A Pathway to Sustainability in Urban Sanitation for Developing Asian Countries

Kumudini Ranmali Abeysuriya

Institute for Sustainable Futures

University of Technology, Sydney

Thesis submitted for the PhD in Sustainable Futures

February 2008

Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

_____

Acknowledgements

The transformational journey this thesis represents would not have been possible without the support and generosity I have received from many quarters. The Institute for Sustainable Futures has been critical in this journey, for the rigorous learning environment it has provided through its postgraduate program. The financial support I have received through an Australian Postgraduate Award administered by the University of Technology Sydney is also gratefully acknowledged.

My Principal Supervisor, Associate Professor Cynthia Mitchell, has guided and shaped my thinking, both with her erudition and uncompromising demand for excellence in scholarship and her warmth and emotional support in my personal journey. I count my access to her as my greatest good fortune over this period. Dr. Juliet Willetts completed my 'dream team' of research supervision, by bringing a complementary set of perspectives and experiences, asking strategic questions that helped me find my own direction, and challenging my arguments to be more defensible. Professor Stuart White provided valuable guidance as my initial Research Supervisor at the Institute, sharing his depth of experience and pointing me to many of the resources that began my transformation.

Several people have generously given of their time to discuss different aspects of my work. I am grateful to Dr. Lyn Carson for her guidance on Deliberative Democracy for Chapter 5, to Dr. Simon Fane for his critique of my economic arguments in Chapter 4, and to Dr. Anna Carew for sharing her insights on epistemology, transdisciplinarity and navigating the unfamiliar terrain of qualitative research. I owe my engagement with Soft Systems Methodology to Dr. Paul Crawford's research and discussions on the subject.

My journey has been enriched by the stimulating and thought-provoking conversations, good humour and friendship shared with my postgraduate colleagues at the Institute, including Suzanne Grob, Nicole Thornton, Michelle Zeibots, Keren Winterford, Jane Palmer, Dana Cordell, Dick Clarke, Chris Riedy, Chris Reardon, and Chris Dunstan. I especially thank Tanzi Smith and Chris Nelson for their empathy, support and friendship within and outside our Group for Accountability and Support (GAS).

Many others at the Institute for Sustainable Futures have supported me in various ways. I especially thank Ann Hobson for always being graciously available for expert advice on writing and presentation of this and other documents, and for smoothening administrative matters relating to my candidature. I thank Damien Giurco for his empathetic encouragement and interest. I am grateful to Dr. Tony Stapleton for his counsel at the brink of my abandonment of this journey.

I acknowledge and thank the individuals I interviewed in Sri Lanka (whom I cannot name under the Ethics Guidelines that governed the interviews), for their generous sharing of information and insights. Dr. Nihal Somaratna proved his claim that "in Sri Lanka, everyone is a friend of a friend" by arranging many of my interviews with senior government officials, with the remainder arranged by Dr. Christopher Panabokke and Ms. Rohini Abeysuriya. Mr. Rajkumar facilitated site visits in Colombo, and, with Mr. R.S.C. George, provided access to studies and reports from the NWSDB that have been most helpful. Dr. Harin Corea offered generous support with data collection if I needed it. I am grateful to them all.

My husband Srian Abeysuriya has supported me in countless ways with his love and his unflagging faith in me that has often exceeded my own. In many ways this has been a journey he has shared with me. My sons Romesh and Nishan have encouraged and supported me variously, and especially helped me place my PhD research into perspective and balance with the rest of my life. I dedicate this thesis to you with my love and gratitude.

Relevant publications

Abeysuriya, K., Mitchell, C. & Willetts, J., 2005. *Cost Recovery for Urban Sanitation in Asian countries: insurmountable barrier or opportunity for sustainability?* 2005 Conference of the Australia New Zealand Society for Ecological Economics (ANZSEE), Palmerston North, New Zealand.

Abeysuriya, K., Mitchell, C. & Willetts, J., 2006. *Kuhn on sanitation: dignity, health and wealth for the children of the revolution*. Ninth Biennial Conference of the International Society for Ecological Economics, New Delhi, India.

Abeysuriya, K., Mitchell, C. & White, S., 2007. *Can Corporate Social Responsibility resolve the sanitation question in developing Asian countries?* Ecological Economics, vol. 62, no. 1, pp. 174-183.

Abeysuriya, K. & Mitchell, C., 2007. *Creating Change through Deliberation and Learning Systems*. Conference of the Australia New Zealand Society for Ecological Economics (ANZSEE), Noosa, Australia, July 2007.

Contents

Table of Figures

List of Tables

Abstract

Sanitation in rapidly growing cities of developing Asian countries is a complex problem that often appears intractable and unyielding to standard problem-solving approaches. In this thesis, I provide a conceptual foundation aligned with sustainability to provide fresh guidance towards resolving this problem.

I frame urban sanitation in developing Asian countries as a 'messy' planning-related problem, characterised by associations with multiple perspectives, key uncertainties and conflicting interests. In recognition that 'messy' problems cannot be confined within traditional disciplinary boundaries, the research uses transdisciplinarity as a guiding principle and methodology. It explores how new processes and complex systems ideas relevant for 'messy' problems can be applied to resolving urban sanitation. To ground the work in a real context, much of this work is explicated with reference to Colombo, Sri Lanka.

My research highlights the role of dominant perspectives and worldviews in the organisation of sanitation practice. A review of sanitation history exposes changing paradigms, and the potential for developing Asian countries to move to radically different practices aligned with sustainability. I demonstrate that conceptions of costs and cost recovery for sanitation depend on perspective, by comparing how neoclassical economics', ecological economics' and Buddhist economics' perspectives indicate different approaches to these, with different alignments with sustainability. By arguing that these perspectives are complementary rather than mutually exclusive, I integrate them to propose necessary principles for sustainable sanitation, namely, that: arrangements for sanitation should emphasise cooperation between stakeholders; efficiency goals should include entropy considerations; society as a whole should live within its means; and ethics and 'goodness' should underpin decision processes and choices.

The thesis proposes a framework for participation to support decision-makers in resolving problematic sanitation. This supports the principle of cooperation between stakeholders, and the sustainability discourse's emphasis of democracy and participation in decisions that affect them. It is a learning process based on soft systems methodology, bringing participants with specialist knowledge, stakeholder interests and broader societal values into dialogue that is explicitly designed to be deliberative, that can lead to a path to resolving the problem.

Finally, I explore how ethics and 'goodness' can be woven into the provision of sanitation services, particularly with private sector actors who can potentially play a key role. I propose that their representation as metaphorical persons within current legal structures be extended so their behaviour is guided by a moral framework like real people in society. I propose that Buddhist economics can provide such a framework, raising expectations of behaviour grounded in ethics and goodness.

1 Problematising urban sanitation in developing Asian countries

"*Water is life, sanitation is dignity*"

Roberto L. Lenton (2005)

1.1 Introduction

This thesis is concerned with facilitating change leading to urban sanitation that is sustainable[1]. It explores how developing Asian countries might arrive at arrangements for urban sanitation that can feasibly be sustained in the long term, as well as support sustainability in general.

Sanitation, with water supply, is critical for addressing the world's main development challenges articulated in the Millennium Development Goals (MDG). The MDG set out to improve poverty eradication, basic education, gender equality, maternal and child health, disease reduction, and environmental sustainability in developing countries (World Bank Group 2004). Increasing access to sanitation improves the prospects for achievement of all the goals (UNDP 2006; WHO & UNICEF 2004).

Urban sanitation in developing Asian countries face particular challenges (Section 1.3), which arise not only from large numbers of people not having access to sanitation, but also from poorly performing sanitation infrastructures serving very large numbers of people. For example, 98% of the urban population of Sri Lanka was reported to have access to improved sanitation in 2004 according to the MDG Joint Monitoring Programme's definitions and estimations (WHO & UNICEF 2006). In terms of numbers of people, this still leaves a large number without access to sanitation. Perhaps more significantly, the majority of the urban population are served by septic tank systems that (in many cases) perform poorly, leading to sewage finding its way into stormwater drains, canals and waterways, thereby polluting surface and groundwater resources – a situation that, with time, "goes from bad to worse" (NWSDB 2001).

My inspiration for this research has its origins in Sri Lanka, my birthplace. The direction of this work has shifted significantly since it was first conceived, when I saw a potential 'solution' to reducing the polluting impacts of human waste through identifying a valued use to which it could be re-directed. My background as a physicist with a passion for sustainability in the Australian energy sector[2] gave me an interest in exploring human waste

[1] In Section 1.4 I discuss what 'sustainability' means for the purpose of this thesis.

[2] Prior to commencing this research, I worked on regulatory and market issues relating to renewable energy and greenhouse gas emissions in the electricity industry in Australia. I obtained an undergraduate degree with a major in physics from the University of Peradeniya, Sri Lanka (1983), and a Master's degree (by research) in physics from Cornell University, USA (1986).

as a renewable energy source. Through my PhD research, I had hoped to discover and propose a readily implementable 'solution' for improving the sustainability around sanitation for Colombo as a case study.

My exploration of the sustainability discourse, and Ecological Economics in particular, soon exposed my hopes of finding 'a solution' as naive. I came to realise that new ways of 'seeing' were required, and that seeking to articulate this new way could make a more useful contribution to resolving the problem of interest. My focus therefore shifted from seeking specific 'solutions' to seeking improvements in the processes of decision-making about sanitation planning, that would pave the way for specific interventions consistent with such planning decisions. Greater generalisation has meant that the research could be adapted and applied to more contexts than Colombo. Therefore I expanded the scope of my thesis to include cities in developing Asian countries generally, since their engagement in various forms of regional cooperation give them some common regional characteristics. The thesis is grounded in specifics drawn from Sri Lanka.

The aim of this chapter is to problematise urban sanitation in developing Asian countries and to outline the central argument and structure of this thesis. The entire thesis may be seen as a problematisation of sanitation, in the sense of the following definition of the term:

> "Problematization is a critical and pedagogical dialogue or process and may be considered *demythicisation*. Rather than taking the common knowledge (myth) of a situation for granted, problematization poses that knowledge as a problem, allowing new viewpoints, consciousness, reflection, hope, and action to emerge." (The Free Dictionary 2007)

This introductory chapter, however, will limit itself to problematise in line with a second definition, as:

> "to consider the concrete or existential elements … as challenges (problems) that invite the people involved to transform those situations" (ibid)[3].

The chapter opens with preliminaries – a definition of sanitation and its objectives, and a discussion of sanitation's value and valuation, and its distinguishing features as an urban utility service (Section 1.2). Some problematic elements of urban sanitation common to many developing Asian countries are summarised next (Section 1.3). A subset of issues that have guided and shaped my goals and approach to this research in particular, are highlighted in Section 1.3.1. These issues are primarily drawn from interviews[4] held with

[3] Both definitions are drawn from Crotty's (1998, pp. 155-156) discussion of Freire's views on problematisation.

[4] The interviews were compliant with requirements of the Human Research Ethics Committee (HREC) of the University of Technology Sydney (Approval Number 03/44A), which includes protection of identity of

twelve senior public officials from five agencies[5] with policy and implementation roles related to sanitation for Colombo at the commencement of my research in 2003.

I next discuss my research questions, research approach, methodology and scope in Section 1.4. In Section 1.5, I discuss the influence of values and ideology on research, and make a declaration of my own ideological orientation. The chapter concludes with an overview of the thesis structure.

1.2 The role and value of sanitation

Sanitation is generally defined as the service that facilitates human excreta disposal such that faecal pathogens do not come into contact with people, animals, insects, crops or water sources (UN 2001; WRI 1999). It is therefore an essential service for protecting human health. Key requirements of an effective service, from the perspective of users, are that the technology and facility are easy to use and maintain, and can be used with dignity, privacy and safety (Schertenleib 2004b).

The Universal Declaration on Human Rights is a declaration of the inherent dignity and inalienable rights of all humans, including the right to a standard of living adequate for health and well-being (UN 1948, Article 25). Access to adequate sanitation, as a facilitator of health and dignity, is accordingly a fundamental human right, as well as essential for the long term wellbeing of society and ecosystems, and therefore, for sustainability.

Distinguishing features:

The relative private and public benefits provided by urban sanitation are different to those provided by most other utility services. All urban utility services such as water supply, electricity, telecoms, and sanitation, provide private benefits to users as well as public benefits as enabling factors for economic development (Kessides 2004). However, these other utility services[6] are almost entirely concerned with providing 'things that people

interviewees. Information provided by interviewees is thus only referenced as "Interview 2003". Securely held notes and recordings can be made available if required, subject to HREC terms and conditions.

[5] These were: the *National Water Supply and Drainage Board* (NWSDB) that has statutory responsibility for centralised urban sewerage amongst other urban and rural water-related functions; the *Urban Development Authority,* responsible for urban planning and development; the *Central Environment Agency* with oversight for environmental management and protection including pollution control; the *Water Resources Secretariat* , the coordinating peak body for national water resources management; and the *Colombo Municipal Council* that had historical responsibility for managing the sewerage network and onsite sanitation systems in the local government area of the City of Colombo.

[6] With the exception of urban or municipal waste management service utilities.

want' as individual householders, and as such, have significant private benefits that are arguably greater than the public benefits. Serageldin (1994 as quoted by McGranahan et al. 2001, p. 99), for example, notes that "private benefits constitute the bulk of the overall benefits of a household water supply" since a service that provides drinking water of high quality and reliability is valued by users.

Sanitation on the other hand, is more complex as it deals with 'things people *do not* want'– a feature that, of all other urban utility services, only urban waste management services share[7]. The private benefit comes mainly from having it taken out of the way of individual users in a manner that affords dignity, safety and convenience; the ultimate fate of the waste which remains within sanitation's domain of responsibility is not of private interest. If, for example, human wastes leak from out-of-sight sewers or septic tanks and contaminate water resources, it might be of little concern to individuals unless the consequences have a direct impact on them. The public benefits of sanitation – public health and urban cleanliness and amenity and environmental protection including water resource protection – are therefore a very significant part of the overall benefit of sanitation.

The public nature of the benefits calls for a certain attitude from actors[8] in sanitation and waste management services for sustaining good quality. Disposing of unwanted things in ways that minimise harm or inconvenience to others requires socially desirable behaviours or public consciousness. It may be argued that such socially desirable behaviours can be driven by a range of different motivations. Motivation may arise from the wish to avoid externally imposed negative consequences for the service provider or individual householder, such as penalties and sanctions for failing to meet statutory obligations or for violating social norms. Alternatively, positive incentives, such as the possibility of capturing some value attached to the waste[9], may drive their behaviour.

In the absence of external inducements or incentives, waste-disposal behaviours that show regard for other people and the environment can be driven by moral or ethical values, or feelings of 'caring' that extend beyond common notions of self-interest. I submit that 'caring' is a critical ingredient for sustainability in general, and for sustainable sanitation in particular, that complements other elements of sustainable sanitation. It may be argued that stressing this 'emotional' aspect of sanitation is in alignment with the argument that the

[7] This means that many of my conclusions for resolving problematic urban sanitation may potentially be adapted for these services.

[8] Actors can be individual householders making arrangements for themselves or external service providers.

[9] For example, recoverable deposits on empty containers, or saleability of old newspapers to traditional collectors in Asian societies (such as Sri Lanka), prompt individuals to save and recover the value of these wastes. Where these incentives are absent, these wastes regularly end up with general household waste even when avenues for recycling these materials exist (White 2001).

logical and rational *complement* the intuitive and emotional, that has been made by many eminent scientists and philosophical thinkers[10] (Blackburn 1971; Chowdhry 2003; Max-Neef 2005; Pirsig 1976). It may also be argued that 'caring' is the overarching *ethic* that underpins a sustainable society that is concerned with the wellbeing of future generations and global populations of humans and non-humans. Ideas about 'caring' keep recurring at various points in this thesis, consistent with the idea that it is a critical ingredient to the subject of the thesis.

While sanitation is not unique amongst urban utility services in providing benefits to society, sanitation's public benefits can extend further due to its place in the nutrient cycle[11], which enables it to support the continuation of human life into the future. When excreted nutrients are returned after sanitisation to their place within the nutrient cycle, their *mis*-placement in water resources is avoided at the same time. Thus, sanitation can help maintain agricultural soil quality, and simultaneously protect water resources and ecosystem health from excessive pollution.

Although urban sanitation's historical role within the nutrient cycle has largely become lost in the last century, this role is likely to regain importance in the future. The use of waterborne sewerage technology for sanitation and the use of mineral and artificial fertilizers in agriculture, have together contributed to the displacement of sanitation from the nutrient cycle (Chapter 2). However, mineral and synthesised fertilizers will not always be cheap and abundant: phosphate rock reserves from which phosphate fertilizer is derived are becoming depleted[12], while measures to mitigate climate change can increase the cost of energy needed for the synthesis of nitrogen fertilizer. Excreted nutrients can partly replace these fertilizers[13] (Esrey et al. 1998; Tidåker 2003; Winblad & Simpson-Hébert 2004). Furthermore, the Millennium Ecosystem Assessment (2005, p. 69) identifies excessive nutrient loading as "one of the most important direct drivers of ecosystem change in terrestrial, freshwater, and marine ecosystems" . By restoring urban sanitation to its place in the nutrient cycle, nutrient loading of water resources and ecosystems can be reduced, thereby supporting the health of ecosystems that provide key ecosystem services such as water purification (Postel 2005). With climate change and excessive nutrient loading predicted to become more severe in the next half-century (Millennium Ecosystem

[10] These include Albert Einstein, Neils Bohr, Werner Heisenberg, Mahatma Gandhi, Ken Wilbur and Taoist thinkers, amongst others.

[11] The nutrient cycle refers to the cyclic flow of nutrients from agricultural soil to food to humans (and animals) to excretions and dead tissue that return to the soil (see Esrey et al. 1998 for more details).

[12] Estimates for the remaining availability of this resource range from 60 to 300 years (EcoSanRes; Lienert et al. 2003; Steen 1998)

[13] An adult is estimated to annually excrete about 4 kg of nitrogen (N), 0.4 kg of phosphorus (P) and 0.9 kg of potassium (K) in urine (Esrey et al. 1998). Winblad & Simpson-Hébert (2004, p. 74) cite Swedish research that estimates the NPK nutrients in the total production of human urine as equivalent to approximately 20% of these nutrients derived from mineral fertilizers in Sweden in 1999/2000.

Assessment 2005, p. 2), it is conceivable that in the future, urban sanitation's role within the nutrient cycle may become its foremost role.

Another characteristic of sanitation is that it generally receives a low political priority amongst problematic urban issues in the developing world – which was also true of the industrialised world prior to the sanitary revolution (Chapter 2). While 'water supply and sanitation' are generally considered the twin cornerstones of urban public health and are regularly mentioned as a single entity in studies, policy statements, media reports and the development aid industry, sanitation is often a neglected afterthought in practice. Four times as much investment is estimated to have occurred in water supply as in sanitation in the decade to 2000 (Evans 2005, p. 6). As a senior official in Sri Lanka told me:

> "Compared to water supply, we haven't maintained a balance with sewerage services. In rural schemes the water supply and sanitation services are progressing in parallel, but for urban areas this is neglected. … Partly because this is not a glamorous area for politicians to back, and partly – it is so very expensive. We haven't determined how to charge for the services. This is one of our weak areas." (Interview 2003).

Interestingly, while the Millennium Development Goals emphasise the need to increase access to "safe drinking water and basic sanitation" (World Bank Group 2004), the term 'sanitation' was included only in 2002 at the United Nations' World Summit for Sustainable Development in Johannesburg. Its predecessor, the 2000 United Nations' Millennium Declaration (UN General Assembly 2000) had only a target for drinking water. The increased recognition given to sanitation by the MDG is reason for optimism that the priority given to sanitation will rise further in the future.

I contend in this thesis that the subject of sanitation is worthy of study disaggregated from 'water supply and sanitation' to accord it the attention it deserves. Its being 'stapled' to water supply can be seen as a historical accident that resulted from the choice of water-borne sewerage technology in the nineteenth century, which presents urban water supply and urban wastewater as parts of a single flow path (Section 2.4). Sanitation could with equal or better logic have been linked to waste management or to health, if it was necessary to pair it with another service. Pairing sanitation with water supply has been particularly unfortunate, as it has relegated sanitation to being the 'lesser' of the two as a natural consequence. Water is essential and non-substitutable, and a high value is placed on the quality and quantity of the water received (Savenije 2002). It means that the public, including the poorest, are willing to pay for water if required, even if poverty forces them to divert expenditures from other services such as education and health (Gutierrez et al. 2003). In contrast, sanitation is less valued since individuals have many informal (even if 'inadequate') options for disposing of their human wastes. Instead, holding sanitation separate allows consideration of all the systems that sanitation is related to, not just the water supply system, but the agricultural, energy, transport, health, social, ecological, economic and political systems, amongst others (Section 3.4).

1.3 Problematic urban sanitation in developing Asian countries

A brief overview of the technological context of urban sanitation in developing Asian countries provides a backdrop to this section, where I examine several factors that contribute to the difficulty and complexity in addressing the problems associated with sanitation.

Sanitation within cities of developing Asian countries comprises of a wide variation in technologies and performance that could range from conventional piped sewerage to a variety of simpler technologies such as pit toilets and more recent ecosan technologies (Section 2.5.2.3). Economically disadvantaged urban communities within these cities often lack any type of sanitation technology and may resort to defecation on open land or waterways (Sevanatha 2002; UNEP 2000).

Conventional piped sewerage networks serve some parts of several of the larger Asian cities, which were in many cases installed by occupying colonial governments[14]. With the exception of a very small fraction, wastewater collected and transported away from cities via these systems are discharged to the environment without any treatment (Schertenleib 2004b). Many of the sewerage systems are poorly maintained; Schertenleib (ibid) notes, for example, that in Thailand, less than 40% of the conventional centralised wastewater collection and treatment systems installed in the last decade are fully functional. Some of the older systems installed by colonial governments have become structurally weak, even collapsing in places, such as is experienced in Colombo (Interview 2003).

Onsite septic tank systems are the most prevalent type of urban sanitation technology: according to one estimate, septic tanks are used by 80% of urban populations of developing Asia-Pacific countries (UNEP 2000). It is common for septic tank systems to be required by law if conventional piped sewerage is unavailable (for example, in UDA 1999). Such laws ignore that adequate technical performance of these systems is contingent on specific local conditions being fulfilled[15]. As a result, septic tank systems are installed in locations that violate the conditions needed for their proper performance, such as in former marsh

[14] For example, the British installed the partial sewerage network of Colombo as well as of several cities in India and Myanmar; the French, of Vietnam (UNEP 2000); and the Americans, of the Philippines (Robinson 2003).

[15] Septic tank systems consist of two elements: a watertight tank (which may consist of one or more chambers) where the solid matter in sewage settles and is broken down anaerobically; and a soil treatment system, such as a soakage pit or dispersal system, where the solid-free effluent discharged from the septic tank is biologically treated by soil-microbes while it percolates through the soil. Certain environmental conditions are necessary for these systems to function as designed, including the soil being within a specified porosity range, there being sufficient land area for soil treatment, and sufficient separation between the system and groundwater resources to prevent their contamination by incompletely treated effluent.

lands where water tables are high, or where small urban lot size concomitant with high urban density leaves insufficient land areas for the dispersal of effluent[16] (Wikramanayake & Corea 2003). The resulting microbial and nutrient contamination of ground water resources renders this valuable urban water resource unsafe for drinking (Interview 2003).

The net effect of this range of technologies performing with varying quality relative to their design performances, and many systems performing poorly, as well as the lack of access to any technologies for some parts of the urban population, is a situation that is problematic overall. A number of factors act as obstacles to addressing the problematic situation, discussed next.

Funding resources

Developing Asian countries lack the economic resources to fund the sorts of centrally planned technological interventions that industrialised countries used for resolving their problems in the nineteenth century. Industrialised countries had their urban population growth occurring at the same time as rapid economic growth, so that the massive spending on urban sanitation infrastructure, namely centralised piped sewerage (or conventional sewerage, discussed in Section 2.4), was feasible. In contrast, rapid urban population growth in developing countries is occurring in a context of poor economic performance, heavy public debt, lack of investment capital, poor governance, weak institutional capacity and extensive urban poverty (Biswas et al. 2004). Cash strapped governments are faced with competing needs for infrastructure investment, and as noted earlier, sanitation generally gets given a very low priority on their action list.

Although international development aid can potentially provide some of the necessary capital for investment in sanitation infrastructure, especially for the poorest of countries in Asia, this resource is likely to become less accessible for the relatively more rapidly developing Asian countries in the future. While large increases from current levels of aid are required in order to meet the MDG (Millennium Campaign 2006), it is likely to be targeted to those identified as most in need. With Sub-Saharan Africa, in particular, being identified as being furthest behind in achieving their drinking water and basic sanitation targets (WHO & UNICEF 2005), it is likely that the limited funds available through international development aid will be prioritised away from some parts of Asia:

> "India and China, and many of the smaller countries of Asia are home to the sort of economic growth and development which may enable them to make steady progress without high levels of external financial support, provided political will exists. By

[16] For example, the legal minimum urban lot size for Sri Lanka is 150 -175 m^2, that a majority of the officials I interviewed in Sri Lanka identified as a concern for septic tank systems (Interview 2003). The equivalent requirement for installation of septic tank systems in New South Wales (Australia), while likely to be erring on the side of being over-cautious, is 4000 m^2 (NSW Dept. of Local Government 1998).

> contrast, many smaller countries and those in other regions (particularly Sub-Saharan Africa, Central America) are unlikely to be able to make this sort of progress unaided. These are areas where external assistance might be best deployed." (Evans 2005, p. 11)

Political aspirations/feasibility disjunct

A further impediment for resolving problematic urban sanitation is the aspiration amongst political leaders in developing countries for 'Western style' sanitation infrastructure. Frequently the planning decision is seen as a dichotomous choice between conventional sewerage and septic tank systems (Sundaravadivel, Trivedi & Vigneswaran 2003), rather than the result of a systematic assessment of a wide range of options. The poor record in the long-term performance of septic tank systems everywhere[17] therefore leads to a conclusion that sewers are the only long-term option for urban sanitation. The very high cost of building and operating conventional piped sewerage infrastructure[18] cannot be borne or sustained by these countries, making these 'decisions' un-implementable. Nevertheless, national agencies go through the motions of progressing such plans by commissioning studies on the costs and feasibility of building these systems, although the reports that result "do little more than sit on the shelf" (Newman 2001).

An example from Sri Lanka provides a vivid illustration. A Presidential Task Force on Environmental Infrastructure recommended piped sewerage for the Sri Jayawardenapura-Kotte area – an area where significant urban development growth has occurred since the relocation of the country's administrative capital here in 1982, and where the lack of sanitation infrastructure hampers further development (NWSDB 2001). A detailed feasibility study was completed in 2001 (ibid), which recommends two significant measures for reducing capital and operational costs. First, it recommends that wastewater treatment facilities be omitted, and wastewater be disposed by connecting the new network to an existing sewerage network that discharges wastewater to the ocean without treatment:

> "… connecting to the [existing sewerage network and ocean outfall] becomes the most cost effective, practical, technically feasible and logical option…At least this option could be considered as the immediate solution for disposal, while the treatment plant option becomes the long term solution." (NWSDB 2001)

Second, the plan bypasses services to low-lying areas, so that pumping requirements are reduced. This represents almost 30% of the area of interest, and is where, ironically, septic tank systems are most likely to fail (Wikramanayake & Corea 2003). The cost-trimming measures, in combination with local costs for materials and labour, leads to a per-household

[17] For example, of the septic systems that serve one in four US households, in excess of 10% are estimated to fail every year (USEPA 2005). This issue is discussed further in footnote 39 in Section 2.4.

[18] It costs more to collect and treat wastewater than it costs to collect, treat and distribute an equal quantity of drinking water; it also requires substantial amounts of energy (UNEP/WHO/HABITAT/WSSCC 2004).

capital cost estimate that is roughly half that for conventional sewerage in Australia, in the rough comparisons shown in Table 1.1. Even so, such costs are unaffordable for an economy whose per-capita gross domestic product (GDP) is one-twentieth that of Australia.

	Sri Lanka	**Australia**
Capital cost per household connection for conventional piped sewerage	Aus$ 5,000[19] (based on NWSDB 2001)	Aus$ 10,000[20] Ho (2004)
Annual GDP in 2002	Aus$ 33.6 billion (Central Bank of Sri Lanka 2003)	Aus$ 697.6 billion (ABS 2004)
Population in 2002	18 million	18 million

Table 1.1: Comparative costs and affordability of conventional sewerage: estimates for Sri Lanka and Australia

This unaffordability was underscored by my interviews with public officials, where every interviewee mentioned the high cost that was virtually impossible to recover. For example:

> "Systems with high capital cost will not work for us."
>
> "Financial sustainability of the sewerage system is a real problem because there is no tariff system or way of generating revenues."
>
> "Hurdle is affordability. Utility service provision is very costly."
>
> "There is something preventing us going into conventional sewerage, it is very expensive."
>
> "Our resources are limited. Funds to pay for infrastructure development – that is the biggest constraint."
>
> "This has to be linked with the economic development of the country. Because money will be the limiting factor." (Interview 2003)

Not surprisingly, no further progress with sanitation infrastructure for this area has been made since the feasibility report.

Nevertheless, aspirations for Western style sewerage run deep. Despite their concerns about the unaffordability of sewerage, a majority of interviewees stated that their long-term vision

[19] A per-connection cost of Rs. 245,000 is based on the feasibility study's reported estimate of construction costs (SLRs. 4300 million) and number of households to be served (17,500). Currency conversions were based on the average historical exchange rates for 2001 from www.oanda.com/convert/fxhistory . This is meant as a 'back of the envelope' comparison to support my argument, and makes no adjustment for the time value of money.

[20] This average cost includes full service coverage and wastewater treatment, in contrast to the figure for Sri Lanka.

would be full urban coverage of conventional sewerage. This may be the result of the commonly held view that

> "One positive aspect of sewer is that it can collect and treat wastewater to a safe standard. Whereas individual systems can give problems." (Interview 2003)

A further complication is that when sewerage has been introduced into established urban settlements, people who already have alternative sanitation facilities, even if poorly functioning, have not been willing to connect to them. During the Water Supply and Sanitation Decade in the 1980s, the Colombo sewerage network was extended into a few adjoining zones that experienced high levels of failure with septic tank systems, but to date, few households have connected to the new system (Interview 2003). Ho (2004) points out that this is hardly surprising as such people are in effect being asked to make a double investment, since they have already invested in their onsite systems. This demonstrates that simply introducing sewerage as a 'solution' will not necessarily resolve the problems.

Myth of future affluence

Another obstacle to resolving problems is what I perceive to be a widely held belief in a future where today's developing Asian countries would become affluent. This belief underlies the arguments made to justify a number of decisions to release raw sewage to the ocean, where prior treatment is seen as desirable but could legitimately be left to be added in the future (NWSDB 2001; World Bank 2000): "the treatment plant option becomes the long term solution" (NWSDB 2001). This belief was also apparent to me when my interviewees described above, saw conventional sewerage as unaffordable for Sri Lanka but nevertheless had visions for a future where cities were fully sewered. The optimism that developing countries would become affluent societies in the future in much the same way as industrialised countries today, may have its basis in the post-World War II notion of 'modernization theory' that postulates that

> ".. industrial development followed a coherent pattern of growth, and would in time produce certain uniform social and political structures across different countries and cultures." (Alvey 2003, quoting from Fukuyama 1992)

I contend that this unexamined optimism, held despite the development context of developing Asian countries being starkly different to those in industrialised countries of the last century[21] (Biswas et al. 2004), can contribute to poor decisions about infrastructure. It can legitimise investments that are currently unaffordable and provide a rationale for living beyond our means 'temporarily', which may in reality escalate problems that impede future prosperity.

[21] As discussed earlier, urban population growth in developing countries is not occurring in a context of simultaneous rapid economic development.

International Development Aid

I argue that a reliance on international development aid[22] in its current form presents another complication to sustainable sanitation in developing Asian countries. This view does not dispute that aid accounts for many achievements in improving the lives of people in developing countries, or the many arguments for encouraging greater levels of international aid (World Vision Australia 2006). However, although donors promote their aid-giving as an altruistic foreign policy tool to reduce poverty and promote development, analysis shows that more strategic interests are generally at play (Alesina & Dollar 2000; Schraeder, Hook & Taylor 1998). The Australian Aid agency AusAID, for example, makes its interest explicit in its Strategic Plan, which states:

> "The objective of the Aid Program is *to advance Australia's national interests* by assisting developing countries to reduce poverty and achieve sustainable development." (AusAID 2002, p. 6 emphasis added).

Most donor countries provide aid in forms that support industries in their own countries (World Vision Australia 2006). For example, over 80% of Australia's international development aid is awarded to Australian contractors (Australian Senate Estimates Hearings 2006). This usually means that practitioners from industrialised donor countries would typically seek to transfer their models and practices to recipient countries. As a consequence,

> "… conventional water-borne systems are still advocated by consultants and lending institutions as the only large-scale solutions. Rather than solving the sanitation problem, such advice may in fact aggravate it." (Stockholm Water Symposium Statement 2002, Principle 3)

Such directions may be consistent with the widely held and well-intentioned conception of development, where

> "the 'less developed' would follow the lead of the 'more developed', and in return the 'more developed' would help them to do so" (McGranahan et al. 2001, p. 3).

I contend, however, that this approach can lead to costly investments that the recipient cities may not be able to afford to operate or maintain, and may be liable to pay for when the aid is in the form of 'favourable-term' loans.

If provided in a mode that is less deliberately strategic to the donor's interests, international development aid can provide critical assistance to developing Asian countries, by supporting them with making their own determinations about what sanitation arrangements

[22] This discussion relates to bilateral aid that comes through governments and multilateral lending agencies, who would be the typical sources for costly infrastructure projects.

are best suited to their context. The current institutional environment of international development aid, however, can act as a hindrance rather than a help.

1.3.1 Three key contextual issues from Colombo

My interviews with institutional stakeholders in Sri Lanka, held early in the course of this research to form part of a situational analysis, were broad ranging and uncovered a number of interesting issues. In this section I describe three of these issues, selected because of their relevance to the particular direction my research has taken. Firstly, the institutional context of decision making, which is of interest for this thesis because any proposition for improving the sustainability of urban sanitation would need to be realistic *within* the context and constraints of existing institutional arrangements. Secondly, the consequences and processes relating to the involvement of the public was noted by several interviewees, that were consistent with emerging ideas about the necessity to involve stakeholders in public decision making. I draw on these ideas and seek to address their concerns in this research. Finally, many of my interviewees raised the subject of an attitude of caring as critical for change, validating its role for quality in sanitation (Section 1.2).

(i) Institutional context

Part of the legacy of British colonialism was an institutional structure where services such as water supply, sanitation, drainage, public health, were the responsibility of local government. Significant institutional reforms since Sri Lanka's independence in 1948 today has led to several overlapping institutions operating in the same domain as the local governments.

In the case of sanitation, the national water utility NWSDB[23] is now responsible for piped sewerage, and ownership of the sewerage network in Colombo has been transferred from the Colombo Municipal Council (CMC) to the NWSDB (with the CMC continuing operation and maintenance under contract to the NWSDB), while new extensions to the network outside the CMC zone are operated by the NWSDB. The CMC and other local governments remain responsible for onsite sanitation systems. Other institutions with overlapping areas of statutory responsibility for sanitation include the Urban Development Authority, the National Housing Development Authority, and the National Health Department, while several others influence sanitation in less direct ways, such as the Central Environment Authority, the National Water Resources Authority, the Land Reclamation and Development Authority and Road Development Authority (Interview 2003).

[23] National Water Supply and Drainage Board

A lack of coordination amongst the various authorities is seen as a serious obstacle to progress.

> "There are 8 major agencies, and another 25 minor agencies having some connection with water, all in competition, with no interaction or co-ordination between them."
>
> "Trouble is that we have no co-ordination. We have planning committees et cetera for co-ordinating things, but only on a special project basis. The famous example that keeps on repeating itself is with roads. A new road is constructed, and shortly after, it is dug up to install water pipes or telecom lines or something. They argue that they get their funds for the project at different times. This is a lack of planning at the national level."
>
> (Interview 2003).

The situation is not helped by a highly changeable political climate. Governments changed 3 times at parliamentary elections in 2000, 2001 and 2004 – and with it, ministerial roles, policies and priorities also changed (Ariyabandu 2005). The recent history of master planning for the Colombo region illustrates the consequence of this variable political climate. A number of draft master plans have been developed under successive governments – the Colombo Metropolitan Regional Structure Plan (UDA 1998); the Western Region Physical Structure Plan (NPPD 2002); and Western Region Megapolis Master Plan (CESMA 2003). In other words, each government preferred to revise plans made under a previous government rather than to bring them to fruition.

> "… So the plan was developed and gazetted. But when the new government came in – now this is the problem, they said we should do a new plan." (Interview 2003)

In this climate, the role of the political champion was seen as a critical factor for progress. Several interviewees noted the benefit and momentum brought by the then incumbent Prime Minister's[24] personal interest and participation in two particular planning and policy reform projects.

> "The [new plan] is now coming with political backing. If the current PM remains there will be some results from this plan."(Interview 2003)

(ii) Public participation and engagement

Water and sanitation service providers, mainly accustomed to a role of professional experts delivering services to passive public recipients under the centralised service paradigm (Section 2.4.1), have recently begun practicing 'demand driven' approaches in their rural water supply and sanitation programmes (Dissanayake 2002). These programmes elicit

[24] Mr. Ranil Wickremasinghe, Prime Minister from December 2001 to April 2004.

stakeholder participation in all elements of water supply and sanitation[25], from decision making in the choice of technology, to in-kind support in construction and maintenance, and administration and management by community based organisations, facilitated by the NWSDB.

Service providers discovered that the public were more competent than they had anticipated; furthermore, that the public preferred to be empowered in matters that they cared about:

> "We have found people understand things better than we think. We found them to be more receptive than we expected towards rainwater harvesting, we thought they would never accept these things."
>
> "We find the people managing their own systems very well, sometimes paying 3-4 times more than they'd have paid for services the NWSDB could have provided." (Interview 2003)

The public's critical role in the enforcement of regulations was identified by another interviewee, who noted that public vigilance and complaints were assisting greatly in monitoring and enforcing compliance:

> "[Industrial entities] construct [facilities to reduce environmental pollution] to get the licence but don't operate it – such cases are also there. This is where civil vigilant groups play a role. [They are] not necessarily formally formed groups, but we get a lot of complaints. Awareness is created now, unlike … about 16-17 years ago when we hardly ever got any complaints about environmental pollution. Now we get an enormous number of complaints per day, which means people are aware. They are aware about method to complain and so on." (Interview 2003)

The process of engaging the public is not, however, without difficulty. There are numerous examples of "articulate and incensed" special interest groups effectively hijacking processes for involving the public in decisions, promoting decisions that are not in the interest of a "voiceless" majority (Carson & Hartz-Karp 2005). This leaves well-intentioned institutional decision makers feeling thwarted in their efforts to 'do the right thing' in consulting with the public:

> "I would like to hear about others' experiences with public consultation. I have found it a frustrating experience – a real headache! Though in theory it's a good thing to do. (…) You should interview the NGOs and see their views about why they protest." (Interview 2003)

The need for, and the benefits of, public participation in the resolution of sanitation is argued in this thesis both from a theoretical perspective (Sections 2.7.1; 4.5) and a practical

[25] Although again, water supply has generally received greater priority than sanitation (Ariyabandu & Aheeyar 2004).

perspective (Chapter 5; Section 6.2.4.3). I also explore mechanisms to increase democracy and reduce the 'hijacking' of processes for public participation (Chapter 5).

(iii) The role of 'caring'

The lack of caring was identified by a majority of interviewees, as a key impediment at both institutional and individual levels. This issue was highlighted in relation to conversations about urban solid waste in most cases, which interviewees saw as more confronting than problematic sanitation[26].

> "The quality of management in Sri Lanka depends on who is in charge. If the person is interested things can be done well, otherwise it can be badly implemented."
>
> "People ask why is Sri Lanka not developed like Singapore or Japan, when it has such a high literacy rate? It has to do with attitude, commitment and organization."
>
> "The present population has no civic sense at all, this is the biggest problem. [They are] always waiting for some authority or agency to take care of their waste. As far as they're concerned they have no responsibility at all."
>
> "So however good a system we might have, it will fail because of people's lack of civic consciousness." (Interview 2003)

The possibility and necessity for changing people from within, towards caring, was recognised as fundamental to sustainable resolution of urban water-related problems.

> "[My vision for the future is for] a very water conscious society. Where people think [i.e., care] about protecting the water and not polluting it."
>
> "Values have been changed due to invasion and due to colonization and so on – so firstly, the mind set has to be changed (…) [We need to revive ancient values that revered water] to serve our heritage and … because it just blends into our society."
>
> "Unless we can have a kind of awareness campaign and bring about a whole mind change, things won't change."
>
> (Interview 2003)

While recognising that all segments of urban society would need to care, the difficulties in accomplishing this in practice must be acknowledged. In particular, motivating the affluent urban middle classes to care is seen as a significant challenge since they are largely able to insulate themselves from the wider problems:

> "…people come in Volvos to dump garbage here." (Interview 2003)

[26] That sanitation and waste are the key urban environmental issues in Sri Lanka is not surprising, since both are dealing with the challenge of managing unvalued 'unwanted things' as noted in Section 1.2.

Furthermore, the affluent may have more to lose from adopting an attitude of 'caring', in having to give up some degree of their wealth and power. Ariyaratne, the founder of the Sarvodaya movement for community development based on Buddhist-Gandhian ideals[27] notes that:

> "…the material gap between the poor and the powerless and the rich and the powerful [would widen] unless the spiritual emptiness that generally exists in the latter is filled with beneficence, love and selflessness. Bringing home this truth is next to impossible with the rich and powerful for a Movement like Sarvodaya however much we try." (Ariyaratne 1999, p. 16)

Thus, while the Sarvodaya movement embodies a long-term vision to mobilise all of society (ibid), the movement's activities are limited to poor communities for the present.

The mobilisation of the urban middle classes can be critical for driving desirable changes for resolving problematic urban sanitation. Chaplin (1999) observes that, in the 19th century sanitary revolution that brought radical improvements for industrialised countries, the activism of the urban middle classes and the political pressures they brought to bear had a very significant influence. She notes however that the middle classes were no more altruistic then than now, but rather, that their activism was driven by a perceived "threat from below": the fear of diseases originating in unsanitary poor neighbourhood spreading to middle class suburbs, and the fear of social uprising by the working classes. The availability of modern medicine and sanitation to the middle classes and the lack of social organisation for revolution by the urban poor have largely removed this perceived threat, with the result that the urban middle classes of developing Asian countries today have little motivation for engagement in the wider problems of dysfunctional sanitation and waste management systems they are a part of (ibid).

1.4 Scope, methodology and approach

This thesis is concerned with sustainability in the practice of urban sanitation, and thus draws heavily from the literature of the sustainability discourse. While there is no consensus on the precise meaning of the term 'sustainability', Daily & Ehrlich's (1996) definition best captures how I think of it:

> "Sustainability characterizes any process or condition that can be maintained indefinitely without interruption, weakening, or loss of valued qualities."

This definition highlights that sustainability is a value-laden discourse, with assumptions and worldviews influencing the range of possible answers to the question "what valued qualities are to be maintained?" My position is that ecological, social and economic aspects

[27] See Footnote in Section 4.6.1.2 for description of the Sarvodaya movement.

that contribute to human wellbeing are valued, and that deciding precisely what these are and prioritising them is best done by democratic and participatory means.

The aim of this thesis is to provide a conceptual foundation for such a democratic process, as well as to develop a practical framework by which the public can deliberate and decide on the valued qualities and criteria for urban sanitation, that can in turn assist planners and policy makers in making decisions to resolve the conundrum.

My research questions are therefore:

1. What intellectual contribution can the sustainability discourse make to provide direction for heading towards sustainability in urban sanitation planning for developing Asian countries?

2. How can these concepts be translated into a practical framework for decision-making?

For the problems to be resolved, not only are planning decisions for sanitation consistent with sustainability considerations necessary, but such decisions need to be implemented. Thus my third research question is:

3. How might planning decisions for sustainable sanitation be implemented: who might be involved and what might motivate them?

A transdisciplinary approach and methodology

The sustainability discourse is a loose term for the collection of research and discourses pertaining to creating change towards sustainability aligned with Daily and Ehrlich's definition above. These discourses converge on some central aspects (Section 2.7.1). Key among these is recognition of a need to integrate knowledges that have become compartmentalised within different disciplines (Bell & Morse 2005; Costanza et al. 1997; Gallopín et al. 2001; Max-Neef 2005; Söderbaum 1999; Sustainability Institute 2001). In the past, General Systems Theory was proposed as the vehicle for such integration (Boulding 1956); today this is cast as *Transdisciplinarity*.

> "Transdisciplinarity complements disciplinary approaches. It occasions the emergence of new data and new interactions from out of the encounter between disciplines [sic]. It offers us a new vision of nature and reality. Transdisciplinarity does not strive for mastery of several disciplines but aims to open all disciplines to that which they share and to that which lies beyond them. (…)
>
> "The transdisciplinary vision is resolutely open insofar as it goes beyond the field of the exact sciences and demands their dialogue and their reconciliation with the humanities and the social sciences, as well as with art, literature, poetry and spiritual experience." (CIRET 1994)

Recent research efforts have sought to articulate the characteristics of the fledgling field of transdisciplinarity. Questions such as how transdisciplinary research differs from interdisciplinary, multidisciplinary and pluridisciplinary contributions and how quality in transdisciplinary research might be assessed, have been explored in academic journals (for example, Max-Neef 2005; Wickson, Carew & Russell 2006) and conferences; a special issue of the journal Futures is devoted to transdisciplinarity (*Futures* vol. 36, no. 4, 2004). Such contributions are essential because

> "It is all too easy for the [trans]disciplinary to degenerate into the undisciplined. If the [trans]disciplinary movement, therefore, is not to lose that sense of form and structure which is the "discipline" involved in the various separate disciplines, it should develop a structure of its own." (Boulding 1956)[28]

I claim this thesis as transdisciplinary in spirit, as it has many of the defining characteristics of transdisciplinary research articulated by others. It shares the aims of transdisciplinary research in general, as identified in Lawrence & Despres' (2004) overview of the special issue of *Futures*: it addresses complexity in problems (Chapter 3); it accommodates the contextual nature of what is known (Section 5.4.1); and it is problem oriented as it seeks learning that contributes to problem resolution (Sections 3.3 and 5.4). It draws on ideas from fields ranging from thermodynamics to deliberative democratic theory and Buddhism, that represent a coordination of knowledge from a spread of hierarchical 'disciplines' that Max Neef (2005) describes as a practical requirement (discussed in Section 2.7.1). It is aligned with the principles of ecological economics (Section 4.5), which itself claims to be transdisciplinary (Costanza et al. 1997).

