Sustainability are stability, durability, robustness and resilience. Depending on the Sustainability goals in question, these properties - and the possible trade-offs between them - may be valued in different ways. The stability of a water and sanitation system relates to its ability to withstand shocks internal to the system, such as engineering failures, switches in ownership or governance, and so on. The durability of the system rests in its ability to maintain service provision even when conditions within the system change, placing stresses, such as declining aquifer levels, periods of drought, or growing numbers of household, agricultural or industrial connections/users. Relatively rapid changes in context can also challenge the system, and the ability for water and sanitation services to cope with these exogenous shocks is a product of system resilience. Examples of such external shocks include disasters such as floods, pollution incidents, rapid urbanization, disease outbreaks, and sudden shifts in land use patterns, like deforestation. Finally, the robustness of the system is the exogenous correlate of its durability, in the sense that it is the ability of the system to adapt to more gradual contextual developments, such as climate change (though this may also generate shocks, such as more extreme weather events), demographic change, agricultural intensification, and industrialisation.

In practice, the way different, interacting and complex processes influence the provision of water and sanitation services may not fall so neatly on either side of the spatial boundary of the system (internal or exogenous) or the temporal boundary (sudden shocks or secular trends). To a large extent, this depends upon how we decide to analyse and organise these real-world complexities, by defining system boundaries and classifying real-world processes and events in certain ways and not others. These are questions about how water and sanitation stakeholders negotiate and interpret water systems – how the system is socially constructed or framed. Whatever the construction, and recognising that this 'systemness' is a necessary simplification of real-world complexity, terms such as stability, durability, resilience and robustness nevertheless provide a language for considering the emergent properties of the dynamic and interacting processes that provide water and sanitation services to the poor, and the likelihood of services enduring future events and developments.

Of course, it remains far from clear what is actually meant by the water system, and how to build in properties like resilience. How should the boundaries be set for studies of water and sanitation resilience? Obvious physical or hydrological boundaries like watersheds are complicated by territorial jurisdictions, and intersected by socio-technical networks whose webs of interaction make boundary-setting more difficult. Should, for example, international trade in virtual water be included within the water system boundaries of analysis and management? And which relations should be privileged or highlighted in analysis of this complexity? In short, whose water 'system' counts? And what Sustainability goals - what kind of water services - should be privileged or prioritised? So along with a concern with the resilient functionality of water systems for the poor, there is a need to be reflexive in analysis and management, and to recognise how framings shape the ways analysts and practitioners approach this challenge.

One example of an approach that treats water issues as part of an integrated social-technological-ecological system geared towards equitable sustainability is Integrated Water Resource Management (IWRM). IWRM may be defined as 'a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems' (Global Water Partnership, 2006). The idea of 'integrated water resources management' grew out of an increasing awareness of the problems created by managing the water needs of different sectors in isolation. IWRM is not only a process as indicated by the definition, but also a management tool, an implementation strategy, and a philosophy.

The core point of IWRM is integrated management of sectoral and aggregate demand (Shah and Van Koppen 2006) to ensure that activities impacting on a water body are co-ordinated, taking into account synergies and accumulative effects of actions. The notion of integration provides a framework that seeks to avoid fragmented and piecemeal approaches to water management and strongly conceptualises water management as embodying interaction between social and hydrological/environmental systems (source:http://www.dwaf.gov.za/iwrm/contents/about/what_is_iwrm.asp). The necessary inclusion of a wide range of features at the IWRM scale means that properties like stability and robustness do tend to be emphasised. This contrasts with many other water management approaches which are more narrowly concerned with the immediate provision of water to those without access, with little regard for long-term sustainability. Understandably, immediate needs, such as health and survival, often eclipse consideration of how such access meshes with wider basin-level concerns about water flows and quality (Satterthwaite et al, 2005).

However, IWRM has been criticised for being a vague and fuzzy concept, and for being difficult to implement in a practicable fashion (Biswas 2004). Moreover Jairath argues that while IWRM recognises inequity in access and control over water resources, this is conceptualized as a management distortion and not as derived from an imbalance in power relations between those with differential access to water benefits. Thus while productivity and efficiency gains may be possible through better organised/coordinated activity, the same cannot be said of equal sharing of the benefits thus generated unless access to these benefits is ensured through political rearrangements (Jairath forthcoming).

The water and sanitation systems framework outlined in this section therefore shares some important emphases with the IWRM approach, in its concern with integrated social-technological-environmental systems, with sustainability, and with equity. However our framework attempts to go further: in specifying the Sustainability goals of poorer and marginalised people, and the systems properties that contribute to them; and in addressing the relationship between systems dynamics and their framing by different groups. This, we hope, offers the potential for a more systematic and operational way of addressing water and sanitation Sustainability, while also addressing explicit normative goals around poverty reduction and the promotion of social justice.

4. MEETING GOVERNANCE CHALLENGES IN WATER AND SANITATION

The increasing dynamism and multiple framings that characterise water and sanitation systems pose many challenges for policies and institutions aiming to address water problems. In this section, we consider how and how far governance approaches in the water and sanitation sector - past and present - have recognised and attempted to deal with these challenges, with what degrees of success. As we show, there have been some key moves in political, institutional and management approaches to water and sanitation issues: from an emphasis on centralised to decentralised systems, recognising the role of local institutions and community management; from supply-driven approaches to an emphasis on demand and rights; and from state-based approaches to those including global governance and market-based mechanisms. Each of these discussions in the water and sanitation domain has roots in longer traditions of political theory, and in broader debates about political and institutional relationships (see STEPS Working Paper 2 on Governance). And the shifts are not linear; there are debates and contradictions within and between them. Overall though, we argue that what is often missing are adaptive dimensions that enable governance to respond flexibly to liquid dynamics, and reflexive dimensions that acknowledge how management approaches are underlain by particular understandings of water and sanitation systems. Both, we suggest, are necessary if water governance is to contribute to pathways to Sustainability and social justice.

