

# 1. Introduction

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## 1.1 THE CONTEXT

A study of the economics of water has many motivations. The simplest route is to emphasise the intrinsic importance of water in our societies and proclaim like Thales in pre-Socratic Greece that ‘all things are water’. A more sombre and tragic rationale is that every year some 2 million deaths including some 1.7 million deaths among children under five years of age are caused by diarrhoeal disease (WHO, 2001; 2005: 190), and it is generally argued that a significant number of these lives could be saved by improving access to water, sanitation and promoting hygiene education. Worldwide, some 1.1 billion people lack access to safe water and another 2.6 billion people lack access to sanitation (WHO–UNICEF, 2004). Lack of access to basic services such as water is a manifestation of poverty and inequality. This is recognised for example in the United Nations Development Programme (UNDP) human poverty index<sup>1</sup> and in discussions of basic capabilities<sup>2</sup> (Nussbaum, 2000; O’Neill, 2000; Sen, 2004a, 2004b). There are also issues related to conservation of natural resources and sustainability given that water is crucial to many ecosystem functions, and our decisions to withdraw water for particular uses can have significant impacts on other uses now and in the future. These are examples of some of the instrumental or consequence-based motivations to study the economics of water.

Improving access to water is not easy. There appears to be a positive association between per capita national income and the proportion of people having access to water. However, economic growth and increased national income do not automatically translate to improved access. There is significant variation in the ability of societies to manage water resources and provide citizens with access to water and this requires a deeper understanding of patterns, regularities and causal relationships.

Further complications arise because of the dynamics related to sources and uses of water over space and time. Some of the variation mentioned above is a product of forces of nature – for example, rainfall patterns. Shocks associated with water are usually attributed to either scarcity or abundance of water. With climate change, the magnitude and frequency of such shocks can become more significant and also more unpredictable.

Further, water is a resource with plural uses whereby water is required throughout the year for some of these uses while for others there are peak and slack periods. To manage such dynamics, there is a need to create institutions that can accommodate these dynamic variations in claims over water. However, institutions cannot be created overnight – cultural, social and economic factors can facilitate or inhibit the evolution and development of institutions. Also, evaluation of decisions about allocation and use of water is not an objective exercise and such evaluation itself depends on underlying values and ethical frameworks. As Adam Smith remarked on the water-diamond paradox (see White, 2002), the way in which we attach values does not necessarily reflect how useful or necessary we consider water to be: it is subjective, and depends on circumstances, culture and institutions. The economics of water supply is essentially an enquiry into understanding how societies deal with water resources and the various incentives and other factors that influence the decisions of citizens, consumers and decision makers.

### **Water Is Life**

As peace lovers, we are necessarily preoccupied with ending war. The total number of deaths from all wars in 2002 is estimated by the World Health Organisation (WHO) to be around 172,000.<sup>3</sup> As mentioned earlier, the number of lives lost due to diarrhoeal diseases is 10 times that number.<sup>4</sup> Unsafe drinking water, lack of sanitation and poor hygiene behaviour are considered to be the prime suspects.<sup>5</sup> Goal 7 of the United Nations Millennium Development Goals includes the target of halving the proportion of population without access to water and sanitation by 2015.

An intelligent being from beyond the earth sent to spy on us would probably find it odd that on this blue planet, both scarcity and abundance of water co-exist and that there continue to be areas and communities facing acute water shortage. Of the 510 million square kilometres of the surface area of our planet, 361 million square kilometres (nearly 71 per cent) are covered by water. According to UNESCO's first World Water Development Report (UNESCO–WWAP, 2003: 68), the total quantity of water on earth is estimated to be some 1.4 billion cubic kilometres. However, nearly 96.5 per cent of it is in oceans, seas and bays. Of the remaining 3.5 per cent of water that is present as fresh water, more than two-thirds of it is in the polar ice caps, glaciers and permanent snow. Some 30 per cent of all fresh water is available in the form of groundwater. All the water in the lakes forms less than a quarter of 1 per cent of all fresh water on earth. All the water in the world's rivers amounts to just 0.006 per cent of all fresh water on earth. Yet, there are some human settlements in arid regions which seem to have

overcome the natural resource constraints, while in other settlements which appear to be close to abundant sources of water, symptoms of water shortage and scarcity are manifest. Therefore, it would not take much effort for our intelligent visitor to conclude that while seemingly abundant, water is not uniformly available, and this variation in its distribution does not fully explain water shortages and scarcity.