On the other hand, collaboration with stakeholders is identified as a central characteristic of transdisciplinarity (Lawrence & Despres 2004; Wickson, Carew & Russell 2006) which raises the question whether academic research conducted by a single researcher can be transdisciplinary. Max-Neef (2005) however, insists that transdisciplinary research contrasts with other sorts of collaborative cross-disciplinary work in that "an integrating synthesis is not achieved through the accumulation of different brains. It must occur inside each of the brains." While it is not clear how to assess the degree of integration that has taken place, I believe it is fair to claim that some integration has taken place 'inside my brain'. This is evidenced by the transformative impact that undertaking this research has had on me, that has, amongst other things, moved me from a strongly rationalist positivist perspective to one that is more accommodating of other ideological perspectives I may not share. Considering all of the above, I argue that this doctoral thesis may defensibly claim to take a transdisciplinary approach.

[28] Boulding uses the term 'interdisciplinary'in his 1956 paper, which broadly coincides with the contemporary term 'transdisciplinary' and which differs from the modern meaning of 'interdisciplinary'. Hence I have replaced Boulding's original "inter" with "trans" in this quote.

There is no prescribed set of methodologies that characterise transdisciplinary research – methodologies may be chosen to "respond to and reflect the problem and context under investigation" (Wickson, Carew & Russell 2006). A variety of different methodological approaches are thus used within this thesis, depending on the issue being examined. The overarching methodology for drawing out concepts from the sustainability discourse is review and synthesis of literature with a particular problem resolution intent; for the analysis of each part of the problem, this (generic) methodology is guided by particular conceptions, frameworks and other methodologies. The review of the history of urban sanitation is structured using a theoretical framework based on Thomas Kuhn's theory of scientific paradigms (Chapter 2). Soft Systems Methodology is used to explore the idea of a learning system for resolving problems (Section 3.5), and as the model for the proposed collaborative decision-making framework (Chapter 5). A synthesis of three traditions of economic thought is the outcome of an epistemological analysis (Chapter 4). Literature review and synthesis is used to argue for the participation of the private sector in urban sanitation, constrained by appropriate institutional arrangements and moral codes of conduct (Chapter 6).

Boyer's (1990) assessment of scholarship validates the above transdisciplinary methodological approach as a legitimate scholarly undertaking for doctoral research. In his landmark report for The Carnegie Foundation for the Advancement of Teaching, Boyer describes different types of scholarship that he argues are appropriate scholarly pursuits within universities. The transdisciplinary approach used here conforms with the *scholarship of integration* in Boyer's typology, that draws together, synthesises and distils new insights out of existing knowledge[29].

Scope

The emphasis in this thesis is on presenting concepts consistent with sustainability to underlie decision-making for urban sanitation planning. To prescribe particular 'solutions'– specific technologies or models for transfer payments or other specifics – therefore lies outside the scope of this thesis. Instead, the translation of concepts into specifics would ultimately rely on the power of the specialist disciplines. Such a scope follows from the transdisciplinary approach taken, where transdisciplinarity is complemented by specialised disciplinary expertise (CIRET 1994). Thus a transdisciplinary approach requires consideration of disciplines to the extent that the issues they raise can be brought to the table, without needing a mastery of each discipline. In practice this means, for example, that I could make the argument that sanitation technologies with nutrient-capturing capability are consistent with sustainability. If, through a democratic process, this concept is adopted within planning decisions, it is left to engineers and technicians to translate this

[29] He names three other types that are largely self explanatory: the scholarship of *discovery*; the scholarship of *application*; and the scholarship of *teaching*.

principle into technologies that meet the requirements on the ground, taking account of the geophysical context and the choices and concerns of local people.

The thesis is focused on sanitation, so that references to wastewater are concerned with the human-waste fraction only (for example in Section 2.1). Urban wastewater would, in practice, generally include industrial wastewater. The management of industrial wastewater is a vast research topic of its own, and left outside the scope of this work.

I have identified an attitude of 'caring' as necessary for quality performance in sanitation (Section 1.3.1(iii)), an issue that was identified by stakeholders and a range of the literature I have reviewed. While I noted this as an important attribute across all sectors of urban society, including the wealthy urban middle class, I have left discussion of this issue outside the scope of this thesis, and limited myself to addressing this generally rather than explicitly, in proposing a deliberative decision making process (Chapter 5) that has the potential to transform individuals beyond solely self-interested perspectives to increase their capacity for 'caring' (Mansbridge 2003).

That the lack of access to sanitation is a violation of the fundamental human right to dignity, and inconsistent with sustainability, is taken as an uncontested given in the thesis. I have taken the position that it is not necessary to make further arguments about why we need sanitation for all, such as highlighting negative impacts from the *lack* of sanitation, and its gender aspects[30], and have left this discussion outside the scope of the thesis.

1.5 Declaration of values and ideology

My 'journey' into the sustainability discourse led to my realisation that values and ideology have a significant influence on how research is conducted. Previously I had believed it possible to take a broadly scientific and objective view to discover relevant truths about the world in general. Yet the idea of a frame of reference is foundational for the scientist: the world is always observed and interpreted *relative to a frame of reference*, which determines what is observed[31]. That people's ideologies, values and beliefs create the frame of reference from which they experience and interpret the world around them (Eccleshall et al. 2003; Söderbaum 1999) is a natural extension of the idea of a physical frame of reference. Furthermore, ideologies and values encompass preferences or ideals about how the world

[30] Women and girls are particularly badly affected by the lack of sanitation (WHO & UNICEF 2005).

[31] In other words, the physical world can look different when observed from different frames of reference. For example, 'fictitious forces' are experienced in accelerating or rotating frames of reference. Einstein's theory of special relativity exposed startling and counterintuitive differences between observations made from a stationary reference frame and a frame moving close to the speed of light.

ought to be (Eccleshall et al. 2003, p. 2). Thus these ideological frames of reference unavoidably influence a researcher's work.

> "Valuations are always with us. Disinterested research there has never been and can never be … There can be no view except from a viewpoint …
> "Our valuations determine our approaches to a problem, the definition of our concepts, the choice of models, the selection of observations, the presentations of our conclusions – in fact the whole pursuit of a study from beginning to end.
> "In this context, I have argued for … and tried to observe, the necessity in any scientific undertaking of stating, clearly and explicitly, the value principles which are instrumental. They are needed not only for establishing relevant facts but also for drawing policy conclusions. " (Myrdal 1978, quoted in Söderbaum 2000, p. 25)

To reflect, acknowledge and be open about the influence of ideology and values in research are seen as a characteristic of quality in transdisciplinary research (Ravetz 1999; Söderbaum 1999; Wickson, Carew & Russell 2006).

In this section I briefly discuss two aspects of my ideological orientation that I am aware as having shaped this work. I use the term 'ideological orientation' in preference to 'ideology' here, in line with Söderbaum's (2000, p. 39) proposition that the former refers to beliefs "perceived by the person as more or less uncertain", based on "often fragmentary patterns of seeing, thinking and feeling", which may change due to "partly unconscious, partly conscious processes" – in contrast to the more definite, formally articulated and organised beliefs encompassed within an 'ideology'.

My ideological orientation aligns most closely with what Kenny (2003) identifies as *ecologism*. These are the recurrent ideological underpinnings that are held in common amongst the wide spectrum of 'greens' – people with commitments to a socio-economic order consistent with a sustainable future. Ecologism is characterised by a view of humans as co-constituents of a vast and complex ecosphere that they should live in harmony and cooperation with; individuals may live "a meaningful and virtuous life in modern settings" within this larger context (ibid). Furthermore, I believe that governments should play an active or affirmative role in ensuring that all its citizens enjoy a standard of living consistent with dignity and health, and that all should benefit from a nation's economic wealth – beliefs that locate me on the Left side of the spectrum of liberalist ideology that emphasises democracy and the freedom of individuals. I value social development that reflects a productive economy, a clean and healthy environment, and social wellbeing that is not measurable entirely in economic terms. The influence of my ideological orientation is apparent in my choices of particular literatures and engagement with particular discourses and not others in this thesis, although I have made a conscious effort to be fair with those with different ideological orientations.

1.6 Thesis summary and structure

This chapter has outlined the main objective of this research: to explore appropriate conceptual foundations that could guide planning decisions leading to sustainable sanitation. In the next chapter, *Paradigms for delivering urban sanitation in industrialised countries,* I explore the historical context of the development of urban sanitation as it is practiced in industrialised countries. An examination of this history illuminates the background to the form of urban sanitation that many in developing Asian countries desire. The chapter traces the changes in these practices, and ends by examining what the shape of a next phase in sanitation might be if it was guided by a goal for sustainability. It concludes by introducing some of the central ideas of the sustainability discourse that I draw upon in the thesis, that begin to address the first research question:

What intellectual contribution can the sustainability discourse make to provide direction for heading towards sustainability in urban sanitation planning for developing Asian countries?

In Chapter 3, *Approaching urban sanitation in developing Asian countries as a complex problem,* I examine how complex or 'messy' problems such as urban sanitation in developing Asian countries might be addressed. The chapter looks in some detail at using systems concepts as a potentially productive way of learning about messy problems in order to resolve them. Soft Systems Methodology is introduced as a useful tool for this purpose, through an illustrative application to the case of Colombo. The example identifies that a focus on cost recovery can provide a leverage point for addressing the problems in Colombo.

Chapter 4 therefore examines issues relating to cost and cost recovery. One of the concepts that emerged from the Chapter 3 is that how an issue is perceived is central to how it is addressed. This idea is explored further in this chapter, *Cost recovery for urban sanitation in developing Asian countries: an inquiry from three economic perspectives*, where the issue of cost recovery is examined from the qualitatively different perspectives of neoclassical economics, ecological economics and Buddhist economics. It integrates these perspectives into a set of guiding principles around the costs that are incurred and need to be recovered or addressed.

A number of concepts about sustainability that are of relevance to urban sanitation emerge from the preceding chapters. In Chapter 5 I then address the second research question:

How can these concepts be translated into a practical framework for decision-making?

This chapter, *An operational framework for deciding on action*, draws on the deliberative democratic discourse to propose a framework for making planning decisions for urban sanitation within a research-project format.

Assuming that planning decisions are made using the framework in the preceding chapter, or by any other means, Chapter 6 then explores the third research question:

How might planning decisions for sustainable sanitation be implemented: who might be involved and what might motivate them?

It reviews the literature on privatisation and private sector participation, and proposes that the private sector acting within certain boundaries, has a key role to play in partnership with public service providers. A moral framework based on Buddhist economic principles is then proposed, to reinforce behaviour by the private sector aligned with Corporate Social Responsibility, to provide benefits to all – itself, users, society and the environment.

The final chapter, *Conclusions*, draws together the key outcomes of this research. It summarises the arguments and key contributions the thesis makes to the body of 'knowledge', and reflects on limitations and further research that could follow.

2 Paradigms for delivering urban sanitation in industrialised countries

"..with a heightened consciousness of our past and a clearer insight into decisions made long ago, which often still control us, we shall be able to face the immediate decision that now confronts man and will, one way or another, ultimately transform him: namely, whether he shall devote himself to the development of his own deepest humanity, or whether he shall surrender himself to the now almost automatic forces he himself has set in motion …"

Lewis Mumford (1961)

2.1 Introduction

The urban sanitary practices of industrialised countries have great bearing on the practices and the aspirations of developing Asian countries (Section 1.3). The particular approaches to urban water infrastructure that dominate planning in industrialised countries are largely the result of historical circumstances in Europe in the mid-nineteenth century[32]. Thus in this chapter, the history of urban sanitation in Europe is examined, with a view to understanding the factors that have determined past changes in sanitation practices. Following the historical trajectory of changes, I contend that radical change in urban sanitation practices would be the logical conclusion – an argument central to this thesis. The aim of this thesis then is to try to discover the shape of this radical change.

This chapter uses Thomas Kuhn's concept on scientific paradigms (Kuhn 1970) as a theoretical framework to examine the history of urban sanitary practices in Europe. In his landmark treatise 'The Structure of Scientific Revolutions'(1970), he examines patterns in the history of scientific developments. While his thesis is devoted to the scientific community's practice of 'normal science'[33], he observes that developments in other fields of human activity display similar patterns, and that historians of these other fields "have long described their subjects in the same way" (Kuhn 1970, p. 208). The developments in the practices of urban sanitation in Europe – primarily Britain (which wielded the most widespread influence in South and South-East Asia) – are examined here through the lens of Kuhn's theory.

[32] Europe's role as empire leaders during this period meant that cities that sprang up in the New World were modelled on European cities.

[33] 'Normal' or paradigm-based science is defined by Kuhn as "research based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice" (Kuhn 1970, p. 10).

A brief overview of Kuhn's thesis is provided in Section 2.2 to describe the theoretical framework used. The remainder of the chapter links the changes in sanitary practices to this framework. Section 2.3 traces the lead-up to the establishment of the first formal paradigm – water carriage. The pre-industrial-age practices that fit with a pre-paradigm era are described, culminating in the circumstances that led to the 'sanitary revolution'. Next, an overview of the 'sanitary revolution' is given which established centralised piped sewerage based on water-carriage as the paradigm for urban sanitation.

Section 2.4 then reviews the dominant urban sanitation paradigm, and the more recently discovered problems that the paradigm does not solve. Section 2.5 examines a number of emerging approaches that have been advanced in response. A more detailed analysis of the history of change in sanitary practices, correlated to Kuhn's theory, is made in Section 2.6. The chapter concludes by proposing concepts that could potentially define the shape of the radically different successor to the currently dominant paradigm for urban sanitation – which the remainder of the thesis will advance further.

2.2 Kuhn's Proposition

Kuhn has challenged the common portrayal of scientific advancement as a steady progression based on the cumulative acquisition of knowledge through history. Instead, his observations on the historical progress of normal science led him to propose a recurring pattern: "a succession of tradition-bound periods punctuated by non-cumulative breaks" (Kuhn 1970, p. 208). The pattern begins with efforts by the group of practitioners to solve problems that are considered important in their field. When one approach is more successful than its competitors, consensus gradually forms around it. Past achievements form the foundation for subsequent practice and for the education of new students, who then continue in the field's traditions without challenging the fundamentals. A "tradition-bound" period follows, where the paradigm, the accepted pattern or model, "gives form to scientific life" (p. 109). While the theory that forms the basis of the paradigm was accepted because it seemed better than its competitors, "it need not, and in fact never does, explain all the facts with which it can be confronted (p. 17-18). In time, situations arise that contradict the paradigm, which lead to a proliferation of new theories signalling the breakdown of the paradigm. At the same time, mainstream scientists resist the new theories, since they are bound to protect their intellectual investment in the traditions of the paradigm they have received instruction in and have applied to the problems they deal with and built their reputations upon. Kuhn labels the intellectual turmoil that culminates in the transition to a new paradigm as a "revolution", and "the usual developmental pattern of mature science" (Kuhn 1970, p. 12).

Kuhn emphasises that the adherence to a common paradigm is central to the professionalisation of the scientific community. Paradigm-based science enables the

development of scientific language and skills, and a level of detail and precision that can be achieved in no other way:

> "Once the reception of a common paradigm has freed the scientific community from the need constantly to re-examine its first principles, the members of that community can concentrate exclusively upon the subtlest and most esoteric of the phenomena that concern it. Inevitably, that does increase both the effectiveness and the efficiency with which the group as a whole solves new problems." (Kuhn 1970, pp. 163-164)

The paradigm provides a way of viewing the world, and a scientist's interpretation of the world s/he sees depends on what s/he has been trained to see; thus, subsequent to the first scientific paradigm being found, "there is no such thing as research in the absence of any paradigm" (p79). For this reason, "the decision to reject one paradigm is always simultaneously the decision to accept another, and judgment leading to that decision involves the comparison of both paradigms with nature and with each other" (p.77). A once-dominant paradigm has never been rejected on the basis of anomalies and contradictions alone, but because an alternative paradigm has become available to replace it. The "revolution" overthrows the old paradigm and replaces it with the new.

2.3 Leading up to the First Paradigm

2.3.1 The 'Pre-paradigm' Era

Until the nineteenth century, a proliferation of different sanitary practices was evident in cities from the earliest times (Mumford 1961), corresponding to the 'pre-paradigm' period of Kuhn's progression. I identify two parallel threads within these sanitary practices, discussed below. One was an indifference to cleanliness that persisted through the history of cities, so that sanitation and hygiene were, in the main, a neglected afterthought. The other, which co-existed with the first, was the valuation of excretions for maintaining soil fertility as well as other commercial purposes. These two threads, as they related to now-industrialised countries, are discussed below[34].

2.3.1.1 Persistently unsanitary cities:

A reasonable starting point for considering the history of now-industrialised cities, and in particular, the long history of indifference to sanitation in cities, is with Classical Greece

[34] I have relied heavily on Lewis Mumford's "*The City in History: Its Origins, Its Transformations, and Its Prospects*" (Mumford 1961), because it is widely quoted by other authors, and gives a comprehensive account of urban conditions through the history of now-industrialised countries, including discussion of sanitary conditions at each stage.

and Rome[35] which have had a very significant influence on later developments in Europe. Mumford (1961, p. 164) notes that archaeological excavations in Greece have not uncovered any public latrines or any household apparatus for defecation, an observation consistent with Greek dramas and other writings of the Hellenic period. While Rome is famed for its monumental sewers or *cloacae*, they serviced only the wealthy and not those in crowded tenements. Mumford (1961) describes this as "a combination of refined technical devices and primitive social planning", and goes on to describe broader conditions in Rome. For the masses, excreta was mostly stored in covered cisterns placed at the bottom of tenement stairwells for periodic collection by 'dung farmers', although some public latrines were available by day for a fee (Mumford 1961, p. 216). A modicum of urban cleanliness was achieved by displacing wastes from the city to pits on the outskirts of Rome. Archaeological excavations have uncovered seventy-five open pits or vaults where "men and beasts, bodies and carcasses, and any kind of unmentionable refuse, were thrown in disorder"[36] (Mumford 1961, pp. 217-218, quoting archeologist Lanciani).

The progressive deterioration of urban environments as a result of the lack of sanitary arrangements is evident in Mumford's (1961) account of the history of European cities. As long as population densities were low, a degree of laxness could be tolerated. Thus, the early medieval town with open spaces and low population densities, "enjoyed healthier conditions, for all the crudeness of sanitary accommodation … than its more prosperous sixteenth-century successor" (ibid, p. 288). As populations increased, it was not unusual for "a pile of dung" to accumulate in the public areas, "carted away only at weekly intervals" (ibid, p. 288). Conditions became quite bad in some places, as described by the fourteenth century Florentine historian Bruni:

> "some towns are so dirty that whatever filth is made during the night is placed in the morning before men's eyes to be trodden under foot ... It is impossible to imagine anything fouler. For even if there are thousands there, inexhaustible wealth, infinite multitudes of people, yet I will condemn so foul a city and never think much of it." (quoted in Mumford 1961, p. 292)

As the form of European cities changed to include heavy fortifications that accompanied the use of gunpowder and the permanent maintenance of war machinery, sanitary conditions deteriorated; the fixed space within fortifications led to overcrowding with increasing population, while it became more difficult for farmers to collect wastes as farms were pushed farther away (ibid, pp. 359-363). Further changes in cities with the dawning of the industrial age sank urban sanitary conditions to a new low, as the poor and dispossessed

[35] The indifference to cleanliness can be traced ever further to the cities of 3000 BC, where according to Woolley's account of excavations at Ur, house sweepings and rubbish were "flung onto the streets so that the street levels were gradually raised and new houses would be built above the risen level of the street and the thresholds of old houses would sink below" (Mumford 1961, p. 75).

[36] The offensive nature of these pits may be inferred from Lanciani's description of their excavation after a lapse of two thousand years, that exposed "a uniform mass of black, viscid, unctuous matter" with a stench that was "unbearable" (quoted by Mumford 1961, pp. 217-218).

crowded into cities in search of work. An example is Friedrich Engels account of the city of Manchester:

> "… masses of refuse, offal and sickening filth lie among standing pools in all directions; the atmosphere is poisoned by the effluvia from these…" (Engels 1844, quoted by Markham 1995, p. 15).

While unsanitary practices have persisted through the history of European cities, a climax was reached in the industrialising age when conditions became so bad that radical reforms had to be undertaken.

2.3.1.2 Valuation of excretions

The second thread concurrent throughout the history of cities was the valuation of excretions that served to mitigate, to some degree, the deterioration of urban environments described above. The value of excretions in maintaining soil fertility had always been recognised. In early European towns and cities, farmers routinely collected human excrement, to the benefit of both city and farmer (Mumford 1961, p. 290). When the use of the water closet became widespread, farmers cleaned out vaults and cess pools (Goddard 1996). By the early-nineteenth century, an established market for human and other organic waste from towns for use as a natural fertilizer, was in place (ibid). The practice of farmers collecting nightsoil persisted in some cities up to the early part of the 20th century.

Urine held quite a separate value at different times. It was valued by the Romans in the treatment of cloth, and urine was collected in special receptacles for this purpose (Mumford 1961). Urine was used in the synthesis of saltpetre, an essential ingredient in gunpowder that was needed for firearms and for civil services such as rock blasting for roads and canals (Cowen undated). The valuation of urine is evident in the 1626 royal decree of King Charles I, which charged

> "his loving subjects [to] carefully and constantly keep and preserve in some convenient vessels or receptacles fit for the purpose, all the urine of man during the whole year, and all the stale of beasts which they can save and gather together whilst their beasts are in their stables and stalls, and that they be careful to use the best means of gathering together and preserving the urine and stale, without mixture of water or other thing put therein. Which our commandment and royal pleasure, being easy to observe, and so necessary for the public service of us and our people, that if any person do be remiss thereof we shall esteem all such persons contemptuous and ill affected both to our person and estate, and are resolved to proceed to the punishment of that offender with what severity we may." (quoted in Cowen undated)

By the 19th century, several factors conspired to weaken the second thread. Increases in urban population meant that more manure was being created than nearby lands could bear (Mumford 1961). Transporting wastes to farmlands became increasingly difficult, because

of increased distance from cities (ibid). When the use of the water closet increased rapidly from 1778 onwards[37], the difficulty with transportation would have increased further.

When exports of guano and mineral saltpetre from South America commenced, for use as fertilizer as well as making gunpowder (Cowen undated; Martinez-Alier 2005), the valuation of human waste decreased even further. With more 'portable' and convenient alternatives made available, farmers had less incentive to empty cesspools and town middens for manure, leading to accumulating wastes in towns (Goddard 1996).The weakening of this second thread thus escalated the deterioration of urban environments to the crisis proportions that catalysed the sanitary revolution, discussed next.

2.3.2 Establishment of the water-carriage paradigm

Radical 19th century sanitary reforms which led to the revolutionary water-carriage technological solution for the cleaning up of cities are often referred to as the 'Sanitary Revolution'. The scientific, environmental, social, and economic conditions at that time had a critical influence on the way in which the 'sanitary revolution' played out, leading as it did to the water-carriage technology paradigm for urban sanitation. These contextual factors that influenced the shape of 'sanitary revolution' in Britain are discussed below and summarised in Figure 2.1.

The miasma theory of disease exerted a critical influence on sanitary reforms. The miasma theory was the explanation that diseases were caused by inhaling miasmas or disease-causing vapours, and established itself as the dominant medical paradigm for hundreds of years. "'...Almost every fourteenth century savant or doctor took it for granted that the corruption of the atmosphere was a prime cause of the Black Death'" (Markham 1995, p. 6, quoting Ziegler). Documenting and cataloguing odours was a respectable scientific activity (McGranahan et al. 2001, pp. 33-34). Prioritising the speedy displacement of miasma-causing substances away from cities to reduce the public health risk from miasma was a logical conclusion of the miasma theory.

Two environmental factors influenced the choice of water-carriage technology within the sanitary reforms. Firstly, the existence of stormwater drainage canals within early European cities, constructed to prevent flooding of urban areas, allowed them to be recruited for transporting excrements away (Schertenleib 2004a). Secondly, water was abundantly available at this time, because of relatively high precipitation rates in Europe, and relatively low urban populations and thus low water consumption (Schertenleib 2004a). Improving

[37] Although the water closet was invented in 1589 (by English poet Sir John Harrington) it did not gain popularity because of sewer gases backing into the dwelling. It took off once Joseph Bramah modified it in 1778 to include a trap (Laporte 2000; Markham 1995; Mumford 1961)

water supplies to enable its utilisation in transporting wastes was therefore feasible within their planning horizon.

Edwin Chadwick's report on "The Sanitary Conditions of the Labouring Population of Great Britain" (Chadwick 1842) highlighted the social problems faced by the urban poor living in squalid conditions as they crowded into newly industrialising cities. A series of cholera epidemics that ravaged London in 1831, 1848, 1853, and 1866 (BBC 2006; Halliday 2002) focused public attention and resolution for solving the public health problems. Chadwick saw the removal of decomposing wastes that caused "atmospheric impurities" as an urgent public health priority, and argued that:

> "the chief obstacles to the immediate removal of decomposing refuse of towns and habitations have been the expense and annoyance of the hand labour and cartage requisite for the purpose. … this expense may be reduced to one-twentieth or to one-thirtieth, or rendered inconsiderable, by the use of water and self-acting means of removal by improved and cheaper sewers and drains. … refuse when thus held in suspension in water may be most cheaply and innoxiously conveyed to any distance out of towns… " (Chadwick 1842)

Water-carriage technology was particularly attractive because its automation placed it as an advance in scientific and economic terms. Economic growth has generally been equated with the substitution of human energy by other forms of energy (Martinez-Alier 2005). A social function of science has been to support such growth, "improving control over the material world and reducing the need for physical labour" (Checkland 1999, p. 32).

While all of the above factors played a role in making the concept of water-carriage technology desirable, it was the heat wave in 1858 that catalysed the actual introduction of piped sewerage in London (BBC 2006). "The Great Stink", as it became known, "overwhelmed all those who ventured near, or lived by, the Thames – including the occupants of Parliament" (BBC 2006). Parliament passed the necessary legislation to meet the colossal expense of a sewerage system, and by 1865 the central areas of London were connected to the network designed by Joseph Bazalgette (BBC 2006).

A public debate ensued after many sewerage systems had been constructed that Beder (1993) describes as a "struggle between water-carriage technology and dry conservancy methods[38]". The advocates of dry conservancy were concerned about the polluting impacts and the wastage of agricultural nutrients associated with water-carriage. Passionate statements such as "we shall not always be able to rob the soil, and give it nothing in return" expressed the concerns about breaking the nutrient cycle (Sydney Morning Herald 1851, quoted by Beder 1990). Sanitary reformers including Chadwick shared these

[38] Dry conservancy methods refer to the collection storage of wastes without the addition of water, and subsequent collection for use in farms.

concerns, and serious attempts to divert sewage to farms were made in the early stages (Goddard 1996). Insurmountable difficulties associated with dealing with large volumes of wastewater having dilute nutrient concentrations soon led to the abandonment of these attempts (Goddard 1996). Rapidly increasing importation of guano and nitrates from South America since 1840 (Cowen undated; Martinez-Alier 2005), offering a convenient alternative to using human wastes in agriculture, was another critical factor that permitted the abandonment of this practice.

The timing of the debate skewed it in favour of water-carriage technology, since the existence of costly physical infrastructure promotes the lock-in of this technology (Beder 1993). Although Beder (1993) observes that the timing of the debate was a drawback, Kuhn's theory shows why this timing was inevitable. The paradigm of dry conservancy and its implicit principle of using human wastes for maintaining soil fertility was age-old, even if considerably weakened at the time of the sanitary crisis, as noted in Section 2.3.2.2. The explicit use of water-carriage in public sewerage had yet to emerge as a practice, and it was not until the infrastructure was in place and the practice commenced that it could become a candidate for paradigm. Only then could the debate and paradigm revolution take place between water-carriage and dry conservancy.

Yet another paradigm revolution may be seen to have played out alongside the 'sanitary revolution' – one relating to disease epidemiology. The germ theory, as a competitor to the established miasma theory, was proposed by John Snow during the 1853-54 cholera epidemic in London (Halliday 2002). Following the form of Kuhn's scientific revolutions, the germ theory faced initial opposition and gained support gradually over the next decades, to displace the miasma theory as the dominant paradigm. The final cholera epidemic in London in 1866 allegedly "turned the current in the direction of water, and tended to divert attention from the atmospheric (i.e. miasmatic) doctrine" (Halliday 2002, quoting Farr in 1888). Yet Edwin Chadwick (who died in 1890) and Florence Nightingale (who died in 1910), amongst others, remained convinced to the end of their lives that epidemics were caused by foul smells or miasmas (Halliday 2002).

The imagery of the term 'revolution' with its military connotations is particularly apt in describing the sanitary revolution, because, just as in a war, had these contextual factors and their timing been different, the outcome could well have been a different one. Had the germ theory been established at the time of the crisis, for example, it is intriguing to speculate whether the argument for mixing disease-causing pathogenic substances in water might have appeared less persuasive and tipped the revolution in favour of dry conservancy. Or, had alternative fertilizers been unavailable, whether dilution of wastes for water carriage would have been less attractive.

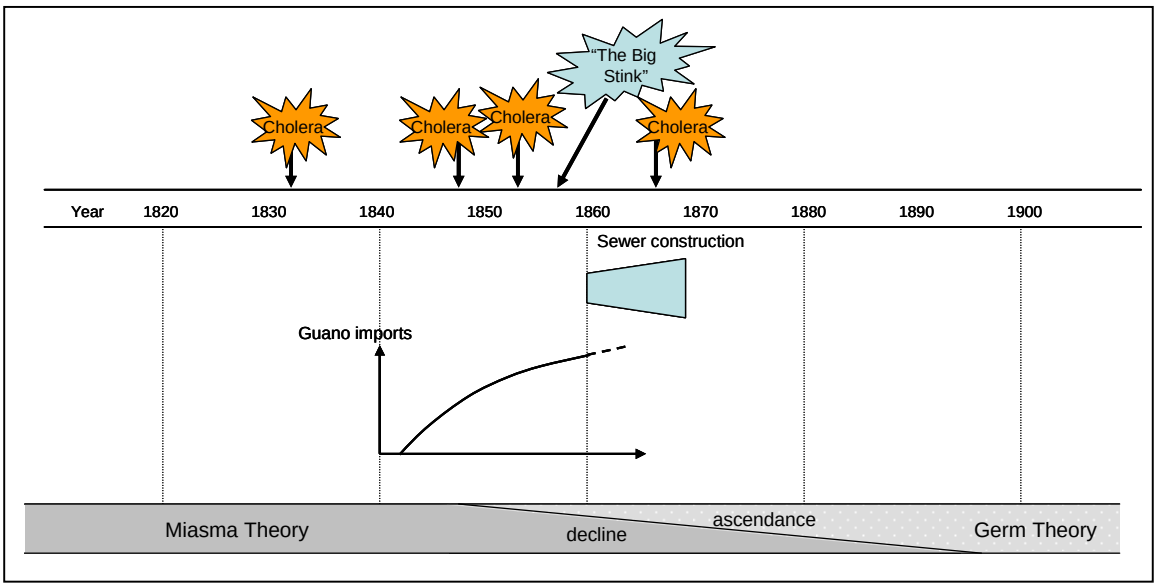

Figure 2.1: Context of the 'sanitary revolution' in Britain

Nevertheless, the sanitary revolution as it did play out marks a turning point in the history of cleanliness in the cities of now-industrialised countries, leading to enormous improvements in public health through the virtual elimination of water-borne diseases, and improved aesthetics and urban amenity. Over the last 200 years, water-carriage has thus become the basis for conventional urban sanitation practice, and the technology desired by governments in developing countries seeking to resolve their urban cleanliness problems.

2.4 The Conventional Paradigm

The achievements of water-carriage technology have formed the foundation for subsequent practice, and for the education of engineering students who then continue in the field's traditions without questioning fundamentals. This is the basis on which, according to Kuhn (1970, pp. 10-11), these practices have become established as the conventional paradigm for urban sanitation.

A centralised approach to service provision has reinforced the water-carriage paradigm for the displacement of human waste from cities. 'A centralised approach' can refer to physical processes where large amounts of material or energy move between a central point and the distributed locations being served, or it can refer to hierarchical administrative processes that manage and control systems via a single 'central' authority. In the case of urban services since the late 19th century, centralisation was the mode for both the physical delivery of services and the administrative control. Large scale centralised infrastructures were designed to transport energy and water to cities from distant places, and to transport wastewater and urban wastes away from cities to distant places. The infrastructures were

administered by vertically integrated government authorities. In this section, I focus on the large-scale centralised physical infrastructures; centralised administration is discussed later (Section 2.6.2).

The development of the water-carriage paradigm took place within a context of the reductionist thinking that had gained prominence by the nineteenth century, consistent with the reductionism within analytic and scientific methods and the increased specialisation within different disciplines (Alvey 2000; Max-Neef 2005). Thus the provision of drinking water, management of wastewater and management of stormwater were reduced into discrete services which were planned for independently, with minimal integration, and often by different agencies. The complementary activity of design and manufacture of water-using appliances that defines end use, which has significant implications for demand management in water supply, was separate again from the provision of the utility services, and delivered by independent commercial entities. The management of onsite wastewater treatment systems was also regarded as a separate activity[39].

2.4.1 Characteristics of conventional sanitation

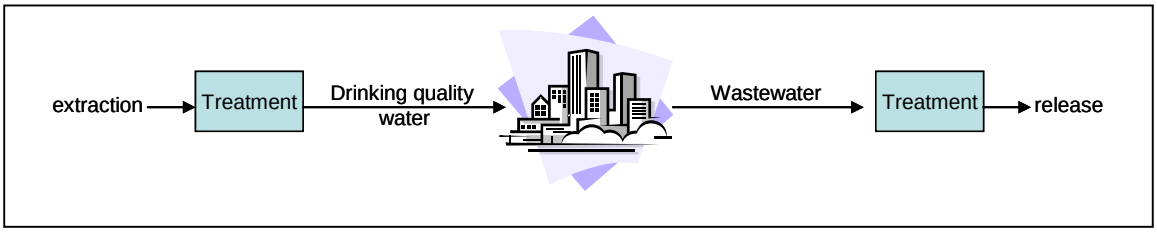

Figure 2.2: 'Once through' linear flow of water from source to sink

The concept of a simple "once through" linear flow (Figure 2.2) from source to point of discharge underlies the design of conventional urban water supply systems, with all water treated to a single (drinking quality) standard and transported via the reticulation network,

[39] Onsite treatment systems, most commonly septic tank systems, were regarded by many as an interim facet of the centralised paradigm, viewed as a short term option until centralised sewerage could be provided. This view of transience may have contributed to the lack of attention given to establishing strong administrative and institutional arrangements to maintain long term performance. In most parts of the world, both industrialised and developing, on-site systems are designed and constructed under the control of local authorities, but ongoing maintenance has been left to property owners who have generally been poorly informed about what is required, and who may not want to take responsibility for the task. As a result, onsite systems experience high failure rates. Lack of consistent monitoring makes it difficult to reliably estimate the magnitude of the problem, while the term 'failure' itself lacks a consistent definition (USEPA 2002). In the USA, estimates of failure rates range widely from below 1% to as high as 70%, while some experts believe failure rates may be closer to 30-50% (Yeager, Ehrhard & Murphy 2006).

to be used once, and the resultant wastewater collected for disposal. A supply-driven logic has underpinned the development of large scale centralised infrastructure (Guy, Marvin & Moss 2001), where sufficient water is collected and treated from distant catchments to meet urban demand, and wastewater systems are sized to collect and transport all the wastewater away from cities.

That large scale centralised infrastructures deliver economies of scale has been an underlying assumption of the conventional paradigm. In addition to the economies-of-scale rationale for such systems, there was a concurrent intention to take over all responsibility and control of sanitation on behalf of the public; as one 1871 British author wrote "the lower classes of people cannot be allowed to have anything to do with their own sanitary arrangements: everything must be managed for them" (quoted by Beder 1993).

The large scale physical infrastructure necessarily places management of centralised urban sanitation systems beyond the capabilities of the public, and within the domain of professionals with specialist training in managing them. In particular, large scale systems are high risk ventures, because failure impacts on large numbers of people. The Australia New Zealand Standard on Risk Management (Standards Association of Australia 1995) defines failure-risk as the product of the likelihood and the consequence of failure; thus risk is managed by *decreasing the likelihood* of failure and/or *decreasing the consequences* of failure. There is little room to manage the consequences of failure of centralised sewerage systems that converge urban sewage towards a single point unless the entire system is restructured; therefore risk management consists almost entirely of decreasing the *likelihood* of failure (Mitchell & Campbell 2004). This entails specialised training for engineers and managers to maintain the performance of the many components of sewerage systems to prevent failures, including redundancies in the system.

Other characteristics that follow from the large scale physical infrastructure, which reinforce its location within the domain of specialist professionals, are the very high costs involved; the longevity of infrastructures and therefore long planning horizons; and the need for treatment of wastewater to prevent receiving waters from becoming a public nuisance. These are explored further below.

2.4.1.1 High capital cost

Infrastructures consisting of water supply pipe networks and sewer networks buried underground, treatment plants, pumps etc reflect a very high capital investment cost, with the network elements representing the highest cost, about ten times more than the cost of the corresponding treatment facilities (Wilderer 2001). According to Wilderer (2001),

> "Estimating the cost of worldwide implementation of centralized [water supply and wastewater] systems, it becomes evident that the capacity of the global money market would not be sufficient to cover the need for investment capital."

The need for high capital investment is not 'one-off' but occurs cyclically. As physical infrastructures age, water and wastewater service providers are faced with a wave of high expenditure, when they require more repairs and maintenance and eventually need replacement. The USA, for example, estimates replacement costs of US$ 250 billion over the next 30 years for drinking water assets alone, and a similar amount for wastewater assets (AWWA 2001). Figure 2.3 below illustrates the trend for projected annual replacement costs, optimised on the basis of repairing or replacing worn assets at the end of their predicted useful lifetimes (AWWA 2001). It illustrates rising annual costs which level off once the majority of infrastructure is replaced. One can expect this to repeat cyclically in another 70-100 years once the current replacements near the end of their lifetimes.

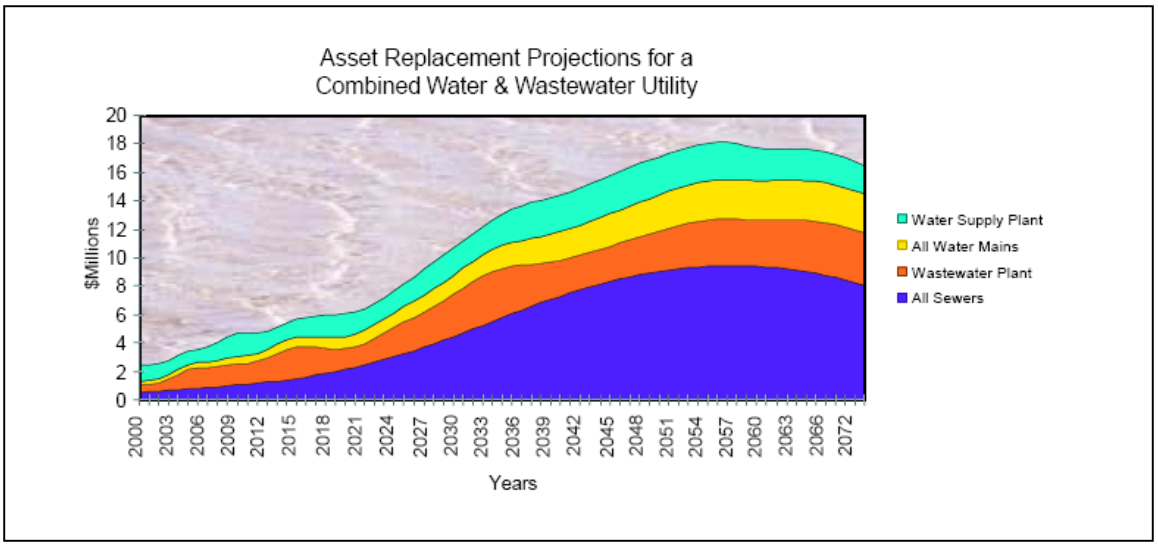

Figure 2.3: Projected annual replacement costs for water/wastewater infrastructure (from AWWA 2001)

2.4.1.2 High operating costs

The ongoing operation and maintenance costs and energy needs are also significant (Otterpohl, Grottker & Lange 1997) for physical sewerage systems comprising hundreds, even thousands, of kilometres of buried pipes, hundreds of sewage pumping stations, and wastewater treatment plants, that also require specialised equipment and vehicles for their maintenance. Sewers are subject to root intrusions from vegetation and various blockages and other damages that require repair and rehabilitation, while pumps are subject to wear and tear; wastewater treatment plants require chemicals and energy and regular maintenance.

Keeping all sewers in good condition through routine regular maintenance is an impossible task because of the expense. Instead, risk management strategies focus on minimising the

probability of failures where the consequences would be most serious. For example, in Britain, systematic rehabilitation is carried out only on the more critical sewers that have the highest economic impacts arising from failure and representing around 20% of sewer assets; the remaining 80% have been rehabilitated only on actual report of failure (Fenner & Sweeting 1999). Recent implementation of Asset Management methods allow the rehabilitation to be optimised using new tools for predictive identification of the assets most likely to fail (Fane et al. 2004; Fenner & Sweeting 1999).

2.4.1.3 Long planning horizons

The scale of centralised sewerage systems means very long lead times between planning and full utilisation. These high cost and long lived systems are planned to meet the needs of projected populations twenty or more years in advance, and investment in projected future capacity is made long before it is needed (Pinkham et al. 2004). This has the disadvantage that the operation of assets such as wastewater treatment plants well below their design capacity in the early years can impact negatively on their operability and performance, increasing their net cost. Additionally, financing such large scale projects that have long lead times to completion, and demographic changes that may occur in the interim, pose further risks (ibid).

2.4.1.4 End of pipe treatment

Treatment of wastewater within conventional sewerage systems is the last step before release to the environment, or conducted at the 'end-of-pipe' of the sewerage network that collects wastewater at a central point. Wastewater treatment evolved as a linear series of processes as the polluting impacts of discharged wastewater were progressively discovered. In the earliest systems, the release of untreated wastewater to waterways outside urban areas soon exceeded the capacity of natural waterways to assimilate the waste, leading to development of the first end-of-pipe treatments prior to release (Schertenleib 2004a). The polluting impacts of suspended solids were identified first, so that simple sedimentation was developed as a 'primary' treatment. In time, microbial and/or chemical treatments to break down or remove organic pollutants were introduced as a 'secondary' treatment, and costly 'tertiary' treatments to remove organic and non-biodegradable inorganic compounds such as phosphates and nitrates were added prior to release to inland waters (Metcalf & Eddy Inc 1991; D.I. Smith 1998). A wide range of technologies has been developed to provide these different stages of treatment. In some cases a final step of disinfection is added to address residual pathogens that survive the treatment process.

Staged treatment allows older treatment plants to be upgraded with additional treatment stages as fresh environmental and public health impacts are discovered– the most recent challenge being endocrine disrupters in wastewater as the use of pharmaceuticals has increased (Schertenleib 2004a). The positioning of wastewater treatment plants on land far

from residential and industrial developments and frequently at the lowest point in the regional landscape (D.I. Smith 1998) is often fortuitous as the land is often relatively inexpensive so space constraints are low, allowing the addition of further treatment stages to existing treatment facilities. This has allowed effluent to meet evolving environmental standards while retaining older treatment facilities and avoiding great costs (Beder 1993).

2.4.2 Benefits and concerns relating to the conventional paradigm

Kuhn noted that in order to rise to the status of a paradigm, "a theory must seem better than its competitors, but it need not, and in fact never does, explain all the facts with which it can be confronted" (Kuhn 1970, pp. 17-18). In drawing a parallel with the practice of urban sanitation, the conventional paradigm has become dominant because it has achieved significant successes, in providing many benefits. Yet it did not solve all of the problems, and is confronted with fresh 'anomalies', or new problems that have subsequently come to light. This section notes the major 'successes' and 'anomalies', grouped as social, economic, technological, and environmental benefits and concerns. The groupings are made for the purpose of structure in communication; they are in fact interdependent facets of sanitation.

Social benefits and concerns

Conventional centralised sanitation has been highly successful in improving public health in sewered cities of industrialised countries, where waterborne diseases have become rare (Wilsenach et al. 2003). Improved health is a significant factor in the economic development of communities (Sanctuary, Tropp & Haller 2005). Further benefits are the contribution to urban cleanliness and amenity surrounding urban water bodies. The automation of waste removal has offered a great convenience to users, allowing them to rely on the service without much thought – or to 'flush and forget'.

Graham (2000) observes that on the other hand, such reliance on centralised networked infrastructures exposes urban society to serious and potentially traumatic consequences arising from any infrastructure collapse. A further anomaly resulting from the invisibility of infrastructure is that users have a low awareness or sense of responsibility for the fate of waste products or to the water cycle (Otterpohl, Grottker & Lange 1997), and often use the system as a "general waste disposal" service (South West Water 2006). The thoughtless disposal of all manner of wastes via the sewerage system can cause blockages and failures and undermine the performance of the system, increase environmental pollution (South West Water 2006), and potentially feedback to society.