FROM CENTRALISED TO DECENTRALISED SYSTEMS

The governance of water resources raises issues at the heart of the relationship between state, society, technology and community. Since Karl Wittfogel's theory of hydraulic despotism that proposed that medieval oriental societies needed centralised bureaucracy to control labour in order to build massive irrigation infrastructure (Wittfogel 1957), water has been at the centre of some theories of the state and civilisation. Contemporary writers such as Worster (1983) have developed Wittfogel's theory to argue that even today, control over water resources has led to the concentration of financial and political power in the hands of bureaucratic and technocratic elites. For example, much research has demonstrated how large centralised water systems have led to alliances between large farmer lobbies, engineers, politicians and financiers (e.g. Mehta 2005).

In the last two decades, several parallel discourses have contributed towards a major policy and political shift in the way water resources are governed. Disenchantment with the state has often been at the heart of these narratives. These range from a politically-oriented environmental critique of colonial and post-colonial governmentality (Gadgil and Guha 1992; Agarwal and Narain 1997), which has demonstrated how power and control manifests itself in natural resource management, to mainstream international policy discourse on the devolution of water resource institutions that seeks to transfer rights and responsibilities to local user groups (Meinzen-Dick 1997; Hooja, Pangare et al. 2002).

In the new discourse, community-based organisations (CBOs) or water user associations (WUAs) are understood to replace state agencies in governing their own resources. Policy-makers target relatively small-scale water bodies such as small dams and reservoirs, indigenous or traditional water systems, or even small patches of canals (Mosse 1997; Mollinga 1998; Jairath 1999). They envisage stakeholder participation for more contentious issues related to urban water resources or at river basin level that may involve several contenders with disparate demands. Proponents of IWRM have formulated it explicitly to create multi-layered, large scale governance structures at the scale of river basins and beyond (Shah and Koppen 2006). Thus the overall trend on the one hand has powerfully moved away from relying only upon centralised state bureaucracies to govern water resources, to finding local governance structures for smaller scales of technology, society and ecological units. On the other hand there have also been powerful attempts like IWRM to create integrated, centralised and national water policy frameworks with a river basin as a unit of water and land resources planning.

Another strand of policy debate advocates joint governance by farmers' organisations and state agencies. Such joint governance is proposed mainly for large technological systems or large areas covered by river basins. Thus overarching legal and institutional frameworks have been developed, discussed and implemented for Irrigation Management Transfer (IMT), turning over the responsibility for irrigation management from the state to users, for Participatory Irrigation Management (PIM), aiming for increased farmer participation in water management, as well as for IWRM (Joshi and Hooja 2000).

A major contribution towards these political and policy shifts have been the studies and literature on collective action and sustainable institutions that developed in response to Hardin's powerful thesis of the tragedy of commons, which implied either state intervention or privatisation as the only possible solution (Hardin 1968). A large body of empirical research has examined the emergence and operation of collective managerial arrangements for common property resources (CPRs) and has studied how local institutions have evolved to govern access to and control over water use (e.g Berkes 1989; Bromley and Cernea 1989; Wade 1988, Ostrom 1990). The Zanjeras in the Philippines and the Balinese water temples are examples of sustainable culturally-embedded common property regimes related to water resources management that have survived several centuries.

The contribution of common property theorists in refuting Garrett Hardin's (1968) 'tragedy of the commons' analysis has been tremendous. They have suggested that institutions can facilitate co-operation, rather than competition, between resource users. From a policy perspective, they have shown how planners sometimes erroneously believe that they are starting de novo when conceiving grandiose projects, and in the process delegitimise and neglect deep-seated indigenous rules for governing resources (Coward 1980). Nonetheless, CPR theorists' portrayal of both institutions and communities tends to be static and aggregated, as well as placing perhaps too much faith in the effectiveness of local or 'customary' rights systems across diverse contexts (Roth, Boelens et al. 2005). The focus on collective action has directed attention away from social difference, often to the extent of portraying the societies concerned as homogenous, and harmonious. Institutions, too, are sometimes portrayed ahistorically and taken to be all-inclusive. Few drive home the fact that institutional arrangements governing natural resources management are often elite-driven, exclusive, messy and conflict-ridden. CPR theorists also tend to gloss over factional dynamics and politics in communities, a weakness which has been criticised by Agrawal (1999) and Mehta, Leach et al. (1999).

For the most part, CPR approaches have also not acknowledged the flexible norms and social conventions that underpin institutions that effectively manage resources, even if they are not designed with this purpose in mind. Conventional approaches still tend to see the environment in static, rather than dynamic, terms. The impacts of global forces on local management are not fully explored and the scientific uncertainties and conflicts concerning different perceptions of resources and their management are ignored (Mehta, Leach et al. 1999). By

contrast, critical social science perspectives have emphasised multiple levels (global, local and in-between), diversity (in terms of livelihoods and perceptions) and see institutions as part of a constant process of negotiation that involves power and conflicting interests within communities (see STEPS Working Paper 2 on Governance). Emerging views try to break down the distinctions between local/global and between formal/informal institutions in order to understand better the complexities and uncertainties that face natural resources management today (ibid).