Water, so essential to sustain life, can also be a cause of death when it is either in the wrong quantity or of the wrong quality.<sup>6</sup> In addition to the health impacts mentioned earlier, water can wreak havoc on societies through different routes. It is estimated that over 220,000 people lost their lives in the tragic Asian tsunami of 26 December 2004. Cyclones, floods and tidal waves present one face of water's destructive power. In Africa and elsewhere in arid and semi-arid regions, the other face of destruction in the form of droughts has been a major disaster, leading to malnutrition, poor health status, migration and loss of economic productivity. Famines are largely human-made and are caused more by institutional and policy failures than by lack of rain. With globalisation and instant access to communication, we get to know about large-scale disasters soon enough. However, many localised and small-scale disasters remain unreported although they devastate lives and livelihoods particularly among the poor rural communities.<sup>7</sup> Climate change and phenomena such as El Niño can impact on both the quantity and the quality of water available in a given society or region from time to time. This can further increase the negative impacts of disasters through mortality and morbidity long after the disaster event has passed (Easton, 1997; Mudur, 2005).

### **Water Is Power**

From ancient human civilisations to modern nation-states, societies have recognised that a key to prosperity is to manage the variability in water. Improving the resilience of societies to cope with variations in water availability over space and time requires considerable ingenuity and investment of resources. Many water projects in the twentieth century were crucial to increasing hydro-electricity production, irrigation and economic development. In recent years, resources allocated to water and sanitation constituted about 2.3 per cent of the World Bank's portfolio and about \$3 billion or 10 per cent of aid by OECD countries.<sup>8</sup> In addition to aid, many countries invest their own resources in water and sanitation infrastructure. Water is also big business. There are at least two global corporations among the *Fortune 100* list whose business is mainly related to water, and there are numerous multinational corporations providing water and sanitation services.

Improving access to water is not merely a matter of investment and technology. As the various global assessments suggest, water is unevenly distributed and for some countries (mainly in the Middle East) the quantity of water available is a constraint imposed by geography (see Kuylenstierna et al., 1997; Shiklomanov, 1997; Gleick, 2000b, ch. 3; WRI, 2000). Others have used population projections to arrive at rather alarmist conclusions that the problem of water scarcity will be a universal problem and not one limited to a few countries (Postel, 1992, 1995; Falkenmark, 1997). However, a lack of water resources and the level of development do not appear to be correlated (Rock, 1998; Anand, 1999a). Rather than the availability (or lack) of water, how efficiently nations use the water that is available to them seems to be the crucial factor.

### **Water Is Elusive**

Water is a fugitive resource that cannot easily be contained by political boundaries or property rights. The various institutions and allocation mechanisms that work very well in the case of other liquid (and somewhat fugitive) resources such as petroleum cannot work in the case of water for two major reasons. First, unlike petroleum, water is not merely an input into production processes but is essential for life.<sup>9</sup> This is recognised and codified into religious or cultural values concerning rights over water in different societies. Such values seem to be operating fairly successfully at the level of an individual across different societies.<sup>10</sup> However, they are not adequate to guarantee water security at the level of a collective, such as a nation or a region or a city. Second, because water is a fugitive resource, property-right institutions are contested far more than in the case of resources such as petroleum. Two types of property rights for allocation of water are predominant: the concept of inalienable right attached to property rights to land (in the case of groundwater) and the riparian rights based on *prior appropriation* doctrine in the case of surface sources such as rivers and lakes. However, in both cases, private decisions have significant externalities on others. As a result, water extraction involves a conflict of common property and private property mechanisms.

### **Water Divides**

Somewhat related to these notions is a viewpoint that future conflicts will be triggered by water scarcity – a statement attributed to Ismail Serageldin of the World Bank, but a subject of interest to conflict analysts as well as journalists (for example, Ohlsson, 1995; Homer-Dixon, 1998; de Villiers, 1999; Swain, 2000). Some studies situated broadly within this viewpoint,

have analysed particular international water resources, such as those in the Middle East (Lowi, 1993; Hillel, 1994; Wolf, 1995). One of the conclusions reached by Lowi (1993: 203) is that in the case of international river basins in the Middle East, the potential for cooperation depends crucially on the distribution of power. She argued that voluntary cooperative agreements are likely to take place when two conditions were met: (a) the dominant state in the river basin concerned is critically dependent on the river and (b) the dominant state is not an upstream state. While these are interesting findings, there is considerable scope to examine the international river basins from the viewpoint of asymmetric externalities and the possibility of self-enforcing agreements (Barrett, 1994; Anand, 2004). For example, even within the Indian subcontinent, there are two water treaties: one where collective action by India and Pakistan has been functioning fairly successfully since 1960, while the treaty concerning the Ganga–Brahmaputra basins between India and Bangladesh has caused considerable friction (see Gulhati, 1973; Iyer, 1999; Biswas and Uitto, 2001).

Others argue that in the context of water, more important than the traditional wars are the so-called ‘paradigm wars’, that is, conflicts of viewpoints, of institutions and norms (Shiva, 2002). These paradigm wars concern the roles of the individuals, the state and other institutions of water allocation.