Economic benefits and concerns

Conventional centralised sewerage and water supply have underpinned the economic development of industrialised countries (Wilderer 2001), through the health and safety improvements they have provided. However, these have been very costly infrastructures to construct, operate, maintain and rehabilitate. For densely populated urban areas, it has generally been accepted that centralised sewerage is the most cost effective option (USEPA 1997); yet this notion has been called to question. Recent Australian studies show that decentralised systems for densely populated areas can be cost effective relative to conventional systems, when evaluated on the basis of whole of society costs or life cycle costs, and the benefits from effluent re-use are included (Fane & White 2001; Mitchell & White 2003).

Technological benefits and concerns

Centralised management gives professionalised service providers a high degree of control in managing their technical systems (Wilderer 2001). A high level of experience with managing and operating sewerage systems has been accumulated, with new approaches such as asset management further improving efficiency and performance.

The impacts from failure of large scale centralised systems can be very serious, making them high risk systems (Mitchell & Campbell 2004). In order to manage risks, the already high cost systems require even more investment, even so never completely removing the risk. Two examples illustrate this. The first deals with a practical shortcoming of conventional systems where manholes, downpipes and gully traps designed for maintenance purposes, allow stormwater to infiltrate the sewerage system. Stormwater infiltration leads to sewer overflows into nearby waterways and to volume peaks at wastewater treatment plants. To minimise the associated risks, recommended strategies include investment in surplus capacity above dry weather flows and wet weather storages (Heijs, Wilkinson & Couriel 2002), adding further costs. The second example relates to the removal of pollutants from wastewater. Harremoes (1999) emphasised that as systems are designed, "any substance used in society will be detectable in wastewater ultimately", and even though it may be possible to treat water to any desired degree of purity at an ever increasing cost, "no matter how well treated, there will always be a detectable residue." In summary, technological capacity to reduce risks to near-zero levels requires further costly investments on an already costly sanitation system, requiring urban societies even in economically developed industrialised countries to 'live beyond their means' (Mitchell & White 2003).

Environmental benefits and concerns

The cleanliness of immediate urban environments has been vastly improved by conventional sanitation systems. But because this is accomplished principally by the displacement rather than elimination of the potential for harm (McGranahan et al. 2001), there are significant concerns in relation to environmental impacts.

There are two related facets to the concerns arising from the interruption of the nutrient cycle and its mixing with the water cycle, resulting in the linear flow of agricultural nutrients via the food chain to water (Otterpohl, Grottker & Lange 1997). These are the resultant wastage of natural resources, and the polluting impacts of their misplacement.

(i) Wasted natural resources:

A large amount of water is needed for flushing toilets. For example, in the United States, more than 18 billion litres of drinking-quality water is used *per day* for flushing toilets, with a litre of wastes being diluted in nearly 40 litres of water on average (USEPA 2006). Treating large volumes of dilute substances makes modern wastewater treatment costly and complex, and makes recovery of resources difficult (Wilderer 2002). Non-recovery of excreted nutrients is wasteful in a context where non-renewable sources for agricultural nutrients such as phosphorus face the prospect of scarcity (Steen 1998). Urine, in particular, is rich in nutrients in a form directly absorbable by plants making it a valuable agricultural resource (Jonsson et al. 1997). Urine contributes around 75%-87% of nitrogen, 50% of phosphorus and 54% of potassium to domestic wastewater; but being diluted over a hundredfold, it is difficult to recover these agricultural nutrients cost effectively (Larsen & Gujer 1996; Wilderer 2004).

(ii) Polluting impacts

The presence of dissolved nutrients in wastewater leads to nutrient pollution and eutrophication of receiving waters. Wastewater discharges to the ocean are linked with toxic algal blooms, fish kill events (Glibert et al. 2002) and damage to coral reefs. In addition to nutrients from food, the increasing consumption of synthetic chemicals such as pharmaceuticals and pesticides results in these substances' migration to wastewater, and are causally linked to deformities observed in fish and other aquatic life forms (Schaefer 2003; Vos et al. 2000).

Costly advanced treatment is required to reduce the concentration of dissolved nutrients and synthetic chemicals in wastewater (Schaefer 2003). While advanced treatments such as reverse osmosis and membrane technologies are highly effective in treating wastewater to a very high quality, a majority of existing coastal wastewater treatment facilities use older technologies, and protect human health by discharging wastewater several kilometres out to sea. Harremoes (1999) notes that wastewater treatment simply transfers pollution from one

medium to another. There are further indirect impacts such as the emission of greenhouse gases from the significant energy requirements for pumping water for flushing and for transporting sewage, and for water/wastewater treatments.

The problems highlighted above are anomalies with the paradigm that Kuhn refers to – problems that the now well-established paradigm has been only partially successful in resolving. In response, a number of alternative approaches and modifications to the conventional sanitation paradigm have been developed, discussed next.

2.5 Alternatives to the Conventional Paradigm

The gathering momentum of the sustainability discourse over the last thirty years, coupled with practitioners seeking ways to solve problems unresolved by the conventional centralised technology paradigm, has led to a number of alternative approaches to urban sanitation practice being proposed (Cordell et al. 2002; Crites & Tchobanaglous 1998; Fane 2005; Otterpohl, Albold & Oldenburg 1999). Alternative 'approaches' refer to strategies that are guided by certain underlying concepts and perspectives (Fane 2005).

My aim in this section is to demonstrate that it is *possible* for developing Asian countries to consider radically different approaches to centralised piped sewerage, by describing a small selection from the wide range of alternatives that exist. I first identify some broad concepts underlying these alternative approaches, and describe three classes of approaches that are guided by these concepts. Some specific approaches within each class are then discussed, with examples of their implementation.

The numerous alternatives to conventional urban sanitation, viewed within Kuhn's framework, indicate the breakdown of the currently dominant urban sanitation paradigm. Kuhn observed in relation to an accepted theory in normal science, that "breakdown and *the proliferation of theories that is its sign* occurred no more than a decade or two before a new theory's enunciation" (Kuhn 1970, p. 74, emphasis added). Mapping the pattern of developments in urban sanitation to Kuhn's theory suggests that the displacement of centralised sewerage as the dominant paradigm could be the outcome of a protracted paradigm revolution.

2.5.1 Characterising concepts

Four broad concepts may be identified as underpinning the approaches to problem solving evident in the numerous alternatives to conventional sanitation.

2.5.1.1 Thinking in terms of 'systems':

Systems-thinking, or holistic thinking, is one of the key values of the sustainability discourse (Dixon 2004; Mitchell & White 2003; Peet 1992; Robert et al. 2002). It complements reductionism which tackles problem through reducing them into smaller isolated components; systems thinking emphasises the interconnectivity of the components in forming the whole. Systems thinking is discussed more generally in Chapter 3. Here, it is summarised as it applies to technological systems.

The hierarchical structure of system components enables systems thinking to occur at different levels. A defined system may consist of component sub-systems, and be a component of a larger system. In practice, thinking in terms of systems means defining a system with distinct boundaries demarcating what is 'external' and 'internal' to it. This enables a structured approach to maximising efficiencies of processes within the boundaries and to identifying interactions across the boundaries such as exchanges of resources (material substances, money, energy etc). The definition of the system in relation to a problem will significantly influence the solutions that result (Larsen & Gujer 1997). A system may be a region, an economy, or a technological process (Guy, Marvin & Moss 2001).It may be a combination of component systems, for example a system consisting of an urban area and an agricultural area with internal transfer of food between them considered by Otterpohl et al (Otterpohl, Grottker & Lange 1997), or the urban water system consisting of water users, technology and organisations (Urban Water 2002).

2.5.1.2 Integration:

Consistent with systems thinking, integration refers to the holistic consideration of various facets of human activity and resource use that are traditionally treated separately (Wilsenach et al. 2003). For example, urban water planning that integrates the traditionally separate areas of water supply, wastewater, stormwater and end-use delivers synergies that lead to resource conservation (Pinkham 1999). With integration, "waste" products from one purpose are treated as valuable resources for another purpose.

2.5.1.3 Optimising resource flows:

According to Guy Marvin and Moss (2001), managing resource flows is a concept for optimising the use of resources to meet environmental and economic objectives. A systems approach allows for systematic consideration of resources being imported or exported. The least negative environmental impacts occur when resource flows mimic natural flows as closely as possible (Mitchell et al. 2002).

2.5.1.4 'Soft paths':

The term "soft paths" was coined by Lovins (1979) to refer to socio-technical systems and practices that are flexible, resilient, benign, matched in scale for the locality, matched in quality for the end-use and of relatively low technology. They are likely to engage natural systems such as soil and vegetation (Pinkham, Ferguson & Collins 1999), natural cycles, water quality cascade to use water multiple times, and to engage public participation (Wolff & Gleick 2002). The explicit use of soft paths is generally aimed at increasing the overall productivity of resources, for example, the benefit per unit of supplied water (Wolff & Gleick 2002). It is distinguished from conventional approaches by shifting the focus to the provision of *services* rather than commodities that enable those services, for example, the provision of clean clothes and removed excreta rather than the provision of water – that can catalyse innovative ways of providing those services. Soft paths include strategies such as efficient end use of water, conservation and substitution of alternative water supply sources as an alternative to expanding water supply systems (White 1998; Wolff & Gleick 2002), and many water sensitive urban design schemes (Niemczynowicz 1999).

2.5.2 Alternative Approaches

The approaches underpinned by the concepts above may be grouped into three broad classes (with some overlaps), which distinguish themselves from conventional centralised systems as follows:

- **'Improved' centralised systems** use practices that remain within the paradigm of centralised large scale systems, but incorporate systems thinking and integration. Centralised sanitation is viewed as a part of the urban water system, so that planning for sanitation is integrated with other elements of the system, namely water supply, stormwater management, end use and fire fighting.

- **Decentralised systems** largely remain within the concept of water-based sanitation, but treat wastewater close to where it is created (Crites & Tchobanaglous 1998). This emphasis contrasts with conventional centralised systems that prioritise the transport of wastewater away from urban areas (McGranahan et al. 2001).

- **Waste-stream separation at source** aims to optimise resource flows through achieving cyclic flows and recycling where feasible. These approaches prevent the mixing of wastes of different qualities, making it simpler and cheaper to treat and to recover resources (Otterpohl, Grottker & Lange 1997; Wilderer 2004; Wilsenach et al. 2003)[40].

[40] Waste separation at source also reduces the deterioration of entropy, discussed in Section 4.5.1.2.

Below, examples of approaches belonging to the above categories are described, including a summary of benefits and concerns. Though described separately, there can be overlap between the approaches, implying that they may be integrated or applied simultaneously in some cases.

2.5.2.1 'Improved' centralised systems

The approaches in this category utilise the current technological and institutional strengths that have developed around conventional centralised systems, to optimise them to respond to the new challenges. Systemic thinking and integrated planning are aimed at reducing water extractions from the environment and reducing wastewater volumes to be treated and released. Approaches include recycling of treated effluent, and end use demand management.

(a) Recycling effluent:

There are several examples of wastewater treatment plants supplying their treated effluent for industrial processes or cooling, to the mutual benefit of both the wastewater utility and industry, such as Sydney Water's supply to BHP Steel (Hird & Standen 2003; Sydney Water Corporation 2004). The wastewater is treated to meet the standards required by the industry and has generally produced positive outcomes for all, by reducing fresh water withdrawals, increasing security of supply and reducing costs for the industry. Sewer mining is another approach where urban buildings extract wastewater from sewers beneath them, treat it on site using reverse osmosis or microfiltration technology, re-use it in toilets and return the wastewater to the sewer; this allows the wastewater to be used multiple times before reaching the centralised sewage treatment plant (Borton 2003). The cost of the required wastewater treatment compared to the cost of alternative water supplies, the proximity of potential effluent users to the wastewater treatment plants, and their demand for water, determine the relative costs and benefits of these approaches.

Another recycling strategy has been *dual reticulation,* such as the system in Rouse Hill, Sydney (Sydney Water Corporation 2002), where the pipe network for potable water supply is superimposed with a second water supply pipe network supplying water for non potable use that is sewerage effluent treated to a high degree at local treatment plants.

Although all the concepts in Section 2.5.1 are apparent in this approach, including the soft path values of multiple water use and matching water quality to end use, a second pipe network for achieving it makes it more akin to a conventional 'hard path' approach than a soft path. From a broader system perspective that takes into account energy and other resource costs, dual reticulation may not be the most cost effective way to conserve water (White & Fane 2002).

(b) Demand management:

This is an integrated approach to urban water services, which has been implemented in Sydney and elsewhere (Howe & White 1999; White & Fane 2002) consisting of three strategies to reduce demand for water:

> *promoting efficiency* through changing the stock of water-using appliances, using incentive schemes or regulatory instruments;
>
> *promoting conservation*, through leakage reduction in the reticulation network and through pricing and consumer education to achieve behavioural changes; and
>
> *substituting alternative supply sources* such as harvested rainwater or recycled grey water[41] and stormwater for non-potable uses.

Reduced water use through water demand management benefits sanitation because they lead to smaller volumes of wastewater to be managed. While alternative water supply sources may not necessarily reduce wastewater volumes, it improves resource management by allowing greater use of available water sources including grey water.

While I have described water demand management as a strategy for improving centralised urban water systems, it is not contingent upon centralised configurations and may in fact be applied to any scale of urban water use. It is a tool of integrated resource planning (Beecher 1996) that considers reducing demand as an alternative to increasing supplies, by considering a range of options and scales where the marginal cost of saving water is less than the marginal cost of increasing supplies, taking all costs including externalities into account (Wolff & Gleick 2002).

Benefits and concerns relating to 'improved' centralised systems

The principal benefit of 'improved' centralised systems is that they allow utilisation of existing infrastructures and management systems, to which significant investment has been committed (Wilsenach et al. 2003). By improving the sustainability of conventional systems, harm can be minimised in the transition to more sustainable alternative systems.

The primary concern is the high levels of investment that are needed for 'improved' centralised systems, such as a second reticulation network of pipes, which then reinforces the centralised water carriage paradigm, locking cities to perpetuate these practices

[41] See Table 2.1 for definition of grey water.

(Wilsenach et al. 2003). The additional treatment and pumping requires more chemicals and energy to be used, with associated increases in greenhouse gas emissions. Schertenleib (2004) asks of efforts to improve and optimise conventional systems: "are we not optimising the wrong system?" Larsen and Gujer (1997) propose that for sustainability:

> "the search for technological alternatives, more in accordance with the principle of closing cycles and using resource and energy cascades rather than relative improvement of presently available technology, is a research obligation".

2.5.2.2 Decentralised systems

Decentralised systems refer to small or medium scale facilities for collection and treatment of wastewater distributed *within* urban areas, that include institutional arrangements to ensure adequate operation and maintenance (USEPA 2003). Numerous examples of decentralised systems at different scales are available (Dietzmann & Gross 2003; Otterpohl, Braun & Oldenburg 2002; Palmer et al. 1999; West 2003).

While many potential technologies and physical configurations for decentralised systems are possible, the best known decentralised system is the septic tank with soakage pit/leach field. It is a very common perception in both industrialised and developing countries, that the options for urban sanitation is dichotomous – being either centralised sewers or septic tanks (Sundaravadivel, Trivedi & Vigneswaran 2003). In the past, septic tanks were seen as an interim option until centralised sewerage could be provided. It is only in the last decade that the possibility that decentralised systems could provide a long term solution has been seriously considered. The United States Environmental Protection Agency's Report to Congress on Use of Decentralised Wastewater Treatment Systems states that:

> "Adequately managed decentralised wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals ..." (USEPA 1997).

This changed perception has renewed efforts for research and development of technical, ecological, social and institutional requirements to ensure the effective performance of decentralised systems and to minimise their risks (NDWRCDP 2004).

There is broad consensus that ongoing performance of decentralised systems should be monitored and delivered by professionals and not householders, to ensure the "adequate" management the US EPA report noted above as a necessary ingredient for their viability as a long-term solution. It is possible for decentralised systems with centralised management by professionals to deliver services that are as convenient to end-users as centralised sewerage, so "the public simply had no concept that decentralized technology was anything other than real sewer" (Dietzmann & Gross 2003). Otis (1998) proposes that the term 'decentralised wastewater treatment' itself is "a misnomer" because adequate management requires centralised administration and coordination just as conventional sewerage does. Different alternatives for wastewater treatment could be viewed as forming a continuum of technologies and scales, which can under centralised management provide integrated

facility planning that considers all treatment alternatives for the urban planning area (Otis 1998).

For the urban context, decentralised systems in cluster configurations may be preferable to household-scale onsite systems. Dix (2001) suggests that cluster systems are more conducive to implementation of effective management systems than individual onsite systems. Newman and Mouritz (1996) state that new wastewater technologies generally work better and more economically at the community scale. The optimum cluster size for urban settings would depend on the specific criteria to be met (Fane & White 2001; Newman & Mouritz 1996).

An interconnected cluster configuration, such as that implemented in Phelps County, Missouri (Dietzmann & Gross 2003) and schematically represented in Figure 2.4, is a particularly promising configuration for urban areas. Here, each subdivision is serviced by a narrow bore sewer network and local treatment plant (represented by straight lines and rectangles in Figure 2.4). The cluster treatment systems of neighbouring subdivisions are interconnected, providing backup in case of failure of an individual system by allowing diversion of effluent to other systems. This also gives some flexibility with capacity, so that growth in a subdivision need not be held back until expansion of its local treatment facility. Such a configuration enables backup and resilience to manage risks, in addition to having a significantly lower cost and lower environmental impact than a comparable centralised system (Dietzmann & Gross 2003).

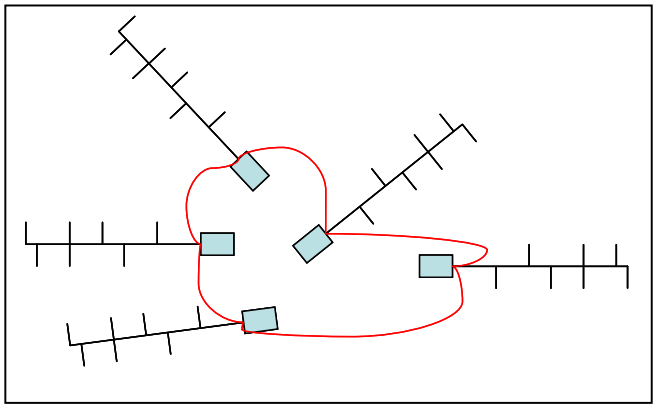

Figure 2.4: Schematic of potential cluster configuration for distributed urban sanitation, described by Dietzmann and Gross (2003)

It is possible that decentralised systems can be designed with their costs comparable to or less than centralised systems. Although centralised systems deliver economies of scale in wastewater treatment, Pinkham et al (2004, pp. 83-97) argue that these can be outweighed by the diseconomies of scale in collection: larger and more dense populations require greater pipe diameters and lengths with costs that would *increase* per-connection costs as the scale of services increases. Case studies of particular decentralised approaches

demonstrate that decentralised services can be cheaper than comparable services with centralised systems (Dietzmann & Gross 2003; Peter-Fröhlich et al. 2003).

Decentralised systems aid the resolution of the new urban challenges by allowing the local integration of social, ecological and technical systems, matched to local characteristics and needs, and facilitating localised re-use (Newman 2001; Newman & Mouritz 1996). Wilderer (2004,2001), Newman (2001), Schertenleib (2004) and others propose that decentralised solutions are the essence of the solution to the urban sanitation dilemma in developing countries, in preference to costly conventional centralised systems that appear unaffordable even to wealthy industrialised countries (AWWA 2001, p. 19).

Benefits and concerns relating to decentralised systems

Decentralised sanitation systems can be cheaper and better suited to some contexts compared to centralised systems, and are generally more resilient and adaptable, and more easily integrated to create synergies with other elements of urban services. The typical modular nature of decentralised technologies allows installations to be sized for present populations, with the ability to add capacity as it becomes needed (Pinkham et al. 2004). Smaller scale systems generally take shorter times to design, gain approvals, raise finance and build (Pinkham et al. 2004), so they are able to respond faster to urgent sanitation needs in rapidly developing cities such as in developing Asian countries. Integrating wastewater technology with the natural environment is well suited to local decentralised systems (Newman & Mouritz 1996), allowing more 'soft path' approaches. Service disruption from a disturbance or failure of a decentralised system affects a smaller population compared to a centralised system. While a large number of decentralised systems could be affected by an extensive disturbance, making it costly and time-consuming to restore services, services can be restored progressively because decentralised systems are often simpler and quicker to repair or replace[42].

The concerns are mainly related to institutional arrangements for managing decentralised systems. Management of large numbers of dispersed systems with a number of different owners is complicated and therefore need new procedures and regulations. The poor public perception created by an inadequate performance history of onsite systems needs to be overcome. There is little available long term data on performance (Fane et al. 2004), making it difficult to design management systems. Decentralised systems also have a more complex range of risks in comparison to centralised systems (ibid), including high sensitivity to user behaviour.

[42] For example, wastewater engineers repairing onsite systems following Hurricane Katrina in the USA, while recognising the enormity of their task, speculate how much more difficult and prolonged the repair of centralised systems would be in this context (Rafter 2006)

2.5.2.3 Waste stream separation at source

The objective of achieving cyclic flows of resources through source separation of different fractions of waste may be achieved with either water-based (wet) sanitation or waterless (dry) sanitation systems. For wet systems, the broad approach is to keep the different fractions of domestic wastewater separate to optimise the recovery of water and raw materials potentially including fertilizer and energy (Wilderer 2004). 'Dry' systems aim to minimise the mixing of water, thereby conserving water and facilitating nutrient resource recovery. At the simplest level, diversion of urine can achieve significant benefits with either wet or dry systems. Ecological sanitation as an approach to dry sanitation, and Household Centred Environmental Sanitation (HREC) as an integrating approach to waste management, are other examples of the concept of waste stream separation at source. These alternatives are discussed below.

Separation of Wastewater Fraction:

The different fractions of wastewater in wet sanitation systems have very different characteristics, summarised in Table 2.1 below (Wilderer 2004).

Wastewater fraction	**Characteristics**
Wastewater containing faeces and urine (black water):	Pathogenic, rich in organic material and rich in inorganic nutrients
Wastewater containing only faeces (brown water):	Pathogenic, rich in organic material and some nutrients
Wastewater containing mainly urine (yellow water):	Generally sterile except of a few specific pathogens (Feacham et al. 1983), it is rich in inorganic nutrients.
Wastewater from laundry and bathroom (grey water)	Mainly diluted detergents (Wilderer 2004), but could also contain varying amounts of a wide range of substances – faeces from nappies, hair dyes, household chemicals, solvents etc
Wastewater from kitchens (green water)	Mainly dilute organic material from food residues, oil, and grease, and detergents

Table 2.1: Characteristics of wastewater fractions

This calls for different treatments for safe handling and return to the environment of the different fractions. For example, 'black' water and 'brown' water (as defined in Table 2.1) are high in pathogens and need to be sanitised, while their organic content is suited for

producing biogas if kept sufficiently concentrated. Grey water may be treated using biofilm methods to produce water suitable for non-potable use (Otterpohl, Albold & Oldenburg 1999; Otterpohl, Grottker & Lange 1997). Several pilot settlements such as Flintenbreite in Lübeck, Germany (Otterpohl, Grottker & Lange 1997) demonstrate the use of vacuum toilets and vacuum sewers to collect 'black' water, treated by co-digestion with other household organic wastes to generate biogas; grey water is treated in constructed wetlands. Comprehensive Decentralised Sanitation And Re-use ('DESAR') based on source separation of wastewater fractions can require significant changes in the socio technological arrangements for water supply and sanitation (such as in Wilderer (2002; 2004).

Urine Separation:

Urine separation, or diversion of urine at the toilet, may be incorporated into centralised or decentralised sanitation systems (Larsen & Gujer 1996; Larsen et al. 2001; Lienert et al. 2003) or dry toilets (Esrey et al. 1998). The potential for using urine in agriculture could be quite large; Jonsson et al (1997) estimated that in Sweden, the annual production of human urine was equivalent, in terms of nutrient content, to 15-20% of the mineral fertilizers used in 1993, and is superior to mineral fertilizer in terms of heavy metal contamination, particularly cadmium. It can partially replace conventional phosphorus fertilizer, which is expected to become scarce in the future as the finite mineral rock from which it is processed runs out (EcoSanRes 2005; Lienert et al. 2003; Tidåker 2003), as well as nitrogen fertilizer, which is energy intensive to synthesise (Tidåker 2003).

Excluding urine from the wastewater stream can result in significant benefits[43]. Urine is the most significant source of inorganic compounds in wastewater (Larsen & Gujer 1996), and its exclusion would reduce the amount of energy or chemicals needed for wastewater treatment, and thus reduce a significant fraction of the costs for tertiary treatment (Wilsenach & van Loosdrecht 2003). In places where no tertiary treatment of wastewater is performed, keeping urine out of wastewater would reduce residual nutrient pollution and eutrophication of the receiving waters. Urine can be diverted at source using specially designed divided toilet bowls which can save up to 80% of water used for flushing (Czemiel 2000; Larsen et al. 2001).

Larsen and Gujer (1996) proposed that for centralised sewerage systems, separated urine could be stored in onsite tanks and remotely released, timed to create a urine-rich wave of wastewater reaching treatment plants. The urine-rich wastewater would have treatment especially designed for nutrient recovery, enhancing the efficiency of treatment processes.

[43] This discussion does not take in to account the cost of diverting urine.

This system is being trialled as part of the Swiss NOVAQUATIS project investigating the feasibility of wide application of urine separation (Larsen et al. 2001; NOVAQUATIS).

A range of pilot scale studies from Europe demonstrate urine separation in decentralised systems (Czemiel 2000; Fittschen & Niemczynowicz 1997; Hanaeus, Hellstrom & Johansson 1997; Jonsson et al. 1997). In many cases urine is stored in tanks for a minimum of six months, long enough to destroy any pathogens[44] (Czemiel 2000). The tanks are emptied periodically and transported for direct agricultural reuse (Czemiel 2000; Hanaeus, Hellstrom & Johansson 1997; Jonsson et al. 1997) or for processing into dry fertilizer. This configuration could also be used to significantly reduce potential nutrient pollution from centralised systems that have no tertiary treatment stage for nutrient removal from wastewater, such as many coastal cities that discharge wastewater to the ocean, and cities in developing Asian countries. These studies show that the success of technical systems is crucially dependent on proper design and installation of hardware and on user behaviour (Fittschen & Niemczynowicz 1997; Hanaeus, Hellstrom & Johansson 1997).

Ecological Sanitation:

Ecological sanitation (ecosan) refers to a range of dry and 'small flush' sanitation systems described by Winblad & Simpson-Hébert (2004) with the objective to "sanitize and recycle". Ecological sanitation, or Ecosan, is founded upon three principles:

- preventing pollution rather than attempting to control pollution after causing it;
- destroying disease causing pathogens in urine and faeces; and
- using the safe sanitised products for agricultural purposes (Winblad & Simpson-Hébert 2004, p. 4).

These three principles contrast with the approach of conventional sanitation which uses "dilution as the solution to pollution" (Wilsenach et al. 2003). Ecosan configurations may include urine separation, exemplifying Uno Windblad's slogan for ecosan: "Don't mix! Don't mix urine and faeces! Don't mix human excreta and water!..." (Schönborn 2000). However, ecosan does not always include urine diversion, but is configured to suit the situation and meet its objectives above.

For ecological sanitation in urban areas, Winblad and Simpson-Hebert (2004, pp. 13-15) recommend a two stage process: primary processing onsite, to contain faecal material and reduce its weight and volume to facilitate transportation, and secondary processing at an eco-station offsite, to sanitise faeces for safe return to the soil. Containment at the primary processing stage can reduce the number of pathogens, aided by strategies such as long

[44] Although urine is largely sterile (Feacham et al. 1983), precautions are taken against possible entry of pathogens due to infection or from external contamination.

storage time (for 6-12 months), dehydration (by addition of dry materials or soil) and increased pH (by addition of ash or lime). The secondary processing may consist of high temperature composting, co-digestion with other organic waste including biogas production, incineration or carbonization, and storage for up to 2 years (ibid).

The relationship of the ecological sanitation concept with the water cycle and nutrient cycle is illustrated in Figure 2.5. It locates an ecosan household (represented by shaded boxes for its water using areas – toilet + kitchen + bath/laundry), within the blue and green water cycles[45] and nutrient cycles, and demonstrates the cyclic flow of resources.

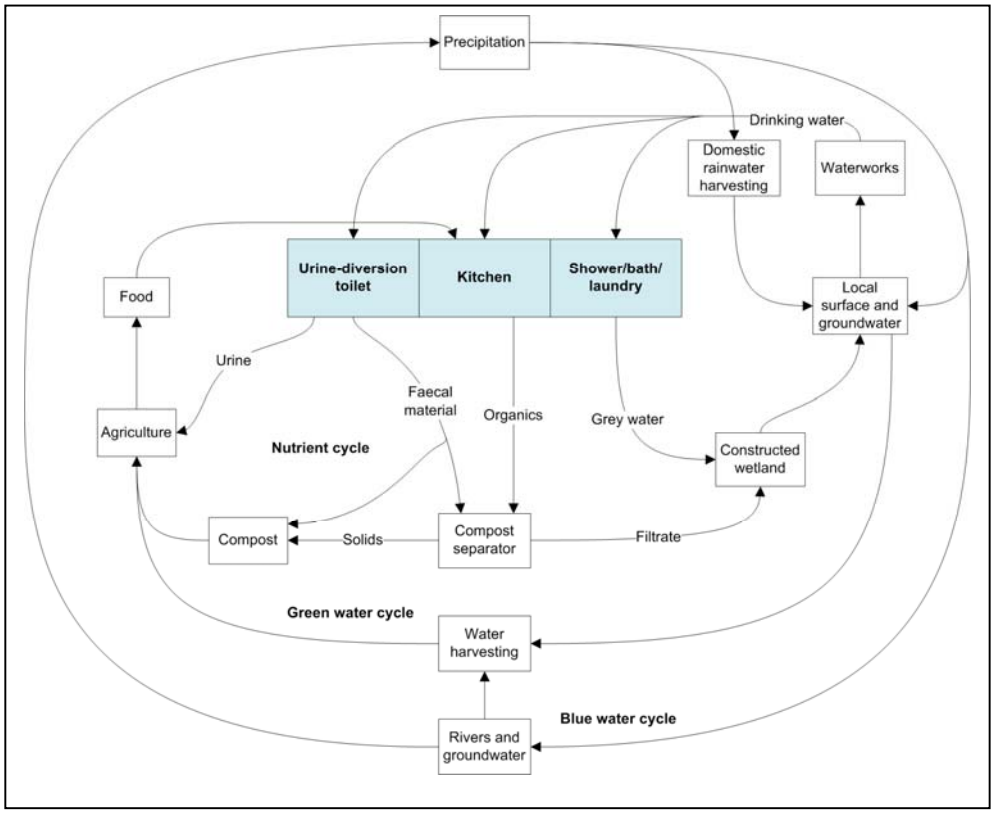

Figure 2.5: An ecosan household located within the nutrient cycle and water cycle (based on EcoSanRes 2005)

[45] The 'blue water cycle' is the cycling of rainfall that runs into rivers and oceans and recharge groundwater; the 'green water cycle' is the movement of water as soil moisture and vapour from evaporation and transpiration by vegetation. Both cycles need to be considered for a complete account of water balance (Falkenmark & Rockström 2006).

The interaction of ecosan systems with the energy system and transport system are not shown in Figure 2.5. The energy requirements are determined by the nature of the technology: 'high tech' systems such as the Japanese Bio-lux (Bio-Lux 2003) would require significant energy for drying and mechanical mixing; the Australian Biolytix vermiculture system has relatively moderate energy needs for pumping (Foley, Kasper & Cameron 2004); while 'low tech' systems such as the Vietnamese double vault system (Winblad & Simpson-Hébert 2004) have low energy needs. The transport requirements depend on the distance to secondary processing units and locations for agricultural reuse.

Household Centred Environmental Sanitation HCES:

In a different approach to source separation, HCES aims to minimise the dilution and mixing of wastes, including household wastes, by addressing sanitation within the smallest practicable domain, beginning with the household (Schertenleib 2004a). In this bottom-up planning approach, waste-producing imports are minimised and reuse is maximised within each domain, and only waste that cannot be utilised within the domain is transferred to the next smallest domain. The domains progress from the household as the smallest domain, and increasing in size, for example to the neighbourhood, local government zone, district government zone, and national government zone, as illustrated on the right side of Figure 2.6 (Eawag 2005), or some other means of zoning..

The approach is guided by the Bellagio Principles (Eawag 2005, p. 40), which place meeting human needs at the household level at the centre of the approach. The principles prioritise the facilitation of human dignity, quality of life and environmental security; good governance that ensures decision making that involves all stakeholders including consumers and service providers; managing waste holistically within an integrated system comprising water resources, nutrient flows and waste management processes; and the resolution of environmental sanitation problems at the smallest size practicable, with wastes being diluted as little as possible. The guiding principles of HCES are consistent with low energy 'soft path' approaches.

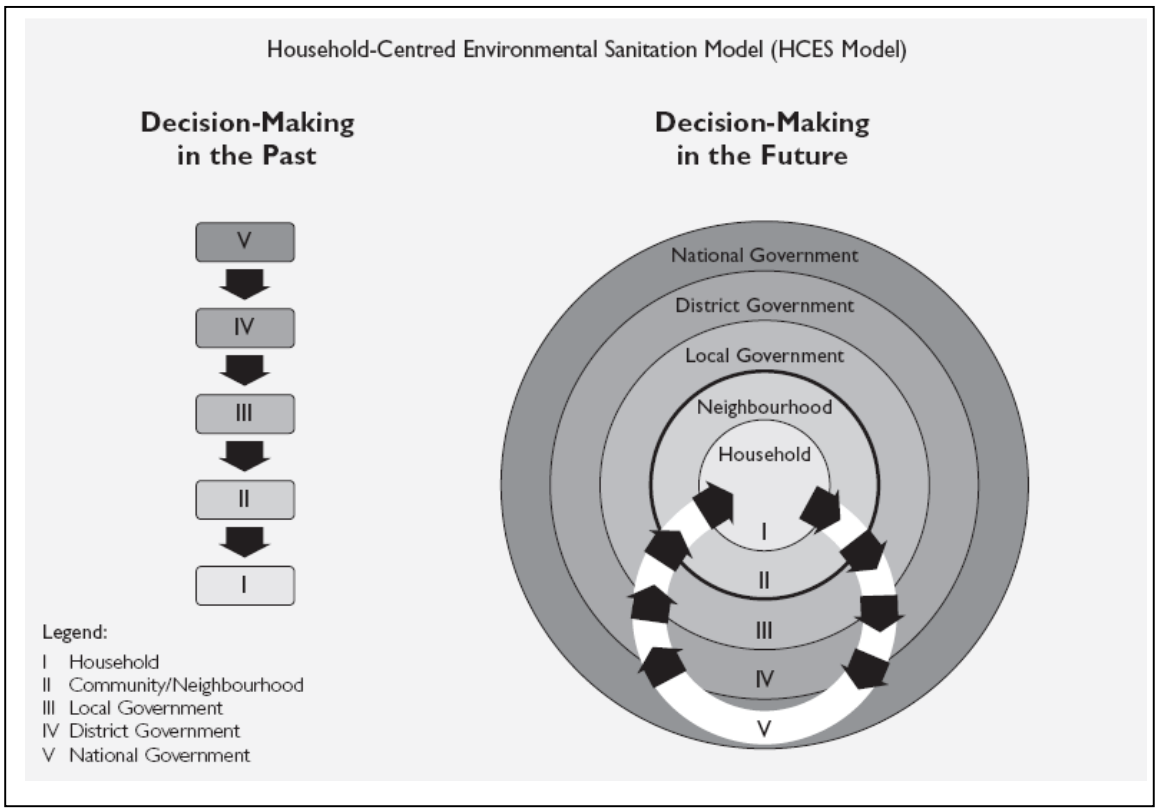

Figure 2.6: Household Centred Environmental Sanitation model for decision making and conventional' top-down' decision making (Eawag 2005).

While other models might include a similar concept of domains, I see the uniqueness of HCES in its quest to *holistically deal with* waste in the smallest domain, and transferring it to the next higher domain if and only if it cannot be dealt with in the smaller domain. Other models place much weaker emphasis on actively seeking to treat and deal with wastes within a domain *before* seeking to transport them across the domain boundary to the next domain[46].

[46] For example, the widely used 'strategic sanitation' concept proposed by Wright (1997), proposes an allocation of costs as follows:
"• Households should pay for most costs for on-site facilities, such as bathrooms, on-site sewer connections, and septic tanks.
• Residents of a block or neighborhood should collectively pay costs of transferring collected waste to the boundaries of their block or neighborhood (and treating the groups' waste *if a facility exists*).
• Residents of a city should collectively pay additional costs of collecting waste from neighborhoods and transporting these to the boundary of the city (and treating the cities' wastewater)."
(UNEP/WHO/HABITAT/WSSCC 2004, quoting Wright 1997. Emphasis added.). It appears to consider treatment within a domain only "if a facility exists" rather than proactively exploring options for treatment before considering transport out of the domain.

Benefits and concerns relating to waste stream separation at source

The approaches of source separation of waste address sustainability by reducing the loss of low entropy matter-energy which is the ultimate resource that sustains life on earth (Daly & Farley 2003, p. 38), and by providing potential economic, environmental and social benefits relative to conventional sanitation. It offers economic savings, in terms of avoided costs for wastewater treatments, avoided costs from saving significant volumes of flushing water, and avoided foreign exchange expenditure by reducing the need for imported fertilizers. It reduces environmental impacts by reducing nutrient loading of receiving waters and maintaining soil fertility. Potential social benefits arise from local employment and support for urban agriculture, and the potential of urine separation to support large scale organic farming (Larsen & Gujer 1997), and the potential to tailor approaches to be affordable to the communities served, whether high or low income.

Significant concerns and barriers to implementation exist, arising from both the lack of data and experience with source separation and the re-use of waste in agriculture, and the lack of supportive institutional arrangements and legal frameworks . In many of the pilot schemes using this approach to sanitation, the lack of experience and knowledge of systems led to improper installation and poor performance (Fittschen & Niemczynowicz 1997; Hanaeus, Hellstrom & Johansson 1997). The systems are very sensitive to user behaviour, so user education and acceptance need development (Pahl-Wostl et al. 2003). Changes to regulation are required to allow reuse of urine in organic farming (Lienert et al. 2003). And a market for urine based fertilizer (Lienert et al. 2003) and human excreta based fertilizer has to be created, coupled with ensuring consumer education, acceptance and satisfaction (Pahl-Wostl et al. 2003). Retrofitting existing facilities could face a significant cost barrier.

Although excreta have been used in traditional agriculture for millennia, there are many gaps in knowledge regarding the use of urine in modern agriculture. Thus ongoing monitoring and evaluation of the performance of urine based fertilizer (Tidåker 2003), the safety for use in food production, and the long term impacts of agricultural re-use (Maurer, Schwegler & Larsen 2003), are necessary. Further research on the impacts of micropollutants in urine from pharmaceuticals is also needed (NOVAQUATIS 2004). The unknowns act as barriers to implementation; the lack of implementation then prevents the accumulation of knowledge of these systems.

2.6 An Analysis of Urban Sanitation Practices

In this section I propose a taxonomy for sanitation in cities around the world based on the trends in urban sanitation as manifest in Europe. The historical practices described in the preceding sections may be broadly categorised into different *stages* in terms of technology, institutional arrangements, and roles and responsibilities. Firstly, I demonstrate that these stages map rather neatly onto the stages in a typical Kuhnian scientific revolution. At the same time, I contend that these historical 'stages' of Europe correspond to different 'states' of urban sanitation in the *contemporary* world, providing a classification system or taxonomy. In this broad generalisation, I do not suggest that the practices in all European countries have moved en masse through these stages, or that it encompasses the diverse, complex and subtle shifts in different contexts. Rather, the analysis offers a simple thinking tool.

In what follows, I consider the stages in technological practice and in institutional arrangements separately, even though they are closely linked, because the strength of their linkage varies widely.

2.6.1 Stages in technological paradigm

The trajectory of urban sanitation practices of Europe (Sections 2.3-2.5) may be segmented into five distinct stages: locally utilised, unmanaged, centralised, neo-centralised and emergent[47]. The segmentation provides the taxonomical categories for the technological status of urban sanitation around the world, as summarised in Table 2.2.

Locally utilised sanitation:

The *locally utilised* sanitation stage corresponds to the period up to medieval times in Europe, when early cities were small in terms of population and geographic area, and able to retain village practices of gathering animal and human dung to increase the productivity of surrounding agricultural lands. This stage of the pre-paradigm era (Section 2.3.1) corresponds to the period when the valuing of excretions adequately compensated the unsanitary housekeeping practices.

A multitude of mainly crude technological configurations and practices comprised this stage (Mumford 1961, p. 288). Small population densities and access to open lands

[47] This is an extension of a proposition first made by White (2005), and developed further by Abeysuriya, Mitchell and White (2007).

compensated for poor housekeeping and the laisse faire attitude towards sanitation and hygiene, preventing dire health consequences (Markham 1995; Mumford 1961, p. 164).

Water supplies were local – drawn from groundwater or nearby rivers, and were valued because human effort was needed to collect it. Thus, society placed an implicit value on both water and excrements in the maintenance of soil fertility.

Unmanaged sanitation:

This stage corresponds to the period of rapid deterioration of sanitary conditions in the pre-paradigm era, characterised by increasing urban populations and urban encroachment into open lands. This stage reflects the weakening of the thread of valuing excretions and its mitigating effect on the persistent uncleanliness of cities.

While, like the *locally utilised* stage, a range of sanitation practices were in place, the uptake of the water closet later in this stage exacerbated the situation in cities, retaining 'foul waters' within urban confines. Some private sector provision of urban water services was available to wealthier households: private water supply services, (Budds & McGranahan 2003; Seppälä, Hukka & Katko 2001), private collection of sewage, private fire fighting services. The majority however were left to their own devices. The lack of adequate arrangements for dealing with waste characterise the *unmanaged* stage.

Centralised sanitation:

The stage of centralised sanitation, as detailed in Section 2.4, is characterised by the technocratic solution of large scale piped sewerage. It reflects the take over of important utility functions of water supply, sanitation, and fire fighting, away from the limited private sector providers to government. Because of its historical impact, centralised sanitation is associated with economic development, improved public health, improved urban cleanliness, fire protection and flood mitigation (through stormwater systems). It is also associated with high financial investment and moderately high per-household cost.

Neo-centralised sanitation:

The stage of neo-centralised sanitation corresponds to the "improved centralised" approaches discussed as alternatives to the centralised paradigm (Section 2.5.2.1). It reflects a continued commitment to the centralised paradigm, modified to resolve the current problems. Because it is a new twist on the centralised approach, often involving further investment in large scale technology, and a new priority for reducing negative

environmental impacts, I have labelled it as 'neo-centralised'[48] (Abeysuriya, Mitchell & White 2007).

The early *neo-centralised* stage had more anthropocentric concerns which were addressed through moves such as constructing long outfalls to release sewage far from the coastline into the ocean rather than rivers, to reduce impacts as experienced by people. The more recent stages of this *neo-centralised* period have seen the progression of end-of-pipe wastewater treatment to advanced treatment and re-use in dual reticulation networks. Because it resolves the problems through additional investments to the centralised paradigm, this stage is associated with a high per-household cost for services.

Emergent sanitation

This stage is characterised by the alternative approaches that do not necessarily remain committed to centralised technology, instead reflecting a philosophical commitment to sustainability from first principles. This collection of practices has been labelled as the *emergent* stage, because of its integral connection with systems thinking[49], as well as for its descriptiveness as a fresh approach emerging or coming into existence (Abeysuriya, Mitchell & White 2007).

This technological stage takes an integrative approach to urban water services (water supply, sanitation, stormwater management), and responds to system limits and risks. The *emergent* stage for urban sanitation includes distributed wastewater treatment and reuse at different scales, and integration with other urban infrastructure services – water supply, stormwater management, energy, waste management and transport. It reflects a fundamentally different way of thinking in relation to urban water and sanitation service provision, replacing a 'predict and provide' or supply-driven approach with an 'end-use, integrated resource planning approach' (Mitchell & Campbell 2004). It provides many opportunities for the private sector to participate, with regulatory oversight (Chapter 6).

With respect to technological practice in sanitation, the key features of each historical 'stage' in Europe, or alternatively, each category of more contemporary states of practice worldwide, is presented in Table 2.2. I have mapped the progression of historical stages

[48] This label is also a play on words, because of its link with neoclassical economics and the world view held by many of its followers, that technological solutions can be found to solve any environmental problem (J.W. Smith, Lyons & Sauer-Thompson 1999).

[49] A key characteristic of complex systems is that, as a whole, they exhibit *emergent* properties that are not properties of the components they comprises of, but emerge from the hierarchical interaction of the components in forming a complex whole (Checkland 1981). Complex systems will be discussed further in the next chapter.

onto periods in paradigm development as proposed by Kuhn (1970). In this mapping, the self-sustaining practices within the *locally utilised* stage correspond to a period of 'equilibrium', where conditions were tolerable and could continue without disruption. The dreadful sanitary conditions of the *unmanaged* stage corresponded to a 'crisis', where the insufficiency of past practices becomes evident. Kuhn argues that crises are "a necessary precondition" for the search and emergence of new solutions and theories (Kuhn 1970, pp. 66-76). It was the sanitary crisis of industrialising Europe that catalysed the sanitary revolution and resulted in the emergence of water-carriage as a solution. The *centralised* stage coincides with a period of *resolution*, where centralised piped sewerage resolved the problems highlighted by the crisis and established itself as the technological paradigm for urban sanitation.