COMMUNITY-DRIVEN WATER GOVERNANCE

A growing body of literature acknowledges the problems of portraying local communities as homogenous and harmonious. Due to the attractiveness of theories of smallness (cf. Schumacher 1973), there is often an implicit assumption that small is always beautiful - and functional and good for the poor. In other words, it is implied that if a project is small, it is bound to be successful and egalitarian and that the principles of democracy, equity and participation are sure to be espoused. As lessons from watershed development schemes show, however, ecological soundness does not necessarily mean egalitarianism. Often the existing power and social relations within a community are based on quite different axioms, as is convincingly demonstrated by Mosse (1997; 1999) and Shah and Raju (2002) in their work on tanks in South India. It is these axioms which ultimately form the basis of present and future patterns of resource use.

In development theory more generally, echoed in the water domain, community on the one hand is considered as a space for consensus generation and on the other a rational, economic space. Not only is it assumed that the consensus builds common good, but that culturally and historically shared or conflicted ideas held by the members of the community have only peripheral importance (Mosse 1999). Community-driven development thus focuses on building consensus, ignoring that communities are always made of various interest groups possibly ridden with conflicts. Various notions of community thus come to interact with each other (rational and economic space, consensus building arena, conflicting interest groups, and community as a cultural space or social organisation with social and historically shared and contested meaning of social identity), creating a great deal of tension (Agrawal 1999). In relation to water governance, a better understanding is needed of the relationship between these various forms of community space, the extent to which, in particular settings, it exists or comes to be 'imagined' around a common idea or interest, and the culturally and historically-specific dynamics of community change. (see for

example DeSouza 2001). Incorporating multiple, possibly contested framings of water issues could draw on Chatterjee's notion of 'community alliances' around ideas, interests and notions; to emphasise the inherently political nature of such alliances he calls this political society (Chatterjee 1998). Yet incorporating such a differentiated, historically and culturally specific, continually contested and changing notion of community poses a challenge to conventional approaches to water governance conceived around far more static notions.

RIGHTS, EQUITY AND JUSTICE

Water management has evolved considerably from the 'hydraulic imperatives' and supply-driven approaches that dominated in the 1950s-70s, in which it was largely an issue of getting the technical solutions right and of building infrastructure and storage. Indeed there has been something of a paradigm shift over the last couple of decades - even if there are now signs that the pendulum is swinging back again. In this shift, many countries have been busy reforming their water policies, concentrating to a large extent on crafting water rights regimes in response to what is perceived as increasing scarcity of water (Saleth and Dinar 2000). Water rights are seen as creating better security, as well as facilitating allocation to promote efficiency of use as well as opening up opportunities for more equitable distribution. Tisdell (2003) in an overview of the three dominant water doctrines - riparian rights, prior appropriation and what he terms 'non-priority permits' - argues that the latter is the most conducive to justice, understood as enabling equitable allocation. However Movik (forthcoming) has critiqued this view, contending that it disregards issues of power asymmetries, rendering a doctrine of priority permits more suitable in instance of severely skewed societies.

Attention to water rights emphasises the importance of institutions in water management (Roth, Boelens et al. 2005). As the literature on legal pluralism acknowledges, the 'rules of the game' that structure access to water in practice involve informal rules and norms as well as formal legislation. The institutions created are not just formal ones (supported by laws, licences and so on) but also include negotiation arenas through which different stakeholders in water management defend, increase and influence access to water (Meinzen-Dick and Bruns 1999; Spiertz 1999). 'Legal pluralism' thus essentially refers to '...the existence and interaction [...] of different normative orders in the same socio-political space' (Roth, Boelens et al. 2005, p. 4-5). Often, local norms, rules and values may partially merge with formalised rules and regulations, creating 'morphed' institutions that are fluid and adaptive in their nature. Acknowledging such complexity is part of a general trend in analyses of resource exploitation which

increasingly recognise that resource governance is more than just the adherence to a set of specific rules; it is characterised by contingency, ambivalence and conflict. Adopting legal pluralism as an analytical framework helps researchers and practitioners understand the multiplicity of ways in which law is given social meaning, and avoids simplistic dichotomies such as formal/informal law or de jure/de facto law (Schlager and Ostrom 1992, quoted in Roth, Boelens et al 2005).

Approaches to water resources management (and irrigation in particular) have drawn on bodies of thought such as new institutionalism and common property theories that tended to focus on institutions, incentives and getting 'rights right', examining the conditions that were conducive to producing collective action. More recently, an approach to management issues dubbed the 'empowerment approach' (ibid) has investigated the impact of unequal power relationships, exploring water management from a social justice perspective concerned with fostering more participatory development practices. Property rights, in this framework, are explicitly regarded as reflections of prevailing patterns of power, although there is a tendency to downplay existing normative values that structure the ways in which needs and interests are negotiated. Using legal pluralism as a lens to explore the fluidity and hybridisation of rules, norms and values thus may help in gaining a more thorough understanding of how institutions respond adaptively to the dynamics of water management systems (see STEPS Working Paper 2 for a fuller discussion of adaptive governance).

GLOBAL WATER GOVERNANCE

The governance of water and sanitation has become truly global issues, giving rise to global discourses on what constitutes 'good governance' in the water realm (e.g. Conca 2006). One such discourse is that of the benefits derived from devolving decision-making authority from national administrations to more local-level institutions. The belief that the principle of subsidiarity serves the water users best has been most prominent in the large-scale irrigation management transfers that have taken place during the last couple of decades. Concomitantly, water rights reform across the globe has tended towards vesting the state with the power of custodian of a nation's water resources in terms of granting permits or licenses to use (Saleth and Dinar 2000).