One issue relates to water-governance institutions. The early model of water-resource management of large dams and engineering works required a great deal of coordination and hence the state taking the central role of planning and implementing large water-resource projects. This model seems to have come into question by the 1980s. For instance, the average number of large reservoirs (>0.1 cubic km) built per annum worldwide decreased from 70 during 1961–70 to 60 during 1971–80 and to 35 during 1981–90 (Gleick, 2000b: 116). The paradigm war here is between the proponents of large projects on the basis of economies of scale, efficiency and cost–benefit analysis and the opponents of such large projects mainly on the grounds of the social and in some cases environmental costs imposed by such large projects. Anti-dam protests such as the *Narmada Bachao Andolan* in India, and protests against the Bakun dam in Malaysia, the Ilisu dam in Turkey, San Roque in the Philippines, and the Lesotho Highlands Water Project are also situated in this strand of discourse (Drèze et al., 1997; Baviskar, 1998; Singh, 1998; Dwivedi, 1999; McCully, 2001). This can also be described in alternative terms as a paradigm war between an economic or anthropo-centric view versus a broader, deeper and eco-centric viewpoint or as a conflict between proponents of ‘a paradigm of masculinity’ with a fetish to control and subjugate nature through large projects versus those who recommend small, localised solutions. Some of these issues are examined further in Chapter 6.

Another highly visible paradigm war in recent times is the one between those who consider privatisation or the use of market-based instruments or valuation mechanisms to be suitable instruments for water allocation versus those who consider such approaches to be incongruous, alien and essentially representing a Northern model of development and an effect of the forces of globalisation (Haughton, 2002; Shiva, 2002). There has been an increasing emphasis on the role of private sector and market institutions in water-resource management with the *World Development Report 1994* (World Bank, 1994) possibly the strongest argument for unbundling the state's role in water-resource management. Some of the early discussions of privatisation centred around water companies in Britain and the development of regulatory instruments (for example, Beesley, 1997, 1998). Other studies in the context of developing countries focused on the development of water markets for groundwater (Bauer, 1997; Shah and Ballabh, 1997; Easter et al., 1999; Salman, 1999; Dubash, 2000; Bjornlund and McKay, 2002) or on privatising water utilities (ECLAC, 1998; Dumol, 2000; Johnstone and Wood, 2001). However, it is important to highlight that compared to other infrastructure sectors such as transport, communications and energy, privatisation in the water sector is considerably less prevalent. For example, as per the data from the privatisation database on the World Bank's website, proceeds (worldwide) from the privatisation of infrastructure sectors in the year 2000 were approximately \$20 billion. This has since fallen to about \$11.5 billion in 2003. Infrastructure sector proceeds accounted for approximately 55 per cent of all privatisation proceeds. The share of the water sector in all infrastructure proceeds was 1 per cent in 1990 and this increased to 3 per cent in 2000. In comparison, energy and communication sectors account for 50 and 36 per cent, respectively.

The most contentious issue with regard to privatisation of water services is that water utility companies pursuing profit have no interest in supplying water to the poor who lack the affordability to pay for the services. In theory, there are four possible solutions for this. First, is to provide a certain 'basic' quantity of water free of charge to every consumer. However, this is difficult to put into practice. How much water should be supplied free remains subjective. Also, as the analyses in Chapters 6 and 7 show, the main problem for the poor may be the lack of access. Extending water and sanitation infrastructure in low-income neighbourhoods raises important challenges, especially when households do not have security of tenure, or when such neighbourhoods exist on lands which are formally considered unsuitable for human habitation (hill-slopes or river banks). A second solution is to provide water for the poor in the form of communal supplies (through standpipes) and provide this free of charge for the poor. Health risks related to handling of water, inconvenience, imputed labour costs of waiting for

and carrying water and so on, remain high and these are borne by the poor. A third solution is to build in some form of cross-subsidy, for example, by charging a higher tariff to high-income consumers and non-domestic users. An alternative form of this is the incremental block tariff system where tariffs are related to the volume of water used. The underlying argument is that per capita consumption is related to income and all other things being the same, high-income consumers tend to consume a larger quantity of water than do low-income consumers. A fourth solution is to include access to water by the poor as a performance indicator and build this into the contracts of private operators. From a study of water companies in Argentina, Galiani et al. (2005) argue that in municipalities that privatised their water supplies, child mortality due to water-related diseases decreased significantly as compared to municipalities that did not privatise. Another point to consider with regard to privatisation of water utilities is that privatisation seems to be more prevalent in Latin America (ECLAC, 1998) and in former French colonies in Africa (Bayliss, 2002), that is, in non-Anglo-Saxon legal systems. However, the *p*-word of privatisation in relation to water raises considerable anxiety among activists and this needs to be recognised in policy discussions.