The discovery of various new problems (Section 2.4.2) indicates trouble with the centralised paradigm. Kuhn describes 'anomaly' with respect to scientific theories as; "recognition that nature has somehow violated the paradigm-induced expectations…[which] closes only when the paradigm theory has been adjusted so that the anomalous has become the expected" (ibid, pp. 52-52). I have thus associated the *neo-centralised* stage with 'anomaly', where the centralised paradigm is adjusted to resolve problems. Yet I suggest that the complexity of these adjustments, that demand even more financial and material resources than the centralised paradigm, would not lead to a long term state of resolution. I compare this with the complex adjustments Kuhn associated with other anomalies, where the sheer complication of the corrections indicated a crisis with the paradigm[50]. I have connected the alternative approaches of the *emergent* stage as the lead-up to a paradigm 'revolution' for sanitation that could see the centralised sewerage paradigm replaced.

[50] One of Kuhn's examples (pp. 68-69) describes the Ptolemaic system in astronomy as working admirably in explaining many astronomical position changes, which developed into a complex system of adjustments to eliminate discrepancies. The adjustments did not however eliminate all inaccuracies, and eventually turned into a monstrously complicated system. The idea that systems should not be unnecessarily complicated, such as conveyed by 'Occham's Razor' (Checkland 1999, p. 35), led Copernicus to seek an alternative explanation: "no system as cumbersome and inaccurate as the Ptolemaic had become could possibly be true of nature" (Kuhn 1970).

PARALLEL WITH KUHN'S PATTERN OF PROGRESS IN 'NORMAL SCIENCE'	Pre-paradigm		Conventional Paradigm		Transition
	Equilibrium	Crisis	Resolution	Anomaly	'revolution'

'TECHNOLOGY' CATEGORY→	**Locally utilised**	**Unmanaged**	**Centralised**	**Neo-centralised**	**Emergent**
APPROACH TO SANITATION →	➢ Collection and use in agriculture	➢ Accumulation	➢ Large-scale water-based transport ➢ Treatment before 'disposal' or limited recycling	➢ Large-scale transport, recycle water	➢ Proliferation of approaches, various scales
DRIVERS→	➢ Sustaining agriculture	➢ N.A.	➢ Public health	➢ Public health ➢ Environment protection	➢ Sustainability
CONTEXTUAL FACTORS →	➢ Small urban size and populations ➢ Close proximity to agriculture	➢ Rapid population growth	➢ Public health concerns ➢ Rapid economic development ➢ Abundant water	➢ Water scarcity ➢ Environmental concerns	➢ Concerns about sustainability
APPROACH TO URBAN WATER →	➢ Local water resources	➢ Piped water	➢ Piped water	➢ Piped water ➢ Efficiency ➢ Conservation ➢ Alternative water supplies	➢ Piped water ➢ Efficiency ➢ Conservation ➢ Alternative water supplies

Table 2.2: Categories of technological states, and link of historical stage to Kuhn's sequence

2.6.2 Stages in institutional arrangements

The evolution of institutional arrangements for managing urban sanitation may similarly be conceived as a progression through several distinct stages, as discussed below, leading to a taxonomy illustrated in Figure 2.7. Institutional arrangements here refer to formal and informal rules, organisations and power relationships (Söderbaum 2000, p. 22) associated with arrangements for the provision of urban sanitation.

Community norms

During the *locally utilised* stage, sanitation was implicitly placed within the nutrient cycle: sanitation and soil fertility were managed as an interconnected activity, needing cooperation between householders and farmers. I propose that arrangements between householders and farmers during this period complied with 'community norms' – a code of conduct without coercion from a higher authority. As long as urban communities were small and interdependent on each other, community norms can adequately protect the social fabric. Traditional communal water management systems were governed by community norms (Dasgupta 1997). Since references to the first 'laws' relating to sanitation do not appear until later, discussed next, it may be reasonably surmised that social or institutional arrangements for sanitation relied on community norms during this period.

Crown decrees

As urban sanitation deteriorated to the *unmanaged* stage between the latter medieval period and early industrialisation, attempts to contain or rectify unsanitary conditions consisted of the passage of heavy-handed laws and 'crown decrees'. These laws implicitly blamed citizens for the bad conditions, and were designed to coerce them into taking responsibility through fear of penalty for not abiding by sanitary laws and decrees.

I submit that 'crown decrees' would have done little to improve conditions without the simultaneous provision of appropriate infrastructures or organisational arrangements to support citizens in their compliance. The first sanitary laws in England, introduced in1388, forbade throwing rubbish into ditches or waterways (Mumford 1961, p. 290) without offering an alternative to piling up the waste on public thoroughfares. By the late 1500s, King Henry VIII declared an edict making householders responsible for clearing the sewer passing by their dwelling, enforced through fines (Gayman 1996). His French contemporary, King Francois, issued an edict that commanded every house dwelling be "equipped with a cesspool" or risk confiscation of property:

> "…We forbid all emptying or tossing into the streets and squares …of refuse, offals, or putrefactions, as well as all waters whatever their nature, and we command you to delay and retain any and all stagnant and sullied waters and urines inside the confines of your

> homes. We enjoin you to then carry these and promptly empty them into the stream and give them chase with a bucketful of clean water to hasten their course." (Laporte 2000, pp. 2-7)

In the 16th century, an ordinance in London bade "no man shall bury any dung or goung [sic] within the liberties of the city … [nor] carry any ordure till after nine o'clock in the night" (Mumford 1961, p. 291 quoting Stow). These laws would have merely shifted the timing of these pollution-causing activities rather than resolve urban pollution.

Centralised control

Institutional arrangements that have paralleled the *centralised* technology stage may be seen to have two phases: the first extending from inception until around the 1980, the second spanning the last thirty or so years. 'Centralised control' characterises the first phase. It reflects the centralised, autocratic systems of government that developed through industrialising Europe. 'Centralised control' was underpinned by the policy objective to expand coverage of infrastructures to wider populations and exploit natural resources to promote economic growth. Centralised physical infrastructure was owned and operated by centralised governments through centralised vertically integrated planning and management, under a public service ethos (Bakker 2001).

Institutional arrangements under 'centralised control' approached the management of urban water and wastewater as a heavily subsidised public good (Bakker 2001; Guy, Marvin & Moss 2001; Tisdell, Ward & Grudzinski 2002). Tariffs for water services in this first phase reflected the public service ethos under which they were developed in Europe (Guy, Marvin & Moss 2001), and subsequently in European colonies. The underlying philosophy was that such services were the right of citizens, so that charges were designed to be equitable and affordable rather than reflective of the cost of supplying the services. Charges for reticulated treated water, piped sewerage and waste collection were usually included in the municipal rates based on the value of a property, imperfectly assumed as a proxy for its owner's ability to pay (Bakker 2001). This model facilitated rapid economic development. However, keeping water sector tariffs almost universally below the cost of supply resulted in low cost recovery, and wasteful or inefficient use of water (Brocklehurst, Pandurangi & Ramanathan 2002; Rogers, de Silva & Bhatia 2002; Zhang 1999). Reforms to address these problems led to the next stage in institutional arrangements – 'market approaches'.

Market approaches

Beginning around the1980s, a second phase within the *centralised* technology stage is identified with discernible policy shifts in response to the difficulties arising from low cost recovery. In industrialised countries, the previous policy for increasing urban coverage of services was largely accomplished by this time. Urban water policy, along with policies for

other utilities, shifted towards a new objective: achieving economic efficiency. The new policy was strongly influenced by neoclassical economics, with growing consensus since the 1980s around the market as the best mechanism for the efficient allocation of scarce resources.

'Market approaches' with a corresponding decrease in government responsibility for welfare provision is aligned with the neoclassical economic ideal for facilitating 'small government' (Edwards-Jones, Davies & Hussain 2000, p. 13) as will be discussed further in Section 4.4. The goal of establishing market approaches is evident in many utility services; the water supply industry follows reforms in the energy and telecommunications sectors, while parallel reforms in centralised sewerage lag behind.

Policy reforms for establishing 'market approaches' had two related strands: institutional reform and tariff reform. Institutional reforms led to the corporatisation (or in some cases, privatisation) of public institutions, to be operated and maintained on market-based principles for economic efficiency, with government taking on a regulatory and oversight role (Bakker 2001). 'Market approaches' created greater opportunities for the private sector to participate in utility services in general (discussed further in Chapter 6). The tariff reform strand was driven by the increasing costs for water infrastructure and incremental costs for water supply (Tisdell, Ward & Grudzinski 2002). Consistent with the concurrent policy shift to decrease government provision of utilities, this meant a gradual decrease in subsidies from government through general tax revenues (Walker 2003), and a gradual increase in tariffs until the 'full cost'[51] of service provision is recovered through tariffs, i.e., by the mechanism of 'full cost pricing'[52].

Tariffs are also an effective market instrument for encouraging resource conservation, as a response to rapid increases in demand for water supplies due to urban growth and development, with the consequential increase in volumes of wastewater. Because tariffs seek to balance a number of sometimes conflicting objectives including cost recovery, economic efficiency, conservation, equity and affordability (Boland 1993; Whittington, Boland & Foster 2002), with constant shifts in the policy weighting given to these objectives at different times, tariff reform is likely to be an ongoing process in time, unlike the institutional reforms of this stage.

In summary, 'market approaches' to sanitation are characterised by utility service providers whose operations are independent from government. The utilities are run as commercial

[51] The notion of 'full cost' is examined in Chapter 4.

[52] This approach is evident in the policies of individual industrialised countries. For example, Australian state governments are provided financial incentives by the federal government, to introduce pricing reforms that enable full cost recovery for urban water systems, and the removal of cross subsidies that are "inconsistent with efficient and effective service" (GPOC 1999).

enterprises under market rules, with a priority to recover the full costs of services from customers. The change from 'centralised control' to 'market approaches' is a transformation of the philosophy of water service provision, from "the supply of a service to citizens", to "the sale of a commodity to customers" (Bakker 2001). 'Market approaches' which commenced in the *centralised* technological stage continues to influence the present, thus spanning the *neo-centralised* and *emergent* technological stages as well.

Participatory approaches

While *centralised control* and *market approaches* constitute the most dominant forms of institutional arrangements for sanitation in contemporary industrialised countries in general, *participatory approaches* to decision making about infrastructure is an emerging trend, aligned to ideas about democracy and sustainability in general (Roberts 1995). Participatory approaches take account of the public's views and values to varying degrees (Chapter 5) and are increasingly included as good practice in decision making(White et al. 2006). I submit that, because the high levels of service reliability achieved by industrialised countries leads to services being used without much thought (Graham 2000), an affluent public would have little interest in being involved with more routine institutional arrangements around ongoing management, so that participatory approaches in institutional arrangements for urban water and sanitation infrastructure would generally be limited to decision-making. For less affluent communities in developing countries, on the other hand, *participatory approaches* offer a viable arrangement for administration of sanitary systems and other utility systems (McGranahan et al. 2001).

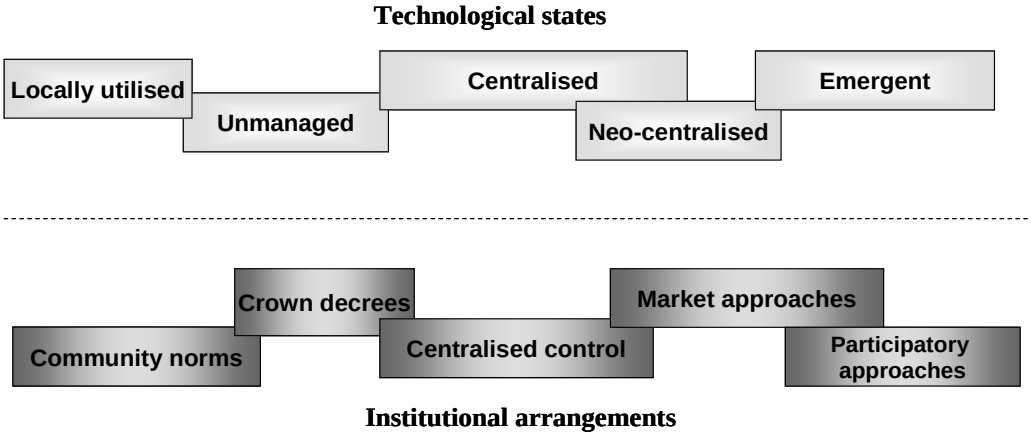

Figure 2.7: A taxonomy of sanitation arrangements

2.6.3 Summary of analysis

The historical stages of technological and institutional arrangements for sanitation in European countries provide a taxonomy for categorising urban sanitation practices today. For example, dual reticulation systems for drinking water and recycled non-potable water in suburbs such as Rouse Hill in Sydney (Sydney Water Corporation 2002) fall into the *neo-centralised* state, administered largely through *market approaches* to service provision and cost recovery. Urban developments incorporating 'high tech' or simple technologies to put ecosan principles into practice (Otterpohl, Grottker & Lange 1997; Peter-Fröhlich et al. 2003), including some 'intentional communities' in industrialised countries (Metcalf 1995), place them at the *emergent stage.* They may be administered through *market approaches* where householders pay private service providers to manage their systems, or in the case of 'intentional communities', through *community norms* within overarching legal systems including environmental protection standards.

For cities in developing Asian countries, the technological states for sanitation in different localities fall between *unmanaged* and *centralised*. The limited centralised piped sewerage infrastructures are in many cases aging and often dilapidated, as noted in Chapter 1, so that although *centralised* by design, the practice tends towards *unmanaged*. Weak institutional arrangements for management and maintenance lead to high rates of failure or malfunction of onsite systems that serve a majority of urban households (Wikramanayake & Corea 2003). Sanitation infrastructures bypass some low-income populations altogether, placing them within *unmanaged* states.

While many post-colonial governments of developing Asian countries had been structured for *centralised control*, institutional reforms to facilitate market approaches are being undertaken widely under the direction of multilateral lending institutions such as the World Bank (Alexander 2003). Thus water and sanitation utilities in developing Asian countries are between *centralised control* and *market approaches* with respect to institutional arrangements. There are also some examples of *participatory approaches*, primarily applied to poor communities given some external assistance with initial capital infrastructure (Ariyabandu & Aheeyar 2004; Dissanayake 2002; Wright 1997). These arrangements are typically managed by community based organisations ("CBO") who take full responsibility for ongoing revenue collection, management (Ariyabandu & Aheeyar 2004; Dissanayake 2002)[53].

The taxonomy is useful in highlighting the possibility that, in principle, sanitation practices of urban communities can move from any one state to a different state, without necessarily having to follow the historical trajectory of European countries. The history that led to the establishment of the centralised sewerage paradigm highlights that it was the solution to a

[53] This model is analysed further in Section 4.4.2.

particular set of problematic circumstances and beliefs (Section 2.3.2) which have been superseded by new problems and improved scientific knowledge. As Feacham et al. (1983, pp. 63-64) state:

> "Those whose job is to select and design appropriate systems for the collection and treatment of sewage in developing countries must bear in mind that European and North American practices do not represent the zenith of scientific achievement, nor are they the product of a logical and rational design process. Rather, treatment practices in the developed countries are the product of history, a history that started about 100 years ago when little was known about the fundamental physics and chemistry of the subject and when practically no applicable microbiology had been discovered. … These practices are not especially clever, nor logical, nor completely effective—and it is not necessarily what would be done today if these same countries had the chance to start again."

The taxonomy points to possibilities for developing Asian countries to move from *unmanaged* states to any other state. In particular, in opens the possibility to 'leap frog' to the frontiers of scientific and technological practices that suit their contexts, rather than being placed in a quandary about needing to invest in unaffordable centralised sewerage systems whose performance is inadequate based on current scientific knowledge and capabilities.

The barriers to 'leap frogging' by developing Asian countries need to be recognised in order that they may be overcome. This thesis aims to contribute to the first necessary step in this process, of becoming conscious of the origins, paradigms and mindsets that create some of these barriers. A particular barrier comes in the form of 'technological lock-in' that leads from commitments to a paradigm – the idea that

> "technologies and technological systems follow specific paths that are difficult and costly to escape. Consequently, they tend to persist for extended periods, even in the face of competition from potentially superior substitutes" (Perkins 2003).

Infrastructure engineering paradigms in particular, that translate into enormous capital expenditures that are consequently very costly to abandon – such as *centralised* and *neo-centralised* states of sanitation in industrialised countries, experience significant technological lock-in. While developing Asian countries, lacking such commitments to costly infrastructure, are free to 'leap frog' from *unmanaged* states to states representing the most advanced scientific knowledge, mental lock-in to the paradigm arising from aspirations for systems similar to those of industrialised countries (Section 1.3) can be significant.

2.7 The Next 'Revolution'?

The trajectory of change in urban sanitation, viewed within Kuhn's theory, suggest that the next revolution in urban sanitation is under way. New environmental, social and economic crises call for major shifts in the interactions between humans and the planet, the economy

and society (Daly & Cobb 1994; Dixon 2004; Odum & Odum 2001; Saul 2005), with corresponding shifts required in urban sanitation. The explicit expression of discontent with the current paradigm, the proliferation of alternative solutions, debate over fundamentals and "recourse to philosophy" are all indications of an approaching revolution (Kuhn 1970, p. 91).

Kuhn suggests that all paradigm crises of normal science close in one of three ways (p84), as represented schematically in Figure 2.7. The existing paradigm may prove able to resolve the crisis-provoking problems. Alternatively, a new candidate for paradigm may emerge successful in resolving the crisis, and a 'revolution' would follow. As a third alternative, the problems may elude even new and radical approaches for resolution, leading scientists to conclude that the present state of their field is insufficiently advanced, and that the problems should be left to a more advanced future generation of practitioners to resolve.

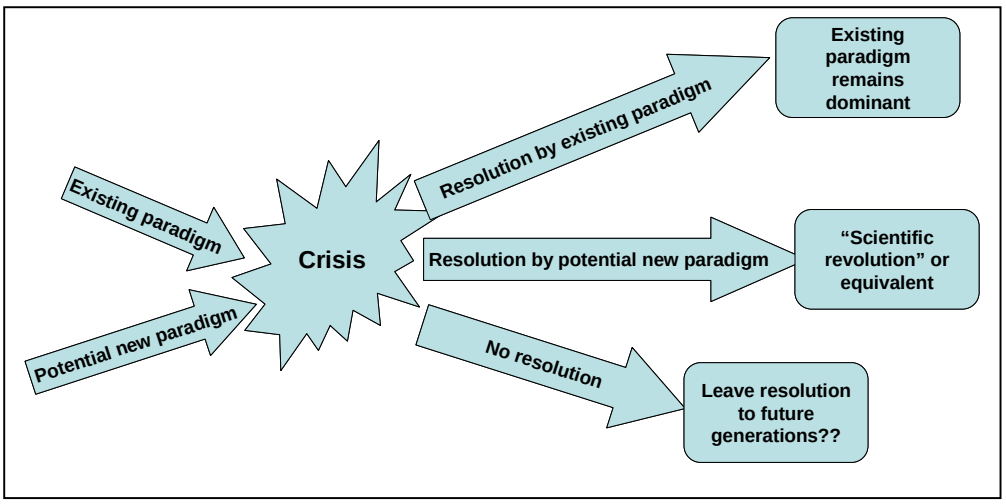

Figure 2.8: Outcomes of a paradigm crisis

In the case of urban sanitation in developing countries, I argue that the currently dominant centralised/neo-centralised technology paradigm is unlikely to be able to resolve the crisis. The enormous financial costs required both for initial investment and ongoing operation and maintenance (Section 2.4.1.1 and 2.4.1.2) are insurmountable barriers especially in the context of developing Asian countries (Biswas et al. 2004). Furthermore, providing necessary sanitation to billions who lack it, under the Millennium Development Goals will demand great volumes of water and create great volumes of wastewater if conventional water based technologies are chosen, so that "environmental sustainability will worsen" (Gijsen 2006). Given the global challenges we face, including water scarcity, ecosystem degradation and poverty, it is clear that the crisis cannot be resolved by the current paradigm even if financial cost was no barrier, given its high demand for scarce resources – water, energy, and chemicals to treat and mitigate its polluting impacts.

At the same time, being unable to resolve the problem is simply not an option for a planet dominated by humans causing enormous and potentially irreversible impacts on its life-support systems (Lubchenco 1998). Furthermore, the ethics of leaving a legacy of unresolved and escalated problems associated with urban sanitation to future generations are questionable.

Thus, it is entirely necessary that alternatives to the conventional paradigm must emerge to resolve the current crises. What would this emergent paradigm look like? I have already demonstrated that viable contenders to the paradigm exist in *emergent* technologies (Section 2.5.2). Will one of these be "more successful than [its] competitors in solving [the] problems that the group of practitioners has come to recognise as acute" (Kuhn 1970, p. 23) and thereby establish itself as the new paradigm?

2.7.1 An emergent paradigm aligned with sustainability

One way of beginning to answer the thesis question, "*What intellectual contribution can the sustainability discourse make to provide direction for heading towards sustainability in urban sanitation planning for developing Asian countries?"* is to propose an emergent paradigm that is consistent with concepts and values of the sustainability discourse. The sustainability discourse is a developing field of study, with consensus gathering around some key ideas that define this field. In this section, I provide brief overview of some central ideas of this discourse and how they might translate in the proposed emergent paradigm for sanitation.

An emergent paradigm aligned with sustainability would fundamentally expand Kuhn's concept of a paradigm as an accepted pattern or model on which subsequent practice is based. As the history of urban sanitation has shown, underlying paradigms and worldviews provide a lens through which problems are perceived and their solutions devised, and "proponents of competing paradigms practice their trades in different worlds" (Kuhn 1970, p. 150). The sustainability discourse emphasises that there can be more than one legitimate way of perceiving a contemporary problem, and that therefore a "plurality of legitimate perspectives" should be considered (Funtowicz & Ravetz 1993; Söderbaum 1999). With an awareness that world-views consistent with specific paradigms can limit the range of possible solutions to problems (for example, the centralised paradigm can predetermine a particular solution to urban sanitation to the exclusion of other options), the emergent paradigm would seek to accommodate the notion of multiple legitimate perspectives. It would therefore subscribe to a broad menu of ideas and perspectives rather than a single model or approach. I see this as a new paradigm that is much broader than earlier concepts

of paradigm but would nevertheless become a pattern or model for approaching contemporary problems[54].

I have selected three broad features of the sustainability discourse that are relevant here as distinguishing the emergent paradigm from the dominant paradigm-based science that informs planning and policy in general, including sanitation planning. The first is *transdisciplinarity*, introduced in Chapter 1, that emphasises understanding or describing problems from more than one disciplinary perspective (Bell & Morse 2005; Gallopín et al. 2001; Max-Neef 2005; Söderbaum 1999; Sustainability Institute 2001). The second is the recognition that planning and policy-related science itself needs to adapt in the current context and incorporate broad community participation and *stakeholder dialogue* (Costanza et al. 1997; Funtowicz & Ravetz 2003; Gallopín et al. 2001; Lubchenco 1998). Third is the commitment to *ethics and morality* made explicit. These features, separately elucidated below, are sometimes seen as facets of each other: for example, Wickson, Carew and Russel (2006) argue that transdisciplinary research necessarily means collaboration with broader stakeholders in addition to collaboration across disciplines; Max-Neef's (2005) description of transdisciplinarity (below) includes the coordination with the higher level disciplines of ethics and values. I disaggregate them below, primarily to highlight their importance as points of divergence from earlier approaches to policy-related science.

Transdisciplinarity

The sustainability discourse seeks to resolve an interconnected set of complex and global problems including poverty, social conflict, climate change and ecosystem degradation, where:

> " in reality, there are no 'economic', sociological', or 'psychological' problems, but just problems, and they are all complex" (Myrdal 1975, quoted by Söderbaum 2000).

Thus the call for transdisciplinarity, the integration or de-fragmentation of disciplinary knowledge, is a central feature for the sustainability discourse.

Transdisciplinarity is a proposition that research underpinning planning and policy requires coordination of knowledges from different disciplines (Costanza et al. 1997; Daly & Farley 2003; Max-Neef 2005). Researchers from different fields have arrived at the idea that the world can be viewed from several hierarchical levels – typically four – and that a deeper and more useful approach to problem solving would include simultaneous consideration of perspectives from all these levels (Bell & Morse 2005; Inayatullah 1998; Max-Neef 2005; Sustainability Institute 2001).

[54] Others might view it as a change in direction from 'paradigm' to 'paradigm pluralism' (Söderbaum 2000, p. 131). Whether the new pattern is a paradigm that has pluralism as a characteristic, or whether it is no longer a paradigm but 'paradigm pluralism', is, for me, a matter of semantics. The key point is that plural worldviews are accorded legitimacy.

For example, Max-Neef (2005) describes the hierarchy in terms of fields of academic inquiry or disciplines. The four levels relate to:

- Empirical disciplines – relating to the observed or "what exists" , that includes disciplines such as physics, chemistry, ecology and geology;
- Purposive or pragmatic disciplines – the subjects that enhance "what we are capable of doing", that include engineering, agriculture, architecture and commerce;
- Normative disciplines – dealing with "what we want to do" – including planning, politics, and law; and
- Values 'disciplines' – considering "what we ought to do" – the domain of philosophy, ethics, values.

The transdisciplinary framing of a policy problem consists of a coordination of disciplinary knowledges from *all four* levels (Max-Neef 2005). Transdisciplinarity requires the "dissolution of disciplinary boundaries" to enable novel context-appropriate resolutions to problems (Wickson, Carew & Russell 2006), in contrast to more orthodox inter-disciplinary or multi-disciplinary collaborations where experts maintain their disciplinary traditions.

What would transdisciplinarity mean for planners and policy makers? Urban planning regularly involves multiple disciplinary experts already. These experts are typically drawn from the pragmatic and normative level disciplines – engineering, agriculture, health professions, design and planning, law – and sometimes, the empirical disciplines – economics, ecology. A commitment to transdisciplinarity would not only *always* include practitioners from these three levels, it would also always include the values-level. While more orthodox planning processes might encourage locally optimised strategies at the expense of globally optimum strategies (Ruth 2006), a transdisciplinary approach would seek to balance these on the basis of an ethical framework. For example, the perspectives on costs would include 'whole of society' consequences including impacts on ecosystems, non-human life forms, and future generations.

Stakeholder dialogue

The sustainability discourse calls for community participation and stakeholder dialogue that goes beyond the arguments for democratic justice or the 'public participation' routinely included within planning processes. Funtowicz and Ravetz (1993; 2003) argue that the very nature of science that informs policy has changed, involving irreducible uncertainty and high stakes that require the public, as stakeholders, to have critical input in order to provide legitimacy, evaluation and quality management in decisions in this new terrain. Costanza et al. (1997, p. 207) note that decisions that arise through stakeholder dialogue that accommodates "opposing theoretical, religious, philosophical and moral doctrines" are likely to be fair, just and enduring.

Funtowicz and Ravetz's (1993; 2003) arguments stem from the observation that the orthodox 'normal' scientific objective of removing uncertainty is unachievable in the context of irreducible uncertainties in linking cause and effect in phenomena that potentially threaten the environment and human health today (Gallopín et al. 2001). Furthermore, the influence of values in science has traditionally been ignored, as science has been viewed as a 'value-free' endeavour that "should and could provide certain, objective factual information for decision-makers" – a view that is increasingly acknowledged as "simplistic and immature" (Ravetz 1999). Ravetz (ibid) writes:

> "It is appreciated that the commitments of scientific advisors can legitimately influence their judgement on issues where there are deep and unresolvable uncertainties. When they enter a negotiation, they cannot leave their values at the door."

In the context of rapid environmental and social change, where irresolvable uncertainties exist, values may be in conflict, responses are needed urgently and consequences of action or inaction may be significant, Funtowicz and Ravetz (1993; 2003) propose a 'post normal science' as appropriate for informing and guiding policy and planning. Post normal science would accommodate a "plurality of legitimate perspectives", examine the influence of values, and manage uncertainties explicitly instead of seeking to eliminate them (Funtowicz & Ravetz 1993). Interactive dialogue with broader stakeholders is a cornerstone of post normal science, which extends and enriches more traditional investigator-initiated processes for scientific inquiry and deductive scientific argument. Just as a scientific peer community provides quality control within normal scientific processes, they argue that an 'extended peer community' of broader stakeholders provides quality control for post normal science and legitimacy for policy decisions informed by it (Funtowicz & Ravetz 2003).

The relevance of post normal science for urban sanitation arises from scientific uncertainties about long-term impacts of some practices, as discussed earlier in this chapter, as well as significant value conflicts. For example, views that the flush toilet represent the "greatest public health advance in the modern era", and anything else as a "celebration of primitivism" (Morano 2003), conflict with values of resource conservation and appropriate technologies (Schumacher 1973). Meeting the needs of present generations at the cost of imposing potential environmental or financial burdens on future generations is another value conflict. The proposition of post normal science is that accommodation of these different perspectives, conflicts and uncertainties in policy and planning decisions can happen only through processes that involve stakeholders in dialogue.

The implications for the emergent paradigm for sanitation is a requirement for sharing of power between traditional decision makers and the public, empowering people to influence public decisions, integrating scientific and technical expertise with "local knowledge and legitimate interests, values and desires of the extended peer communities" (Funtowicz & Ravetz 2003). A process for facilitating these outcomes in practice is explored in Chapter 5.

Commitment to ethics

The commitment to ethics leads from the acknowledgement of values in influencing policy-related science for sustainability. The previous 'value-free' position of science supported the notion that science was concerned with objective facts that excluded subjective ethical, political or value judgements. Max-Neef (2005) argues that planning and policy will not be coherent with the challenges they seek to resolve unless explicit ethical principles and values "conform a society oriented towards the common good". Ravetz (1996, quoted in Funtowicz 2001) stresses that morale, morality, idealism and leadership are necessary attributes for quality assurance in science. While morality has been assumed in the practice of science (Funtowicz 2001) and in policy and planning, the sustainability discourse makes a commitment to *explicitly* "hold fast to the goal of goodness" (Meadows 2002).

These three features of the sustainability discourse would distinguish the emergent paradigm from previous paradigms. In addition, its alignment with sustainability would include the use of systems thinking, or thinking in terms of connectedness, relationships and context (Costanza et al. 1997; Gallagher & Appenzeller 1999; Gallopín et al. 2001; Meadows 2002; Peet 1992; Robert et al. 2002). Systems thinking at a pragmatic level was introduced in Section 2.5.1 and will be explored further in the next chapter.

I submit that an emergent paradigm for sanitation aligned with the sustainability discourse would be framed by these high level features, complemented by the more disciplinary or 'normal' scientific approaches at the operational level. While the tools and methodologies for addressing problems within the sustainability discourse would depend on the particular problem, their analyses would utilise systems thinking and be framed by transdisciplinarity, ethics and stakeholder dialogue. Within the emergent paradigm for sanitation, decision makers would expect to discover the most appropriate technological option for the context in collaboration with stakeholders and experts spanning all four levels of disciplinary knowledge. They would consider a full range of technological alternatives, comparing centralised and decentralised options of small and large scales on fair and consistent grounds. In contrast, decision makers within the centralised paradigm typically enter the problem-solving arena with a pre-conceived dichotomy of options – a choice between centralised sewers and septic tanks (Sundaravadivel, Trivedi & Vigneswaran 2003).

2.8 Conclusions

This chapter used Kuhn's "structure of scientific revolutions" (Kuhn 1970) as a theoretical framework for examining the historical progression of sanitation practices of industrialised European countries. It illuminated how the globally dominant model for urban sanitation came to be, and anticipated a paradigm revolution and a transition to an emergent paradigm in the future.

The historical literature showed that scant attention was paid to the formal organisation of sanitation for urban populations through the history of Europe until the public health and environmental crises in the mid-nineteenth century. The response to the crisis was the emergence of centralised sewerage, crucially shaped by the circumstances and beliefs of the time, as an alternative to the prevailing multiplicity of less formal practices.

As urban populations have risen rapidly and human impacts on global life support systems have escalated, the centralised piped sewerage model's ability to resolve problems for the long-term have been questioned. Alternative approaches to the centralised model, driven by a search for sustainability, have emerged in response to the new crises. According to the pattern identified by Kuhn, these are signs indicating a new paradigm revolution whereby the existing paradigm may be replaced or be appropriately transformed.

At the next level of analysis the progression of sanitation technology was conceived as a series of stages – locally managed, unmanaged, centralised, neocentralised and emergent – that map onto Kuhn's stages in the development of scientific paradigms – the movement from equilibrium to crisis, resolution, anomaly and revolution. Institutional arrangements show a parallel series of stages – community norms, crown decrees, centralised control, market models, and cooperative or participatory models – that have loosely matched the technological stages in the case of industrialised countries. The analysis was useful because the 'stages' present a taxonomy for classifying the broad range of technological and institutional practices globally. It highlights the possibility for leaping from one classification to another rather than having to follow the trajectory through the stages – in particular, the potential for developing Asian countries to leap to the emergent stage, from whatever stage (or mix of stages) they may currently be.

The chapter culminated with an exploration of the shape of the emergent 'paradigm', potentially as a broad and flexible set of ideas aligned with the sustainability discourse. In such an emergent paradigm, problem analysis would be framed by transdisciplinarity, a commitment to ethics, and stakeholder dialogue. It would be a collaboration involving disciplinary knowledges at all four levels: empirical, pragmatic, normative and values, as well as including community knowledges and perspectives of wider stakeholders. It would support and inform policy, planning and decision-making where uncertainty in science and

a multiplicity of legitimate perspectives are acknowledged and incorporated within a 'post-normal science' approach.

Such an emergent paradigm aligned with sustainability would not be as much a replacement of the dominant paradigm, as its complement, with an enlarged scope that incorporates higher level disciplines, critical reflection upon the influence of disciplinary paradigm and ideology, and stakeholder dialogue, that would facilitate planning that is tailored to the context rather than the one-size-fits-all solution of the conventional paradigm.

3 Approaching urban sanitation in developing Asian countries as a complex problem

"Is it preferable to have the wrong strategy for the right problem, or the right strategy for the wrong problem? Is it … better to have a crude and less-than-comprehensive strategy for the problem you are really interested in, or a precise and comprehensive strategy for a problem which is only an approximation of what you are interested in?"

Timothy J. Cartwright (1973)

3.1 Introduction

Previously I described the problem of urban sanitation in developing Asian countries as a complicated confluence of a number of factors – its low appeal as an issue for political campaign, its administrative association with water supply, domestic economic constraints, technologies that are not matched to the context, and a frequently indifferent public, to name some (Chapter 1). I argued that in order to move towards sustainability, radical changes are necessary. An examination of the history of urban sanitation, viewed within the framework of Kuhn's 'structure of scientific revolutions' (Chapter 2), indicated signs that radical change in the form of a new paradigm for urban sanitation is pending. I argued that this emergent new paradigm, to be aligned with the goal for sustainability, would adopt concepts from the sustainability discourse and post-normal science – acknowledge the legitimacy of many perspectives and worldviews, and make decisions through processes that bring these worldviews to light, with a strong commitment to ethics.

The aim of this chapter is to begin to explore how the above elements can be brought together to answer questions about how a complex problem can be analysed and resolved taking multiple perspectives into account, and what concepts and methodologies might be useful.

I begin by exploring further the idea that how a problem is perceived also determines how it might be solved (Section 2.7.1). I review the literature about the different types of problems based on their levels of complexity – simple, intermediate and messy – and the different approaches to their analysis. The literature argues that messy problems, which I contend includes urban sanitation in developing Asian countries, are usefully represented as complex systems that are inherently difficult to predict or control. It is proposed that 'learning' might be the path through which messy problems might be resolved (Section 3.3).

Relevant aspects of complex systems theory are summarised in Section 3.4, to provide foundational concepts of a systemic approach. Soft Systems Methodology (SSM) is presented as a particular case of a systemic approach for the resolution of messy problems (Section 3.5). I illustrate the use of SSM by applying it to the situation of problematic urban

sanitation in Colombo. Through this exercise, I identify cost recovery as a potential leverage point to attack the problem from – which is then examined in the next chapter.

3.2 The nature of 'problems' and their 'solutions'

In any discussion about 'problems' and their 'solutions', two assumptions are implicit: there are human actors involved who *perceive* a situation or a process as problematic; and the problem calls for *deliberate intervention* to improve the situation (Cartwright 1973). "A problem is what somebody or something perceives as a problem; and without somebody or something to perceive it, a problem is an absurdity" (Cartwright 1973). While problematic situations may occasionally resolve themselves of their own accord, the types of problems in the domain of planning in general, and urban infrastructure planning (such as urban sanitation) in particular, are not only unlikely to spontaneously resolve themselves, but are likely to escalate without intervention. Thus, the necessary planning response to problems requires 'solutions', or interventions in the form of deliberate actions.

Because the identification of problems involves human perceptions, there are many alternative ways in which a single problematic situation might be described, depending on one's perspective or worldview (Cartwright 1973; Checkland 2001; Gallopín et al. 2001). Thinking of problems in systems terms, Gallopín et al. (2001) state that "an infinite number of systems can be defined on the same portion of reality, depending on viewpoint, objective and previous experience".

The possible forms of solution to a problem depend fundamentally on how the problem is defined in the first place (Cartwright 1973; Rittel & Webber 1984). Cartwright (1973) elucidates this by conceiving a problem as a function that is dependent on a number of variables, say P(x,y,z), where the variables might be specifiable and quantifiable in some classes of problems, and unspecifiable and/or unquantifiable in others, as discussed later. The previous statement then implies that the solution is also defined by the same set of variables, as S(x,y,z). The problematic situation and its various potential solutions may be conceptualised as occupying different points in a 'space' defined by the variables, where some areas of the 'space' are perceived to be problematic. In systems language, the proposition may be stated as follows: the definition of the problem is the definition of the *system* that represents the portion of reality that constitutes the perceived problem (Cartwright's 'variables' would correspond to various 'subsystems' that define the system of interest). The system can occupy different states: a successful intervention ('problem solving') transforms a system from one state ('problematic') to another ('non-problematic').

I illustrate Cartwright's concept with a hypothetical example. Suppose the issue of 'access to sanitation' is seen to be defined by two variables: the distance to latrines and the proportion of able-bodied adults in a household. Different states of 'access to sanitation' could be placed in a 'space' as illustrated in Figure 3.1, where states above the demarcating

line are seen to be problematic. Thus, a household situation described by the point *P*, with a high proportion of very young or elderly members in the household (i.e., a low proportion of able-bodied adults) having to travel far to reach a latrine, is seen as problematic. With the issue described this way, 'solutions' would take the form of interventions that move the situation P to below the dotted line, say to a point *S*: 'solutions' would decrease the distance (providing latrines closer to the residence) and/or increase the proportion of able-bodied adults in the household who could assist the less able to reach the distant latrine. Any other intervention influences the situation only to the extent that the defining variables are affected. For example, an intervention such as 'increase household income' affects the issue because of its effect on one or both of the variables. It can reduce the distance by providing the means to build a closer latrine; or it can reduce the 'effective distance' by increasing the mobility of non-able-bodied individuals in a household (with prams or wheelchairs)[55]. Thus, the variables 'distance to latrine' and '% of able-bodied adults in household' become proxies for all other influencing factors in this particular formulation of the issue of 'access to sanitation'.

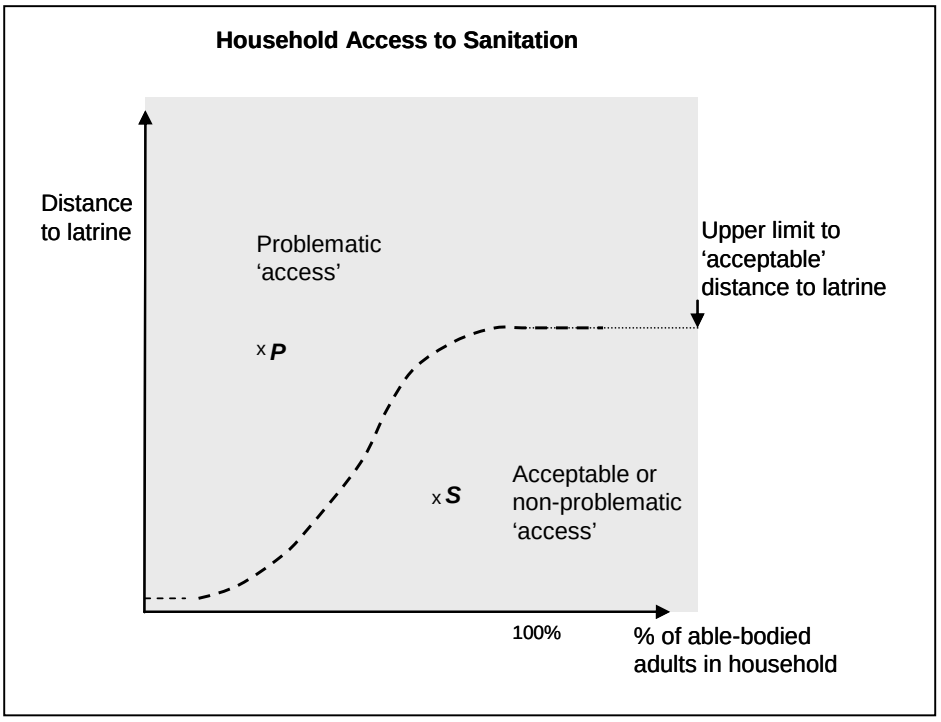

Figure 3.1: Hypothetical example: 'Access to sanitation' described by the specifiable and quantifiable parameters of 'distance to latrine' and '% of able-bodied adults in household'.

[55] In the latter case, the demarcating line between problematic and acceptable access would be altered by a higher acceptable upper limit for distance to latrine.

There is considerable appeal to defining problems in specifiable and quantifiable terms such as in the above example, which allows analysis and solution through reason and logic. However, such an approach fails to include more complex issues that can determine the success of any solution – such as whether the individuals in the example want to use the latrines in the first place. Including more complex issues of relevance changes the dimensions of the problem, as discussed next.

3.2.1 Typology of problems

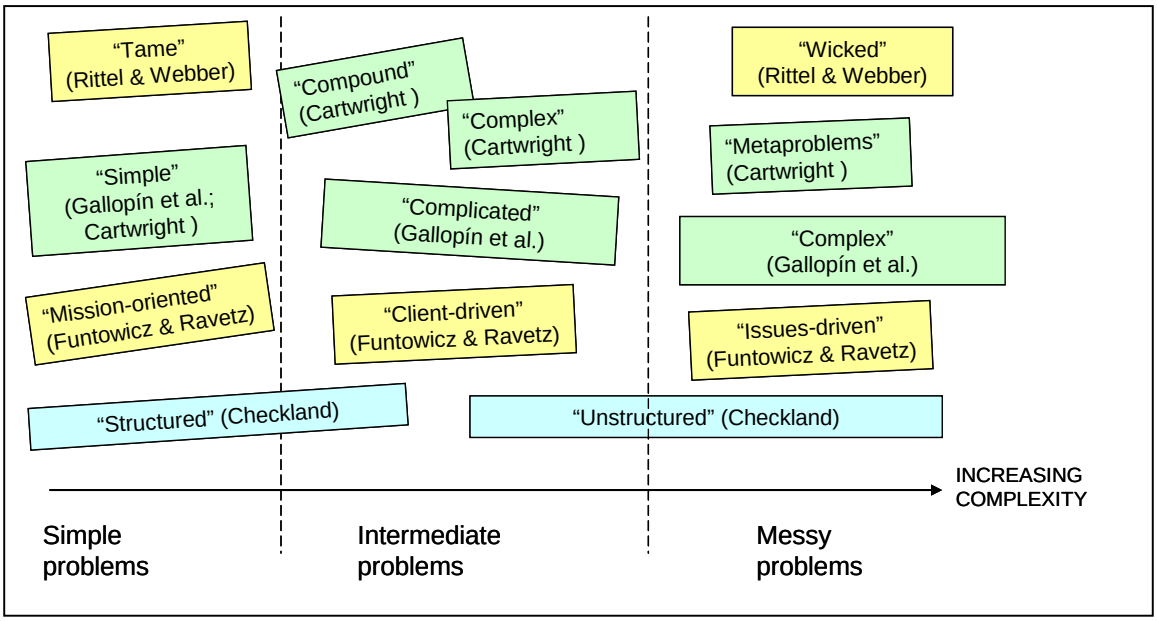

Figure 3.2: Problem typologies by various authors

Since a problematic situation may be defined in many ways that in turn would determine the nature of its 'solution', it is useful to review the characteristics of different problem types, the appropriate strategies for understanding them, and the scope or limits to their potential solutions. I have categorised the spectrum of problem types as simple, intermediate or messy, based on their levels of complexity, and related them to the characterisations by other authors in Figure 3.2 and in the description that follows.

3.2.1.1 Simple problems

Simple problems are not necessarily 'easy' problems, but are problems that can be stated explicitly in terms of the objectives to be met, and can be solved by figuring out the best way to achieve those objectives (Checkland 1999; Gallopín et al. 2001; Rittel & Webber 1984). This class includes problems labelled as 'simple' by Cartright (1973), 'structured' by Checkland (1999, p. 155), and 'tame' or 'benign' by Rittel and Webber (1984). In

Cartwright's description, simple problems are described by a specifiable number of variables which are all calculable if given sufficient data (Cartwright 1973). There is no ambiguity about whether an intervention has solved the problem (Rittel & Webber 1984).

Systems thinking about simple problems utilise "simple systems" that Gallopín et al. (2001) describe as "adequately captured using a single perspective"; i.e., there is consensus about how the situation is described and about what is required. They are satisfactorily represented by standard models implying their solution is within an existing paradigm (Gallopín et al. 2001).

Funtowicz and Ravetz (1993; 2003) provide a different but consistent classification of problems (Figure 3.3) on the basis of the interactions between uncertainties in knowledge or "systems uncertainty", and conflicting values and interests of stakeholders or "decision stakes". *Simple* problems are associated with low systems uncertainty and low decision stakes. Their uncertainties are mainly "at the technical level" that can be managed through standard techniques and routine operations (such as traditional statistical manipulation of data, and standard procedures for reliable technical operations) (Funtowicz & Ravetz 1993). Their decision stakes are simple and small, and adequately captured by a single and consensual perspective (Funtowicz & Ravetz 2003; Gallopín et al. 2001). Since such problems have clear missions, "mission oriented" strategies of applied science using comprehensive and rational analysis (Cartwright 1973; Funtowicz & Ravetz 2003) are suitable for solving simple problems.