Along with the growing emphasis on global water governance, however, has emerged a tendency to focus on universalised conceptions of problems and solutions. Because water is a resource that knows no boundaries, and therefore increasingly has come to be regarded as an inherently 'global' problem, debates

tend to revolve around a search for generalised, standardised principles and ideas Yet as Roth et al.(2006) argue, this overlooks more contextualised understandings of what water management problems actually are. Aggregated and simplistic representations risk impoverishing the debate and hampering the search for effective solutions to problems faced by water users in local settings. Indeed, many actors involved in the process of crafting global governance structures and institutional forms attenuated to the perceived scale of the problem tend to overlook and downplay that such governance challenges are often local rather than global in nature. It is such global governance processes, for instance, that tend to produce the problematic framings of water scarcity that we discussed in section 1. Thus policy documents and big international events often produce statements such as 'the global water crisis must be tackled' or 'global water resources are growing scarcer' rather than focussing on scarcity as a localised phenomenon.

Moreover, global water governance arrangements have generally followed the established approaches to 'regime building' based on inter-state treaties for dealing with trans-national environmental problems, such as managing resources held in common or preventing transboundary travel of pollution and toxic waste. Yet critics point out the problems of such approaches, including difficulties of implementation amidst unequal global power relations, and a tendency to promote narrow views of problems and of institutions. Rather, recent approaches emphasise multi-level, networked governance arrangements (see STEPS Working Paper 2 on Governance). These often include a multitude of non-state actors working beyond conventional international regimes. They often incorporate more pluralistic understandings of authority and territorial sovereignty, and of the nature of water problems. Such approaches are starting to be increasingly present in water frameworks (see e.g. Conca 2006) offering potential ways forward in shaping pathways to Sustainability.

THE RISE OF NEO-LIBERALISM AND MARKET-BASED MECHANISMS

There is now an emerging consensus that international public sector reform in irrigation and water management arose from transnational pressure for structural adjustment and liberalisation. Often known as beyond the border consensus across donors and multilaterals (Mehta 2004), devolution – like privatisation programmes – responds to global economic ideas that markets and local governments should take on more of the tasks hitherto performed by large, inefficient, central state machineries (Crook and Manor, 1998). These result

in 'Washington Consensus'- inspired models of decentralisation and privatisation. Accordingly, the need for the reform is based on reducing state subsidies, increasing cost-recovery, and relieving the state of financially burdensome obligations. The underpinning ideology sees the user as a rational, optimising actor making financially beneficial choices instead of an individual embedded in specific social, historical and cultural milieux (Mosse 1997; Mosse 1999). More recent international policy packages like IWRM follow a similar logic that emphasises trading in water as an economic good to compensate for increasing scarcity (Shah and Koppen 2006). Several of these internationally generated policy reforms have been criticised for depoliticising the dynamics of water use and management by simply focusing on creating appropriate governance structures to mitigate scarcity (Mehta 2005).

The neo-liberal institutional framework has acquired far-reaching legitimacy in the current policy climate. The privatisation of public or state-owned agencies is just one aspect of the large spectrum of issues that converge under the rubric of property relations and entitlements. Ironically, the commodification and private use of commonly held resources is integral to current models of both community-driven development, and integrated water management. Both these governance reforms can be and in many cases are being directed towards increasing market efficiency and maximisation of the resource use. The hegemonic presence of omnipresent market and consumerism also structures assumptions about aspirations, desires and interests of 'free' individuals. Overall, and especially given their high financial costs, these models will invariably affect community dynamics and seem likely to reinforce power relations. Furthermore, they are often introduced without local participation, rendering their fit with local Sustainability goals questionable. Instead, as earlier examples in this paper have illustrated, market-based approaches sometimes bring high social costs that can contribute to poverty and social injustice.

WHAT'S MISSING IN THE WATER GOVERNANCE DEBATE?

According to Turton et al. (2007) there is a need to 'unpack the black box of governance'. Arguing that many failures of implementation of water laws can be put down to a lack of understanding of governance as a concept, they advocate adopting a perception of governance as a 'trialogue'. In this view, 'good' governance requires effective, and appropriately balanced, interfaces between society and science, and between government and society, as well as between government and science. This model has given rise to a definition of water governance as:

> ...the process of informed decision making that enables trade offs between competing users of a given resource so as to balance protection with beneficial use in such a way as to mitigate conflict, enhance equity, ensure sustainability and hold officials accountable. (Cited from Minister of Water Affairs and Forestry, LB Hendricks' speech at the 'Governance as Trialogue' book launch 22 March)

This definition recognises the importance of how decisions are made and who makes them. However, the discussion in this section emphasises the need to go further. Amidst contemporary liquid dynamics, charting pathways to Sustainability that work for the poor will require greater attention to the politics of knowledge and decision-making. This is a politics that often maintains dissonance between the three elements of the trialogue. To bridge it may require more attention to participatory approaches, but also greater reflexivity from powerful institutions, to recognise how their framings of water problems are only certain views amongst many, often drowning out other important perspectives, including those of poorer water users. Furthermore, scale remains an issue, with multi-level, networked governance arrangements being an important complement to both global-level and local approaches. Dealing with liquid dynamics may require adaptive approaches and institutions that can respond flexibly to emerging conditions. Above all, knowledge politics, issues concerning a wider political economy and the politics of framing need to come to the fore in water and sanitation governance debates. This implies a significant shift from the current situation, in which most dominant governance approaches emphasise the universality of knowledge and consistently ignore the plurality of perspectives and local practices. These tendencies in turn impact on (and respond to) the ways that water and sanitation policies and programmes are appraised, as the next section explores.