While privatisation in the form of unbundling of an existing public utility is one route, there are other routes of private sector involvement in water and sanitation. First, in many countries, many households are forced to 'exit' and make their own arrangements. Second, in some countries, while privatisation in entirety of a water utility has not taken place, many utilities and local governments do involve (mainly local) private sector firms to produce specific services on their behalf. Third, the private sector has also been playing an important role in water provision more directly in the form of water vending through donkey carts in Khartoum in Sudan or Cairo in Egypt or tanker trucks in Karachi in Pakistan and Chennai in India, and indirectly in the form of many small firms engaged in supplementing the role of the state, or in supplying various technologies which households then use. As Jolly (2004) notes, this form of privatisation is more relevant and important to understand in relation to improving access to water in the context of the Millennium Development Goals (MDGs) (United Nations, 2002).

Another paradigm war relates to the role of individuals (ultimate users of water) in the planning and design of water allocation mechanisms. Important contributors to participation discourse such as Chambers and Uphoff draw significantly from their analyses of water institutions concerning irrigation (see, for instance, Chambers, 1988; Uphoff, 1996). Another strand relates to the identity of the individual and in particular on the gender dimensions of water and whether the mainstream analysis of

water institutions systematically ignores gender aspects (Adams et al., 1997; Gaard, 2001).

### **Water Unites**

Quite distinct from the state and market paradigms, and somewhat related to the participatory approaches, a strand of literature in the water sector has developed on collective action issues. Collective action is a situation that requires actions by two or more agents to accomplish a collective purpose (Sandler, 1992). In the context of allocating water resources to individuals, there is a vast literature that draws from Mancur Olson's (1965) work to improve our understanding of why voluntary collective action may not take place in the case of common property resources (CPR) and what we can do to overcome the barriers to collective action: Runge (1986), Jodha (1990), Ostrom (1990, 1993), Seabright (1993), White and Runge (1995), Baland and Platteau (1996), Noronha (1997), Bardhan (1995, 2000, 2005). Some of these, especially those of Ostrom and Bardhan, are located within the institutional economics whereby institutions are considered as formal and informal systems of norms (following Douglass North). Some of the studies mentioned above focus on the development of formal structures which correct the incentives and the creation of the necessary framework of norms and sanctions. North (1990) emphasises the importance of property rights and transaction costs, and explains the richness of different types of formal and informal institutions and their importance in contributing towards stability in economic transactions. The need for a flexible and graduated system of sanctions is recognised in calling such institutions 'robust'. A related issue is that of 'publicness' of the goods and services and the choices available to individual citizens. Paul (1992) and Ackerman (2004) adapt Hirschman's (1970) 'exit-voice' framework to accountability issues in the context of public services. Depending on the degree of publicness of the good, the citizen can either exit the public provision and seek the good in a market or use voice (and mobilise collective action in Olson's framework) for public policy to be changed. Maria-Saleth and Dinar (2004) also focus on the link between institutional change and performance (though they do not explicitly use the exit-voice framework).

While the CPR literature has identified various design considerations for self-governing irrigation institutions, other critics observed that crafting institutions leaves scope for corruption (Wade, 1988) and 'bending irrigation markets' (Wood, 1999). There is a need to take stock of the design principles of local collective action institutions in relation to issues emerging from the analyses of corruption and rent seeking (for example, Rose-Ackerman, 1999; Khan and Jomo, 2001). People of different faiths

consider water to be holy and that rivers wash away sins. However, faith at the level of an individual works in a different matter from faith as a moral regulating device at the level of a society: thus, when we look at indices such as the Corruption Perception Index of Transparency International, corruption can exist in any society irrespective of whether a predominant majority practise one faith or another. Poor governance and lack of transparency institutions led many a water project to be riddled with corruption.

A gap in the literature is that research on water resources has not taken note of a considerable literature on transboundary externalities and international environmental agreements (Haas et al., 1993; Barrett, 1994; Dasgupta et al., 1997; Chasek, 2000; Folmer and von Mouche, 2000). A small number of studies explore the use of collective action approaches for international environmental issues (Sandler, 1992, 1997, 1998; Keohane and Ostrom, 1995; Hollick and Cooper, 1997). While the potential to apply the collective action approach to international waters is recognised (Benvenuti, 1996; Rausser, 2000), there are few other studies which focus on collective action institutions for water resources. The large number of international river basins suggests that the potential for designing collective action institutions and the scope to minimise water-triggered conflicts is significant.<sup>11</sup>

At the heart of the contentious issues described above are aspects of justice and fairness. These relate to justice in relation to claims over water resources, and justice and fairness in procedures related to water allocation decisions, between different extractive uses of water or between the needs of present and future generations or between the needs of human societies versus non-human ecological functions.

## 1.2 AIMS AND RESEARCH THEMES

Against this background, this book aims to examine water supply using various tools of economic analysis. Standard graduate textbooks on economics include water supply mainly as a subsection of chapters related to public utilities, privatisation and pricing issues. Textbooks on economic development (for example, Meier and Rauch, 2000; Todaro and Smith, 2001), until recently had little discussion on water or sanitation issues, though more recent editions of these books do include some discussion on environment and development and water and sanitation issues.