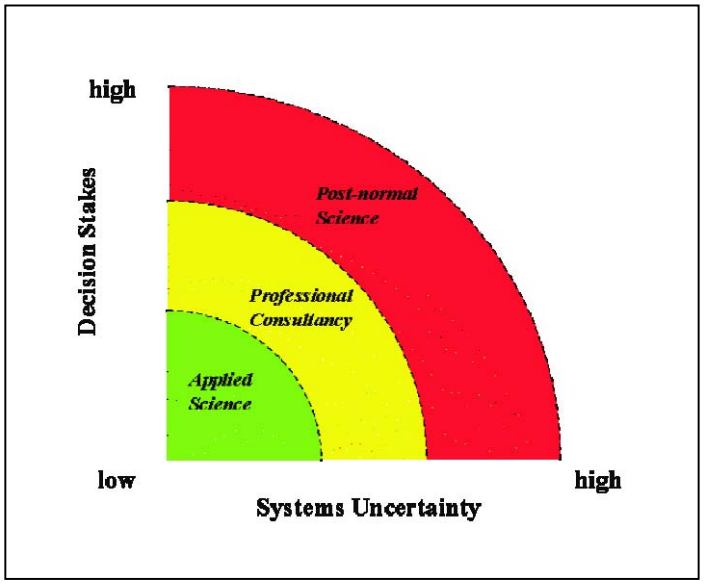

Figure 3.3: Funtowicz & Ravetz's classification of problems and strategies (Funtowicz & Ravetz 2003)

3.2.1.2 Intermediate problems

Intermediate problems may partly consist of a combination of simple problems, but in Cartwright's (1973) characterisation of problems, would additionally depend on some variables that are either unspecifiable or unquantifiable. These correspond with those labelled 'complex' or 'compound' by Cartwright (1973).

Intermediate problems require "complicated systems" to represent them, systems that cannot be fully characterised through standard techniques, but approximations, computations or simulations can improve their characterisation according to Gallopín et al. (2001). A complicated system may be adequately defined from a single perspective (ibid) – implying that any conflict in viewpoint is small.

In Funtowicz' and Ravetz' classification (1993, 2003), intermediate problems correspond to problems associated with moderate levels of both systems uncertainty and decision stakes. Problems of this class have uncertainties that are more complex than can be managed at a technical level using standard routines, because their origins are more complex – such as uncertainty about the reliability of theory. Their decision stakes are also more complex, so that 'value-neutral' strategies of applied science are not sufficiently able to deal with conflicting values between different stakeholders. Funtowicz and Ravetz (1993, 2003) propose that "professional consultancy" is the appropriate strategy for responding to this class of problems. In contrast to the reproducibility of results from applied science, professional consultancy explicitly recognizes the role of competent individuals involved in the task of understanding and proposing interventions to the problem: "personal judgments depending on higher level skills are required" (Funtowicz & Ravetz 1993).

Simple and intermediate problems can both meaningfully use the methodology of systems analysis popularised by the RAND Corporation (Checkland & Scholes 1999, p. 137), presented in Figure 3.4 below. The steps may each be clear and unambiguous when strategies of 'applied science' are applied to simple problems; or they may be "shot through with intuition and judgment" (Hitch 1955 quoted by Checkland 1999) in the case of professional consultancy applied to intermediate problems.

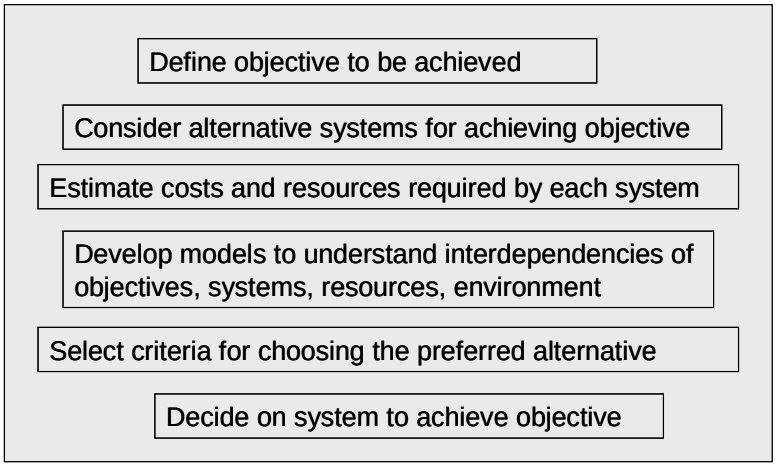

Figure 3.4: Systems analysis framework for decision-making for intervention in 'structured' problems (based on Checkland 2001)

3.2.1.3 Messy problems

Many problems that come under the domain of planning and policy and management are more 'messy' than can be fitted into the descriptions of simple or intermediate problems. These correspond to Rittel's and Webber's (1984) "wicked problems", Checkland's (2001) "unstructured problems", Cartwright's (1973) "meta-problems", and "messy problems" as named by several others (for example, Eden & Ackermann 2001). A messy problem has no consensus about a definitive formulation, which is associated with multiple perspectives, multiple actors, key uncertainties, important intangibles and conflicting interests (Mingers & Rosenhead 2004). Often the problematic situation may be "manifest in a feeling of unease but which cannot be explicitly stated without this appearing to oversimplify the situation" (Checkland & Scholes 1999, p. 154). The problem is often a symptom of a higher level problem (Rittel & Webber 1984). It is not possible to judge whether a 'solution' is 'correct' or to know when a messy problem has been solved (Rittel & Webber 1984).

"Complex systems" are required to account for the complex interrelations in messy problems from a systems perspective (Gallopín et al. 2001). Gallopín et al. (ibid) submit that complex systems, unlike simple or complicated systems, need "two or more irreducible perspectives or descriptions" in order to characterise them and represent the lack of consensus amongst different perspectives. Complex systems, discussed further in Section 3.4, exhibit properties that cannot be logically derived, such as the emergence of properties in the system that were not properties of its elements, and non-linear relationships between system-perturbations and their consequences. Therefore messy problems do not yield to standard analytical and reductionist scientific approaches.

Messy problems correspond to Funtowicz & Ravetz's "issues driven"[56] class of problems that need "post-normal science" strategies for their resolution, introduced in Section 2.7.1 (Funtowicz & Ravetz 1993; 2003). They are characterised by high and irreducible system uncertainties often of an epistemological[57] or ethical nature, and high decision stakes arising from a multiplicity of legitimate perspectives and conflicting values and interplays of power amongst stakeholders. Strategies of post-normal science prioritise dialogue and mutual respect based on the principle of the "plurality of legitimate perspectives" on any problematic situation. While normal (paradigm based) scientific strategies that are used to prove one perspective 'true' and another 'false', post-normal science promotes "tools displaying to each and to all the legitimate presuppositions and commitments of the parties", and aims to integrate scientific and technical expertise with "local knowledge and legitimate interests, values and desires of the extended peer communities" (Funtowicz & Ravetz 2003).

Identifying approaches for dealing with messy problems is central to this thesis, where I make the proposition that the problem of urban sanitation in developing Asian countries is a messy one. I have argued (Section 1.3) that a number of interrelated factors contribute to the problem to make it seemingly intractable. The problematic situation may be viewed as a confluence of factors including economic constraints, particular choices of technology and institutional arrangements, a history of European colonization, abandonment of cultural practices and respectful traditional attitudes to water, amongst others. Given its messy nature, the problem requires a wholly different strategy for resolution (Cartwright 1973; Checkland 1999; Funtowicz & Ravetz 1993, 2003; Gallopín et al. 2001; Rittel & Webber 1984) – a strategy consistent with the sustainability discourse, and founded on a complex systems perspective.

3.2.2 Limit of interventions in problems

Cartwright (1973) further argues that the problem type determines the best-case solution, or the 'limit' of possible effects of interventions in a problem. This follows from the argument that how a problem is perceived or defined determines what constitutes its possible solutions and appropriate solution-strategies. In the case of simple problems, where all determining variables are specifiable and quantifiable, comprehensive and rational analysis can lead to optimization as the 'best' solution. In contrast, intermediate and messy problems, whose variables are not all specifiable and quantifiable, cannot have optimal solutions.

[56] "Issues" arise from the diverging perceptions and evaluations of a problematic situation, which would-be problem solvers need to cope with (Checkland 2001).

[57] Epistemology provides the basis for "how we know what we know" (Crotty 1998, p. 8) – the philosophical or ideological basis for justifying 'knowledge' as distinguished from 'belief'.

A possible 'best' solution is limited by the degree to which the problem can be subject to comprehensive and rational analysis. For an intermediate problem where some variables are completely understood while others are unknown, a 'best' solution could be sub-optimisation – the optimisation of the known part of the problem. On the other hand, if an intermediate problem is defined in terms of variables that are *all* partially understood, a 'best' solution that is a clear 'overall improvement' might be possible, that Cartwright sees as comparable to a Pareto optimum[58]. For messy problems, where the variables are neither fully known nor all quantifiable, only a *partial* improvement can be expected at best.

Messy problems can thus never be 'solved' – a feature that characterises messy problems for Rittel and Webber (1984). Instead, they argue that "at best they are only re-solved – over and over again" – consistent with Cartwright's argument that the 'best' effect of any intervention is a partial improvement. Throughout this thesis, I therefore refer to the *resolution* of urban sanitation and other messy problems, rather than their 'solution'.

The risk of defining a problem as a simple or intermediate one when a messy characterisation could be more useful is illustrated in an example related to me independently by two interviewees in Colombo in 2003, discussing the problematic situation of dealing with urban solid waste. I quote:

> "Wherever you have a scientifically selected waste dump, the people in surrounding area get hold of a politician, and protest. When there's a project to benefit the community, some narrow minded people object. There is a social layer in Sri Lanka that can be easily whipped up to rise against any issue…… There have been several potential sites for waste dumps, with World Bank aid also, for scientific waste disposal – landfill – but they were not allowed. I know of a project to treat waste and generate bio-gas, even that was objected to. This is a lack of awareness among the people."

> "Solid waste is a huge problem because we don't have the infrastructure. … [The new urban masterplan] is addressing the issue – not sure what will come out of it but at any rate thought is being given to the issue, for collection and disposal. Finding a disposal site is difficult. A site for landfill disposal was located at Meepe, [the environmental impact assessment] process was completed, but due to some political reasons it didn't go ahead. … The proposal for the sanitary landfill site evoked a public outcry and the politicians then didn't allow it to go ahead."
>
> (Interview 2003)

[58] A Pareto optimum in economics has everyone as well off as they can be without making someone else worse off (Daly & Farley 2003). Applied to this type of intermediate problem, it means that the 'best' intervention would 'improve' the situation with respect to each variable or subsystem without tradeoffs.

My interviewees, both governmental officials accustomed to traditional autocratic approaches to problem solving, saw the problem as a *simple* one dependent on the technical issues of "collection and disposal" of waste, constrained by the limited availability of space for a potential landfill site. An exact solution to the question of 'disposal' was found with the identification of a potential site for a "scientifically selected sanitary landfill site"[59] that met the regulatory requirements. Their dismay at the obstacle presented by a public who did not understand, indicates their view of the public as external to the problem as defined. The definition of the problem as a *simple* one was inappropriate in this instance, so the logically derived solution was not implementable, and the problem of urban solid waste has remained unresolved. A resolution strategy that deliberated with the public as co-owners of a *complex* problem could have led to a more constructive outcome. The consideration of the complex problem does not preclude options arising through considering it a simple problem: it is possible that the complex problem strategy might have arrived at the same landfill site as the most preferred (or least worse) option. The difference is that dialogue processes that treat the public as co-owners of the problem, such as described in Chapter 5, empower the public to accommodate broader needs and accede to decisions that may affect them adversely. In contrast, when stakeholders are excluded from decision-making that affect them, the only role they can have is that of 'objector' with their only real power being to protest and veto the decision (House 1996).

The description of a problem depends on the perceptions and worldviews of the problem solvers, so that a single problematic situation can have more than one description and lead to different solution strategies. I demonstrate this below by proposing three views of the perceived problematic situation of 'the lack of adequate wastewater management' in developing Asian countries.

First, it may be perceived as a *simple* engineering problem, defined in terms of physical and/or calculable variables such as technical factors, cost, and protecting public health. For such a problem definition, an appropriate solution strategy would use 'applied science' using standard engineering techniques with priorities to minimise cost, use appropriate technical systems that allow effluent discharges to meet prevailing environmental quality standards, and instigate supportive management systems. A potential solution could be to design and manage a sewerage network that discharges effluent through an ocean outfall such that coastal water quality standards are met.

Alternatively, it may be perceived as an *intermediate* problem, dependent on the physical calculable variables in the simple formulation above as well as a need to protect the health of effluent-receiving ecosystems. The solution strategy would then involve expert consultants who attempt to understand potentially affected ecosystems and their capacity to absorb substances in effluent, and might explore options for treating wastewater or for

[59] Their use of the adjectives "scientifically selected" and "sanitary" are suggestive of the technical nature of the issues they perceived.

identifying and controlling the sources of problematic pollutants. Standard engineering techniques alone would not suffice in this case, 'professional consultancy' utilising intuition and judgment of experts is called for (Funtowicz & Ravetz 2003). The resultant solution might be the installation of a sewage treatment plant with appropriate performance specifications as judged by the experts together with a program to manage problematic pollutants upstream.

As a third alternative, the problem may be seen as *messy,* dependent not only on the factors of technology, cost, public health protection and ecosystem protection, but also on issues such as cultural attitudes, the food cycle, equity, the interests of future generations, and any number of sustainability-related issues that can be viewed from a multiplicity of perspectives. Accounting for the different perspectives and values, including the interests of future generations, could lead to deliberative dialogue that might explore alternatives to water-based sanitation. The decisions taken would largely depend on the particular individuals involved in the process at that point in time and place; a very different decision could be taken by a different group of involved stakeholders, or even by the same group in a different context. In the latter case, it is not possible to judge whether the intervention is 'correct', but only to judge in retrospect whether things improved.

3.3 Problem analysis as a learning process

The previous section highlighted the importance of allocating an appropriate level of complexity in perceiving problems, which determines the scope for interventions to improve the situation. While planners and policy makers are increasingly willing to recognise urban problems as more complex and more interrelated than previously appreciated, Cartwright (1973) notes that they face a conundrum because the methodologies and tools for dealing with planning problems are dominated by comprehensive analytical approaches that structure problems as simple ones. Although alternative new tools for approaching complex problems have been developed in the three decades since Cartwright's paper, the departure from more structured analytical approaches in favour of new problem structuring methods has thus far been limited (Mingers & Rosenhead 2004)[60].

A mismatch between problems and their 'solutions' results when messy problems are tackled with methodologies better suited for simple or intermediate problems. Arriving at a detailed comprehensive and prescriptive 'solution' to a messy problem without having

[60] The situation may be seen as a paradigm revolution in progress (Chapter 2), with the new methods and tools in competition with the dominant analytical approaches to resolving messy planning problems. In line with the pattern of paradigm revolution highlighted by Kuhn (1970), the new approaches would be resisted by mainstream planners who have invested in the older practices and methods to attain their own professional standing.

appropriate consideration of its complexity has been described rhetorically by several authors as reaching the "right answer" to the "wrong question", including the opening quote in this chapter (Bell & Morse 2003; Cartwright 1973; Gallopín et al. 2001). At the same time, while more cross-systemic explanations and integrative approaches can lead to a better description of a messy problem, Gallopín et al (2001) warn that it could also produce "a useless answer" that is not readily implementable as an intervention.

The rhetoric emphasising the "right question" can potentially become a stumbling block because of associations with widely used problem solving strategies suited to simple or intermediate problems. These see the clear statement of the problem, or asking the "right question", as the first step towards resolving a problem – for example, in approaches such as systems analysis as illustrated in Figure 3.4. The implication is that no real progress can be made until the 'right question' has been formulated. In line with this thinking, the Brundtland Commission[61] posited an operational definition for sustainable development as the starting point to achieving sustainable development: "…*once satisfactory definitions have been found*, indicators for measuring progress towards achieving sustainable development should be defined" (quoted by Meppem & Gill 1998, emphasis added). It implicitly assumes that it is possible to gain consensus around an operational definition of the objective – or "that there is a truth, a goal, an end point which needs to be determined" – when in reality, little consensus has been achieved in over a decade of debate about such definitions and indicators for the messy problem of sustainable development (Meppem & Gill 1998). Checkland sums up the difficulty with getting the "right question" in relation to messy unstructured problems:

> "…questions such as: What is the system? What are its objectives? ignore the fact that there will be a multiplicity of views on both, with alternative interpretations fighting it out on the basis not only of logic but also power, politics and personality" (Checkland 2001).

As a way forward, a new paradigm for analysis of messy problems has emerged over the last thirty years (Rosenhead & Mingers 2001b). It has shifted the focus on to practical processes to gaining understanding about the problem as a *learning process* that moves beyond a need for prior consensus on the definitions or the "right questions" (Checkland 2001; Meppem & Gill 1998; Rosenhead & Mingers 2001a). A range of methods and tools for finding out about messy policy and planning problems have been developed to aid the learning process (for examples, see Checkland 1999, pp. 254-264; Mingers & Rosenhead 2004; Rosenhead & Mingers 2001b). The learning occurs through a constant and iterative process which aims to accommodate a wide range of stakeholder perspectives, which can then lead to action aimed at improving the situation as perceived by those involved at the

[61] The Brundtland Commission, or World Commission on Environment and Development, is famous for its general definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"(World Commission on Environment and Development 1987, p. 43)

time (Checkland 2001; Meppem & Gill 1998). Rosenhead and Mingers state this as follows:

> "the aim of problem structuring methods is both more modest and more ambitious than that of the previous generation of optimizing methods. More modest, because they do not set out to capture a single truth about the situation from which the one best answer can be derived. More ambitious, because their aim is rather to provide useful assistance to those processes of dialogue and debate which prepare the way for decisions that significantly affect future prospects." (Rosenhead & Mingers 2001a, pp. 1-2)

The corresponding paradigm shift in systems thinking is described by Checkland (1999, pp. A9-A10) as a shift from 'hard' to 'soft' systems thinking, illustrated in Figure 3.5. The world of simple or structured problems can be seen to comprise of a set of interrelated systems that can be engineered for improvement – an approach Checkland labels "hard" systems thinking. The world of complex messy problematic situations cannot be represented in a similar way, but the *process* of finding out about it can be organised as a *learning system* – a way of thinking he labels as "soft". 'Soft' systems thinking is a *systemic process of inquiry* into a world that is a complex system that cannot be reduced to a set of readily definable systems.

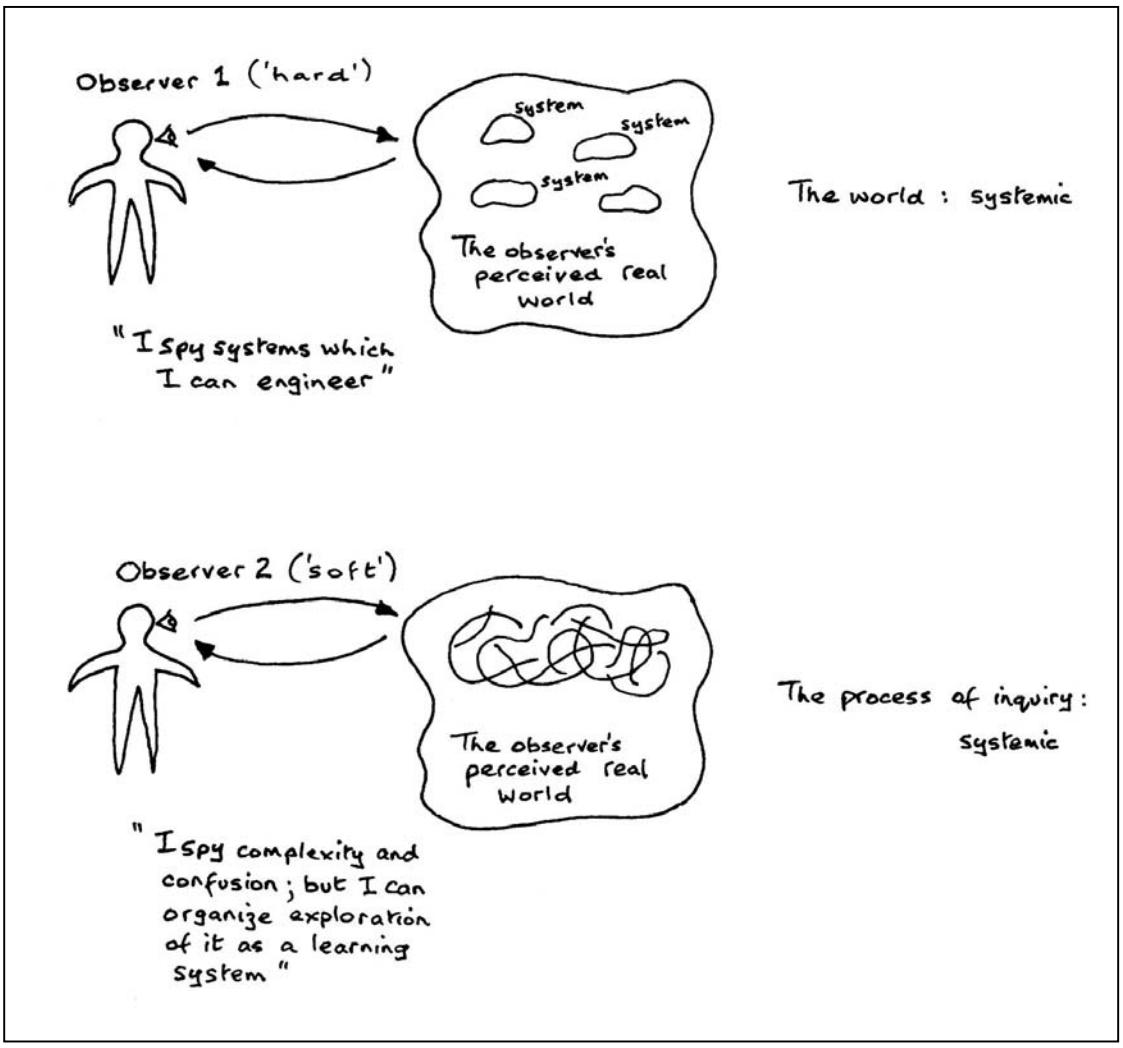

Figure 3.5: Hard and soft systems thinking for tackling simple/intermediate and messy problems (Checkland 1999, p. A11)

Soft systems methodology (SSM) is one member of the new family of methodologies for dealing with messy problems which I draw upon in this thesis. I describe SSM in Section 3.5, illustrating it with my application of it to the messy problem of urban sanitation in Colombo. SSM also forms the basis for an operational framework for decision-making that I propose in Chapter 5. Since SSM emerged out of the systems movement (Checkland 2001), I begin with a brief account of some of the systems concepts that are relevant to messy problems and SSM next.

3.4 A systemic approach

Systems thinking is increasingly recognised as highly relevant to messy problems in sustainability oriented planning (Costanza et al. 1997; Gallopín et al. 2001; Meadows 2002; Meppem & Gill 1998). The systems movement originated from the study of biological organisms, which exhibit the characteristics of what are now known as complex systems (Checkland 1999, pp. 75-79). The biologist Bertalanffy extended the system theory of biological organisms into thinking more generally about systems (ibid). The issues of interest in the sustainability discourse are often metaphorically linked to complex biological systems; for example, terms like "social metabolism" and "urban metabolism" are used to describe society's or cities' consumption of materials and energy and related production of waste (Røpke 2005; Warren-Rhodes & Koenig 2001). Complex systems are 'open systems', i.e., they exchange energy and materials across their boundaries, and thus are responsive to their environment and context.

The relationships and connections between a complex system's constituents manifest in an 'organised complexity', so that complex systems have several defining characteristics. The most prominent of these are described below (Checkland 1999; Gallopín et al. 2001; Meadows 2002). A defining property of complex systems is that they exhibit characteristics that cannot be fully explained by understanding its components (Gallagher & Appenzeller 1999), which make them impossible to understand using the customary thinking tools of logic and analytical reduction.

> ***Emergence:*** A complex system exhibits novel properties as a whole that could not have been deduced through analysis of its elements, so that "the whole is more than the sum of its parts" as put forward by Aristotle (Checkland 1999, p. 75). A human being, for example, can 'be wise' or 'be funny', properties that can only be attributed to the whole in different contexts, but not predictable based on any elements that make-up the human. The emergent behaviour manifests as the enablement to fulfil a purpose (Checkland 1999, p. 75).

> ***Hierarchy:*** The structures within a complex system are organised hierarchically, with each level exhibiting emergent properties that did not exist at lower levels. For example, an organism is a hierarchical organisation of molecules, organelles, cells, and organs, which interact to form the organism that has emergent properties that are absent at the lower levels. There is strong interaction between levels, so that each level must be considered with reference to the levels above and below it, and the system must be considered simultaneously at many scales (Checkland 1999, pp. 81-82; Gallopín et al. 2001). Concepts and techniques that are applicable at one level often may not apply at levels above or below it, requiring different languages of description at different levels (Checkland 1999, pp. 81-82).

> ***Self organisation:*** The components of a complex system act in concert to produce coordinated organisation at a larger scale (Checkland 1999; Gallopín et al. 2001). Social insects such as ants and bees self-organise as colonies without imposed central control. The maintenance of self-organisation is predicated on *communication* of information to allow *regulation or control* of the hierarchy.

Checkland (1999) proposes that the foundation of systems thinking is encapsulated above, in the related pairs of ideas of *emergence and hierarchy*, and *communication and control* (Checkland 1999, pp. 75-92). Gallopín et al. (2001) explicate further characteristics of complex systems that are worth highlighting, although it may be possible to capture them within Checkland's headings.

> ***Non-linear feedback:*** A complex system's response to a stimulus is not always proportional to the magnitude of the stimulus (Gallopín et al. 2001). For example, a complex system might sometimes undergo very large changes as a result of an infinitesimal perturbation; at a different set of initial conditions, it may remain quite stable.

> ***Irreducible uncertainty:*** A complex system is likely to have inherent uncertainties that cannot be eliminated by gathering additional information (Gallopín et al. 2001), or:
>
> "… self-organizing, nonlinear feedback systems are inherently unpredictable. They are not controllable. They are understandable only in the most general way."(Meadows 2002).

> ***Multiplicity of legitimate views:*** There is no single 'correct' or 'true' way to describe a complex system, which Gallopín et al. (2001) describe as "a conceptualization of a portion of reality" – a conceptualization that depends on each observer's worldviews, objectives and previous experiences.

There are many possible classifications and typologies of systems, that Checkland (1999, pp. 110-121) categorises into five classes on the basis of their origins: natural systems, designed physical systems, designed abstract systems, human activity systems and transcendental systems:

- ***Natural systems*** are the physical systems that originate with the universe, as a result of the natural forces and processes that occur in the universe;
- ***Designed physical systems*** are man-made systems designed for some human purpose;
- ***Designed abstract systems*** are intangible systems that are the product of the conscious human mind;

- ***Human activity systems*** are the sets of human activities (that might typically also utilise and depend on natural and designed systems) that, as a whole, fulfil a purpose or mission; and,
- ***Transcendental systems*** are the "inescapable unknowables" (Checkland 1999 quoting Boulding 1956), systems of faith such as ideas of God.

A messy problem may be represented by a particular complex system, shown in generic form in Figure 3.6. The defined system itself is part of a 'higher' system in a hierarchy, and its position within this larger system gives it context. I have included transcendental systems within this context because of its potential to influence the worldviews and perspectives of stakeholders.

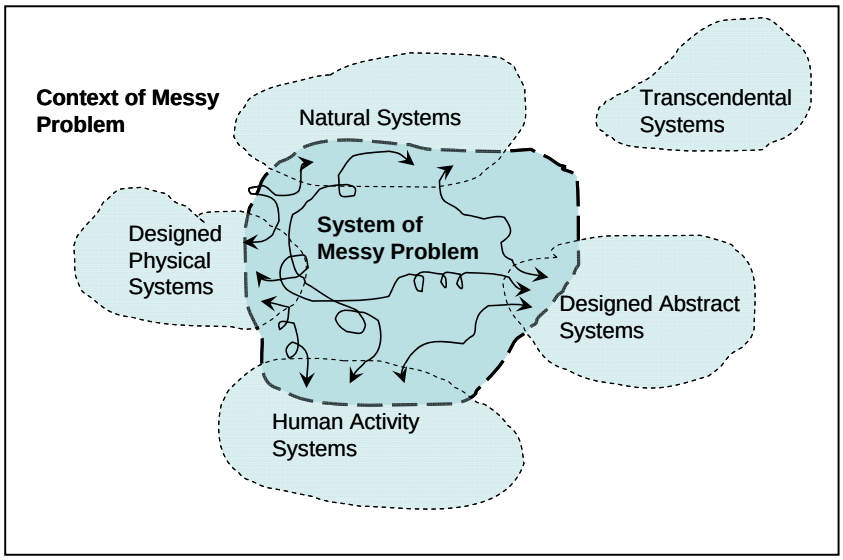

Figure 3.6: A messy problem represented as a system consisting of natural systems, designed physical systems, designed abstract systems and human activity systems that interact in complex ways.

That a multiplicity of perspectives allows the definition of any number of representative systems does not imply that 'anything goes'; rather, that

> "each of those views or systems, *if constructed with a modicum of care*, will have some correspondence with what is "really out there"" (Gallopín et al. 2001, emphasis added).

I see the "modicum of care" above as an essential ingredient for quality assurance of the process, that constrains an 'anything goes' philosophy. It calls for more than simply to 'be careful'. Pirsig describes caring as "a feeling of identification with what one's doing" (Pirsig 1976, p. 290) and insists that an "attitude of caring" is the proper emotional attitude that allows one to attend to detail, to speculate wisely and to make sound judgements – necessary attributes for excellence (Consigny 1977). This coincides with the accumulated

"systems wisdom" described by Meadows'(2002) through her experience with modelling complex systems, that includes the need to "expand the boundary of caring":

> As with everything else about systems, most people already know about the interconnections that make moral and practical rules turn out to be the same rules. They just have to bring themselves to believe that which they know."

Thus, the explicit commitment to ethics and enthusiastic caring allow the systems corresponding to messy problems to be defined with integrity, with the attempt to identify the issues and variables that influence the situation, and to define the problem in terms of all the issues that cannot safely be ignored (Gallopín et al. 2001). Gallopín et al. (2001) state that it is the responsibility of those who define the system "to consider the potential impacts of his/her scientific research from the beginning, and to assess to what extent the systemic, interlinked nature of reality can be safely neglected", based on scientific grounds rather than on social values or individual preferences. Such consideration of systemic linkages would include consultation with stakeholders in a manner that is consistent with the approaches of post-normal science, so that the decisions to include or exclude issues have greater legitimacy and quality assurance (Section 2.7.1).

Every real-life problem does not necessarily need to be tackled as a complex problem as defined above. There may be circumstances where interconnections and context may safely be neglected, and a system such as in Figure 3.7 may adequately represent the system of interest. A *systemic approach* that defines the relevant system in line with Figure 3.7 is, however, distinct from a conventional analytical approach that may reach Figure 3.7 through a reductionist interpretation of Figure 3.6. In the former, the system definition is arrived at through considering the particular problem through a defensible line of argument, as described in the previous paragraph, with presuppositions declared and their influence acknowledged. In contrast, conventional analytical approaches reduce or simplify problems within the paradigm of conventional rational analysis:

> We often end up persuading ourselves that everything is more simple than it actually is. Dealing with complexity by presuming that it does not really exist. (Morgan 1986, quoted by Söderbaum 2000, p. 12)

For example, significant contextual factors may be defined as "externalities" placed outside the problem domain so that interventions are not designed with explicit consideration of them; externalities are "left to the regulators and ethicists to catch up with when they can" (Gallopín et al. 2001). This highlights the weakness in not recognising or disclosing our presuppositions and commitments implicit in the tools we choose. Noting this weakness is not a suggestion that conventional analysts might be anything other than well intentioned.

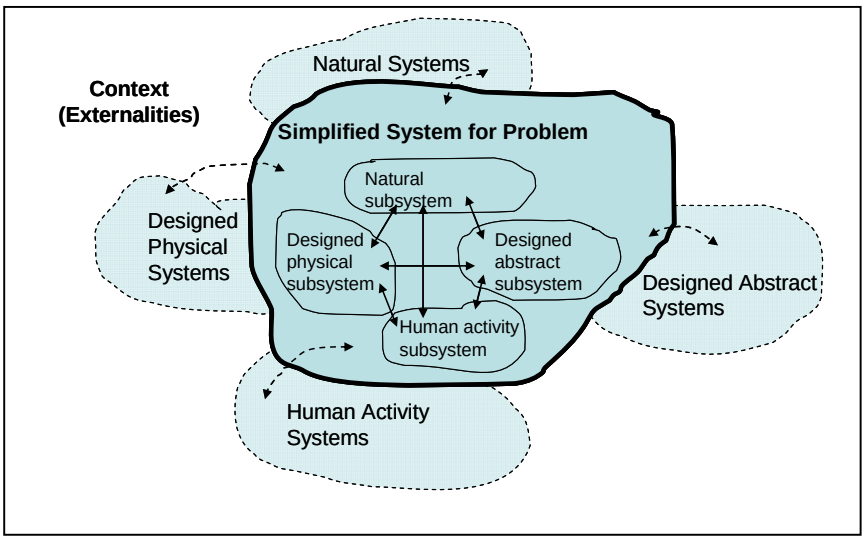

Figure 3.7: A representation of a simplified system that omits issues, interconnections and contexts that can safely be neglected.

Based on the foregoing discussion, I have represented conventional urban sanitation as a complex system in Figure 3.8 where a generalised configuration of urban service arrangements (water, sanitation, municipal solid waste, food supply, energy supply, transport, health care and so on) common to most cities around the world have been taken as the starting point. I have identified a 'material sanitation system' as the primary system to consider for improving urban sanitation towards sustainability. Within it lies the 'urban system' in relation to sanitation, where the primary inputs of food and water are transformed to waste outputs. I have chosen the boundaries of the 'material sanitation system' to include parts of the water supply system and agricultural system on the input side, and parts of landfill systems and systems that provide ecosystem services on the output side. The 'material sanitation system' boundary is represented as a broken line to indicate the interactions with, and influence of, other systems; the systems outside the boundary create the *context* in which the 'material sanitation system' operates. Interactions that may be specifiable and quantifiable are represented as straight arrows; more complex interactions are represented as curly arrows. I have distinguished between the systems that principally deal with biophysical material or energy (oval shapes) from systems that influence how the various other systems are designed and interact – three abstract systems: economic systems, political systems and civil society, and the climate system (cloud shapes), which all influence each other as a complex system would.

Labelled arrows in Figure 3.8 represent the primary material flows related to conventional urban sanitation – water, food, organic and excreted waste. Here, excreted wastes are collected and possibly treated within the 'wastewater (WW) treatment system' that may consist of onsite systems and/or sewers and sewage treatment plants. Effluents (or in some cases, untreated sewage) from the 'WW treatment system' are released to ecosystems

(including soil systems, rivers, oceans, and wetlands amongst others) where effluents are improved in quality through ecosystem services before being returned to the water cycle. Food wastes and other organic wastes from the 'urban system' are managed through arrangements for municipal solid waste, and may end up as landfill (or compost, in some cases); biosolids from the 'WW treatment system' may be handled in a similar manner.

A systems representation helps identify potential interactions and influences that can be missed in more familiar planning approaches. It can thereby identify various influences and envision different relationships between elements in order to improve the system as a whole. For example, recognition of the relationships between the urban sanitation system and other systems can lead to a vision of urban sanitation as set of synergistic services that removes human waste, co-digests human waste with other urban organic waste, produces energy (bio-gas) and certified greenhouse gas emissions reductions, produces fertiliser and so on. Each subsystem would need to be examined in relation to other systems – so that subsystem-based (reductionist) analysis is complemented with an integrative systems perspective. Questioning the wider range of relationships can support decisions about their significance that is based on evidence rather than the values and preferences of those involved (Gallopín et al. 2001). This approach can be used to explore alternative visions that favour options that provide resilience and adaptability, while acknowledging the complexity of the system and the limits of our ability to control it.

Meadows (2002) sums up, with delightful eloquence, the optimism that systems thinking brings to responding to complex problems that defy and frustrate analytical reductionist thinking:

> "We can never fully understand our world, not in the way our reductionistic science has led us to expect. Our science itself, from quantum theory to the mathematics of chaos, leads us into irreducible uncertainty. For any objective other than the most trivial, we can't optimize; we don't even know what to optimize. We can't keep track of everything. We can't find a proper, sustainable relationship to nature, each other, or the institutions we create if we try to do it from the role of omniscient conqueror.
>
> "For those who stake their identity on the role of omniscient conqueror, the uncertainty exposed by systems thinking is hard to take. If you can't understand, predict, and control, what is there to do?
>
> "Systems thinking leads to another conclusion, however – waiting, shining, obvious as soon as we stop being blinded by the illusion of control. It says that there is plenty to do, of a different sort of "doing". The future can't be predicted, but it can be envisioned and brought lovingly into being. Systems can't be controlled, but they can be designed and redesigned. We can't surge forward with certainty into a world of no surprises, but we can expect surprises and learn from them and even profit from them. We can't impose our will upon a system. We can listen to what the system tells us, and discover how its properties and our values can work together to bring forth something much better than could ever be produced by our will alone. We can't control systems or figure them out. But we can dance with them."

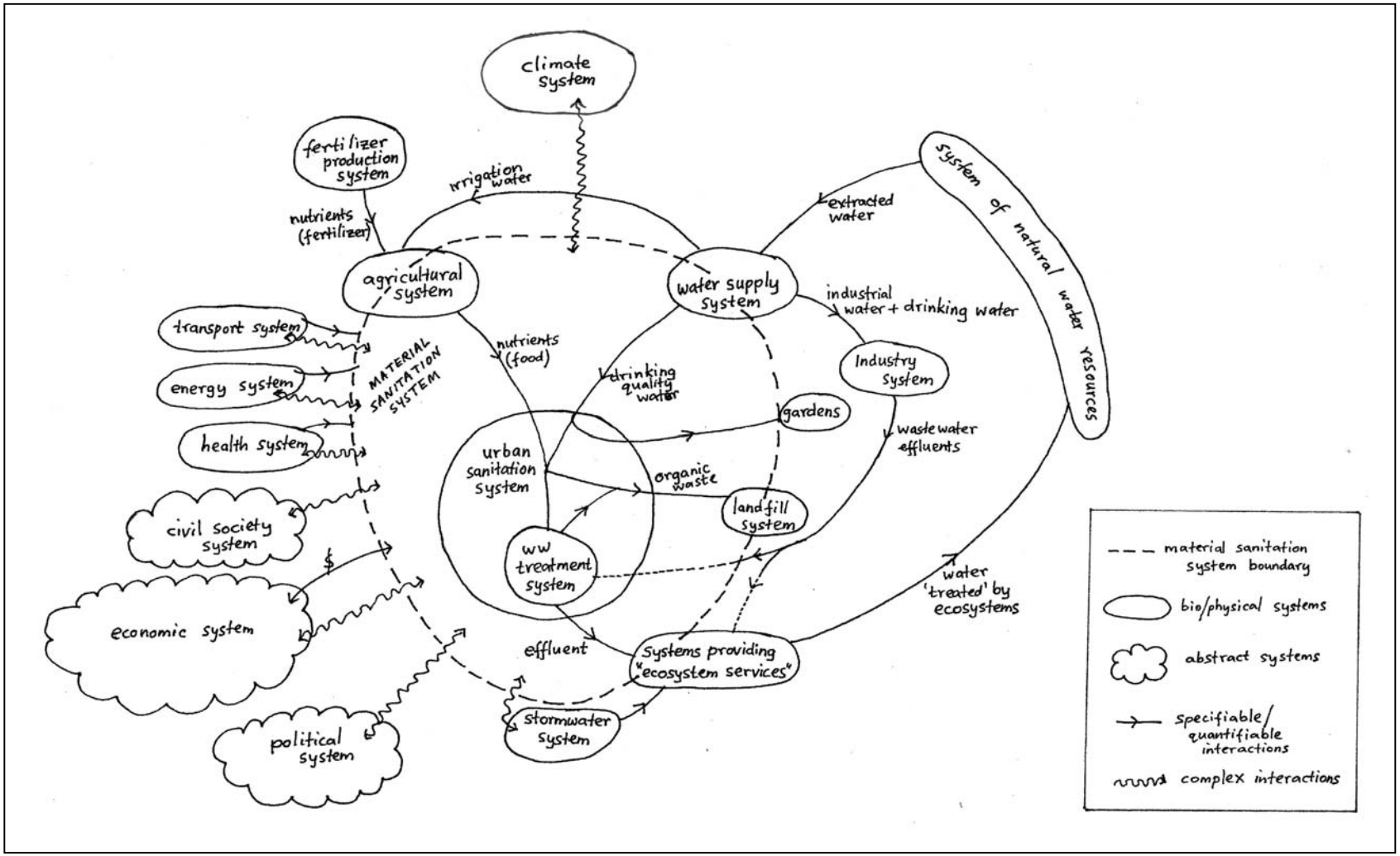

Figure 3.8: A complex system representation of urban sanitation

3.5 Soft Systems Methodology

Soft Systems Methodology (SSM) evolved out of the failed attempts to use the 'hard' systems thinking approaches of systems engineering to improve management situations (Checkland 2001). The term 'management' is used in its broadest sense, as defined by Checkland and Scholes (1999):

> "To 'manage' anything in everyday life is to try to cope with the flux of interacting events and ideas which unrolls through time. The 'manager' tries to 'improve' situations which are seen as problematical – or at least as less than perfect – and the job is never done … because as the situation evolves new aspects calling for attention emerge, and yesterday's 'solutions' may now be seen as today's 'problems'."

By this token, designing policy and planning for sustainable development and its various elements, including sustainable urban sanitation, are 'management' situations.

With such broad scope of application to 'management' situations, SSM has been adapted to inquire into a wide range of situations amounting to several hundred projects (Checkland 2001). I will provide a high-level overview of SSM, illustrating it with my use of it to improve the 'management' of my thesis research.

3.5.1 A systemic action framework for inquiring into messy problems

SSM uses systems models as devices to explore a situation that is perceived to be problematic. Checkland justifies this use of systems:

> "We use systems models because our focus is on coping with the complexity in everyday life, and that complexity is always, at least in part, a complexity of interacting and overlapping relationships. Systems ideas are intrinsically concerned with relationships, and so systems models seem a sensible choice; and since they have been found, time after time, to lead to insights, they have not been abandoned." (Checkland 1999, p. A24)

SSM, represented in Figure 3.9, is a system for learning about a complex problematical human situation, that leads to finding ways for taking deliberate or purposeful action aimed at improving the situation – actions that appear sensible to those concerned at the time (Checkland 2001). It is a system, a set of activities linked in an organised structure to form a whole, with learning as an emergent property. It is designed to bring together different stakeholders with a multiplicity of perspectives on the problem, into a process of inquiring about the problematic situation, to generate constructive debate that leads to accommodations between different interests about actions that might improve the situation.

SSM's aim for reaching accommodations amongst participants is realistic about what can be achieved. Conflicts between stakeholders are inevitable, but reaching *accommodations*

refers to the willingness of different parties to 'go along with' a course of action for the sake of improvement despite their differences, in contrast with seeking *consensus* amounting to resolution of conflicts between the parties.

> "It is wrong to see SSM simply as consensus-seeking. That is the occasional special case within the general case of seeking accommodations in which the conflicts endemic in human affairs are still there, but are subsumed in an accommodation which different parties are prepared to 'go along with'." (Checkland & Scholes 1999, p. 30)

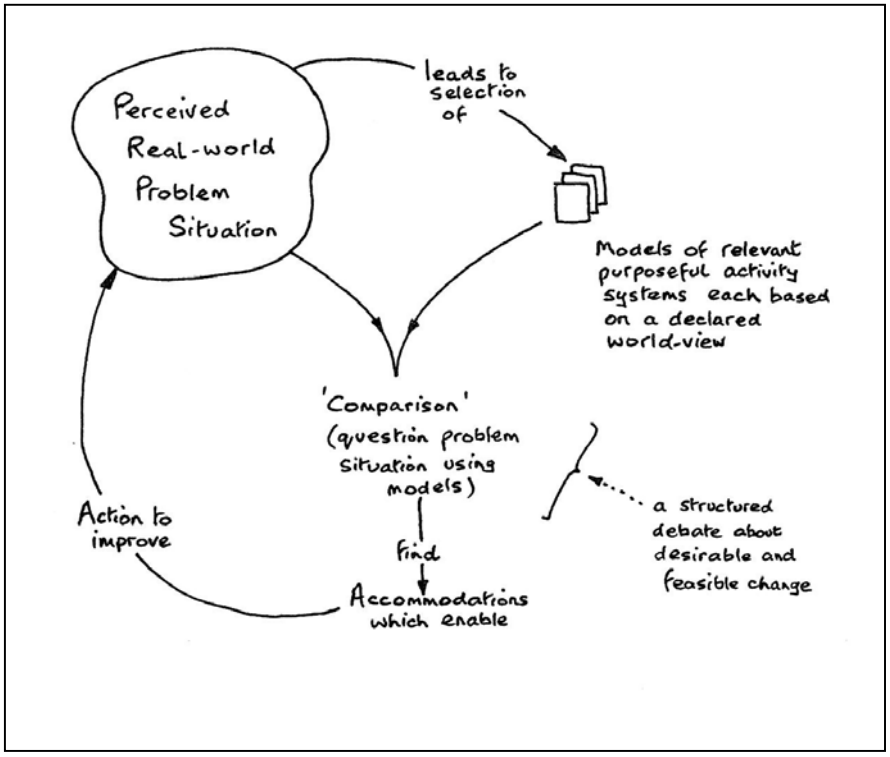

Figure 3.9: The general shape of soft systems methodology (Checkland 1999, pA9)

The general shape of SSM is represented in Figure 3.9, that Checkland (1999, pp. A7-A9) describes as consisting of several key ideas:

A. Each real-world problem situation under investigation is a human situation, where those involved are attempting to decide on purposeful action that is meaningful from their perspective;

B. Systems ideas can be used to build models of such purposeful action as purposeful human activity systems – remaining conscious that these are conceptual models rather than descriptions of the real world. For each model, the presuppositions or viewpoint from which the 'purpose' is interpreted must be declared before the model is built;

C. The models can be compared with the perceptions about the real-world situation to structure inquiry and debate – leading to new knowledge and insights about the

problem situation. This could lead to further ideas for more models, new inquiry and debate and knowledge – so the process of learning could be iterative;

D. The learning cycle above could end with accommodations reached among those involved about the choice of a certain course of action to improve the situation, that are seen to be desirable and feasible as they see it.