5. DESIGNING APPRAISAL OF WATER AND SANITATION

Strands of debate concerning the governance of water and sanitation systems are often echoed in their appraisal - by which we mean the social processes through which knowledges are gathered and produced to inform decision making and wider institutional commitments. In this section, we review a range of appraisal designs that have been applied in the water and sanitation arena, addressing their potential for enhancing equity and Sustainability. The section

charts trajectories of change from closed and narrow forms of appraisal design, epitomised in the use of cost-benefit analysis to appraise large dams, through to those that better allow for complexity, negotiation of perspectives, and sensitivity to power relations. This is, again, by no means a linear history; closed, narrow approaches still dominate in many settings. Nevertheless, and echoing broader arguments in STEPS Working Paper 3 on Designs, we suggest that examples that open up and broaden appraisal offer scope both to include poorer people's voice and agency, and to link appraisal with pathways to Sustainability. This in turn requires attention to how certain framings of the problem lead to different designs; how these lead to institutional arrangements that have a real material effect in water and sanitation systems and to the actual outcomes for poor people.

COST BENEFIT ANALYSES AND LARGE DAMS

Conventionally, most forms of appraisal in the water sector have been both narrow (drawing on a very limited range of often highly technical expertise) and closed (offering singular recommendations to policy, regardless of context). For instance, appraisal techniques have drawn on dominant economic frameworks that focussed on ranking and appraising monetary costs and benefits. A classic example is the application of cost-benefit analysis in the social appraisal of large dam projects. The history of these large technological projects has been observed in many ways to parallel the wider history of development in general (Mehta 2005). In the 1950s and 1960s, with the modernisation paradigm reigning supreme, development tended to be project-focussed, with 'progress' conceived in a highly unilinear fashion. The large dam, executed in a top-down way, epitomised this understanding of modernity, as evident in India's then Prime Minister Nehru's assertion that 'these are the modern temples of India at which I worship.' This phrase pointed to the enormity of the potential consequences presented by large dam projects for people's lives and livelihoods and their wide distribution in time and space. Of course, these consequences can be both positive and negative, including promises of Nehru's 'great leap forward' in the transforming of barren landscapes and the generating of power and employment as well as potentially devastating environmental impacts and miseries of human displacement and resettlement.

It was the imperative to find ways to characterise these kinds of enormous potentialities in a tractable fashion that gave rise to the development of the archetypal supposedly 'sound scientific' appraisal technique of cost-benefit analysis in the first place. Developed by the US Tennessee Valley Authority in the first

half of the twentieth century specifically to appraise large dam projects, this addresses the diverse range of issues by focusing on identifying and measuring the contending associated 'costs' and 'benefits' emerging out of individual projects. While direct financial costs or benefits are easy to calculate and so render visible, less intangible economic factors and social issues tend to be neglected and so remain ambiguous – such as changes in socio-cultural identity and gender relations (Elson 1998; Kabeer 1994) or impacts on geographical space and the environment (Cornerhouse 1998). By contrast with later applications that extend across a range of contending policy options this paradigmatic application of cost-benefit analysis focuses on a single legitimised technological intervention (the large dam project), to the exclusion of alternative possible pathways associated with other technological or policy routes.

As traditionally practised, these designs fail to account for uncertain dynamics (such as changes in river flow due to floods / droughts / climate change whose probabilities are poorly understood). Problems of water scarcity, underdevelopment, poverty and so on are typically framed in highly specific ways, such as to reduce ambiguity and privilege the benefits of large dams. The political attributes of the issues in question are reduced to a simple linear balance between the rights of the majority (or nation as a whole), pitted against the rights of a small minority who are asked to sacrifice their interests in the face of this greater good (Roy 1999). In this way, these approaches epitomise centralised thinking, monolithic planning around single pathways and a neglect of local knowledges and framings and alternative modalities for appraisal.

When considered in detail, cost-benefit analyses typically display a further strong bias in the quantification of costs and benefits, privileging prevailing values in existing markets. Given that markets are not neutral but are laden with social and power relations, this means that certain attributes and interests tend to be valued more highly than those of other groups (e.g. irrigated land is often valued more highly than common property land or men's economic activities receive greater value than those of women). Beyond this, it is often impossible to put a discrete monetary 'cost' or 'benefit' on intangibles such as the loss of livelihoods that have never entered the market-place. In particular, women's lives and activities are often disproportionately centred around these intangibles – making it especially difficult to calculate the gendered aspects of costs and benefits.

It was not until the 1980s and 1990s that the social and environmental impacts of dams came to be more fully documented (e.g. Goldsmith and Hildyard 1992; Cernea, 1997; Scudder, 1995; Thukral 1992). The ensuing critiques of cost-benefit analysis have highlighted the importance of making the invisible

more visible. They have been sceptical of quantitative reductive approaches to the estimating of costs and benefits and their respective distributions. They see socio-cultural issues as a function of equity and distribution, just as access and control over resources are intrinsic to it. In particular, gender scholars have demonstrated how a balance sheet approach uses dominant modes of enquiry which serve to legitimise the unequal distribution of resources (Elson 1997).

Despite this growing body of criticism, however, wider indirect impacts of dams on the lives and livelihoods of diverse groups of people across entire river basins, have not received as much attention. These include the wide scale dynamics of changes in the environment, in social organisation (including family, community and kinship networks), in natural resources and financial resources, in infrastructure development and in consumption and production processes. Vulnerable groups like women and children tend to be impacted by dams in ways that require an evaluation that goes beyond the excluded monetary loss of land (Colson 1999; Mehta and Srinivasan 1999). These analyses suggest that appraising the impacts of large-scale water development projects requires a broader approach that includes the perspectives of a wider range of stakeholders, addressing vulnerabilities across scales.