Is water supply a public good?<sup>12</sup> A pure public good is non-excludable and non-rivalrous in consumption (see Musgrave and Musgrave, 1989; Cullis and Jones, 1992; Cornes and Sandler, 1996: 8–10). The former implies that it is either impractical or prohibitively expensive to exclude

anyone from consuming the good and the latter means that one person's consumption does not diminish the availability of the good for others to consume. A third characteristic, not often mentioned is that of indivisibility (Loehr and Sandler, 1978). A 'pure' public good has all three of these characteristics while a 'pure' private good is exclusive, rivalrous and divisible. Many goods are either 'impure' public goods or 'impure' private goods. Excludable but non-rivalrous goods are club goods or networks or commons where the ability to exclude enables the formation of collectives to supply such goods (Ostrom, 1990; Cornes and Sandler, 1996).

As one person's consumption does not diminish the amount of the public good available for others to consume, all consumers can enjoy it. As exclusion is not possible, they need not reveal their marginal willingness to pay for it. These can be referred to as 'the problem of free riding' and 'the problem of preference revelation', respectively.<sup>13</sup> Because of these reasons, market mechanisms will not be able to supply efficient quantities of the 'pure' public goods.<sup>14</sup> In such cases, the government takes on itself the responsibility to provide the public goods, and their provision is financed by coercive payments (taxes) or from general government revenue.

However, domestic water supply is not a public good in the above sense. It is both rivalrous and excludable. Nevertheless, there are three reasons why there is an important role for public policy concerning water supply and sanitation. First, if consumers decide independently, they may not consume appropriate levels of certain goods due to *informational failure*. In such cases, even though markets would provide efficient quantities of this good, there is a role for public policy to correct for such failure. Second, related to this is a concern about *distribution equity* that certain sections of the population may not be in a position to acquire adequate quantities of the goods. Third, even though water supply and waste management are like other private goods, there are certain *externalities* in both cases, some of which may have public good properties. For example, in the case of water supply, individual decisions to pump groundwater may affect the intrusion rate of sea water, beyond its natural movement. This may in turn have irreversible impacts if certain inland freshwater aquifers become brackish.

This duality of having some aspects of public goods and at the same time having quite clearly the properties of private goods has been a source of policy confusion in the water sector. Policy conclusions based on one of these two properties can lead to extreme viewpoints, on the one hand of making water a government monopoly or on the other hand privatisation as the justified course of action. From the experiences over the last two decades, we have seen that in the UK, privatisation has indeed produced significant investments to improve the water infrastructure. On the other hand, the Buenos Aires concession, lauded as a success a few years ago, was

later described as a fiasco. Many other instances in developing countries in Asia and Africa with regard to privatisation of water utilities have polarised the debate further.

Both public and private sector managers recognise that it is important to know the viewpoints of the stakeholders and involve them to the extent possible in decision making. Participation is considered an attribute of sustainability, risk mitigation and as the necessary approach towards rights-based development. In the context of water, South Africa's approach of making the right to water an essential commodity has received much acclaim. However, creating rights is not enough if we cannot find corresponding resources (Holmes and Sunstein, 1999).

### 1.3 ACCESS TO WATER AND WELL-BEING: A CONCEPTUAL FRAMEWORK

In this section, an attempt is made to provide a conceptual framework. In developing this framework, I draw from discussions of institutions (North, 1990; Bardhan, 2005), preferences (McFadden, 1999), and entitlements and capabilities (Sen, 1984a, 1999a; Nussbaum and Sen, 1993; Nussbaum, 2000). For simplicity, let us refer to this as the 'water and well-being' (WaW) framework.

Consider an individual with a given profile of socio-economic characteristics, knowledge, and preferences. The vector of socio-economic characteristics (S) includes variables such as gender, income, education, age, number of dependents, state of health and so on. In the case of private goods, such as soap, based on knowledge and preferences, individuals use resources at their command to produce an outcome that improves their well-being. In Figure 1.1, the path to well-being in such scenarios is through arrows 1 and 2. For such private goods, the entitlements are in essence private property rights. Models of individual decision making based on neoclassical models of utility predominantly use this path of reasoning.