One description of SSM sees it as the interaction of two parallel streams of inquiry: a stream of logic-based inquiry and a stream of cultural inquiry (Checkland & Scholes 1999). The logic-based stream chooses and models relevant systems and compares them with perceptions of the real-world situation. The cultural stream seeks to describe the perceived real world situation and to inquire into the myths and meanings, and examine the roles, the social system and political dimensions of the situation, which illuminate the feasibility and desirability of actions.

While SSM has been described as a series of stages with the application of systems tools in particular ways to assist model-building (for example, as described in Checkland & Scholes 1999, pp. 28-52), it is presented as a *methodology* or "the principles of method". Checkland (1999, p. A32) writes:

> "When [the] principles are used to underlie, justify and inform the things which are actually done in response to a particular human problem situation, those actions are at a different level from the overarching principles. Methodology in that situation leads to 'method', in the form of the specific approaches adopted, the specific things the methodology user chooses to do in that particular situation."

3.5.2 Using Soft Systems Methodology

In this section, I describe one way of using SSM, which I illustrate with my application of SSM for inquiring into urban sanitation in Colombo as the particular real-world problematic situation. My account here remains true to my thinking between September and October 2004 when this work was carried out. At the time, I still believed my research related to finding a 'solution' to the problem, while just beginning to recognise its messy level of complexity. Realising that there were many aspects to the problem which could not be all included within the time frame of a PhD research project, I needed to narrow my focus to some particular aspect that would be 'most' useful – a leverage point that would allow my research to have an impact. I hoped that the SSM learning cycle might lead me to identifying this leverage point.

My application is described in relation to the 'key ideas' of SSM set out in the last section. As a novice in approaches that departed from reductionist analytical thinking I had been accustomed to, I chose to use SSM in a highly prescriptive way much like following a recipe rather than try to develop my own methods based on SSM's 'principles of method'.

A. Perceiving the real-world problem situation:

This stage of 'finding out' about the situation belongs to the cultural stream of inquiry. As a first step, pictures of the situation are drawn, identifying the slow-to-change structures and the more dynamic elements; and representing the important relationships pictorially as 'rich pictures'. Checkland emphasises the value of 'rich pictures' for capturing the complexity of multiple and interacting relationships that would become lost if linear prose was used (Checkland 2001, p. 74).

Further steps in the analysis seek to expose the social and political dimensions. The social system is examined as the interaction of *roles* (the social positions considered significant in the situation), *norms* (expected behaviours) and *values* (the beliefs that allow the performance of actors to be judged as good or bad) (Checkland & Scholes 1999). The political analysis seeks to understand how power is expressed in the situation, important because how accommodations are reached is strongly influenced by the dispositions of power (ibid).

The extent of my formal 'finding out' step is presented in Figure 3.10, which maps my perceptions of those I identified as key actors that interact in the problem situation of sanitation in Colombo. While further aspects of the 'finding out' as described above would have been valuable for a process that involved many participants to make accommodations about interventions, I felt the limited level of 'finding out' was adequate for my purpose, to gain practice with SSM while seeking an appropriate narrowing of my research scope, rather than to resolve the problem itself.

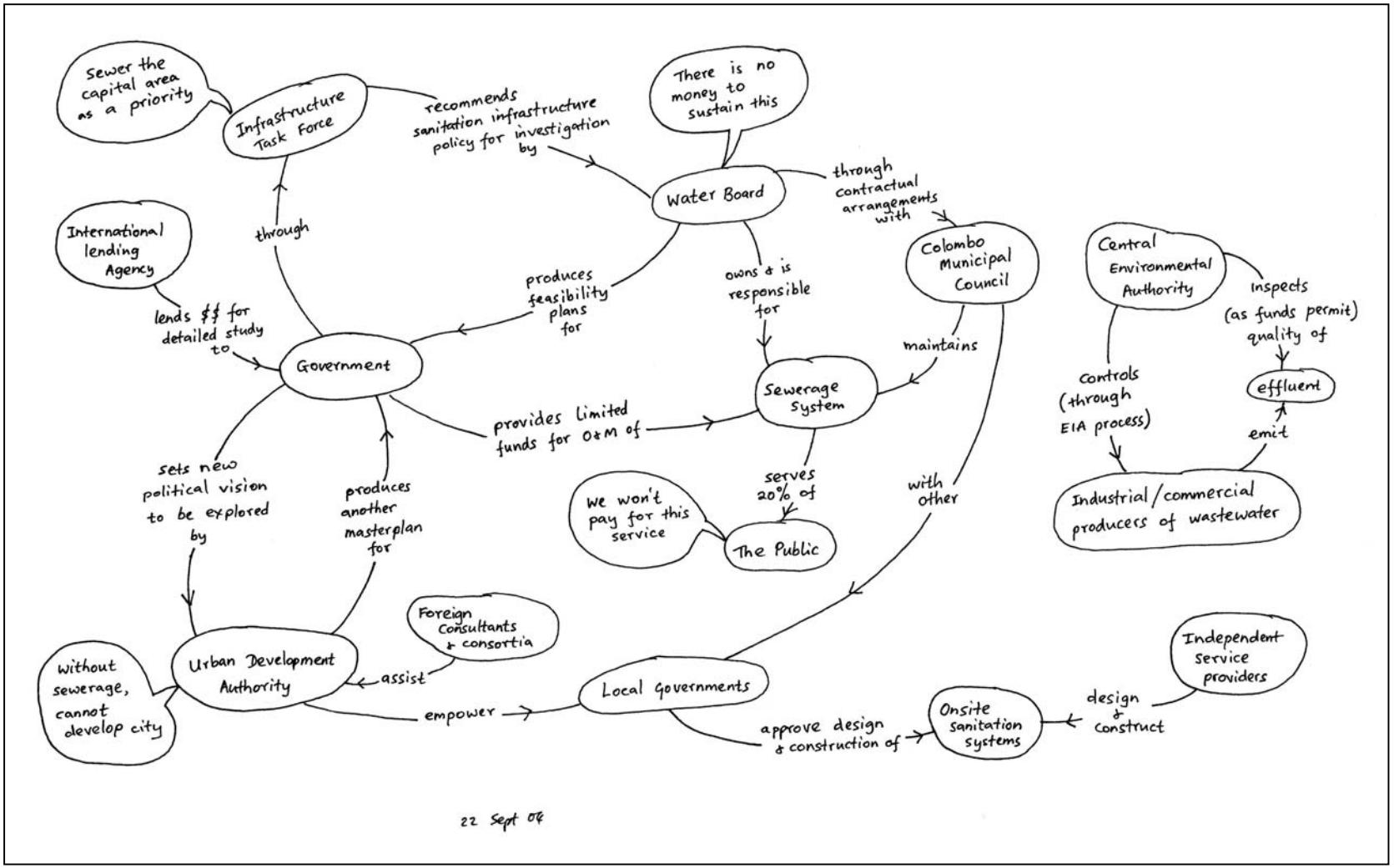

Figure 3.10: Rich picture of urban sanitation in Colombo

B. Building models of systems of purposeful action

Making conceptual models belongs to the logical stream of inquiry in SSM. To use complex systems ideas in modelling relevant activity systems, the first step is to state the purpose of the system. The conceptual model, as a complex system, would then have the fulfilment of this purpose as an emergent property. Many interpretations of 'purpose' are possible, depending on worldview (Checkland 1999, p. A7). Thus, it is necessary to name the purpose of the activity system and simultaneously declare the worldview upon which it is based.

Checkland & Scholes (1999, p. 33) recommend that the 'purpose' be stated in the form of creating a *transformation,* where a relevant 'thing' is transformed from an initial or input state into an output state (Figure 3.11). This helps to retain logical consistency in translating the idea of the emergent property as being the fulfilment of a purpose in the models.

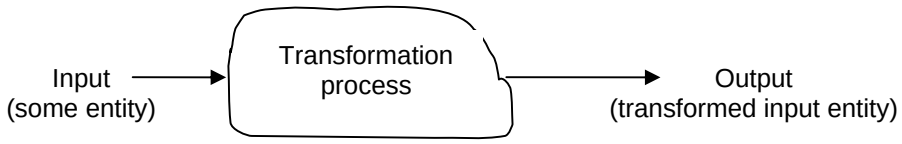

Figure 3.11: Transformation as the purpose of a modeled activity system

To illustrate the central role of the transformation in modelling activity systems, I expand on an example given by Checkland and Scholes (1999, p. 34), of a library. Some perceived purposes of a library might be the transformation of:

a local population (input) → a better informed population (output)

books on library shelves (input) → books out in the community (output)

books (input) → 'dog eared' books (output)

The first may be based on a worldview that it is desirable to produce a better-informed population, so the modelled activity system might incorporate a range of educational measures to enhance the transformation. Likewise the second may model ways to encourage borrowing. The third transformation may be based on a worldview that the output state is undesirable; a model of this activity system might explore ways to discourage mistreatment of books. Alternatively, the third transformation may be based on the worldview that books will undergo wear-and-tear in the natural course of events, in which case a concept model would include arrangements for repair and replacement of damaged books. Thus, the statement of both transformation and worldview are critical for modelling.

In my exercise, I identified a number of 'purposes' of urban sanitation for Colombo as transformations together with my worldviews that determined these purposes as desirable. Three of these are provided in Table below, to illustrate:

Input state	Transformed output state	Worldview
Dysfunctional technical systems	Well-functioning technical systems meeting health and environmental criteria	Given adequate information tools and resources, local engineers can design, build and maintain well functioning sanitation systems
Uninterested poorly-informed system users as passive service recipients	Well informed customers demanding and committed to having well-performing systems	The engagement of users, including their financial commitment, is essential for the good performance of sanitation systems.
Regulatory system with low levels of compliance	Regulatory system with high levels of compliance	Supportive regulations enable the achievement of desired performance outcomes when compliance is enforced.

Table 3.1: Potential transformations achieved by a conceptual system for sanitation in Colombo

"Sentences elaborating the core transformation" comprise a second step before modelling can commence, as the transformation is not sufficiently rich to make models from (Checkland & Scholes 1999). Thus the transformation forms the basis of a 'root definition', that identifies who will undertake the purposeful activity, who can stop it, who are its beneficiaries or victims, and what environmental or contextual constraints are taken as given (ibid, p. 35). The root definition of a purposeful activity system is expressed in the format: "*a system to do X by Y in order to achieve Z*", and is aided by the mnemonic CATWOE below (ibid):

The CATWOE mnemonic to aid formulation of root definitions	
C: 'customers'	The victims or beneficiaries of the transformation T
A: 'actors'	Those who would perform the transformation T
T : 'transformation process'	The conversion of input to output
W: 'weltanschauung'[62]	The set of interpretations, biases, prejudices and value systems we bring in our worldviews, which makes the transformation T meaningful in context
O: 'owner/s'	Those who could stop the transformation T
E: 'environmental constraints'	Elements outside the given system which it takes as given

Table 3.2: The CATWOE mnemonic

I chose the following CATWOE associations for a conceptual model to incorporate all three of the transformations in Table 3.1:

C : community;

A : utility (professional service provider);

T : a need for "well performing" sanitation → need met;

W : appropriate technical systems can provide the needed service if and only if
(i) the community gives its ongoing support and
(ii) organisational arrangements provide adequate management

O : regulators, planning authorities;

E : socioeconomic status of community, environmental political and cultural factors.

This led to the following root definition for a purposeful activity system:

> **"A utility-operated sanitation system overseen by regulators and supported by the community, that performs well on a long-term basis."**

[62] Checkland (2001) prefers 'W' to stand for the German term "weltanschauung that refers to "the stocks of images in our heads, put there by our origins, upbringing and experience of the world, which we use to make sense of the world and which normally go unquestioned" over its rather "bland" English translation as 'worldviews'.

A model of the conceptual activity system may now be constructed as an assembly of activities (or activity sub-systems) that meet the requirements of the root definition and the CATWOE. Checkland and Scholes (1999, p. 38) recommend keeping the number of activities to the minimum necessary; each of these activities could be further elaborated separately and modelled based on a fresh root definition at the next level of resolution if needed, in keeping with the notion of hierarchy in complex systems.

To be true to the representation as a self-organising complex system, the conceptual model needs to include monitoring and control activities, so that changing environments can be detected and responsive action taken to enable survival. In Checkland's words:

> "…our models, to use systems insights, need to be cast in a form which in principle allows the system to adapt in the light of changing circumstances. That is why models of purposeful activity are built as sets of linked activities (an operational system to carry out the T in CATWOE) together with another set of activities which monitor the operational system and take control action if necessary." (Checkland 1999, p. A24)

Checkland (ibid) notes that monitoring must be based on a set of criteria against which the performance of the system as a whole may be judged. The measure of success in performance, as the transformation of the input state to the output state, may be judged on at least three counts: the criteria of *efficacy* (whether the intended output is produced – or 'does the means work?'); *efficiency* (whether minimum resources are used to complete the transformation); and *effectiveness* (whether the transformation is worth doing in terms of long-term or higher level aims)[63]. Checkland (1999, p. A25) proposes that these "3Es" performance criteria are relevant for assessing every model. It is possible to include more performance criteria at higher levels as possible measures against sustainability. For example, Checkland (ibid) proposes two further possible "Es" – ethicality (whether the transformation is morally correct) and elegance (whether the output and the transformation process are aesthetically pleasing). The key point is that systems for monitoring against performance criteria of at least efficacy, efficiency and effectiveness, and for taking control action must be included in any conceptual model of a complex system.

I constructed a conceptual model (Figure 3.12) based on the root definition and CATWOE described above, which included activities that addressed the key phrases in the root definition: *"a utility-operated sanitation system overseen by regulators and supported by the community, that performs well on a long-term basis"*. I saw the operational part of the model driven by the *utility*, with *regulators* playing a central role in facilitating monitoring and controlling functions. The *sanitation system* needs to be selected on the basis of an

[63] These criteria resonate with Max-Neef's (2005) notion of transdisciplinarity consisting of different disciplinary levels that consider "what we ought to do" (similar to the *effectiveness* question), "what we want to do" (that has its parallel in the efficacy question) and "what we are capable of doing" (including the efficiency question).

assessment of possible technical options[64]. To ensure that it *performs well*, performance criteria and goals need to be set. S*upport by the community* need to be canvassed through initiatives to inform them, identify their preferences and gain their commitment. It is necessary to secure adequate funding, establish robust management systems and monitoring and control functions to enable the conceptual system to function on a *long-term basis*. Thus the elements of the model were chosen so all these activities could take place[65].

Figure 3.12 shows the conceptual model I constructed based on the root definition above, as an operational system consisting of ten activities together with monitoring and control systems for tracking efficiency, efficacy and effectiveness[66]. Each of the elements in the conceptual model is itself an activity system – 'a system to decide on performance goals', 'a system to appreciate the community's commitment', 'a system to decide on possible technology options', and so on, and could be elaborated further with root definitions and conceptual models of their own as noted by Checkland and Scholes (1999, p. 38). Note that the numbering of the activities in the conceptual model in Figure 3.12 are tags to assist with referencing them and does not denote sequential activities. The arrows indicate the dependencies. For example, collating potential technological options in (3) '*deciding on technology options*' is contingent on each option being able to meet performance goals set in (1), gain community commitment (2), and having an accompanying set of costings (5). *Deciding on technologies to commission* (7) depends on having consultations with stakeholders (6) to take their preferences into account, and a realistic proposal for recovering costs (5) which in turn depends on cost estimates of the options having been made (4).

[64] The conceptual model is framed in language that suggests new investment, but could conceptually include retrofit activities to rectify existing problematic systems.

[65] It is interesting to note the similarity of these elements with the elements of a systems analysis framework (Figure 4.4), which reflects my thinking about the level of complexity of sanitation as simple or intermediate rather than messy at the time of this work (September-October 2004).

[66] Note that in a 'real world' application of SSM, there are likely to be a number of root definitions and corresponding conceptual models that result, whose properties will be highly dependent on the individuals involved in the process.

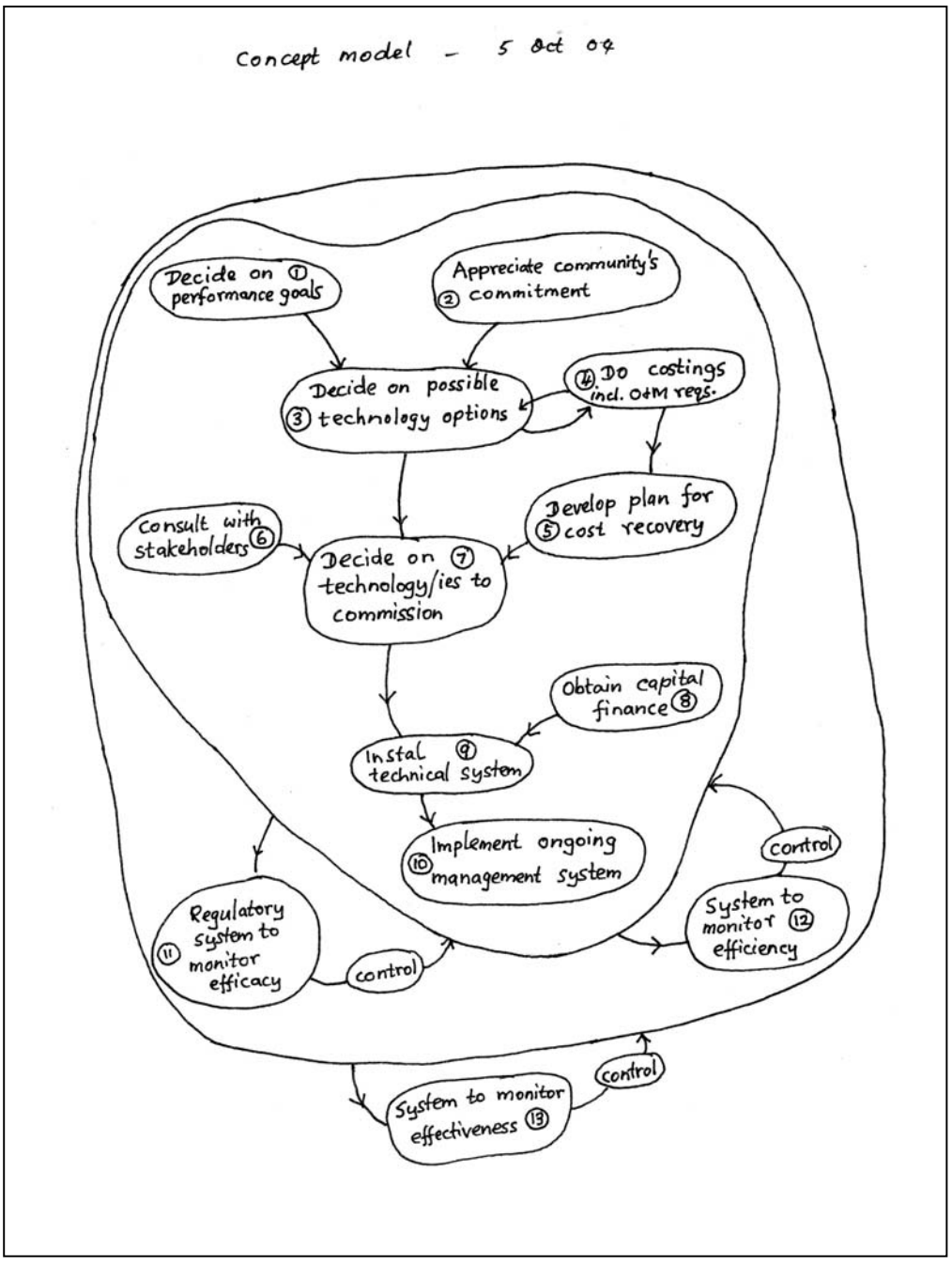

Figure 3.12: Conceptual model based on root definition

C. Comparing models with the perceived real-world situation

Conceptual models in SSM are tools for *thinking about* the real-world situation, which provide a framework for dialogue and discussion. Constructive debate or dialogue is structured using the models that are based on a range of carefully expressed worldviews ('a multiplicity of legitimate perspectives') and comparing them with how the real-world

situation is perceived. The discussion focuses attention on the preconceptions implicit in the views about the world and possible alternative views, and provides the opportunity to reconsider many aspects of the activity system as an intervention in the problematic real-world situation (Checkland 2001).

Checkland and Scholes (1999, pp. 42-44) indicate several ways of structuring the comparison – such as formal questioning, informal discussion, or creating scenarios using the models.

> "The models are used as a source of questions to ask of the real world; answering those questions initiates debate, which may be conducted in any way that seems appropriate to the particular situation. It may be carried out by a group of people gathered in one place at one time to have a discussion, or carried out in one-to-one interviews spread over a period of time. It is impossible to generalise" (Checkland & Scholes 1999, p. 43).

The tyranny of distance prevented my using my conceptual model as the basis for dialogue and debate with any stakeholders in Colombo. Instead, I used it as a thinking aid. I used a matrix (Table 3.3) for comparing my conceptual model with the real-world situation in Colombo *as I perceived it*, structured along the lines recommended by Checkland and Scholes above. Each activity element of the conceptual model was compared and the changes that might bring the reality closer to the conceptual model were identified from my perspective, as summarised in Table 3.3. The last column, tabling changes that could potentially bring concept and reality closer, identified possible research opportunities, which I then assessed against my views on the leverage it would have in influencing outcomes. A short commentary on each activity element is provided below[67].

1. *Decide on performance goals*: I was uncertain whether this was explicitly done in Colombo. Research could potentially devise a *process* for identifying desirable and feasible performance goals.
2. *Appreciate community's commitment*: My interviews revealed that this was generally not done, leading to situations where householders in new urban housing developments refused to pay for their local sanitation services (Interview 2003). Research could potentially be focussed on processes for dialogue with the community to assess and increase their interest in and support of their sanitation services.
3. *Decide on possible technology options*: The considered options were generally piped sewerage or septic tank systems[68], with some regulatory exceptions made for pilot-scale or small-scale schemes for decentralised technologies including ecosan systems (Dissanayake 2002; Wikramanayake & Corea 2003). An opportunity exists to research

[67] As noted earlier, the numbering of the activities is for referencing purposes and does not denote sequential activities.

[68] Current planning regulations prescribe only two options: "All sewerage and waste water outlets shall be connected to an existing public sewerage system … [or if this is not possible] sewerage shall be disposed through a septic tank … and waste water shall be suitably disposed through a soakage pit" (UDA 1999, p. 48)

how a wider range of options can be brought to the table, including how reforms to regulatory arrangements for sanitation might enable this.

4. *Do costings – capital, operation and maintenance requirements*: This is generally done for centralised options using standard text-book procedures (NWSDB 2001), while householders would generally estimate their own capital costs for installation of on-site systems. Research on the impacts of using least cost planning and whole of society cost estimates for cost-based decision making could potentially be useful.
5. *Develop plan for cost recovery*: Cost recovery for sanitation presents a real quandary for officials in Colombo (Chapter 1), since there is currently no tariff or mechanism to raise regular revenues. Research that contributed to resolving this problem could potentially make a significant impact.
6. *Consult with stakeholders*: A traditionally supply-side ethos means that stakeholders are not routinely consulted about their preferences – including what they value and are willing to pay for (Interview 2003). Research on processes for dialogue with stakeholders and broader community combining (6) and (2) above could potentially form a worthy project.
7. *Decide on technology/ies*: Decision making is primarily based on cost (NWSDB 2001). Research could potentially expand scope for decision-making processes to take sustainability criteria including economic, social and environmental costs into account.
8. *Obtain capital finance*: Mechanisms to secure some level of capital finance appear to exist (Interview 2003). The possibilities for obtaining capital financing would be strengthened through cost recovery mechanisms that provide financiers with reasonable returns, so research on (5) would make a contribution here as well.
9. *Install technical system*: There was a high level of technical and engineering competence in Colombo, so research here would be of little value.
10. *Implement ongoing management system*: While institutional management systems are in place for centralised sanitation systems, none exists for regular monitoring and management of onsite systems. Designing a centralised management system for the entire range of scales of technologies could potentially form a useful research contribution.
11. *A regulatory system to monitor efficacy*: Measurement of efficacy would depend on there being some specific goals to be met, such as performance goals (1), and regulatory monitoring to ensure that the goals are adequately met. While environmental objectives in the form of standards representing world best practice in most cases exist, enforcement is weak (Interview 2003). I felt that research into a regulatory system that monitored different facets related to efficacy could be important, but that the poor record of implementation in general could work against any practical impact such research might have.
12. *A system to monitor efficiency*: A Public Utilities Commission was set up in 2003 to fill the role of economic and service quality regulator for energy, water (and centralised sanitation) (Interview 2003). Its functions include promoting and monitoring efficiency in capital investment and operations and internal resource allocation (PUCSL 2007). Research in this area at this time is therefore not likely to have much relevance.

13. *A system to monitor effectiveness*: The ad hoc advocacy of citizen groups and NGOs may highlight cases in breach of effectiveness or desired long term objectives as they arise (Interview 2003), but this does not occur as routine monitoring on an ongoing basis. Research could potentially create a useful contribution by exploring the shape of a system that monitors effectiveness and ethics continually, possibly using an independent watchdog agency.

The exercise above identified many more options than could be dealt with within the course of a single PhD project. The criteria I considered important for my research were: to address a fundamental 'blockage' or obstacle to addressing problematic sanitation; to open up opportunities for sustainability to be made central to a resolution of the problem; and to be able to work from a distance. Using these criteria as a filter, I chose activity (5), *Develop plan for cost recovery* as a suitable leverage point that fitted with my priorities and limitations. A further consideration was the perceived intractability of the problem of cost recovery that my interviewees in Colombo communicated, which suggested that research responding to this challenge would have relevance, as well as a broad impact on other activities such as the feasibility of management and maintenance and ability to secure finance. With cost as a new focus I therefore returned to the beginning of the learning cycle: 'perceiving the real-world problem situation', to review literature on economics, pricing, subsidies and related issues which led to the synthesis set out in the next chapter (Chapter 4).

	Activity	Exist in real world?	How it's done	Ideally	Difference	Changes
1	Decide on performance goals	no?	not specifically set	Set location specific performance goals wrt health, environment, social outcomes and resource use		develop framework or system to enable setting of desirable feasible goals
2	Appreciate community's commitment (and ability/willingness to contribute)	no		be able to influence (increase) and find out about the community's commitment and support for good sanitation		develop communication and education program to increase knowledge and commitment; collect information on willingness for financial contribution
3	Decide on possible technology options	yes	Sewer or septic based on distance to sewer. Special arrangements for other options on case by case basis	Consider wider range of possible technologies capable of meeting performance goals and better suited to the local conditions	reduce limiting / impeding effect of regulations	review regulatory arrangements - prescriptive vs objective oriented; facilitate information dissemination about other tech alternatives
4	Do costings -capex and O&M for each option	yes	Feasibility study by utility following text book procedures	Consider whole of society cost including externalities	increase scope of feasibility study	Develop capability for using life cycle costing/LCP type methods; include impacts of project construction time on cost of finance
5	Develop plan for cost recovery	?	Historical no charge for sewerage. Examining overseas models with view to introducing user charges	Consider innovative options and wider set of beneficiaries who can contribute	Not be limited to models in developed countries	Examine options with creativity and daring! (perhaps using tools de Bono type or thinking aided by ssm)
6	Consult with stakeholders	?	Invitation to comment on plans?	Consult at early stages to involve and give ownership to solution process	Increase scope of stakeholder consultation	Develop stakeholder consultation methods for extensive and meaningful consultation for enabling informed input to decision making
7	Decide on technology/ies	yes	Utility/planners/developers decide sewer or estate scale decnt depending on circumstances	use 3,4,5,6 to reach accommodations and make decision	More qualitative interpretive decision making process	Develop systematic decision making framework that accommodates the complexity of different stakeholder interests
8	Obtain capital finance	yes	Foreign/government finance (with interest payable)			
9	Instal technical system	yes	Utility engineering department or contractors			
10	Implement ongoing management system	?	ad hoc as available O&M funds allow	centralised management and regulatory oversight	O&M that's adequate to meet goals is enabled by 5	Develop management system within existing organisational landscape, for implementing o&m and monitoring technical performance

11	A regulatory system to monitor efficacy - to enforce compliance with regulatory requirements (assuming these are efficacious themselves) and to verify that goals are met
12	A system to monitor efficiency (who??)
13	A system to monitor effectiveness and ethics (intergenerational equity)- run by a non-governmental (green? Public advocacy? Consumer group?) watchdog

Root Definition

A utility operated sanitation system overseen by regulators and supported by the community, that performs well on a long term basis.

	ACTIVITY
"sanitation system" - contingent on examining technical options and deciding on selection	3,7 enabled by 4
"performs well" - performance criteria and goals	1 + 11, 12
"supported by community" - inform, establish commitment, involve in decision making	2,6
"long term basis" - adequately funded, management system, monitoring and control function	2,4,5, 10, 11 12 13

6-Oct-04

Table 3.3: Matrix comparing elements of conceptual model and perceived reality

D. Deciding on action to improve the perceived real-world problem situation

Checkland (1999, pp. A7-A9) noted that the learning cycle consisting of steps A, B and C – finding out, building conceptual models and comparing models with the real world – could be iterative, with fresh insights leading to new inquiry. The cycle concludes in step D when learning leads to a decision about action as a result of accommodations reached through dialogue between those involved in the process. This stage draws on the cultural stream and the logical stream of inquiry to decide on what is seen to be both desirable and feasible to those involved.

As noted in the preceding section, in my application I did not reach step D in the SSM cycle (which was in any event outside the scope of this thesis), but instead returned to new inquiry (Chapter 4) as a result of the insights gained in the earlier steps.

In real-world applications of SSM, the 'learning' that results is generally seen as the most valuable outcome of the process, which corroborates Meppem & Gill's (1998) idea of 'sustainability as a learning concept' . While it can reveal a way forward to improve the problematic situation of interest, often this outcome is viewed as secondary to the learning itself. Bell and Morse observe:

> "… perhaps the most noticeable outcome of our work in Malta [on developing sustainability indicators through a process based on SSM] was the joy that the participants showed in learning about [sustainable development] through indicators. Perspectives were widened, and even if not a single indicator gets 'used' in the sense of helping to guide policy intervention, all agreed that much insight was gained and there were benefits as a result. This is not a new insight in itself, and others have had a similar experience (...) It was as though the journey through the cycle in itself provided useful outcomes, even if none of the resultant indicators are ever used." (Bell & Morse 2003, p. 157)

3.6 Conclusions

Two key concepts emerged in this chapter out of my synthesis of scholarly contributions from the sustainability discourse and academic research on planning. First was the idea that the *approach* to addressing a problem must match the *type* of problem. In particular, that commonly used analytical and reductionist scientific approaches, that are better suited for problems of 'simple' or 'intermediate' levels of complexity, are not able to resolve problems belonging to the 'messy' class, such as problematic urban sanitation in developing Asian countries.

Second was the observation that messy problems are much like complex systems in having many facets or elements that are related to each other and to their contexts in ways that are

complex and often little understood. Thus, complex systems representations of messy problems can provide relevant and useful explanations. Complex systems representation leads to acknowledgement that messy problems are inherently unpredictable and difficult to control. This led to the insight that, rather than seeking to 'predict and control' situations that cannot be predicted or controlled by their nature, it would be more fruitful to seek to 'explain and learn' (Meppem & Gill 1998) and through this process, to discover ways of improving these situations.

I presented soft systems methodology (SSM) as one available tool that can apply the above concepts and draw together multiple worldviews through a collaborative learning process. SSM is a system for learning about messy problems, out of which decisions to improve the situations generally emerge. As a methodology, it is logically structured around systems concepts that combine a logical stream of inquiry with a cultural stream of inquiry that is appealing to practitioners who want to adopt the concepts relating to messy problems while being more familiar with a structured analytic thinking style.

How SSM might be used was illustrated by applying it to inquiring about the real world problem of urban sanitation in Colombo. My account here reflects my thinking at the time the work was carried out, which differs significantly from my current position and scope of my research. I was then seeking a leverage point from which to seek a 'solution' to the problem, and, as a result of using SSM, identified cost recovery as an appropriate focus for this. This led to my exploration of cost perspectives in the next chapter. My use of SSM described in this chapter, which chronologically preceded the work earlier in the chapter, marked the beginning of my realisation about the complex and messy nature of the problem. The gradual shift through the course of the research journey brought me to the position argued in this chapter, that finding an 'answer' or 'solution' to the messy problem of urban sanitation in developing Asian countries is beyond the scope of any thesis or process, and that drawing out culturally specific concepts and identifying culturally specific processes by which they could be adopted in practice would make a more useful contribution.

4 Cost recovery for urban sanitation in developing Asian countries: an inquiry from three economic perspectives

Economists argue that all the world lacks is
A suitable system of effluent taxes
They forget that if people pollute with impunity
This must be a symptom of lack of community

Kenneth Boulding

4.1 Introduction

In this chapter I seek to address Checkland's (1999, p. A25) effectiveness question with respect to sanitation – about 'what is the right thing to do' in terms of contributing to longer-term aims – by drawing out a set of guiding principles for sanitation aligned with sustainability. This would address my first research question "*What intellectual contribution can the sustainability discourse make to provide direction for heading towards sustainability in urban sanitation planning for developing Asian countries?"*

Through experimenting with soft systems methodology in the last chapter (Section 3.5.2), I identified cost recovery as a leverage point for creating a shift in sanitation towards sustainability. This chapter follows on, using cost and cost recovery issues as the basis for drawing out sustainability principles for urban sanitation. These principles could then be used to frame interventions or resolutions to the problem.

The process of exploring cost recovery issues led me to look at their underlying paradigms or mindsets. My initial focus had been at the implementation level, leading from the particular way I used soft systems methodology in the last chapter – an inquiry I therefore began by considering pricing models, subsidies and other mechanisms of cost recovery. As I assimilated the ideas set out in the last chapter, however, it became necessary to examine the epistemologies and worldviews that resulted in the particular models for cost recovery.

This shift in focus is consistent with my seeking to increase the leverage of the cost issue in resolving the problem. According to Meadows (1999), the different points at which interventions in a problematic situation can be targeted have different amounts of leverage; points with high leverage are where interventions representing a small shift can create big changes in the system. The Sustainability Institute founded by Meadows uses the metaphor of an iceberg (Figure 4.1) to illustrate the relationship between points of intervention (leverage points) and the amount of leverage they can have in creating change in the system (Sustainability Institute 2001). Their iceberg of intervention points has four hierarchical 'regions': *events* comprising of the visible symptoms of a problematic situation including

events, issues and trends; *patterns of behaviour,* the human practices that give rise to the events; *systemic structures* which cause these patterns of behaviour, including historical, cultural, technological, economic, institutional and political structures of society; and *mindsets* – the paradigms, mindsets and worldviews that underpin and carry the entire structure. Meadows (1999) argues that the leverage of potential interventions increases as we move from the top to bottom of the iceberg (Figure 4.1): small shifts at the paradigm level can alter the entire system. I see interventions in the mechanics of cost recovery as being at in the *events* and *patterns of behaviour* regions of a 'cost-recovery iceberg'. Illuminating the worldviews that support the mechanics of cost recovery is the first step in potential intervention at the *mindsets* level, with greater leverage in creating change than tweaking the mechanics.

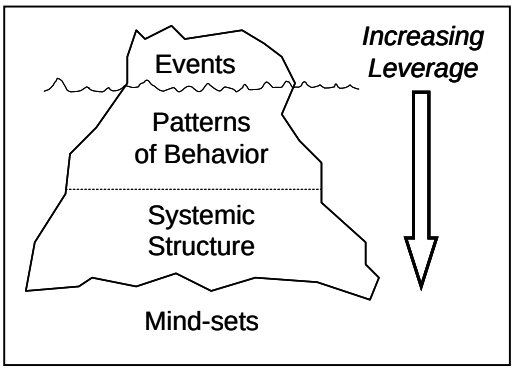

Figure 4.1: The 'Iceberg' metaphor of leverage in points of intervention (Sustainability Institute 2001)

Consistent with the above, this chapter is underpinned by the premise that the meaning of 'cost' and the rationale and principles relating to the recovery of cost are based on mindsets or perspectives. This also follows from the arguments made in the last chapter – that the way in which a problem is perceived determines the 'solutions' possible (Section 3.2). The premise is explicated through my exploration of cost recovery based on three qualitatively different economic perspectives: neoclassical economics, ecological economics and Buddhist economics, which point to different ways by which to address cost issues.

The chapter opens with broad-brush definitions of the concepts of cost and cost recovery that are central to this chapter (Section 4.2) as well as the goal of economics (Section 4.3), about which a general consensus between the three economic perspectives may be claimed. It includes a brief discussion on wellbeing (Section 4.3.1), relevant as the ultimate purpose of economics. This sets the basis for summarising the acknowledged views from each economic perspective, about what overall wellbeing may mean, and how scarce resources are utilised to achieve wellbeing. The three economic perspectives – neoclassical economics, ecological economics and Buddhist economics – are examined in turn in Sections 4.4, 4.5 and 4.6, with their implications for cost recovery for sanitation.

My choice of these particular fields of economic thought is based on the following reasoning. Neoclassical economics (NCE) is the prevailing perspective underpinning current government policies in most places around the world including donor countries and multilateral lending agencies, making its inclusion essential to the current context. Ecological economics (EE) is concerned with discovering the conditions that will sustain life in the long term (Daly & Farley 2003, p. 20), and thus a member of the sustainability discourse, and able to contribute towards the aims of this thesis – in particular, towards answering my first research question. Furthermore, EE takes a qualitatively different ideological stance from NCE, unlike fields such as environmental economics and resource economics that are based on the same premises as NCE (Daly & Farley 2003; Faber, Petersen & Schiller 2002).

The third model, Buddhist economics (BE), was chosen for two main reasons. BE is an ancient philosophy that originated in Asia with concepts that are shared by other strands of Eastern spirituality, while at the same time very much aligned with modern concepts of sustainability (Daniels 2003), making it a promising vehicle for disseminating sustainability arguments in developing Asian countries[69]. Secondly, it is a system of economics embedded within the explicitly moral philosophy of Buddhism which separates it from NCE and EE. In particular, critics argue that NCE has abandoned its roots in moral philosophy and has instead aligned itself with positivist sciences and mathematics (Alvey 2000), that has led to the level of abstraction that ignores ecological constraints and physical limits. EE seeks to incorporate ecological constraints and physical limits back into economics, while also emphasising ethics and transdisciplinarity, making it receptive to BE perspectives. At the same time, a consensual view about EE's position would exclude explicit ideas about ultimates that are 'beyond knowledge', and 'transcendental' systems dealing with the 'inescapable unknowables' (Section 3.4). These form the very foundation of BE. Thus NCE, EE and BE may be seen to be not only qualitatively different, but also complementary.

I argue that the complementary relationship between NCE, EE and BE makes it possible to integrate relevant concepts from all three perspectives, which is consistent with the values of the sustainability discourse in accommodating multiple perspectives. I use the integration of NCE, EE and BE to draw out principles that emphasise cost recovery consistent with sustainability (Section 4.7).

[69] I should declare that I am a practicing Christian, and an intention to proselytise Buddhism is not amongst my reasons for including Buddhist economics in this study.

4.2 Preliminary concepts of cost

The cost for some good or service is a concept acknowledging that resources[70] have been expended in relation to providing that good or service. This section provides an overview of the types of cost, and some concepts related to cost recovery.

4.2.1 Cost types

A range of qualitatively different costs can be incurred, most commonly described as a combination of monetary costs[71], environment costs and social costs (Figure 4.2). As there are various terminologies in use to describe different aspects of these costs, I clarify the terminology used in this thesis.

Monetary costs are measurable in dollar or equivalent terms, and consist of direct costs and a range of other costs I will call 'institutional costs'. ***Direct costs*** are the sum of capital expenses and operational and maintenance expenses in relation to the provision of the good or service. ***Institutional costs*** are the various other monetary costs that providers of these goods and services are liable for, which are artefacts of policy, accepted accounting methodology, or commercial and institutional arrangements. These may include taxes, interest payments related to capital-financing debt, cost of asset consumption (depreciation), and return on capital (dividends) (ERA 2004a; Rogers, Bhatia & Huber 1998). Which of these are included in the estimation of total monetary cost, and how these costs are estimated, varies according to the legal and institutional arrangements in different locations, including whether a utility is operated by local government, or as a State-owned corporation, or private entity[72].

[70] The term 'resources' is used in a broad sense to mean *material resources* as well as *capacities* for provision of supporting services (such as ecosystem services).

[71] While many authors label this as 'economic cost' here (such as in Triple Bottom Line literature), I have chosen to call this 'monetary costs' to avoid confusion with the broader view of 'economic costs' as the costs from a 'whole of society' perspective that encompasses environmental and social costs (for example, in McNeill 1998).

[72] For example, a number of acceptable methods for estimating the cost of water supply for water utilities in Australia are described in GPOC (2003) and ERA (2004b).

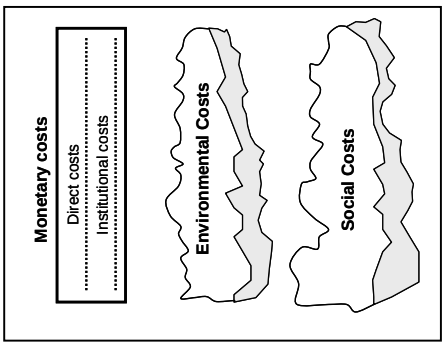

Figure 4.2: Cost Types

Environmental costs are understood as "costs connected with the actual or potential deterioration of natural assets due to economic activities" (United Nations 1997) which can be defined in different ways reflecting different perspectives. Resource depletion and waste creation resulting from human activities lead to environmental deterioration when they occur at rates above certain thresholds. Thus, environmental costs are incurred when resources are withdrawn from and wastes are emitted to the environment at rates that exceed the capacity of the environment to regenerate and recover. Their representation in Figure 4.2 as an irregular 3-D shape is intended to convey their multidimensional character, in contrast to monetary costs whose elements are single dimensional and additive (being expressible in dollars or equivalent). Environmental costs are typically made up of qualitatively different elements that are non-additive and often difficult to quantify – for example, impacts on biodiversity, atmospheric pollution, aqueous pollution, soil erosion, soil salinity and loss of habitats.

Social costs are the impacts that the provision of the good or service have on people. Like environmental costs, social costs are multidimensional and non-additive (Figure 4.2) and consist of qualitatively different elements such as aesthetic, spiritual, communal or cultural impacts. In the terminology of Section 3.2.1, estimating environmental costs and social costs are messy problems, where impacts are often poorly understood, and may be differently interpreted from different perspectives.

4.2.2 Cost recovery

Corresponding with the notion of *cost* as resources expended in providing some good or service, the notion of *cost recovery* is the recognition that, in order for continuous provision of this good or service, the expended resources must be replenished (or substituted) so that the necessary resources continue to be available.

Thus, cost recovery may be seen as a *requirement* for the sustainable provision of this good or service: the more completely the 'full cost' can be recognised, estimated and recovered,

the better the chances of achieving sustainability would be. It would mean that monetary costs are quantified and revenues are raised to recover them. It would mean that environments are restored to a level where impacts occur within the natural capacity of ecosystems to regenerate resources and assimilate wastes. The idea of 'recovering' social costs is more complex, because societies may respond to impacts by choosing to absorb costs through adaptation and change rather than requiring restoration or compensation, especially if benefits are seen to outweigh costs. Nevertheless, cost recovery would include genuine efforts to explicitly identify and address impacts on society, most defensibly through a process involving deliberative public participation [73].

As noted before, estimating environmental and social costs are messy problems, and there can be many perspectives about how they should be tackled. Thus in practice, the composition of 'full cost', how it is estimated, and which costs are explicitly 'recovered', depends on the perspectives and worldviews of policy makers and the economic ideologies that guide them.

While the above discussion relates to costs and their recovery at a generalised global level, there are other cost perspectives at the levels of different stakeholders, depending on where they perceive their system boundaries to be placed (Mitchell et al. 2007) . For example in a water supply system, the catchment manager, the water utility, a residential scheme developer and the customer would each have different perspectives of their costs. For sustainable systems, balancing costs and revenues need to be considered from all the perspectives – those of the various individual stakeholders as well as of the whole of society (ibid).

I make a point of clarification here to emphasise the distinction between the *principle* that expended monetary costs must be recovered and the *mechanism* for doing so[74]. Monetary costs can be recovered through a range of mechanisms for raising revenues, including pricing, government budgetary allocations, or a host of other legitimate income-generating or revenue-raising activities. Thus, I emphasise that pricing is not the only mechanism for raising revenues. Furthermore, revenue-raising is not the sole purpose of pricing. Pricing (or tariffs, a formula by which price is determined), is the basis for determining the amount service-users are charged for services, and is often promoted as the primary mechanism for cost recovery in much of the current literature, arising from the dominant neoclassical economic perspective (Section 4.4). However, policy makers see pricing as an important management tool whereby a number of objectives might be met (Boland 1993; Brocklehurst, Pandurangi & Ramanathan 2002; Whittington, Boland & Foster 2002). These objectives include not only revenue sufficiency and revenue stability for a service provider,

[73] Deliberative participation is discussed in Chapter 5 and contrasted with other types of public participation.