MULTI-STAKEHOLDER FORUMS – THE CASE OF THE WORLD COMMISSION ON DAMS

Protest movements around the world have questioned conventional approaches to dam-building and appraisal since the late 1980s. They have demanded accountability from implementing agencies: for example the Inspection panel in the World Bank was set up in DATE to investigate rights and policy violations in a host of water projects around the world. Such protests have also led to several changes in decision-making procedures and appraisal methods.

The World Commission on Dams was a unique multi-stakeholder dialogue initiated by the World Bank, IUCN, donors and activist groups in 2000. Its mandate was to investigate the myriad aspects of dams concerning economic growth, equity, environmental conservation and participation, as well as to produce guidelines for future decision-making in water resource development. It concluded that while dams have made a considerable contribution to human development, in too many cases unacceptable costs have been borne in social and environmental terms. Some of the guidelines around decision-making processes included participatory and comprehensive needs assessment before new dams are built and a thorough investigation of all options and alternatives to the proposed project. Furthermore, the Commission called for free, prior

and informed consent of indigenous peoples. It also demanded demonstrable public acceptance of binding formal agreements among all stakeholders with implementable arrangements for monitoring and addressing grievances before a scheme is implemented (see WCD 2000).

A central proposal of the World Commission on Dams' (WCD, 2000) new framework for decision-making was the adoption of a 'rights and risks' approach as a practical and principled basis to identify all legitimate stakeholders in negotiating development choices and agreements. Support for the WCD framework implicitly recognises the value of the 'rights and risks' approach and that past problems with dam projects often derive from a lack of recognition of the rights of the adversely affected population (not only those resettled, but others affected such as downstream communities), the 'involuntary' risks to which they have been subjected, and their associated rights at risk. It is a framework underpinned by internationally agreed principles embodied in the Universal Declaration of Human Rights (1948), the UN Declaration on the Right to Development (1986) and the Rio Declaration on Environment and Development (1992). It encompasses those people directly or indirectly affected, either positively or adversely, as well as other interested parties including those with no direct voice, such as those representing biodiversity.

In order to achieve this, the WCD proposed moving away from a conventional aggregate 'balance-sheet' approach, in which benefits to one group are numerically offset against adverse impacts to other sections of society, to a process of negotiation with the stakeholder interests involved. Recognition of rights and assessment of risks (particularly rights at risk) formed the basis of the WCD's approach to stakeholder analysis and more effective participatory processes, starting with a needs and options assessment early in the planning process. In the event that a dam emerged as the most appropriate response, or part of a broad range of measures, then the 'rights and risks' approach was seen as fundamental to negotiated processes around not only mitigation, monitoring and management measures, but benefit sharing and other steps to enhance the overall development performance of dam project. It was envisaged by its proponents as an integrating tool for economic, social and environmental dimensions. Its relevance goes beyond the dams arena and, as a tool for stakeholder involvement and enhancing the effectiveness of participation, is applicable in a wider development context.

The 'rights and risks' approach is intended to serve as an integrating tool that has the potential to encompass social, economic and environmental dimensions in a single framework through a combination of qualitative and quantitative techniques. As such, it offers potential as a framework for appraising equity and Sustainability. It is also a vehicle to operationalise rights-based approaches

with the overarching aim of achieving equity. Moreover, it is an analytical procedure to help create conditions that legitimise and promote stakeholder involvement, leading to more effective participation and thereby improved development outcomes. However, several tensions exist. Consider, for example, issues of human rights. The perception of what should be understood as comprising a 'basic human right' often draws on universal standards that define water use as a minimum quantity of litres per capita (cf. WHO 2003), with a vibrant debate still ongoing regarding how much water would be adequate (see e.g. the synthesis on the human right to water from the 4th World Water Forum in Mexico, http://www.worldwatercouncil.org/fileadmin/wwc/News/newsletter/synthesis_righttowater_4wwf.pdf). But human rights and, when it comes to involuntary resettlement or displacement, what being displaced means, are not just legal matters; they also depend on culture as well as on the development standards of a country. Human rights themselves can be contradictory and contested, while the governments' right to develop national and water resources can come into conflict with local communities' rights to their local land and access to water resources. Finally, power imbalances can exist in a society that influence whose voices are heard and whose rights are recognized (Bird, Haas and Mehta, 2004).

Similar tensions exist around risks. Risk assessments in water continue to be very technocratic and top-down, and to emphasise narrow notions of risk rather than the range of kinds of incertitude that tend to be at play in dynamic systems (see STEPS Working Paper 1 on Dynamics). The challenge is thus not only to continually improve and extend risk assessment, but equally to introduce tools to balance risk and uncertainty assessments across different disciplines - tools that are stakeholder friendly and not overly complex. In particular, the poorest and the vulnerable have their livelihoods at risk, but have usually had little if any influence on decision outcomes.

In this light, Bird, Haas and Mehta (2004) tried to operationalise the rights and risks approach and argued for the need to add 'responsibilities' as the 'third R'. The responsibilities dimension can provide a means to inform decision-making at different levels. Moreover, rights are often incomplete without clarity on duties, obligations and responsibilities. Defining the roles and responsibilities of different actors can help monitor and evaluate decision-making processes. It also creates necessary conditions for constructive negotiation at different stages, building on previous experience, as well as providing mechanisms to seek accountability and redress when rights are violated or when risks are borne disproportionately by individual interest groups (e.g. those to be displaced, the poor and vulnerable). But a central tension over responsibilities results from fundamental differences in the perspectives of interest groups. Although it is

a broad characterisation, government agencies and/or developers (public or private) may be suspicious or concerned about the 'rights' agenda and similarly civil society, including NGOs, may be suspicious about dominance of the 'responsibility' agenda.