For resources which involve public good and common property characteristics, in addition to knowledge, preferences and socio-economic characteristics, access to resources is an important determinant of well-being.<sup>15</sup> (The path now is 1, 3, 4.) Socio-economic characteristics and knowledge can also determine the individual's ability to convert resources into well-being – thus the focus is on what the individual can do with resources rather than on the per capita or other measure of resources alone. The individual does not have access to all resources and in the case of resources such as water, access depends on institutions and policies (1, 3, 4 subject to 5). Access to some resources may be governed by entitlements which are a

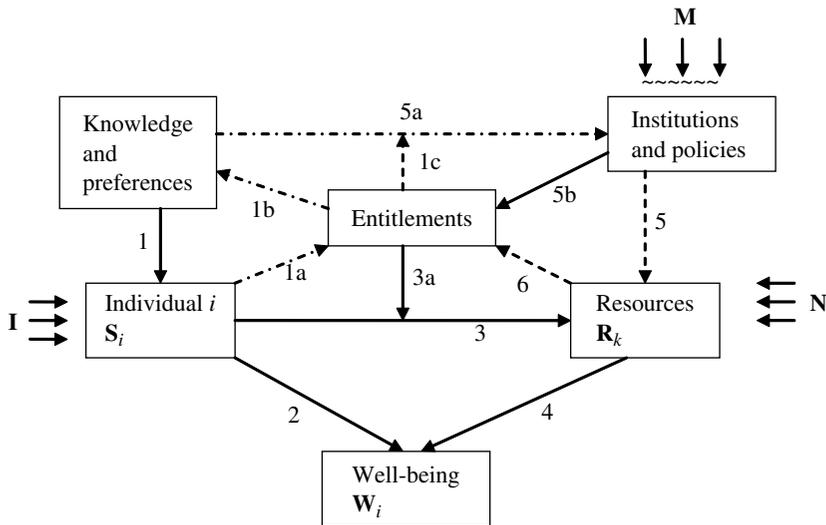


Figure 1.1 Water and well-being: a conceptual framework

product of institutions and policies (1, 1a, 3a, 3, 4 subject to 5b). The creation or existence of entitlements does not automatically lead to improved access. Citizens must be knowledgeable and aware of the entitlements (1b). Institutional space must include fairness and transparency guarantees and there should be scope for deliberation and participation to influence policies (5a).

'Access' can be defined in a number of ways. A legal definition of access is the right and ability to reach a property (for example, land). In the context of water, similarly, it is recognised that access includes both the availability of physical infrastructure and that it is functioning (see UNDP, 2005: 32). Since property right is included in the concept of entitlement, access here is defined mainly in terms of (i) physical availability of the service or resource in quantity and quality, (ii) such resource being open to be reached by our individual concerned, and (iii) the resource being usable by the individual to generate well-being.

Scarcity is interpreted to mean that constraints in the form of diminished resources  $R$  affect access (that is, the path 1–3–4) in turn diminishing the well-being of the individual. Considerable discussion on water scarcity treats the vectors  $S$  and  $R$  as given and the magnitude of water resources is determined solely by environmental factors such as rainfall or water-resource availability (or population). In the framework above, the role of institutions and policies is emphasised.

In the framework, on the left-hand side, we are broadly in the individual or private domain. On the right-hand side we are in the public, social and institutional domain. Both entitlements and the final outcome in terms of well-being are in the space between the individual and the social or institutional domains. Knowledge and preferences need not be external or fixed. There is scope for the individual to acquire or adapt preferences; alternatively, there is also scope for entitlements to affect or limit the range of opportunities available or to affect preferences (1a–1b–1–3–4 subject to 5). Knowledge and analysis can help in challenging entrenched inequalities in the definition of entitlements and this deliberative process can lead to policies that change entitlements (for example, through new legislation). (The path now is 1–1a–1b–3–4 subject to 5a and 5.) It is important to recognise the role that collective action can play: path 1a–1c–5a in the framework above is a channel for collective action or ‘voice’ (Hirschman, 1970). Through collective action claims can also be made for changing entitlements and influencing policies and institutions.

Why is knowledge included with preferences? In conventional models of rational choice, preferences are exogenous and these are assumed to be well behaved (that is, complete, rational and stable). However, individuals are not mechanical and selfish utility maximisers, but often value the well-being of others as being important. Also, as free agents, individuals seem to temper and modify their preferences depending on the context, the needs of others, the value of sacrifice and how it can make a difference. This link is also to emphasise that entitlements and rights come with correlated duties or obligations.

Aren’t entitlements a subset of policies and institutions? Do we need to show these separately? In some respects, entitlements (and property rights) are also institutions. However, here, entitlements are considered to be a product of policies and institutions. The expression ‘entitlement’ is used rather than ‘property rights’ for various reasons. A right is a specific form of entitlements under certain conditions. The term ‘entitlements’ includes both active and passive rights, and also claims over resources which are not absolute claims but those that include individual and group-based claims.