[74] I include this clarification because discussions with colleagues has exposed a common tendency for readers to infer that 'full cost recovery' implies 'full cost pricing', which I argue to be two separate issues.

but other objectives such as economic efficiency (for example, to achieve patterns of water use that minimise costs of providing water services), resource conservation, fairness and equity, amongst others. The different objectives are often conflicting so that prices are constantly adjusted to reflect trade-offs between objectives as priorities change (Boland 1993).

4.3 The goal of economics

There are various definitions of 'economics' which generally concur that it is fundamentally concerned with allocating scarce resources amongst competing alternative uses such that it leads to an overall increase in social welfare or wellbeing (Edwards-Jones, Davies & Hussain 2000). There is disagreement, however, about what resources are scarce, what mechanisms are appropriate for allocating scarce resources, and how the alternative uses should be ranked in terms of importance (Daly & Farley 2003, p. 37).

Economics has a long history of being concerned with allocation and distribution of scarce resources (Daly 1992). Allocation is concerned with the relative division of resources amongst different uses or purposes (for example, dividing scarce water for use in irrigation, urban water supply and industrial use). Distribution is concerned with the division amongst different users (for example, present and future generations, or rich and poor people). There can be many mechanisms or policy instruments for effecting allocation and distribution (McNeill 1998), with each economic perspective preferring some mechanisms over others.

Wellbeing

While increased social welfare[75] may be claimed to be an agreed ultimate goal of economics, there is less agreement as to what constitutes this. Thus, I examine the concept of welfare itself here, in preparation for considering the three economic perspectives' interpretations of welfare-increasing economics.

Since the wellbeing of society is constituted of the wellbeing of individuals in society (Daly & Cobb 1994, p. 164), an examination of the wellbeing of individuals can illuminate the discussion of social welfare. Wellbeing itself is a highly subjective notion that has much to do with mental modes: two individuals in identical circumstances may feel widely different

[75] In line with a definition of welfare as "[referring] to the well-being of individuals or groups and, by implication, those measures which can help to ensure levels of well-being" (A Dictionary of Sociology 2005), I use the terms welfare and wellbeing interchangeably. This is consistent with usage by others including Edwards-Jones et al. (2000) and Miles (1992, p. 293).

degrees of wellbeing. Nevertheless, I see one measure of individual wellbeing as having needs and wants satisfied, and use this as a handle for investigating wellbeing.

Human needs and wants may be classified in many different ways, as several authors have demonstrated (Edwards-Jones, Davies & Hussain 2000, pp. 71-77). All of these highlight that human needs have several dimensions. One of the most widely known classifications is Maslow's (1970), shown in Table 4.1. Max-Neef (1992) provides an alternative classification system, where his "axiological" needs mostly overlap with Maslow's categories. Max-Neef postulates that fundamental human needs are finite and few, and are the same in all cultures through time: it is *how* these needs are satisfied that varies with culture and through time. Satisfiers of needs are not limited to economic goods and services, and can include social practices, attitudes, organisational arrangements, values and norms, physical spaces and a range of other means (ibid).

Maslow's typology of human needs (Table 4.1) is presented as a hierarchy on the basis of their 'prepotency' or dominance: the lower needs are prepotent and need to be satisfied before higher needs appear. Physiological needs are the lowest and most prepotent; once these needs are met, other needs appear (Maslow 1970, p. 17).

AESTHETIC NEEDS – e.g.: beauty COGNITIVE NEEDS – e.g.: learning, philosophising, experimenting SELF-ACTUALISATION NEEDS – e.g.: being true to one's potential
ESTEEM NEEDS – e.g.: self-respect, adequacy, respect from others
BELONGINGNESS AND LOVE NEEDS – e.g.: intimacy, belongingness
SAFETY NEEDS – e.g.: security, stability, protection, freedom from fear
PHYSIOLOGICAL NEEDS – e.g.: food, water, sleep

Table 4.1: Maslow's hierarchy of needs[76] (based on Maslow 1970)

While Maslow is argued to have subsequently moved away from viewing a progression of needs as a strict hierarchy (Ekins & Max-Neef 1992, p. 194), Max-Neef agrees that when the satisfaction of a need is below some threshold, the feeling of deprivation can be so

[76] This hierarchy is often depicted within a triangle whose base represents the most prepotent needs, with the apex representing the self-actualisation needs. Kiel (1999) disputes the representation by enclosure of the higher needs in the apex; she argues that an open, wide-faced structure at the top would better represent the never-ending process of development within self actualisation.

severe as to overshadow all other needs. However, above this minimum threshold, needs may be seen as simultaneous and interrelated, rather than as a hierarchy (Max-Neef 1992).

Maslow (1970) and Max-Neef (1992) differ in their characterisations of 'freedom', which warrants comment. While Max-Neef characterises freedom as another need, satisfied by conditions such as justice and social orderliness amongst other means, Maslow asserts that it is one of the "preconditions for the basic need satisfactions" rather than a 'need' itself. He sees conditions such as "freedom to do what one wishes so long as no harm is done to others", "the freedom to investigate and seek information", and conditions of justice and social orderliness as necessary conditions to facilitate the satisfaction of needs, and takes care to distinguish these from needs:

> "these conditions are not ends in themselves but are almost so since they are so closely related to the basic needs, which are apparently the only ends in themselves" (Maslow 1970, p. 22)

Maslow's distinction has an interesting relevance within the assumptions of neoclassical economics, which I note in the section that follows. While each scholar's characterisations are shaped by their worldviews, as argued by Söderbaum (2004), I see a possible alignment of Maslow's worldviews with neoclassical economics', and Max-Neef's worldviews with ecological economics'.

Maslow's and others' classification systems demonstrate a range of needs whose satisfaction may be seen as a constituent of individual and therefore collective societal wellbeing. I next explore how economics aims to meet these needs, through the lenses of NCE, EE and BE, beginning with some of the assumptions and worldviews that shape these perspectives.

4.4 Perspective of neoclassical economics

In this section, I consider neoclassical economics as it is currently represented in practice. I discuss relevant features of the NCE model and how these features play out in water and sanitation policy, and assess the potential of the NCE approach for supporting cost recovery as conceptualised in this thesis (Section 4.2) for sanitation in developing Asian countries.

The purpose of my analysis is to explore how an economic perspective (here, NCE) affects approaches to cost recovery for urban sanitation, perspectives that are shaped by theory, values and ideology to varying degrees. As Söderbaum (2004) observes: "… neoclassical economics is not neutral in terms of values and ideology. The same is true of alternatives to neoclassical economics…" Thus, I discuss NCE as it is manifested as a mixture of theory and ideology without attempting to disentangle these.

The NCE approach is characterised by the 'recipe' of reducing government spending, reducing government provision of welfare, and reducing taxes, along with the privatisation of state enterprises (Schwartz 2005). Its credibility has been on the rise since the 1970s, as countries following its 'recipe' have experienced spectacular increases in their gross national products (ibid), establishing NCE as the dominant paradigm shaping economic policy in the industrialised world. Its influence is also on the rise in the developing world as multilateral financial institutions provide them with advice consistent with the Washington Consensus[77].

Freedom and autonomy for its economic actors is a priority in neoclassical economics. Autonomous individuals within households, and firms that produce goods and services for consumption by these individuals, are the central actors who collectively constitute society in the NCE worldview (Daly & Farley 2003; Edwards-Jones, Davies & Hussain 2000). An ideal society from the NCE perspective is one where individuals have the freedom to choose how they satisfy their wants and desires, with minimal interference from governments. Any attempt to define their wants is seen as an infringement on the freedom of individuals, because it may result in policies that "force everyone to have [the defined needs] satisfied even if in fact they value something else more strongly" (Edwards-Jones, Davies & Hussain 2000, p. 71). Furthermore, if an economic system were to address issues of wants and desires, it would necessarily need to consider values because wants and desires are based of values (Daly & Farley 2003, p. 3). Instead, an economic system's goal of increasing the welfare or wellbeing of society is seen to be best served by increasing the *opportunity* for individuals to satisfy their needs and wants as they choose (Edwards-Jones, Davies & Hussain 2000). Thus NCE rejects the necessity to define 'needs', and instead embraces the enabling conditions of individual freedoms. Maslow's distinguishing of the latter from actual 'needs', but rather as "preconditions for the basic need satisfactions" (Section 4.3), thus appears to stand in support of NCE's claims to value-free objectivity.

Neoclassical economics (NCE) has evolved over the last century to position itself as a positivist value-free science that studies economic phenomena much like the physical sciences study the natural world (Alvey 2000; Edwards-Jones, Davies & Hussain 2000). This is supported by a particular view of the nature of human actors in the economy.

NCE view of human nature, welfare and consumption

Two assumptions about the autonomous individuals have contributed to the transformation of NCE into a 'value-free science'. Firstly, the assumption that their welfare is equivalent to

[77] The Washington Consensus refers to "the lowest common denominator of policy advice addressed by the Washington- based institutions" (including the World Bank and International Monetary Fund) since 1990, that is aligned with the ingredients of NCE including deregulation, privatisation and trade liberalisation amongst others (Williamson 2000).

their 'utility' (satisfaction derived from consumption of goods and services), and may be determined by their level of consumption of goods and services (Edwards-Jones, Davies & Hussain 2000, pp. 30, 36). This allows the quantification of their welfare, because consumption is readily converted to a monetary value, and the *opportunity* to increase their welfare can then be measured by wealth. By aggregation, a nation's wellbeing can thus be measured by its gross domestic product or gross national product (GDP/GNP[78]). Furthermore, humans are believed to have unlimited wants, whose satisfaction is constrained only by limited resources (Edwards-Jones, Davies & Hussain 2000; Payutto 1992). It logically follows that increasing consumption leads to increasing satisfaction and wellbeing. Correspondingly at a country level, a constantly increasing GDP/GNP is viewed as a desirable economic objective (Daly 1999).

The second assumption is that individuals and firms are driven by *rational self-interest* to maximise their welfare and profit respectively (Söderbaum 2003), with rationality implying that they act with neither benevolence nor malevolence towards others. While economics texts note the limitations of this assumption, they nevertheless defend it as a useful basis for the study of economics as an objective science:

> Real people are indubitably more altruistic than homo economicus, because they couldn't be less: homo economicus is entirely selfish. (The technical term is acting in one's *self-interest.*) That doesn't necessarily invalidate the conclusions drawn from the theory ... Thus, while there are limits to the applicability of the theory of self-interested behavior, it is a reasonable methodology for attempting a science of human behavior. (McAfee 2006, pp. 1:5-1:6)

In combination with the equation of welfare with quantifiable consumption, the model of humans as welfare-maximising *homo economicus* (Figure 4.3), allows objectivity, logic and rationality to be applied to the behaviour of individuals and firms that collectively make up society[79]. The interaction of *homo economicus* and its counterpart, the profit-maximising firm, enables "the tracing out of the *mechanics* of self-interest and utility" (Jevons 1970 quoted by Alvey 2000, emphasis added), that support NCE to position itself as a value-free science.

[78] Gross Domestic Product (GDP) is the total monetary value of final goods and services produced by a country in a year. Gross National Product (GNP) differs from GDP only by the consideration of inter-country transfers. Economists are not unanimous about which is the more appropriate indicator to use, hence I use the term GDP/GNP to refer to this index. Whether GDP/GNP adequately measures economic activity that contributes to wellbeing is disputed by many (England & Harris 1998; Hamilton 1997).

[79] To be rational is assumed to be interpreted from within the NCE paradigm and is seen to be 'value free' to the extent that NCE values are not acknowledged.

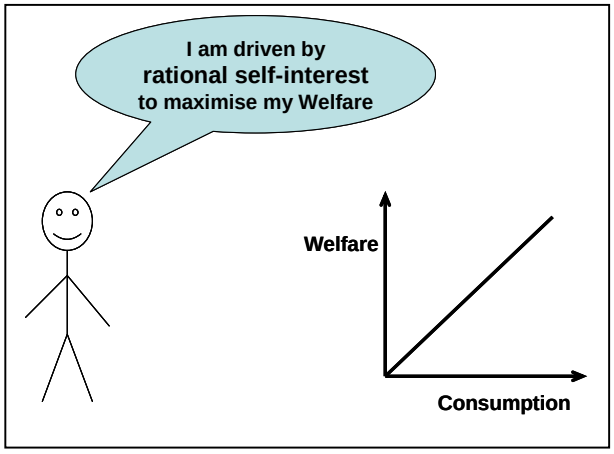

Figure 4.3: The individual actor within Neoclassical Economics – *homo economicus*

4.4.1 Relevant features of the neoclassical economic model

Neoclassical economics (NCE) is often referred to as 'market economics' because of its strong preference for the market as the means of allocating scarce resources (Daly & Farley 2003, p. 3). The market is a forum for individuals and firms to interact and exchange goods and services, and few people would disagree that it is an efficient means of allocating certain types of resources that go into these goods and services. Free competition between market players is seen to lead to socially desirable outcomes, so that the ideal role of government, according to NCE, is that of market facilitator, providing oversight and intervention to correct malfunctions of the market mechanism, and with little responsibility in directly providing for the welfare of individuals (Edwards-Jones, Davies & Hussain 2000; J.W. Smith, Lyons & Sauer-Thompson 1999). Market economics has driven the rapid increase of consumer goods and services such that "poor people in affluent countries today have many luxuries that kings in Europe could not have dreamed of in centuries past" (Daly & Farley 2003, p. 7).

Price is the communication tool that operates in the market to affect the behaviour of market participants.

> "For individuals, price determines commodity consumption and, correspondingly, their decisions as workers about how much employment to substitute for leisure time. For firms, decisions about what to produce and how to produce it is also governed by price. The prices of resources are adjusted, through changes in demand and supply, so that resources are employed to produce those goods and services which society desires…" (Edwards-Jones, Davies & Hussain 2000, p. 33)

I next examine two effects of the NCE worldview that are of particular significance to developing Asian countries: the issue of "full cost pricing", and the approach to the distribution of resources amongst different people.

4.4.1.1 Full cost pricing

Price is seen as the primary instrument for achieving economically desirable outcomes in the NCE model where governments do not interfere in the market. Thus, NCE's tool of choice is 'full cost pricing' where the total cost of the service is recovered from users of the service, enabling cost recovery without government involvement. I note that there can be other mechanisms for raising revenues that do not require government involvement. However, the NCE perspective appears to consider it self-evident that the price mechanism is the only way of raising necessary revenues, implicit in statements such as the following:

> "basic economics require that the price of a service be at least as high as the cost of providing that service" (Rogers, de Silva & Bhatia 2002)

Thus in the NCE model, all costs – monetary, environmental and social – must be reflected in the price in order to recover them. If all monetary costs were included in the price, revenues raised from service users would be sufficient to recover costs incurred by service suppliers. If environmental and social costs are included in the price, consumption patterns will change in ways that reduce these costs. The latter are regularly treated as 'externalities': costs (or benefits) imposed by firms or individuals on other agents in society that are not compensated (Edwards-Jones, Davies & Hussain 2000, p. 35) – in effect, issues that are left outside the boundaries of the systems of interest. To estimate the full production costs to society, it is necessary to internalise the externalities (ibid) – i.e., to expand the boundaries of the system to include these issues. In the NCE view, this requires the conversion of environmental and social costs into their price equivalents.

There are two issues within NCE's perspectives on full cost pricing that I examine further – internalising externalities, and the use of full cost pricing as a tool for allocation.

Internalising externalities

While the inclusion of environmental and social costs within prices by internalising externalities is conceptually appealing, the practicalities of doing so are fraught with difficulties. NCE's supposition that such a conversion is possible arises from its positivist stance – a stance which assumes the existence of a single objective reality that can be known identically by all knowers (Bawden 2000). Translating multidimensional, often unspecifiable and/or unquantifiable costs (Section 4.2) into their alleged single-dimensional monetary equivalents is in fact a value-laden exercise whose legitimacy is disputed[80] (Söderbaum 2003). Meppem and Gill (1998) observe that while a monetary equivalent may

[80] This is illustrated by an example provided with my discussion of the next issue within full cost pricing.

in some cases provide a useful approximation for environmental and social costs, it can create a false veneer of confidence about the rigour of the process that appeals to a culture that desires objectivity, precision and rigour.

Internalising environmental externalities in prices can contribute to limiting environmental damage, but is not explicitly designed to keep ecosystems within their natural capacity to provide ecosystem services. Edwards-Jones et al. (2000, pp. 226-228) note that, while it may be desirable that economic activity produces wastes that are non-polluting or within the assimilative capacity of the environment, the required radical shift in consumption patterns would imply reduced social welfare[81]. Instead, they explain that:

> "The economic approach does not seek to ban or even minimize the level of pollution; rather, it seeks to attain the optimum level – that level of economic activity, and hence pollution, that maximizes the total benefits to society."

This occurs, by definition, when the marginal private cost of reversing damage is equal to the marginal social cost of such damage (ibid). This approach is thus limited to addressing the anthropocentric interests of the economic actors involved. The concept of internalising externalities in NCE is not designed to 'recover' environmental costs in the sense of seeking to maintain ecosystems within their carrying capacity, a requirement for cost recovery aligned with sustainability (Section 4.2.2).

Allocation through pricing

NCE's commitment to the market for efficient allocation of resources means that some authors recommend a further element be included as a cost within full cost pricing, namely, *opportunity costs* (Briscoe 1996 quoted in Perry, Rock & Seckler 1997; Rogers, Bhatia & Huber 1998; Rogers, de Silva & Bhatia 2002). Opportunity cost is a ranking of the relative 'value' to society when a scarce resource is used in different alternative purposes, which can help to direct scarce resources to uses that provide the greatest value to society[82]. When a resource is used for some purpose, there is an 'opportunity cost', defined as the value of the best alternative that has been foregone because it was allocated to this particular purpose (McAfee 2006). With respect to water resources, Rogers, Bhatia and Huber (1998) explain:

> "[Opportunity cost] addresses the fact that by consuming water, the user is depriving another user of the water. If that other user has a higher value for the water, then there are some opportunity costs experienced by society due to this misallocation of resources."

---

[81] Other economic perspectives would suggest that the such shifts in consumption patterns may not necessarily lead to reduced welfare, and may in some cases increase it (Section 4.5.1 and 4.6)

[82] While allocation of resources may not be *directly* relevant to sanitation which *removes* what is unwanted, it is indirectly relevant and critical for the dominant model of water-based sanitation which uses water resources.

The NCE argument is that, if opportunity cost is included in the price, less valuable uses would become more expensive, thus enabling the market to direct resources towards more valuable uses. On this basis, Rogers, Bhatia & Huber (1998), amongst others, propose that the 'full cost' of water services should include not only monetary costs associated with supply, and environmental costs which are 'internalised' by converting them to price equivalents, but also opportunity costs expressed as monetary values.

As with internalising externalities in prices, the process of expressing multidimensional opportunity costs in monetary terms is value-laden, and imposes a system of values that favour effects that are more easily quantifiable, and may ignore others that are more fragile and potentially more important (Meppem & Gill 1998). I submit an example to illustrate this. The World Bank (1996, quoted by Houtart (2005) and La Via Campesina (2006)) made a set of recommendations for policy makers in Sri Lanka to encourage small-scale rice farming to be replaced by larger scale farming of high value export crops (Fernando 2000; Houtart 2005; La Via Campesina 2006). The World Bank authors identified rice cultivation by small farmers as being a less valuable use of land[83] compared to efficient large-scale cultivation of export crops, because rice may be grown more cheaply and imported from elsewhere (ibid). The relative valuation appears to have been based on the potential net income that may be generated – an effect that is easily quantifiable – but failed to recognise other dimensions of value in comparing the two alternatives. In particular, social and cultural identities embedded in the rich historical and cultural heritage in rice farming extending over 2000 years in Sri Lanka, were not assigned any value. The report also failed to consider a sufficient range of alternative ways of using land to increase the net income, such as changes to small-scale rice farming practices[84], or other dimensions of costs, such as the greenhouse gas emissions associated with transporting rice from overseas.

I argue that including opportunity costs in the estimation of 'full cost' for water supply and sanitation is not easily defensible. Firstly, there are the difficulties with the legitimacy of quantifying these costs, as highlighted above. Furthermore, opportunity costs are not costs that are manifested in a bill that needs to be paid, but rather, are an economic construct; a decision to include opportunity costs in prices is a *policy choice* about the using the market mechanism for allocation (McNeill 1998). If resources were misallocated, the cost of misallocation would be reflected in the monetary, environmental and social cost elements in the 'full cost'. Finally, McNeill (ibid) points out that price is not the only means of effecting allocation to preferred uses, nor is it necessarily the most desirable in all cases. He

[83] The scarce resource here may be seen to be agricultural land, although the arguments can hold equally if irrigation water is identified as the scarce resource.

[84] Fernando (2000), for example, proposes an option for reducing the monetary costs associated with small-scale rice farming, thereby increasing its net value. He notes that use of imported chemical fertilizers is a significant factor in the high economic cost of rice cultivation in Sri Lanka that could be significantly reduced through extensive adoption of the FAO's Integrated Pest Management program. This program has not only led to reduced chemical use, it has also increased yields, reduced water requirements and reduced labour requirements, cutting costs for small-scale rice farming by up to half in some places.

notes that socio-political methods of allocation, such as the water allocation mechanisms of ancient Sri Lankan monarchs, and the role of temples in water allocation in Bali, could be as effective.

4.4.1.2 Distribution: NCE and the poor[85]

The distribution of scarce resources amongst different people is amongst the concerns of economics (Daly 1992), although most descriptions of 'economics' appear to place greater emphasis on its concerns about allocation. A good distribution is one that is just and fair, that limits the inequality in access to resources to some acceptable level (Costanza et al. 1997, p. 80) so "the poor share in the gains of society as it grows, [and] the rich share the pains of society in times of crisis" (Stiglitz 2002, p. 78). Addressing distribution means addressing poverty that reduces the opportunity for poor individuals to satisfy their needs and wants as they choose.

It is particularly relevant to discuss distribution in relation to developing Asian countries, where a very large proportion of the population is poor. In the metropolitan areas of Colombo, for example, an estimated third to half the population live in low income communities where housing structures are predominantly temporary or semi-permanent and sanitary facilities are lacking (Wikramanayake & Corea 2003). The treatment of distribution and of the poor within the NCE model therefore warrants examination here.

The NCE approach to poverty reduction is simply to increase economic growth, based on the assumption that the benefits of economic growth will automatically 'trickle down' to become distributed through society (Dagdeviren, Hoeven & Weeks 2001; Stiglitz 2002). While this makes certain logical sense – if the economic 'pie' is larger, more people can have a share of it – the evidence has not substantiated the claims of 'trickle down' economics (ibid).

The belief in 'trickle down' economics is, to me, internally inconsistent with the NCE worldview. Using the economic 'pie' metaphor again, I see that the rational self interest of NCE's *homo economicus* would mean that those that already have a piece of the initial 'pie' would want to secure a larger portion in order to maximise his/her welfare. Furthermore, these individuals are more capable of doing so than the poor who have no initial share, by virtue of the greater power and resources they have as a result of their initial advantage. Thus in a freely operating NCE world, economic growth *by itself* will not lead to poverty reduction, but rather, would increase inequality by making the rich richer. Interestingly, neoclassical economists themselves argue that wealth inequality would

[85] I have chosen to use the term 'the poor' because of its universal meaning, while acknowledging that other terminology may be preferable to the development industry.

increase with growth, on the basis of Kuznets' theory (1955, quoted by Dagdeviren, Hoeven & Weeks 2001), and assert that it is a favourable initial condition for rapid economic growth. After some critical level of economic development was reached, Kuznets predicted that inequality would automatically decline. The evidence, however, is cause for scepticism about the reality of Kuznet's theory or 'trickle down' effects. In the USA, for example, where exceptional economic growth has occurred in NCE terms, the commonly cited average CEO-to-worker pay ratio has been progressively increasing in the last 20 years, and reached 400-to-1 in 2004 (Kirkland 2006); at the same time, poverty rates have been increasing since 2000 (Stark 2004). "If ['trickle down'] had not worked in the United States," Stiglitz (2002, p. 78) notes, "why would it work in developing countries?"

NCE does not specify distribution mechanisms by which the benefits of economic growth 'trickle down' (Dagdeviren, Hoeven & Weeks 2001), but appears to rely on the action of the 'invisible hand' proposed by Adam Smith ([1776]1904). The metaphorical 'invisible hand' describes self-interested behaviour by individuals that simultaneously and unintentionally promotes the public interest:

> "Every individual (…) intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for the society that it was no part of it. By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it." (A. Smith [1776]1904, IV.2.9).

However, Adam Smith's proposition was made in a context where economics was aligned with moral philosophy, and the presence of moral values was assumed within an economy that was based on "the good conduct of individuals" that included caring for the weak and disadvantaged of society (A. Smith [1776]1904, II.III.36). The force of the 'invisible hand' was thus embedded within an economics that was a moral science (Alvey 2000). In NCE, on the other hand, individuals are modelled as indifferent rather than caring towards the weak and disadvantaged, bearing them neither benevolence nor malevolence. Thus, there is no basis for the existence of the force of an 'invisible hand' in NCE as a value-free science that would lead to increase in the welfare of the poor.

I submit that the poor are notably absent in the NCE model of society. As a newcomer to reading economics, I have been surprised not to come across this point in the literature. I argue that the NCE model of individuals as *homo economicus,* the consumer and wage-earner who freely decides what goods and services to consume, is unrepresentative of poor individuals whose incomes may barely provide their most prepotent needs – food and water, shelter, healthcare, energy. While the resources of *homo economicus* are not unlimited, they are assumed to be sufficient to provide some measure of free choice so that he/she is "sovereign" over the decisions about what he/she wishes to consume (Edwards-Jones, Davies & Hussain 2000, p. 33). The poor, who have no such ability to choose, are a discrepancy or aberration in the model, so that they have to be treated as exceptions to the rules that apply to the rest of society. Some may argue that the poor do have choices, even

if they are choices between essentials[86]. The relative choices available to the poor, compared with the choices that *homo economicus* can make with the aid of markets, raises ethical issues about the distribution of wealth within society. The insistence of NCE to allegedly remain 'value-free' contributes to its weakness in engaging with distribution, which is ultimately about the ethical issue of fairness.

4.4.2 NCE as manifest in water and sanitation policy

The influence of NCE is evident in the current policies for water and sanitation that facilitate the provision of services by the private sector, and utilise the price mechanism to recover all costs from customers. This is made quite explicit in the recommendations of the World Water Commission's acknowledgement of the critical need for cost recovery:

> "If governments accept the World Water Commission's recommendation of full-cost pricing for water services, this will be a great incentive not only for local investors but also for international private investment ..." (World Water Council 2000, p. 61)

Increasing implementation of allegedly 'internationally accepted' policies consistent with NCE ideals is evident in the water supply and sanitation sector, including service provision separate from government; "financ[ing] services through user charges, not from general tax revenues"; and full cost recovery through 'full cost pricing' on the basis of the 'user pays, polluter pays principle'(Walker 2003). It has been accompanied by greater private sector participation in the sector (examined in Chapter 6).

The 'user pays' principle consistent with 'full cost pricing' is progressively being applied to urban water supply and sanitation around the industrialised world, as the potential first step towards a market model in this sector. After initial resistance from a public unaccustomed to paying for water, arguments such as Serageldin's below, have facilitated acceptance of more cost reflective water tariffs:

> "The provision of water supply to the households carries several benefits. Households themselves value a convenient, reliable, and abundant water supply because of the time savings, amenity benefits, and to a varying degree, health benefits. Because these "private" benefits constitute the bulk of the overall benefits of a household water supply, …[i.e.,] because this is principally a "private good", most of the financing for the provision of water supply services should be generated from user charges sufficient to cover the economic costs of inputs …" (Serageldin 1994 as quoted by McGranahan et al. 2001, p. 99).

The progressive move to a 'user pays' economic model for water and sanitation in industrialised countries has seen the introduction of water tariffs with fixed and volumetric

[86] This is called the 'substitution effect' where expenditure for water, for example, may mean that other essentials such as healthcare or education may be forgone (Gutierrez et al. 2003).

components, and sewerage tariffs with a fixed component and a variable component based on volumetric water use in some jurisdictions (for example, WSAA 2003). While debate continues about whether drinking water is the sort of 'economic good' to which the 'user pays' model is applicable (Barlow 2001; Kasrils 2001; McNeill 1998; Perry, Rock & Seckler 1997; Savenije 2002), it is nevertheless progressively being adopted in developing countries, where water tariffs are progressively being raised with the aim of achieving 'full cost pricing' (McIntosh 2003). Parallel introduction of sewerage or sanitation tariffs in these regions lags in comparison (Tapvong & Kruavan 1999; Walker 2003).

Policies that embrace the NCE ideal of 'full cost pricing'' at the same time include protection for the economically disadvantaged, so that their inability to pay does not exclude them from access to essential services (IWA 2004; Walker 2003). Such policies usually involve a range of subsidies (Whittington, Boland & Foster 2002) that exempt eligible households from paying the economically efficient market price. As noted earlier, it may be construed as demonstrating that the poor may be served only by making an exception, or departure, from NCE ideals.

Hoering and Schneider (2004) point out that a recent participatory approach to serving the poor is more aligned with NCE ideals than the provision of subsidies. Demand Driven Approaches (DRA) are a currently popular model applied by multilateral donors to rural and urban poor communities in developing countries. In this model, communities take responsibility for managing and financing their own water and sanitation infrastructure (Ariyabandu & Aheeyar 2004; Hoering & Schneider 2004). Hoering and Schneider (2004) argue that removing government responsibility for water-related welfare, aligned with NCE preferences, is one of the goals of DRA. This goal is implicit in the Asian Development Bank's water policy:

> "Participatory management and *turnover of responsibilities to users* has started in many small and medium-scale irrigation schemes. Participation of consumers in local water supply and sanitation projects has also been sought to improve efficiency, increase ownership…." (ADB 2001, paragraph 40, emphasis added)

DRA, as a tool of NCE, further demonstrates that NCE fails to serve the long-term interests of the poor. Firstly, it excludes the poorest members of the community who lack the means to pay their share in this cooperative model (Ariyabandu & Aheeyar 2004; Hoering & Schneider 2004). Secondly, the scheme relies on administration by unpaid volunteers acting through Community Based Organisations in order to keep financial contributions from the community at a minimum. The reliance on volunteers is internally conflicted with NCE's *homo economicus* representation of these individuals who would choose between working for wages, leisure and volunteering, who would seek to allocate their time to serving their rational self-interest rather than placing communal interest ahead of their own. The prospect of sustained management of the scheme is at risk unless reasonable administration payments can be paid out, but this would require higher charges that could place the service out of range for more people (Ariyabandu & Aheeyar 2004). Thirdly, the focus on cost recovery and financial sustainability can conflict with poverty reduction goals where

there is widespread poverty, causing people to forego other essentials (commonly children's education) in order to pay for water (Hoering & Schneider 2004).

4.4.3 Assessment of NCE potential for sanitation

I argue that the 'full cost pricing' policy recommendation following from NCE cannot succeed for sanitation because of the nature of the service. Sanitation provides qualitatively different and overlapping benefits to individual users, society and the environment: removing unwanted waste products from individual households, protecting public health and amenity for society, and protecting water resources (from pollution), and potentially protecting nutrient resources (from depletion) for the environment (Chapter 1). Thus, if revenues to recover all costs are raised from charging householders, who are not the recipients of the bulk of the benefit from the service, it is easy to see that a state of externality has occurred: the benefits to society and the environment are not being compensated.

The externalities associated with sanitation are positive (such as public health and amenity resulting from sanitation that performs well), so that the benefits to externalities should be *deducted* from the consumer price. This is the corollary to internalising *negative* externalities by *adding the cost* of externalities to the price. In this instance economists from all sides agree that it is appropriate that services are subsidised by governments (Edwards-Jones, Davies & Hussain 2000; McAfee 2006), who in effect fill the gap in the recovery of financial costs of supply. This would be consistent with the distributive justice implied by the 'beneficiary pays' principle, that all those who benefit should pay in proportion to the benefits they receive. As the representative of the public, government is then responsible for paying for the share of benefits to the public and environment.

I see NCE's emphasis on cost recovery through the 'user pays' principle and full cost pricing for sanitation services as reflective of NCE's ideological preference for enabling the distancing of governments from responsibility for services, that contradicts its theoretical approach to externalities. The 'user pays' principle is appropriate when the 'user' is the recipient of *the bulk of* the benefits, when 'user pays' is equivalent to 'beneficiary pays'. For the case of sanitation, where the 'user' is not the sole recipient of the benefits, I argue that the ingredients of NCE's 'recipe' of distancing governments from responsibility for welfare, and full cost pricing, are inappropriate[87].

The analysis of the NCE perspective – as a combination of theory and ideology – reveals that for urban sanitation, prices charged to users cannot be defended as the *sole* mechanism

[87] Many similarly argue against full cost pricing with respect to the provision of basic drinking water supplies (Barlow 2001; Kasrils 2001; McNeill 1998; Perry, Rock & Seckler 1997; Savenije 2002).

for recovering financial costs: governments have a clear responsibility to bear some of these costs because of positive externalities[88]. Furthermore, 'internalising' externalities is not designed to sufficiently 'recover' any negative environmental costs that might be imposed by sanitation services. It also highlights that NCE is insufficient for addressing the needs of a significant portion of the population in developing Asian countries, the poor. Thus it is necessary that the NCE perspective is complemented with other perspectives in order to resolve the complex issue of cost recovery for urban sanitation in developing Asian countries.

4.5 Perspective of ecological economics

A broad overview of ecological economics (EE) is provided in this section, with a description of some of its features relevant to sustainable urban sanitation (Section 4.5.1) and the implications of their application to sanitation (Section 4.5.2). While some of these are discussed in some detail, others are merely outlined or mentioned simply to highlight a comparison with NCE. Contrasting EE with the dominant NCE perspective is consistent with my aim of demonstrating that economic perspectives influence how cost issues are addressed.

Ecological economics (EE) is a relatively new field of inquiry whose origins may be traced to the 1980s, around dialogue that took place between scholars of different disciplines united by a concern for the mounting environmental problems of contemporary society (Costanza et al. 1997; Söderbaum 2000). EE's focus is on resolving these problems: "a commitment or mission to engage in public debate and practical action with a view to dealing constructively with the problems" (Söderbaum 2000, p. 19).

Sustainability focus of EE

EE seeks to locate economic thinking within the biophysical constraints of a finite planet to enable development that is sustainable (Costanza et al. 1997; Daly & Farley 2003; Edwards-Jones, Davies & Hussain 2000). It therefore folds into the sustainability discourse outlined in Section 2.7.1, sharing the core values of transdisciplinarity, stakeholder dialogue and a commitment to ethics as described below.

[88] Where 'full cost pricing' translates to an easily affordable cost to users, such as in an affluent society with high wealth distribution, I concede however, that it may be unnecessary for governments to bear a share of the cost even when there are positive externalities. Thus the application of my argument for governments to bear responsibility for a share of the costs would need to be toned according to the development context and the relative affordability of 'full cost pricing'. I thank Professor Frank Fisher for guiding me to this point.

EE's commitment to transdisciplinarity is manifest in its advocacy of a 'conceptual pluralism', that acknowledges that scholars' preferences for particular conceptual frames of reference are not exclusively founded on fact but also on ideology and values, and emphasises the need to listen and learn from others holding different preferences (Söderbaum 1999, 2000). "Only a situation of simultaneous coexistence of theoretical perspectives in economics appears compatible with democracy" (Söderbaum 1999). Consistent with this pluralistic approach, the analytical framework of NCE is encompassed within EE, along with other frameworks (Costanza et al. 1997, p. 69). While most ecological economists "are sceptical of the pretensions about the sufficiency of the neo-classical perspective", those with preferences for NCE perspectives within EE would be characterised by an open-mindedness towards other perspectives (Söderbaum 2000, pp. 20-21). In other words, EE's criticism of the NCE paradigm is primarily a call to limit its application to where it is appropriate, to limit its domination in influencing policy when it obstructs sustainable development (Daly & Farley 2003, pp. 4-5), to be open about the influence of ideology and values, and to complement NCE with other perspectives.

Stakeholder dialogue is emphasised within EE's call for broad democracy in decision-making processes characterised by dialogue between stakeholders holding different values and ideologies (Costanza et al. 1997, p. 177; Söderbaum 1999). A decision that is "a consensus that is affirmed by opposing theoretical, religious, philosophical and moral doctrines is most likely to be fair and just, and is also most likely to be resilient and to survive time" [89] (Costanza et al. 1997, p. 207). In this context, Soderbaum (2003) suggests that the role of experts, such as scientists and economists, should be one of illuminating the issues for the stakeholders, and not to "dictate correct values for societal resource allocation" as happens in traditional autocratic decision-making processes.

Ecological economists see stakeholder participation as not only a matter of democracy, but as a mechanism for improving knowledge and capacity to resolve problems, because "local people can imagine solutions and reformulate problems in ways for which the accredited experts, with the best will in the world, are not prepared" (Ravetz 1999)[90].

Finally, EE makes an explicit commitment to ethics through its concern for decision-making that meets the interests of both human and non-human life forms, of present generations in domestic regions, as well as of future generations and global populations

[89] While the quote uses the term 'consensus' as the basis of collective decision-making, I prefer Checkland & Scholes' (1999, p. 30) view that 'accommodations' between stakeholders is all that is necessary. 'Accommodations' allow participants to compromise and go along with decisions which do not require the unanimity and the resolution of disputes implied in the term 'consensus' (Section 3.5.1).

[90] While Ravetz's quote relates to post-normal science, I justify its inclusion as a facet of EE by pointing out that the Online Encyclopaedia of Ecological Economics includes an entry on post-normal science (Funtowicz & Ravetz 2003).

(Costanza et al. 1997; Daly & Cobb 1994; Söderbaum 2003). In particular, ecological economists argue for the 'precautionary principle' to be the basis for urgently required decisions in the environmental context of rapid rates of change, scientific uncertainty and high stakes (Costanza et al. 1997; Ravetz 1999; Söderbaum 2003). The precautionary principle states that when there is threat of irreversible damage to the environment or human health, "precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Wingspread Statement 1998).

EE view of human nature, welfare and consumption

EE highlights the limitations of NCE's individualistic *homo economicus* as the basis for predicting and modelling microeconomic behaviour (Daly & Cobb 1994, pp. 85-96), and proposes alternatives to this representation of individuals as autonomous welfare-maximising consumers and wage earners (Faber, Petersen & Schiller 2002). Primarily, these alternatives emphasise individuals as more complex "persons in community" (Daly & Cobb 1994), embedded in a social context that can lead to different behaviours that include not only self-interest (and profit motivation for firms), but also altruism, cooperation and goodwill within networks of relationships (Söderbaum 1999, 2000).

In contrast to NCE, EE does not accept the direct relationship between welfare and utility derived by consumption of economic goods and services. Instead, the range of human needs and satisfiers (Section 4.3) are acknowledged in EE, so the wellbeing of individuals is seen as a multifaceted and multidimensional psychic state, influenced by the consumption of economic services and ecological services (Daly & Farley 2003, p. 17), as well as by ideology, identity, lifestyle, socio-cultural context, and power position, amongst other factors (Söderbaum 2000, pp. 33-41). As such, EE argues that wellbeing can decouple from consumption once some reasonable standard of living is achieved, beyond which further increases in consumption will not necessarily lead to increased welfare (Røpke 2005).

I depict a caricature of the individual actor in EE based on Söderbaum's (2000) 'Political Economic Person' in Figure 4.4. It includes a map of EE's view of individual welfare as a function of increasing consumption[91], to match my presentation-style of NCE's individual actor *homo economicus* in Figure 4.3.

[91] This figure does not depict EE's further proposition that welfare can be increased without increasing consumption, discussed later.

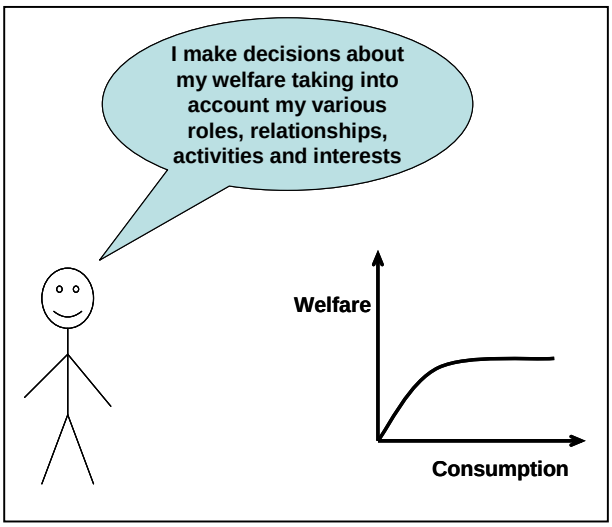

Figure 4.4: An individual actor in Ecological Economics

4.5.1 Relevant features of ecological economics

Ecological economists perceive the economy as embedded within a physical planet subject to the physical laws of thermodynamics. The economy is seen as an open[92] sub-system contained within the closed[93] biophysical ecosystem Earth (Daly & Farley 2003; Edwards-Jones, Davies & Hussain 2000). The economy draws natural services, raw materials and energy from the ecosystem – 'natural capital' that enables the provision of economic goods and services, and emits waste products back to the ecosystem (Daly & Farley 2003, pp. 17-18). Ecosystem services may convert some of these wastes back into natural capital (Figure 4.5).

[92] An open system is one that exchanges matter and energy with its surrounds.

[93] A closed system is one that may exchange energy with its surrounds but does not exchange matter. The Earth may reasonably be approximated as a closed system since the amount of matter exchanged with space is negligible (entry of meteors and cosmic radiation, exit of materials from human space exploration programs).

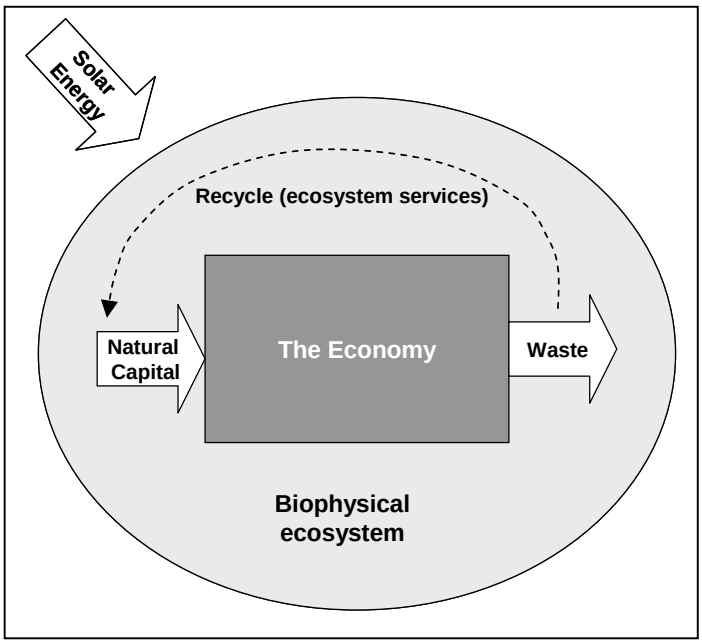

Figure 4.5: The economy as an open subsystem of a closed biophysical ecosystem

This simple model highlights the physical impossibility of NCE's vision for endless economic growth, an impossibility supported by sophisticated modelling in Meadows et al.'s seminal report to the Club of Rome in 1972, *The Limits to Growth*. The economy cannot grow indefinitely because, as it encroaches more on the ecosystem, the capacity of the ecosystem to provide the natural capital that the economy depends on decreases. Ecological economists argue that the economy needs to stay within the carrying capacity of the environment (Daly 1992) that indicates an upper limit for the size of the economy in physical terms. Therefore, they argue that the economy needs to equilibrate and settle into a 'steady state economy' well before this limit is reached, rather than aim for continuous growth as NCE does, that would unavoidably move towards the limit. Our limited understanding of the planet's complexity means that no-one knows what this limit might be. Many are concerned that this limit may already have been exceeded globally (Meadows, Randers & Meadows 2004; Røpke 2005).

To deal with this threat to life support systems is a challenge taken up by EE (Røpke 2005). In doing so, ecological economists make a distinction between 'economic growth' – the quantitative increase in the size of the economy – and 'development':

> "a qualitative change, realisation of potential, evolution toward an improved, but not larger, structure – and increase in the quality of goods and services (where quality is measured by the ability to increase human well-being) provided by a given throughput" (Daly & Farley 2003, p. 6).

EE contends that it is entirely feasible for the quantitative size of the economy to be limited while development continues without ending. It would enable the quality of the human condition to improve, for individual and collective potentials to keep developing, while human activity remains within the carrying capacity of the planet. In terms of Max-Neef's (1992) discussion of needs and satisfiers (Section 4.3), EE's aim may be understood to be to facilitate meeting the full range of human needs through a range of satisfiers not limited to economic goods and services. Kamenetzky (1992, p. 185) argues that:

> "when one need or another goes unsatisfied, human beings frequently find distorted paths for reducing the pain associated with the deprivation of the corresponding satisfiers. … [For example] this may explain the explosion of consumption among rich but emotionally starved people."

EE's goal could be seen to be to enable all needs to be met and avoid such "distortive" over-consumption.

I highlight two features of EE of relevance to this thesis: its call to simultaneously address issues of scale, distribution and allocation, and its recognition of low-entropy matter-energy as the ultimate means to achieving economic ends.

4.5.1.1 Scale, Distribution, and Allocation

EE emphasises three simultaneous and independent economic goals as necessary for sustainability: sustainable scale, equitable distribution, and efficient allocation (Costanza et al. 1997; Daly 1992; Daly & Farley 2003). These goals are seen to be independent to the extent that attaining one of them does not necessarily lead to attaining another (Daly & Farley 2003, pp. 360-361). Ecological economists argue that each independent goal requires a separate policy instrument to address it: if a single instrument seeks to address several independent goals, there would necessarily be some ranking and tradeoffs between them[94] (ibid). EE's recognition of three independent goals represent a point of departure from NCE, which is almost exclusively focussed on allocation, with distribution as a secondary concern (Costanza et al. 1997, p. 80).