In sum, the rights, risks and responsibilities approach (3 Rs) allows for interesting and unique ways to achieve openness and breadth in designs and appraisals. But they somewhat fall short of tackling issues concerning unequal power relations amongst different stakeholders and how power might determine whose rights, risks and responsibilities prevail. Furthermore, in most situations stakeholder negotiation, where it is practiced, is largely seen as a way to inform decision-makers at the political level of the convergent and divergent views and degree of consensus on a project. To date stakeholders are rarely empowered to make the final decision on whether to develop a dam project or not; this is seen primarily as the responsibility of government or parliament (ibid).

While the WCD currently occupies the moral high ground in appraisal design for large dams, however, translating this into the reality of actual projects is often another matter. Given new aid, development and geo-political conditions, including the entry of countries such as China to the dam-building scene in developing countries, ensuring that WCD-type principles are followed is proving very difficult - and they are frequently flouted. Indeed, the WCD's conclusions were discredited both by the World Bank, and by a number of powerful countries. There are therefore major limits to the effectiveness of such appraisal processes in contexts where powerful actors can reject them or continue to violate rights with impunity. The WCD itself was not clear on issues concerning relations of power - how to share power; how to contain the power of the powerful, or how to deal with the impunity of powerful actors.

Other recent stakeholder initiatives include the multi-stakeholder dialogue on the private sector and multi-stakeholder dialogues at the Bonn Freshwater Conference in 2001. This is to be welcomed as a clear move away from top-down and closed decision making appraisal systems. Still, the overly technical nature of many stakeholder platforms can exclude the genuine participation of local people. Take the controversial Berg water project in South Africa. While South Africa officially endorses the recommendations of the World Commission on Dams and is open to deliberative and participatory decision making processes on large dams, Thompson (2005) revealed that the so-called stakeholder processes were top-down and constituted a rubber stamping exercise where authoritarian 'scientific' notions of risk and scarcity blanked out a genuine debate around the options to the dam. Thus, even progressive stakeholder platforms can also serve as fig leaves for decisions that have already been made.

ACTION LEARNING/RESEARCH AND REFLEXIVITY

In response to critiques concerning the narrow, top-down nature of many appraisal processes in the water sector - as well as to the challenges of dealing with complex dynamic systems - there has been growing attention to appraisal approaches that emphasise participatory action research, learning, and reflexivity.

For instance, action learning processes are emerging around community-led sanitation initiatives in South Asia. These are becoming connected through learning alliances, a process in which research and development agencies share knowledge and learn together what works and why[8]. The partners then join forces to build local capacity to use that knowledge in practice. In the South Asian context, the learning alliances have formed especially around issues of scaling up community-led sanitation initiatives, concerned with how islands of success can be replicated in other regions and cultural contexts. This means bringing community members, researchers and practitioners together to think about issues such as phasing, community inclusion, institutional design and facilitation as well as participatory monitoring and evaluation. Initial results suggest that the emergence of emergent and spontaneous leaders who spread the approach, intensive community mobilisation and excellent facilitation processes are key to achieving sustainability in sanitation practices. These help maintain open-defecation free villages as well as the spread of total sanitation practices. By contrast, top down financial systems that encourage hardware subsidies, bureaucratic practices that ignore local mobilisation and excessive reporting systems tend to be inimical to successful and sustainable scaling out/up (see http://www.livelihoods.org/hot_topics/CLTS.html)

Action-learning and learning alliances can provide a vehicle to open up reflexivity amongst the various partners involved concerning their own knowledge and understandings of the system, and other possible knowledges that might be excluded. This connects with debates about and proposals for 'reflexive institutions' in social theory. In the context of water and sanitation, what is key is how new policies can access previously 'hidden' or suppressed knowledge, and accelerate the implementation of agreed policy objectives by gaining the trust and understanding of citizens. Reflexive institutions thus offer potential for generating and critiquing knowledge and discourse, providing a forum and

[8] For examples of learning and practice alliances in the African context see RiPPLE - Research-inspired Policy and Practice Learning in Ethiopia and the Nile Region http://www.odi.org.uk/wpp/Projects/RiPPLE.html

mechanism for assessing and implementing public policy in ways that avoid many of the problems of dominating discourses and social exclusion discussed in this paper.

LOCAL, SUSTAINABLE AND EQUITABLE?

Nevertheless, critiques directed to the Habermasian notion of deliberative democracy (see STEPS Working Paper 2 on Governance) also apply in the water and sanitation domain. These critiques question the assumption that citizen dialogue and debate can build consensus based entirely on reason and rational communication; the assumption in various forms of participatory water management such as water user associations. Rather, social groups may have incommensurable worldviews that could not be reconciled with deliberation and reason alone (Mouffe 1999). The heavy emphasis put on building procedural democracy (legal frameworks, building institutions and association, rules and regulations) at the expense of ensuring equitable distribution of resources has also come under criticism. Incidents of elite capture of these associations and institutions are commonly reported (Raby 1991; Michener 1998; Jairath 1999; Mollinga 2000).