How access to resources translates into well-being in this framework is subject to three kinds of external shocks or forces shown in the form of arrows from **I**, **M** and **N**.<sup>16</sup> Societies may differ in the extent of water required and intensity of its use to achieve the same level of outcomes. Thus, there can be variations in access to water in two otherwise similar contexts, due to structural or macro-level relationships or, for example, due to differences in external assistance or aid or differences in effectiveness of governance (due to the nature of institutions or the prevalence of corruption). These are represented by vector **M**. Access to water can be subject to

natural phenomena or shocks such as El Niño or long-term or secular change in rainfall pattern, as, for example, in the Sahel (discussed in World Bank, 2003). These are represented by vector **N**. While we have already included knowledge and preferences within the model, the individual citizen's exercise of agency can be subject to external forces, for example, in relation to identity. Such micro-level forces are represented by vector **I**.

In this framework, the goal of public policy is to improve well-being. This broader goal can be achieved by improving access to water for those who lack such access. Inequality in access can be caused by different factors: variations in individual characteristics (for example, gender, number of dependent children, disability, economic status) or variations in the resource (water resources per capita, availability of groundwater, risk of salinity ingress, distance to the source) or ineffectiveness of or absence of entitlements which affect and influence the definition and content of access (thus, water is appropriated by some and others are deprived). Improving access may require the clarification of existing entitlements or the creation of new entitlements, strengthening of policies and institutions, promoting knowledge and awareness, creating policies for sustainable use of (water) resources and so on. This would also require steps to understand the various shocks or external forces that can interfere and taking appropriate steps to redress vulnerability.

A conceptual framework is not a theory. Like a road map, it is a device to help connect a number of issues with a view to targeting policies and institutions. Research presented in this book is based on the conceptual framework and it aims to explore the following themes:

1. How is water 'scarcity' defined? Are there patterns or regularities about how nations use the freshwater resources available? Does water shortage make nations use water more efficiently? These issues are explored in Chapter 2. In the conceptual framework, this chapter examines arrows 3 and 4, with a focus on resources **R** and the external shocks to this from **N**.
2. What do we know from national-level statistics about access to water and sanitation? What has been the progress with regard to the MDGs related to water and sanitation? Are we on track or wide off the mark? Which countries have made progress? To what extent is progress amenable to policy interventions? Is water scarcity an environmental constraint? That is, are countries not meeting the MDG target constrained by a lack of freshwater sources? Is aid a catalyst for improving water access? These issues are discussed in Chapter 3. The focus of this chapter are arrow 5, and the role of structural or macro-level relationships **M** in influencing access.

3. Those who use the rhetoric of water wars often present the case that such wars are likely to erupt mainly with regard to the sharing of international river waters. There is a need to critically review the existing small number of studies of various international river-water agreements and collect information on other international agreements for sharing river waters and on this basis, to identify the conditions in which collective action seems to be working. This is the focus of Chapter 4. In the framework, this relates to path 6 and how shocks from natural factors **N** or macro-level issues **M** influence and shape entitlements.
4. Moving from the global or international to the national policy domain, we begin with an exploration of river disputes. In many countries, the transfer of water between or within basins is significant and is on the increase. Some such transfers relate to supplies to large metropolitan areas; in other cases, it is essentially from one use to another. In federal contexts, this leads to a situation of inter-state water transfers with considerable potential for dispute. There are five sets of issues. The first relates to how water policy is framed and whether the 'paradigm of masculinity' drives water policy in the direction of large projects and 'hard' investments, ignoring the 'soft' aspects of institutions and norms. The second relates to property rights and distribution between claimant states. The third concerns allocation of water to different uses such as agriculture, domestic use and so on and whether there is institutional bias towards water for agriculture. The fourth relates to environmental flows, potential impacts of water withdrawals on sustainability and whether these are taken into account. The fifth relates to whether claims over river waters become entwined with identity issues and the extent to which de-politicisation is desirable and feasible. These are examined in Chapter 5. In the framework, this relates to the path 6-1b-1-1a.
5. Given that much attention in relation to the MDGs is given to the figures on 'access' in Chapter 6 an attempt is made to unpack the definition of access with a detailed case study at the micro level, applying Amartya Sen's entitlements approach with regard to water security at the level of individual households. In this view, water scarcity is not so much a case of there being not enough water but one of some people not having water. This is explored further to link the entitlements approach with other institutions governing the allocation of water and whether the narrow individual-centredness of the entitlements approach can be overcome by adapting a broader capabilities approach. Also explored in this chapter is the issue of water quality and household responses to water quality. These correspond to path 1a-3a-3-4 in the framework above.

6. A commitment to participatory policy analysis can be put into practice in a number of ways, including through surveys to understand consumer preferences. There has been a significant growth in the number of studies focusing on consumer preferences for water and sanitation services. However, consumer preferences may not be homogeneous and in some cases, such preferences may be subject to institutions and entitlements. In the standard application of the so-called 'contingent valuation' methods, these issues are not always recognised. Some of these issues are examined in Chapter 7, and relate to 5a in the framework.
7. Given that inequality in access to water is a manifestation of pervasive inequality in all aspects of life in a society, Chapter 8 focuses on rights and capabilities. Since the publication of General Comment 15 by the United Nations in 2002, a 'right to water' approach has received some consideration. An alternative is to apply a capability approach (Sen, 1999a) to water which requires us to focus on what access to water allows an individual to be or do, that is, the functionings. These are mainly related to 5b and 3a in the framework.