Moreover, it is questionable how far ecological sustainability and democracy are necessarily compatible. Straight Habermasian communicative rationality may in fact be counter-productive to environmental objectives in instances where 'local' knowledge does not include sufficient appreciation of environmental dynamics and long-term environmental risks and uncertainties. For example, open defecation free villages in Bangladesh may achieve toilet construction through local participation and empowerment. But the overall impacts on groundwater levels and issues concerning water contamination are often unknown to local community members and NGO workers. In other instances, people's rationality, as expressed in dialogue, may focus on particular livelihood issues at the expense of a longer-term or wider perspective. Thus in an extensive review of watershed development projects, Kerr (2002) found that people selected soil and water conservation measures because they were linked to employment opportunities, but that these often did not meet their ecological needs or priorities, leading to poor long term maintenance of the conservation systems. In short, the challenge is to marry perspectives on Sustainability that reflect the priorities of the poor, while also taking account of biophysical complexities and uncertainties. This will require approaches that emphasise new learning alliances and partnerships across places and disciplines.

6. CONCLUSIONS: TOWARDS A RESEARCH AGENDA

This paper has argued that despite growing global attention to water and sanitation, there often remains a major disconnect between globalised assessments and policy debates, and the needs and priorities of poor and marginalised people as they live with liquid dynamics. Such dynamics emerge from the complex, interconnected processes of social, technological and biophysical change that pervade water and sanitation systems. They operate across multiple scales, and involve many forms of incomplete knowledge and incertitude as complex, unpredictable forces such as climate change and rapid urbanisation interplay with already-dynamic socio-technical systems. Yet despite such dynamics, approaches to defining water and sanitation problems and designing solutions often rest on an image of a more stable, controllable world. Coupled with views that see water and sanitation problems in aggregate, technical terms, ignoring the social, political and distributional issues that often underlie what may appear as 'scarcity', for instance - the result is often policies and interventions that promote singular views of 'progress' in water and sanitation. Yet such progress often fails to address sustainability, or to meet goals of poverty reduction and social justice.

This gloomy diagnosis does not of course apply across the board. Indeed the paper has traced many important moves in the governance and appraisal of water and sanitation issues: moves that, for instance, recognise and value decentralised, local and community based approaches as part of multi-level governance processes; and moves away from narrow, closed appraisal procedures such as cost-benefit analysis to approaches that embrace a greater breadth of inputs and openness to different possible outcomes. Nevertheless, even those approaches that recognise complex social dynamics often fail to connect these effectively with the complexities of the biophysical world: with the dynamic hydrology and ecology of water and sanitation systems. And most fundamentally, we have identified a pervasive tendency to ignore or downplay the multiple, divergent understandings or framings of system dynamics and Sustainability goals held by different people and groups - whether local water users, development agencies, scientists or engineers.

As these multiple framings interplay with the liquid dynamics of water and sanitation systems, so there are many possible pathways to Sustainability. These will be directed towards different goals, and emphasise different dimensions of systems properties - of stability, durability, resilience and robustness - as key to achieving these. Some of these pathways might lead to Sustainability, poverty

reduction and social justice as valued by particular groups; others will not. As we have explored, which pathways unfold over time depends heavily on power relations and institutional arrangements. We have traced many instances in which these are profoundly not geared to meeting the Sustainability goals of poorer groups, whether in cases where political and commercial interests drive the development of large dams that displace people, or where global water governance is geared to universalised notions of scarcity that fail to reflect people's livelihood priorities. In other instances, governance is aimed at supporting local users - for instance through community-based approaches - yet in ways that overlook intra-community and gendered power relations. Alongside attention to adaptive forms of governance that can respond flexibly to dynamics and uncertainties, then, this paper has underscored a need for attention to power relations - across all scales - as a central feature of any analysis.

Furthermore, we have argued strongly for reflexivity in analysis and governance, whereby those involved recognise more fully how their social and political positions shape the ways they understand water and sanitation systems, and how this in turn shapes their management interventions. Only though such reflexivity amongst the institutions that currently dominate water and sanitation debates, we suggest, can space be opened up for attention to the alternative pathways to Sustainability that might better suit poor and marginalised water users.

These arguments suggest a number of elements that need to inform a research agenda for the STEPS Centre in the water and sanitation domain. In short, this needs to include attention to:

- The dynamics of complex socio-technical-ecological water and sanitation systems, and how resilience, robustness, durability and stability might be built in the context of new shocks and stresses from, for instance, climate change, rapid urbanisation and new middle class hygiene movements;
- Processes at different scales (temporal and spatial), and the ways these interlock and are felt in different places and by different groups;
- The framings of water and sanitation systems and dynamics held by different people, and how they lead to particular, valued Sustainability goals and properties;
- The governance and appraisal of water and sanitation systems, exploring how these are shaped by power relations, including political-economy and power-knowledge, and how approaches might better

enable poorer people's own perspectives and agency in water and sanitation services provision;

- The influence of history and culture in shaping water and sanitation knowledge and practice, whether in divers local settings or in the contexts of global debates and agencies.

Building pathways to pro-poor, equitable Sustainability in water and sanitation will inevitably involve a plurality of approaches. Mapping what works when, where and how will need to involve detailed case studies, urban as well as rural, whether focusing in on water and sanitation issues or examining their interaction with other processes - for instance in relation to health, food or agriculture. Learning through such case studies, in turn, should help further develop the pathways approach introduced in this paper, to understand how poor and marginalised women and men can exercise agency over the functionality of water and sanitation systems, helping to make them Sustainable over time. As demonstrated in this paper, it is now time to move beyond those conventional indices of sustainability - and those definitions of water and sanitation problems and solutions - that tell us little about equity, pro-poor agency, power and resilience. By drawing together a concern with material and biophysical dynamics, and with the ways that different people frame these, the STEPS Centre hopes to advance an agenda for understanding and action in the water and sanitation domain that will link poverty reduction and social justice with Sustainability in today's accelerating liquid dynamics.

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