An economic approach to water is potentially subject to criticism from other social sciences for ignoring many dimensions of agency and focusing on methodological individualism based on a conception of rational choice. There is a need to examine the extent to which the sociology of science and knowledge creation can bias how institutions emerge and the extent to which the direction of scientific enquiry is determined by a definition of what science is (Irwin, 1997; Yearley, 1997). We examine some issues in trying to balance the economics and ethics of water supply in the final chapter.

## NOTES

1. The human poverty index (HPI-1) measures deprivations in three dimensions of human development, namely, *vulnerability* measured as probability at birth of not surviving to the age of 40 years; *deprivation of knowledge* measured in terms of proportion of adults who are illiterate; and *deprivation of a decent standard of living* measured as an average of two variables, namely, percentage of population without access to water and the percentage of children underweight for their age. See UNDP (2006).
2. While Nussbaum suggests that a universal list of basic capabilities to be provided for every human being provides an important policy goal, Sen alludes to basic capabilities but in general he does not provide a universal list. See Sen (2004b). These are discussed in Chapter 8.
3. The WHO reported that the number of deaths from wars during 1998–2002 is approximately 320,000 per annum. For the corresponding period, the number of deaths from wars according to Lacina and Gleditsch is estimated to be 80,000 per annum. See Human Security Centre (2005: 30).

4. Diarrhoeal disease is the seventh deadliest cause of death after ischaemic heart disease, cerebrovascular disease, lower respiratory infection, HIV/AIDS, chronic obstructive pulmonary disease and perinatal conditions (WHO, 2004).
5. The public health classic text *Drawers of Water* (White et al., 1972) has been crucial in analysing the impact of water supply on health. White et al. classified water-related diseases into four categories: water-borne (typhoid, hepatitis), water washed (trachoma, scabies), water based (schistosomiasis) and those caused by water-related vectors (such as insects) (Gambian sleeping sickness). They point out (p. 209) that improving access to water is important to control diarrhoeal disease. Also see Thompson and Cairncross (2002).
6. For example, while lack of water causes dehydration, water taken in large quantities can also be lethal. Water quality in terms of contamination is a source of death through various water-related diseases. High levels of arsenic and fluorides as found in some parts of Bangladesh and India can also be detrimental to health. Another cause of death related to water is by drowning. It was reported in the *British Medical Journal* that in 1998 up to half a million deaths worldwide were caused by drowning, of which nearly 57 per cent were children (Brenner, 2002).
7. This issue was highlighted in the discussions on the theme of 'water and disasters' for the World Water Day 2004.
8. A detailed analysis of aid for water is presented in Chapter 3. Other sectors getting a similar share of DAC (Development Assistance Committee) aid are: health (4.2 per cent); government and civil society (4.2 per cent); and energy (4.6 per cent) (OECD, 2001: 223). The share of water supply and sanitation in total ODA (Official Development Assistance) appears to have increased steadily from about 0.3 per cent in 1971 to about 3 per cent in the 1970s, to over 5 per cent in the 1980s and to over 8 per cent in the 1990s, and to its highest level of 10 per cent in year 2000 (my calculations based on data from Table 5 in OECD, 2001).
9. Although vast quantities of water are used mainly for agriculture, it is difficult to develop property-right institutions to isolate productive use of water from consumptive use.
10. Hence, it is highly improbable that *thirst* and lack of water is recorded as the primary cause of the death of an individual in any society.
11. The number of international river basins was estimated to be 214 as per a UN assessment. A 1999 estimate that uses more accurate maps, places this number at 261. Some of this increase is also due to the break-up of the erstwhile Soviet Union. See Gleick (2000b: ch. 2).
12. A related question is whether water is a global public good. Such a question is not very useful given that there is no corresponding international organisation responsible for global water allocation. However, water sources and how a society manages them could have important implications for all people dependent on such water. In as much as actions by one nation can impinge on a group of other nations, water, as in the global hydrological cycles, can be considered a global public good (see Sandler, 1998; Anand, 2004).
13. Kaul et al. (1999: 7–8), refer to the latter as the 'prisoner's dilemma'.
14. See Randall (1993) for a discussion on the scope for achieving Pareto efficiency in the provision of exclusive and non-rival goods (that is, club goods), and exclusive and congestible goods (for example, networks and other commons).
15. Links 3 and 4 also highlight the contribution that natural resources make to well-being. This leaves open the scope to consider both intrinsic and instrumental aspects.
16. **I** here captures issues such as identity and related aspects; **M** represents macro or structural factors; and **N** stands for natural (or environmental) factors.