Sustainable scale

The goal of a sustainable scale for economic activity refers to the creation of policy for stabilising the quantitative scale of the economy to a level that lies within the carrying capacity of the biophysical system (Costanza et al. 1997; Daly & Farley 2003).

[94] For example, using pricing for urban water supply to achieve the independent goals of cost recovery, resource conservation, economic efficiency, equity and affordability leads to constant policy adjustment to prices reflecting the tradeoffs due to changing political ranking of these goals, as noted in Section 2.6.2.

In asserting this goal, I submit that EE's goal for a sustainable scale coincides with the 'recovery' of environmental costs as defined in this thesis – i.e., the prevention of ecosystem degradation that could result from resources being withdrawn from and wastes being emitted to the environment at rates that exceed the capacity of the environment to regenerate and recover (Section 4.2). This response to environmental costs contrasts with NCE's approach, which seeks to limit damage to a level that is 'efficient' from the perspective of the economic agents involved (Section 4.4.1.1). EE's approach considers the interests of a much broader group of stakeholders than the economic agents involved in the economic activity, to include non-human species as well as future generations (Söderbaum 2003).

EE's process for making decisions in relation to sustainable scale reflects another point of departure from NCE. Daly (1992) observes that scale is "a social decision reflecting ecological limits", recognising that specifying this limit is a matter for post-normal science (Section 2.7.1 and 3.2.1.3) due to the inherent uncertainties in our understanding of the planet. Ecological economists further advocate safety margins in determining scale limits (Daly & Farley 2003, p. 361; Røpke 2005). EE notes that once this limit has been decided democratically, a range of policy instruments for achieving sustainable scale can be evaluated from which one could be chosen (Costanza et al. 1997; Daly & Farley 2003).

Just distribution

EE contends that the division of resource flows amongst alternative stakeholders on a just and fair basis is a necessary condition for sustainability. A large disparity in access to resources is undesirable, not only from an ethical standpoint but from a biophysical one (Daily & Ehrlich 1996). Poverty tends to increase poor people's direct reliance on ecosystem services while their options for avoiding ecosystem degradation decrease, creating a downward spiral of increasing poverty and further ecosystem degradation (Millennium Ecosystem Assessment 2005, pp. 62-63). At the other end of the scale, affluent people consume economic goods and services that are derived from enormous amounts of natural capital and produce correspondingly high amounts of waste (Hawken, Lovins & Lovins 1999, pp. 51-52).

EE's goal of sustainable scale contradicts NCE's approach to poverty reduction through economic growth (Section 4.4.1.2), since the latter would require appropriation of increasing amounts of global natural capital. Instead, EE makes the difficult call that improving living standards for the poor would require affluent people to decrease the quantity of natural capital they appropriate through their consumption (Røpke 2005). Such a call would be ethically impossible to justify from the NCE perspective that assumes a direct relationship between consumption and wellbeing. Since EE sees welfare as derived from many more factors than consumption, however, it can defend its call for the affluent to decrease consumption because it not only does not mean a sacrifice of their welfare, but

makes it possible for them to still achieve a qualitative improvement in welfare (Costanza et al. 1997; Daly & Cobb 1994; Daly & Farley 2003).

That the poor are integral members of EE's model of an economy is evident from the equal emphasis given to equitable distribution amongst the three goals. The model of the individual as a person-in-community (Daly & Cobb 1994) or political-economic-person (Söderbaum 2000) represents poor individuals as much as it does those who have the means to freely determine what and how much to consume. EE includes discussion about a range of policy instruments for achieving just distribution (Costanza et al. 1997; Daly & Farley 2003), while stressing that just distribution is determined by a social decision (Daly 1992).

Efficient allocation

EE is similar to NCE in being concerned with achieving efficient allocation of scarce resources to alternative uses. The choice of mechanisms for achieving this, however, positions NCE as a sub-set within EE. NCE sees markets as the efficient mechanism for allocation (Costanza et al. 1997, p. 80). EE recognises that not all goods and services can be allocated efficiently through markets. 'Non-market goods' cannot be assigned meaningful prices and values, and cannot be allocated efficiently through markets (Daly & Farley 2003, p. 406). Thus, EE is concerned with the allocation of both 'market goods' that are suited to allocation through markets, and 'non-market goods' that are better allocated through other policy mechanisms.

4.5.1.2 Low entropy matter-energy as the most fundamental economic ingredient

EE emphasises that the economy exists within a biophysical world subject to natural laws. This is another point of departure with NCE, which largely abstracts the economy from the constraints of natural laws (Daly & Farley 2003, pp. 30-33). Ecological economists refer to the interaction of the economy with the biophysical world (Figure 4.5) as a throughput, a flow of inputs of energy and material substances from nature through the economy and back to nature as wastes (ibid, p. 29). While the total quantity of matter and energy is unchanged as a consequence of the first law of thermodynamics (conservation of matter-energy[95]), the second law of thermodynamics[96] determines that the end-state is in a less

[95] While matter and energy are separately conserved in classical physics, they are referred to as 'matter-energy' in recognition of their equivalence as expressed through Einstein's famous equation $E=mc^2$ (Daly & Farley 2003, p. 38).

[96] The Second Law states that all processes within an isolated system lead to an overall increase in entropy, a measure of the chaos in the system, which means the utilisable energy in the system is decreased. The universe as a whole may be approximated as an isolated system, defined as one that exchanges no energy or materials across its boundaries. A closed sub-system may reduce its entropy (and thereby increase its usefulness) through active energy inputs – such as the refining of mineral resources – but the system as a

useful form than the initial-state due to a gain in entropy. Thus throughput may be seen as the transformation of matter-energy from low-entropy states (i.e., resources) to high-entropy states (i.e., wastes) which are more chaotic states from which useful work cannot be extracted without the input of energy (Costanza et al. 1997).

The choice of technology affects the rate and extent of the entropic degradation that occurs. As an illustrative example, the throughput in conventional urban sanitation (Figure 4.6) reflects a transformation of water and soil nutrient resources into higher-entropy wastewater, where the choice of sink affects the extent of overall entropic degradation. If the sink is chosen to be the ocean, the dilution and dispersal of soil nutrients in the ocean reflects a very high-entropy final state; re-capturing the nutrients would require enormous energy input. In comparison, sanitation that uses minimal water and a land based sink would represent a lower gain in entropy.

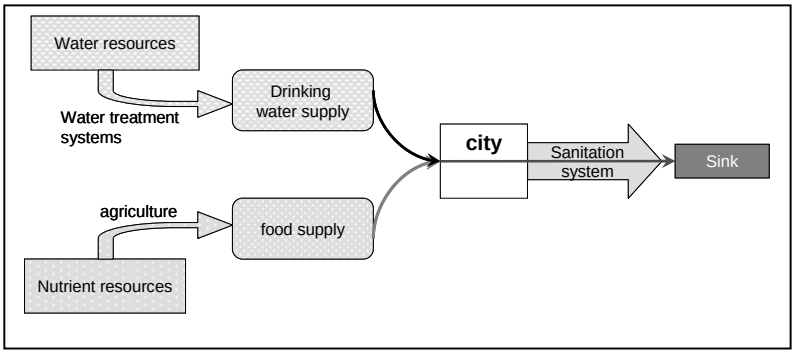

Figure 4.6: Throughput in a conventional urban sanitation system

EE identifies low entropy matter-energy as the ultimate or most fundamental means for achieving human ends (Daly & Farley 2003, pp. 38, 48).

> "Low-entropy matter-energy is the physical coordinate of usefulness; the basic necessity that humans must use up but cannot create, and for which the human economy is totally dependent on nature to supply." (ibid)

Nature supports and maintains the supply of low-entropy matter-energy through the cyclic flows of matter-energy in the earth's natural processes driven by the sun (such as in the water cycle, nutrient cycle, nitrogen cycle and carbon cycle, amongst others).

For sustainability, EE sees it necessary to be frugal with using up available supplies of low-entropy matter-energy, and to pay attention to keeping entropy gain as low as possible when choosing technological processes in human activities (Costanza et al. 1997, pp. 57-59; Daly & Farley, p. 34).

---

whole experiences an entropy increase when the energy and resources used in lowering the entropy of the component sub-system are accounted for.

4.5.2 Implications of EE for water and sanitation policy

The EE perspective guides policy and process in the selection of urban sanitation arrangements in ways that are quite different from NCE. Daly and Farley (2003, pp. 360-363) propose six principles for policy aligned with what is valued in EE. First is to take the present context as the starting point, the current problematic situation with urban sanitation in developing Asian countries – thus emphasising the necessity to capitalise and build upon what exists. Second is to seek to address problems at the smallest domain in which they can be solved – a principle that offers guidance in determining appropriate scale for a sanitation system, which is also in alignment with the principles in Household Centred Environmental Sanitation (Section 2.5.2.3). This principle indicates policy supporting a range of technological scales that serve domains that are as small in physical scale as possible, taking into account the context and the objective to limit degradation of the environment, in preference to a single centralised system that seeks to address sanitation at the city-wide scale. Other principles for policy include the minimum of sacrifice to individual freedoms (in common with NCE); allowing safety margins for incomplete knowledge of the complex biophysical system; enabling policy to be adaptable to changing conditions; and the principle of one policy instrument per independent policy goal. The process for making policy, including addressing the issues of scale, distribution and allocation, is recommended to be participatory and democratic.

The entropy-reducing imperative of EE for sanitation services has explicit implications for the design of material flows in water and sanitation systems. It indicates cyclic material flows (Figure 4.7) that lead to an end state with lower entropy than in the linear flow case illustrated in Figure 4.6. It would mean returning sanitised nutrients to agriculture, decreasing (or even eliminating) the use of water as the transport medium, and treating the water that *is* used so the quality and quantity of effluent can be released to the water cycle without causing ecosystem degradation. Keeping the *net* entropy increase as low as possible requires careful choice of socio-technical systems so that large amounts of energy are not required to transform high-entropy wastewater into sanitised fertilizer and clean water. It points to reducing the mixing and dilution of different qualities of waste streams (Otterpohl, Albold & Oldenburg 1999; Wilderer & Schreff 2000), indicating certain types of technologies that adopt waste separation at source (Section 2.5.2.3).

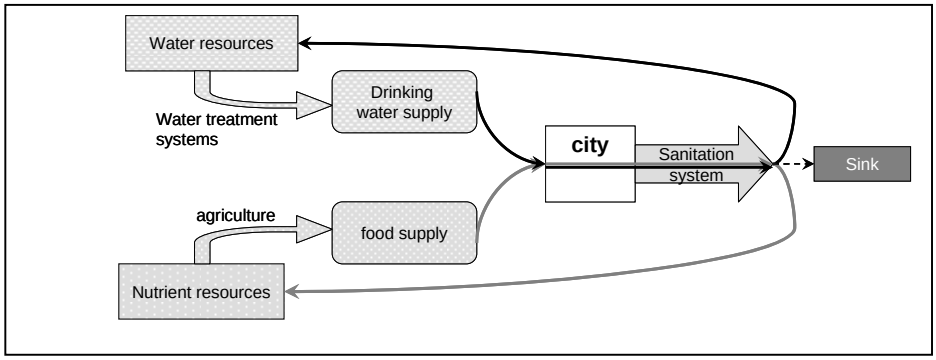

Figure 4.7: Material flows in a sanitation system indicated by ecological economics

A sanitation system that is consistent with the entropy imperative of EE, with material flows represented in Figure 4.7, has the potential to aid cost recovery defined in Section 4.2.2. The cyclic flow of nutrients would relieve nutrient depletion, and relieve degradation of ecosystem sinks by reducing sanitation-related nutrient loading, so less environmental costs are incurred. It would reduce the need for artificial or mineral fertilizers, leading to economic cost savings from avoided imports of fertilizers. Such arrangements create additional beneficiaries from urban sanitation, creating additional revenue streams that aid monetary cost recovery.

In conclusion, I submit that the perspective of ecological economics offers potential for urban sanitation in developing Asian countries to move towards sustainability – consistent with EE's aspirations for sustainability. It indicates arrangements that can create a number of beneficiaries that can improve prospects for monetary cost recovery. It emphasises sustainable scale that would address environmental costs by respecting ecological limits. Its recommendation of democracy and participation in decision-making about sanitation policy and planning creates the opportunity to expose social costs of sanitation decisions and thereby address them.

4.6 Perspective of Buddhist economics

In this section, I describe aspects of Buddhist economics (BE) of relevance to my arguments in this chapter, following a similar structure to the preceding two sections. I begin with a broad introductory overview, and BE's views on human nature, welfare and consumption, followed by a description of some of its features that I consider relevant to sustainable urban sanitation (Section 4.6.1) and what these features imply for urban sanitation in developing Asian countries (Section 4.6.2). As with EE, I discuss some aspects of BE in detail, while others are merely outlined or mentioned so that comparisons with NCE and/or EE can be made.

Economic activity is presented as an integral component of the Buddhist way of life, rather than a specialised discipline in a separate 'economic domain' of human experience (Ariyaratne 1999; Payutto 1992). Buddhist economics (BE), a term coined by Schumacher (1973), refers to the collective economic ideas dispersed through the Buddhist scriptures, dealing with the management of material wealth consistent with Buddhist philosophy (Daniels 2003; Payutto 1992; Schumacher 1973).

Philosophical view of the world

The Buddhist perspective on economics is underpinned by a particular philosophical view of the world, which I outline to justify the central role given to ethics in BE.

Two 'universal truths' from the Buddhist understanding of the world are relevant to this discussion: first, that nothing is absolute – that everything is conditioned, relative and interdependent; and second, that everything is obedient to the Karmic law of cause and effect – that action is followed by reaction (Rahula 1996, pp. 32, 53). Therefore, results are conditioned by methods and means, and:

> "one action gives rise to results, which in turn becomes a cause for further results. Each result conditions further results. In this way, action and reaction are intertwined to form the vibrant fabric of causes and conditions that we perceive as reality." (Payutto 1992)

This idea of interdependence is consistent with the view of the natural world as a complex system (Chapter 3) where "everything influences everything else; nothing can be done in isolation" (Peet 1992, p. 78). Buddhism extends the idea of this interdependence beyond the natural world, to include the domain of thought and intent. The ethical quality of intent and action ('good'/'bad') shapes the nature of the consequence ('beneficial'/ 'harmful') (Payutto 1992) including consequences in the natural world.

BE view of human nature, welfare and consumption

The 'universal truths' above translate to a view of humans as relational beings, connected to all things past, present and future. Human existence is thus seen to occur simultaneously within the spheres of the individual, society and the environment (Payutto 1992), making the wellbeing of individuals contingent on the near-term and long-term wellbeing of society and the environment. A view of connectivity makes 'caring' a rational ethic, and enables non-reciprocal investment in "perfect strangers" to be seen as a way of improving one's own self (Gupta 2006). In contrast, such 'caring' would be seen as irrational and baffling 'altruism' (Fisher 2006), when people are seen as isolated individuals, such as NCE's *homo economicus*.

An understanding of the Buddhist notion of wellbeing is core to the discussion on Buddhist economics. BE is defined as the systematic study of how to attain wellbeing using the minimum of means or resources (Schumacher 1973). In the Buddhist view, wellbeing occurs through the accomplishment of three sequential goals: an initial goal of material wellbeing, an intermediate goal of mental wellbeing, and an ultimate goal of 'inner freedom' (Payutto 1992). Buddhism espouses that ultimate or 'true wellbeing', which is the cessation of human suffering, is attained through ethical conduct, mental discipline and wisdom in accordance with the Noble Eightfold Path (Rahula 1996, pp. 45- 46). Thus BE is concerned with the management of material wealth for the purpose of facilitating the development of highest human potential, commensurate with attaining wellbeing in the material, mental and spiritual domains (Payutto 1992).

The 'goals' may be compared with 'needs' which lead to wellbeing when satisfied, and may be seen as a qualitatively different categorisation of human needs, distinct from those by Maslow, Max-Neef and others (Section 4.3). Like Maslow's conception of 'needs' (Maslow 1970), the goals are hierarchical based on prepotency: the initial goal of material security must be met before the intermediate goal of mental wellbeing can be attained through mental training, which is then the foundation for 'inner freedom'. However, the notions of 'freedom' are interpreted very differently: Maslow sees it as an *external condition* that determines how and whether needs can be met. In contrast, Buddhism sees freedom as *internal* – a mental state reached through one's efforts, characterised by a cessation of suffering – which cannot be controlled by an external agent[97].

A notion of sufficiency is implicit in BE's hierarchical nature of wellbeing. The hierarchy means that sufficiency at the lower levels is not only possible but also necessary: it is only

[97] In Max-Neef's (1992) language of needs and satisfiers, it may be said that the need for this 'freedom' is satisfied in part through certain mental attitudes (Section 4.3), which then simultaneously satisfies all remaining needs (subsistence needs having been met by the first goal) – although BE's concept of 'freedom' itself would appear to be different from those of Max-Neef and Maslow.

when material wellbeing is *sufficiently satisfied*, for example, that progress towards mental wellbeing can be made. Buddhism is referred to as the 'Middle Way' because it advises consumption of the 'right amount', which is neither deprivation nor excess:

> "[an] optimum point where the enhancement of true well-being coincides with the experience of satisfaction. This optimum point, or point of balance, is attained when we experience satisfaction at having answered the need for quality of life or well-being. Consumption, for example, which is attuned to the Middle Way, must be balanced to an amount appropriate to the attainment of well-being... " (Payutto 1992).

Furthermore, BE's hierarchy supports a logic that if material needs are small, they are more easily satisfied, enabling the pursuit of higher goals sooner. Thus Buddhist monks are admonished to develop a 'paucity of wishes' to allow them freedom, mobility and contentment, unburdened by personal cares (Payutto 1992). The rationale of reducing material needs aligns BE with ecological economics and the sustainability discourse that seeks to reduce throughput of material and energy through the economy (Daniels 2003). In cost terms, it suggests reduction of net material costs (monetary and environmental).

To parallel the caricatures of the individual actor in NCE and EE in the preceding sections, I propose an individual actor in BE as shown in Figure 4.8, whose wellbeing is maximised when consumption is of a 'right amount'. Wellbeing is lower when consumption is less than the right amount which amounts to deprivation; when consumption is greater, 'excess' leads to decreased wellbeing, creating a distraction from seeking higher goals.

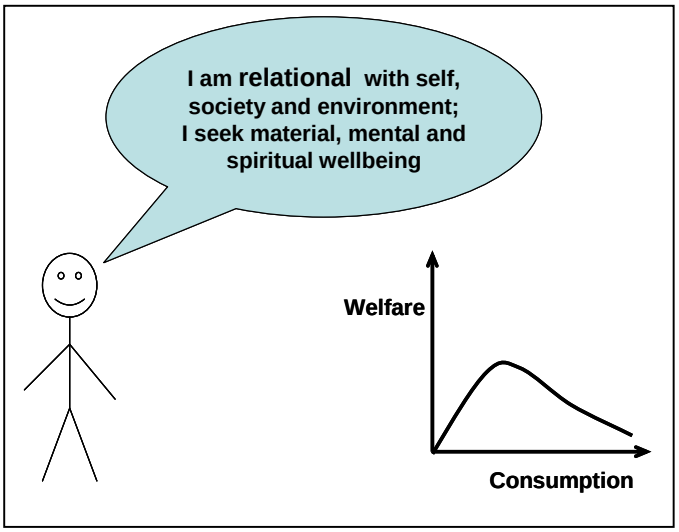

Figure 4.8: An individual actor in Buddhist Economics

BE's view of the relationship between wants/desires, their satisfaction, and the attainment of wellbeing distinguishes it from NCE. BE acknowledges that individuals can have unlimited wants and desires, in agreement with NCE. In BE, however, personal morality constrains these wants and desires (Payutto 1992), rather than limited resources as proposed in NCE. BE explains the relationship between the satisfaction of wants/desires and

wellbeing in terms of a two-fold nature of human desire. One type is driven by '*tanha'*, a craving for pleasurable feelings (or aversion to displeasurable feelings), the other by '*chanda'*, a desire for wellbeing in its broad sense described earlier (Payutto 1992; Rahula 1996). Satisfaction results when either type of desire is fulfilled, but with different ethical consequences (Payutto 1992). There is no limit to human wants driven by '*tanha'*. The Buddha is reported to have said that "even if money were to fall from the skies like rain, man's sensual desires would not be satisfied" (ibid). At the same time, Buddhism recognises an inherent human desire for "quality of life or wellbeing, the desire for self improvement and goodness" (ibid) – wants driven by '*chanda'* that lead to sufficiency and contentment in BE.

In BE, individuals and societies are explicitly given moral responsibility for the economic choices they make. BE highlights that humans can control the quantity and quality of their desires and wants, and that their choices of ways to satisfy them have ethical consequences in the karmic chain of causes and effects. NCE's description of individuals as having 'unlimited wants' would be seen as only a partial view of human nature, the part governed by the restless and insatiable wants motivated by *'tanha'*. By recognising that economic activity can also be motivated by '*chanda'*, BE shows that 'unlimited wants' motivated by *'tanha'* can be constrained by morality and sufficiency with the 'right amount'. The BE idea of economic sufficiency and its purpose in developing the highest human potential coincides with ecological economics' idea that a qualitative improvements in the human condition can occur without a quantitative increase in consumption beyond the 'right amount' (Section 4.5.1.1).

4.6.1 Relevant features of Buddhist economics

The karmic law linking causes and effects, in conjunction with the distinction of 'true' wellbeing sought by *chanda*, brings ethics to the centre of the Buddhist economic system. The karmic law implies that the ends are crucially shaped by the means and have far reaching consequences in the interacting chain of causes and effects, rejecting the possibility that the ends can justify the means (Payutto 1992). It would indicate, for example, that using economically efficient levels of environmental harm as a means to achieving economic growth, permissible by NCE, would cause harmful consequences for the quality of that economic growth. The ethical quality of economic activity is central in BE, which is evaluated in terms of its impacts (effects) and in terms of the intentions behind the activity (causes). These features that characterise a Buddhist economy are examined further below.

4.6.1.1 Ethical motivations behind economic activity

The ultimate 'cause' in economic activity might be identified as a thought or intent, whose 'effect' is the decision chain leading to physical action related to economic activity. Thus

according to the karmic law, the ethical qualities of the motivation which drives action 'conditions' the outcomes of those actions. For economic activity to be ethical, the *intent* or *desire* driving the activity must be *chanda*, the desire for improving quality of life, goodness, and 'true wellbeing' (Payutto 1992).

Ethical or virtuous motivation based on *chanda* is therefore necessary for economic activity to produce results that are truly beneficial. Ethical motivations include a desire for improving the quality of the human condition, development of human potential, poverty alleviation, creating opportunity for 'right livelihood' and wealth creation by rightful means. They exclude greed and self indulgence (Payutto 1992).

Evaluation of the ethical quality of motivations in practice is not simple, since the true motivation driving an individual is known only to the individual. The complexity is compounded by the fact that any self-assessment would be coloured by the individual's perceptions and beliefs and ideological frame of reference. Payutto (1992) observes that "as wisdom is developed, *chanda* becomes more dominant, while the blind craving of *tanha* loses its strength". However, when wisdom is less developed, introspection and self-examination is not likely to reveal this state of weak wisdom or a desire for greater wisdom.

The challenge is how to create ethical or 'right motivation' in the development context in general, and for sanitation in particular. I submit that participation in genuine democratic processes of the sort envisaged by the sustainability discourse has the potential to achieve a collective 'right motivation'. Such processes can create space where actors traditionally in competition for resources and power might begin to build cooperative relationships, "united in their ignorance of how best to improve the general situation that brings them together" (Fung & Wright 2003). The potential for deliberative democracy to lead to ethical motivation is discussed further in the next chapter (Section 5.2.1.2). Interestingly, the recent rise in civil society groups wanting to participate in decision-making is seen to have been catalysed by a "widespread disenchantment with a society where neither industry nor elected officials appear to act 'in the public interest'" (Roberts 1995). In other words, deliberative democracy may be seen as a response to the perceived deficit in 'right motivation' behind prevailing decision-making processes.

4.6.1.2 'No harm' should result

The second test for ethical quality of economic action is whether it causes no problems to individual consumers, causes no agitation in society, and has a benign impact on the environment (Payutto 1992). It has its basis in the interconnectedness of the spheres of human existence as individual self, within society, and within the natural environment, so that impacts on all these spheres determine the ethical quality of economic activity. Economic activity of 'high' ethical quality would imply utilising the capacity of humans to cooperate in harmony with other actors (including ecosystems) to protect the interests of

all. Caring for others and the environment is in accordance with the Buddhist precepts of abstaining from harming any life (‘*ahimsa’*) and extending loving kindness to all beings (‘*metta*’) (Daniels 2003). Accordingly, the ethical test that ‘no harm’ results, points to economic systems that foster social cohesion, human dignity and freedom (Schumacher 1973), and environmental care – that identify and address issues relating to social and environmental costs.

Since Schumacher wrote ‘Small is Beautiful’, a Buddhist economy has frequently been interpreted as one that specifies organisation at a small scale – neighbourhood scale arrangements and intermediate technologies with local resources supplying local needs, and cooperative, nurturing social environments (Ariyaratne 1999; Daniels 2003; J.A. Nelson 2004; Schumacher 1973). There are many who argue that decentralised small or medium scale technologies and social organisation at local levels facilitate sustainability (Newman & Mouritz 1996; Schertenleib 2004a).

Nelson (2004), however, disputes that BE is necessarily about scale, but rather, that its key emphasis is the *relational* nature of individuals, society, business, government, and the natural world, and the capacity for them to interact cooperatively to achieve beneficial outcomes for all, irrespective of scale. She argues that an insistence on small-scale organisation can implicitly dismiss the possibility that large-scale organisations such as large corporations can be expected to do ‘good’, and concurrently lower society’s expectations from such organisations. I agree with Nelson, that neither BE nor sustainability necessarily requires that the *social organisation* of activities around sanitation need to be small scale[98]. What Nelson stresses is that irrespective of size, recognising the relational nature of organisations involved in economic activity, and their interdependence with their wider stakeholders, would raise the expectations of society that these organisations would demonstrate a sense of ‘enlightened self interest’ by acting with ‘caring’. The recent growth of ethical investment and corporate social responsibility around the globe demonstrates how recognising the relational nature of companies has led to different expectations and behaviours, and will be explored in Chapter 6.

The values of BE can be the basis of an entirely different social order, such as that being implemented by the Sarvodaya Shramadana Movement in Sri Lanka[99]. However, to extend

[98] For example, centralised organisation and management of decentralised sanitation technologies are increasingly promoted as more conducive to sustainable sanitation than smaller scale organisation (Section 2.5.2.2).

[99] The Sarvodaya Shramadana Movement has been active in Sri Lanka over the last forty years, working to create a society of “No Poverty, No Affluence” to exemplify a model Buddhist economy and social order (Ariyaratne 1999, p. 6). Here, development is seen as an “awakening process” for development of the human personality, and the establishment of “spiritual, moral and cultural values at individual, family, group, village and urban community, and national levels” – spreading to the awakening of “the world community” (Ariyaratne 1999). Economic activity is viewed within the context of attaining the Buddhist concept of

the point made by Nelson (2004) above, I argue that it may not be necessary to structure an entire new social order to shift present trends towards more ethical and caring directions. If participants in today's economies adopt the values of relationality and of causing 'no harm' (or reversing harm where possible), significant behavioural change can result within existing structures of society. Whether in existing or new social orders, it is an attitude of 'caring' that would seek to cause 'no harm' and align with achieving sustainability outcomes.

4.6.1.3 BE and the poor

Buddhist economics' relational view of society presupposes a shared responsibility for addressing the needs of the poor. Three groups are identifiable: the poor individuals, the non-poor individuals (and private commercial entities), and those in authority. A ruler (or government) is admonished to prevent abject poverty from arising; the *absence of poverty* is the measure of ethical economic performance of a nation, rather than the presence of surplus wealth in government treasuries or in the hands of a few (Payutto 1992). Simultaneously, non-poor individuals are called to perform meritorious deeds according to their means, and to extend kindness and assistance to the less fortunate. At the same time, poor individuals are advised to exert diligence and effort in order to escape from poverty, and to achieve a state of material wellbeing through ethical means.

Thus the poor are intrinsic members of the Buddhist economy, with responsibilities like all others, giving them dignity and hope of escaping from poverty. In this respect, BE stands apart from NCE which excludes the poor as participants in the economy. Addressing the needs of the poor requires a departure from NCE ideals through provision of subsidies to the eligible poor (Section 4.4.2). Perhaps most significantly, these policies require poor households to meet sometimes humiliating eligibility criteria, and frequently gives them little incentive to escape poverty (Foster, Gomez-Lobo & Halpern 2000), effectively confining them to be forever marginal, and effectively excluding a sustainable sanitation solution for all of society. The EE approach is more consistent with BE, in explicitly requiring the issue of distribution be addressed so resources are divided equitably amongst alternative users including the poor. At the same time, its call for the affluent to lower their consumption in order to make resources available to the poor can be interpreted as a call for 'sacrifice'. BE strengthens and complements EE's approach by emphasising responsibility founded in relationality – assigning responsibility to the poor to make good use of

---

wellbeing, although the model is sufficiently pragmatic to recognise that not all would aspire to the higher levels of wellbeing:

> "Self realisation is a long and ardous process which needs [a] lot of mental, verbal and bodily discipline, and patience and effort. Only a very few people in a community will have the urge and energy to tread a path of this nature. Yet they can motivate most if not all the other people in their community to respect the importance of this understanding and cultivate much of it while living the normal householder's life" (Ariyaratne 1999, p. 22)

resources and opportunities to rise out of poverty, and to the affluent to be motivated by *chanda*-based 'caring' that simultaneously leads to qualitative improvements in their own welfare.

4.6.2 Implications of BE for sanitation policy

BE brings ethics and 'caring' to the fore in addressing sanitation. I submit that its call for 'right motivation' to drive decision-making processes about sanitation can best be achieved by involving broad participation. This is discussed further in Section 5.2.1.2.

The BE call for consumption in the 'right amount', together with the call to do 'no harm' indicates sanitation to consist of appropriate technologies and scales that enable efficient use of resources with minimal harm to the environment. Daniels (2003) interprets this in terms of materials flow analysis that seeks "a socioeconomic metabolism reduction goal", or reduction in throughput. I see this as equivalent to keeping costs – made up of economic, environmental and social costs – as low as is possible in order to achieve sanitation that contributes to sustainable well-being.

With respect to environmental costs, BE is very clear not only that 'no harm' should be caused, but that the environment should be treated with reverence (Schumacher 1973). It points to keeping demands on the environment *well below* its carrying capacity – consistent with EE's call for a sustainable scale, and in contrast to NCE's allowing of an anthropocentric 'economically efficient' level of environmental harm.

The monetary costs may be kept low by choosing technology and management options that are both affordable and appropriate to the cultural and socioeconomic circumstances of urban communities in Asia (Schumacher 1973). Keeping monetary costs low improves affordability and hence the feasibility of their recovery – so that society can live within its means. Furthermore, if monetary costs are small, recovering them becomes more feasible, improving prospects for service providers to make a profit and increase wealth, which is encouraged by BE within the boundaries of a proper mental attitude (Section 6.5.1). A profitable service can provide better and more secure livelihoods for those employed in it – another goal of BE (Schumacher 1973).

In recovering monetary costs, BE shifts the expectations of the three main groups of actors – government, customers, and service providers, who are relational with each other and wider society and the environment. It calls service providers to be service-oriented, committed to the wellbeing of society and the environment they are in relation with – a commitment that may ultimately determine the company's long-term future. It calls on individuals to cooperate with service providers, with a willingness to pay a fair price for the services they receive, and with caring behaviours that support the proper operation of their

technical systems[100]. Finally, it calls on governments not to abdicate responsibility for public welfare, and therefore, to compensate service providers for the societal and ecological benefits delivered.

4.7 Integrating NCE, EE and BE

Economics is sometimes described in terms of ends and means: for example, as the study of the allocation of scarce means to competing ends (Daly & Farley 2003, p. 37), or BE as the study of how to attain given ends with the minimum means (Schumacher 1973). Aligned with the Buddhist concept of means giving rise to ends that then act as the means for further ends (Section 4.6), it is possible to view means and ends as a spectrum.

I use the ends and means spectrum as a way of integrating NCE, EE and BE (Figure 4.9). It draws on the spectrum conceptualized by Daly and Farley (2003, pp. 48-50). Daly and Farley propose that at the bottom of the spectrum, we have the ultimate means from the perspective of EE, namely, low entropy matter-energy – the subject matter of physics, the most fundamental of sciences. At the top, we have the ultimate end, that which is "intrinsically good and does not derive its goodness from any instrumental relation to some other or higher good", however dimly perceived – the subject of philosophy and religion. The mid range of the spectrum is broken into smaller segments and studied by the various different disciplines – for example, technics studies how to turn ultimate means into intermediate means that are artefacts useful for some intermediate end. They argue that intermediate ends are ranked on the basis of their nearness as an operational approximation of the ultimate end. Since the ranking is based on values and ethics, the range of the spectrum between intermediate ends and the ultimate end is the subject of ethics.

Daly and Farley (2003, pp. 49-50) argue that the range of the spectrum between intermediate means and intermediate ends is the subject of NCE. NCE's analysis assumes a *given* ranking of intermediate ends based on economic valuation, while staying outside the value-loaded process of making this ranking. Furthermore, they argue that NCE assumes technology as given, that has converted ultimate means into *given* intermediate means that are the starting point of NCE [101]. Thus, NCE is concerned with the allocation of intermediate means to intermediate ends.

---

[100] Users often adopt a 'flush and forget' attitude towards sanitation, thoughtlessly disposing of inappropriate materials that lead to technical malfunctions of sewerage systems (Section 2.4.2). BE calls for an attitude of caring that would eliminate such behaviour.

[101] This is also consistent with the characterisation of NCE with an ideological reliance on advanced technological solutions and the belief that scientific investigation (primarily physics and engineering) has the ability to solve environmental and social problems (J.W. Smith, Lyons & Sauer-Thompson 1999)

EE deals with the range of the spectrum from low-entropy matter energy, its ultimate means, to its unspecified ultimate end – almost the entire spectrum (Figure 4.9). Daly and Farley (2003, p. 42) submit that ecological economists "must be dogmatic about the existence of the ultimate end [while being] very humble and tolerant about our hazy and differing perceptions of what it looks like." Its respect for multiple perspectives means it cannot specify *the* ultimate end which lies beyond knowledge, only to conceptualise that it exists.

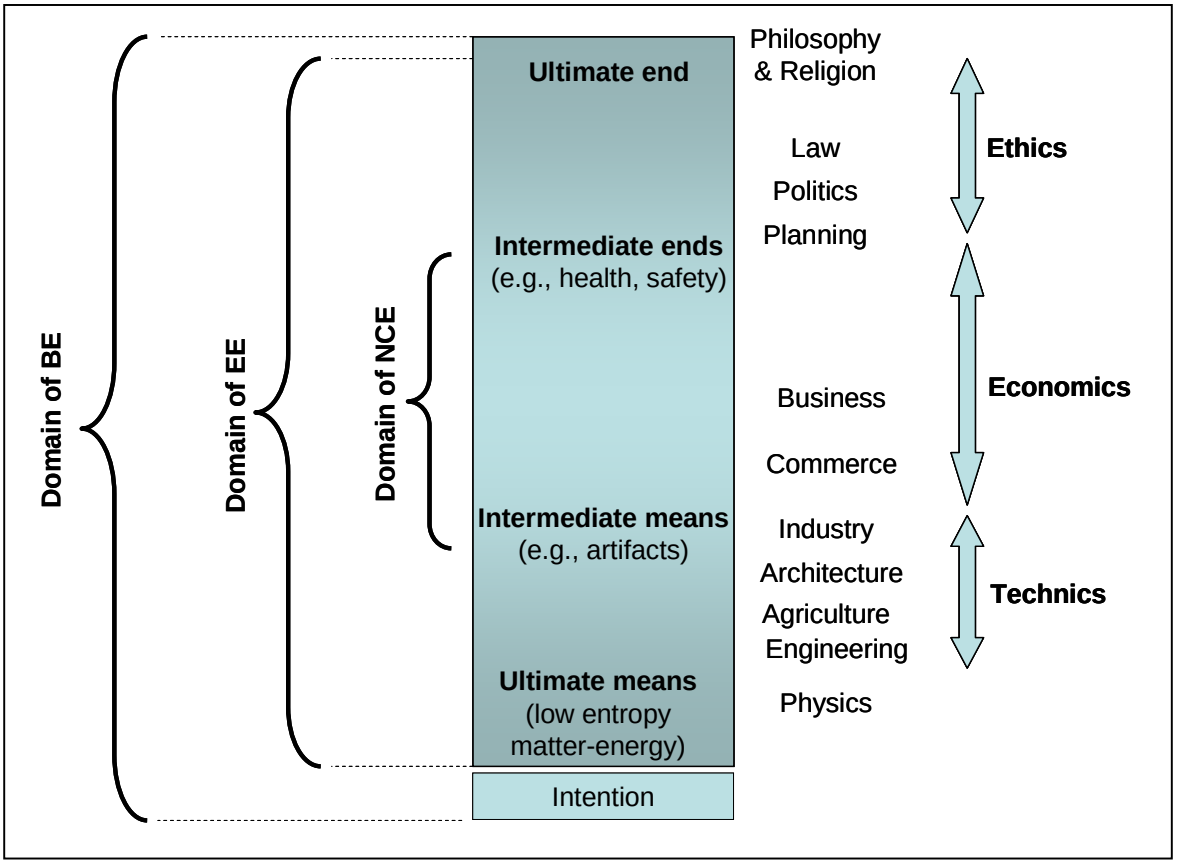

Figure 4.9: Spectrum of Ends and Means (adapted from Daly & Farley 2003, p. 48)

In BE, the *ultimate* ultimate means is the thought or intention that sets off the chain of action and reaction for utilising low entropy matter-energy for various intermediate ends. Moreover, BE is specific about the ultimate end – which is to reach a state of absolute freedom from all causes of suffering, or *Nirvana* (Rahula 1996, pp. 35-44).Thus I submit that the range of BE overlaps that of EE on the spectrum and extends it at both extremes[102] (Figure 4.9).

[102] I recognise that EE's plurality may arguably encompass BE, so it can be debatable whether BE encompasses EE at the top of the spectrum or vice versa. This matter is however of no consequence to the guidance to sanitation policy and planning that I draw from this discussion.

The differing ranges of the spectrum that NCE, EE and BE are concerned with may be interpreted as follows. EE and BE both deal largely with 'messy' problems (Chapter 3) while the domain of NCE is simple or intermediate problems. Therefore, NCE is able to indicate comprehensive and optimising solutions to the problems in its domain. EE and BE on the other hand are largely able to indicate 'overall improvements' or resolutions, and strategies that are open to interpretation rather than tightly prescriptive. Problems arise when NCE is applied to problems that are outside its domain, where a 'messy' problem is treated without appropriate consideration of its complexity. Thus, criticisms of NCE made by ecological economists and Buddhist economists are a call to limit NCE to its domain of validity rather than a wholesale rejection of NCE.

An alternative explanation may be made in terms of satisfiers of human needs (Section 4.3): NCE's domain of concern is with economic goods and services as satisfiers; EE and BE are concerned with a full range of satisfiers, including but not limited to economic goods and services; BE furthermore includes satisfiers of spiritual needs in its domain of concern. Thus BE is concerned with addressing the full spectrum on needs, including the wide area of the spectrum addressed by EE, and the smaller area of the spectrum that concerns NCE.

NCE, EE and BE are all concerned with efficiency – using the least means to reach desired ends. It can be argued that efficiency is the prime concern of NCE, but EE and BE are equally concerned with effectiveness – i.e., not only concerned with 'doing the thing right', but with 'doing the right thing'. EE asks the effectiveness question taking a number of perspectives into account, leading it to be concerned with distributional effects and justice. BE asks the effectiveness question in light of how the means contributes to achieving the ultimate end of spiritual freedom.

Stressing the relationship between BE, EE and NCE means that the strengths and benefits of NCE can be taken advantage of, while its activity occurs within the constraining guidance of BE and EE.

4.7.1 Guiding principles for sustainable urban sanitation

The relationship between BE, EE and NCE makes it possible to draw together a set of guiding principles for sustainable urban sanitation policy. BE and EE provide guidance at a high level for overall improvement, and NCE can provide comprehensive 'solutions' where appropriate. I submit that these principles are necessary, though possibly not sufficient, and may be complemented by other contextually appropriate principles.

Guided by BE, EE and NCE as complements, I propose the following set of principles:

- Arrangements for sanitation should emphasise cooperation between stakeholders
- Efficiency goals should include entropy considerations
- Society as a whole should live within its means
- Ethics and "goodness" should underpin decision processes and choices

Their basis in the perspectives of BE, EE, and NCE are elucidated below.

- **Arrangements for sanitation should emphasise cooperation between stakeholders**
    - EE calls for democratic decision-making that considers a wide range of stakeholder perspectives. For sanitation, participants in the process could potentially involve the public to be served, potential service providers, property developers, government stakeholders, sustainability researchers, scientists, planners, environmental groups and NGOs (who might represent the interest of future residents/generations), amongst others.
    - BE's relational perspective positions sanitation as a partnership between service providers, service recipients and the government to provide for the wellbeing of individuals, society and the environment.
    - Sanitation can contribute to development as seen by EE, by examining ways of enhancing the quality of life of individuals in the community. The engagement of individuals with each other in pursuing sanitation as a partnership would build community, as well as provide an opportunity to identify additional ways to benefit local communities.
    - Participatory decision-making processes can potentially draw out 'right motivation' emphasised by BE, by having stakeholders focus on common interests.
    - Involving stakeholders in decision-making creates space for social impacts of the sanitation options to be identified and considered – essential for addressing social costs as envisioned in this thesis (Section 4.2.2).

- **Efficiency goals should include entropy considerations**
    - NCE, EE and BE emphasise efficiency – to gain as much benefit for as little cost as possible – that aids living within society's means. Efficiency would be sought, that increases individual, societal and environmental wellbeing with fewer input resources. It means multiple use of resources – such as re-use of wastewater.
    - EE calls for efficiency to be regarded from a systems perspective that looks to conserving low-entropy matter-energy as far as possible. Efforts would be made to design material flows as closed loops using as little energy and non-cycling materials as possible. For sanitation, this means returning nutrients to agriculture in a sanitised and useable form, decreasing or even eliminating the use of water in sanitation, and treating any water that is used so its quality and quantity cause no ecosystem degradation, using technologies that have low requirements for energy and other resources.
    - Efficiency in BE depends on how little material resources are required for a sense of wellbeing, which is largely a moral choice by individuals and society. For sanitation it would mean choices of effective technologies to suit the context, that require as little material infrastructure and energy resources as possible – that consequently reduce consumption of low-entropy matter-energy resources. Intermediate scale technologies are indicated.
    - EE, BE and NCE all encourage that ways to improve efficiency be explored, including recovering waste products in the form of useful marketable products, creating multiple revenue streams and simultaneously increasing opportunities for employment and right livelihood – a further factor to increasing overall efficiency by increasing benefits.

- **Society as a whole should live within its means**
    - BE argues for activities to be chosen to allow people to live within their means. Keeping economic, environmental, and social costs of sanitation as small as possible facilitates 'recovery' of all these costs, aiding people to live within their means.
    - EE and BE insist that demands on the environment should not compromise the health of ecosystems – consistent with 'recovery' of environmental costs as defined in Section 4.2.2. Thus, physical systems need to be designed to be within the carrying capacity of local and global ecosystems.
    - EE argues that the scale of the service be defined to remain within this carrying capacity. This is consistent with BE's requirement for the 'right amount' of demands on the environment, that cause 'no harm'.
    - EE argues that sanitation depends on ecosystem services, and the earth's capacity for providing these services must be maintained. BE supplements this argument with the relationality of all things that means that wellbeing of

the environment (including non-human life forms) is necessary for human wellbeing.

- Sanitation services need to be designed so they are within the economic means of the community – so monetary costs are recoverable. NCE calls for all costs that can legitimately be assigned a monetary value be recovered. Application of the 'beneficiary pays' principle allows distributive justice to be achieved where prices reflect the users' share of benefits and government pays for the share of benefits to society and environment.
- The physical scale of the service would consider keeping system-wide costs as low as possible, allowing safety margins for remaining within natural limits.

- **Ethics and "goodness" should underpin decision processes and choices**
  - BE requires the goal of sanitation to be to enhance the quality of life of individuals in the community without causing harm to others
  - EE calls for precautionary principle to be observed when science is uncertain, so that potentially excessive costs on future generations are avoided.
  - Having ethical or 'right motivation' is necessary for decisions to lead to beneficial outcomes according to BE. There is potential for collective 'right motivation' to be drawn through participatory decision-making processes that reflect on individual ideological orientations and underlying motives (as discussed in Section 5.2.1.2), to reach collective decisions in the common interest
  - EE emphasises that the issue of distribution be addressed so that no individual is excluded from having access to sanitation
  - BE places a shared responsibility on all, that no-one should suffer the deprivation of basic services necessary for dignity including sanitation.

My integration of BE, EE and NCE for urban sanitation in developing Asian countries leads me to the above principles as necessary, for alignment with sustainability. The set of principles is not meant to be exhaustive, and other perspectives could add further principles.

4.8 Conclusions

In this chapter I have used cost as a leverage point for sustainability in urban sanitation systems. I introduced a general concept of cost, as consisting of monetary, environmental and social elements, and argued that sustainability requires that costs must be recovered. This means that sufficient revenues need to be raised to recover monetary costs; that

environmental costs – degradation caused by resource extraction and waste emission related to sanitation – need to be avoided or reversed; and that social costs – impacts from sanitation that affect people adversely – need to be brought to light so that they may be addressed, necessarily involving the public in decisions about sanitation.

I submitted that perspectives on cost issues depend on the mindsets and worldviews of the perceiver, and that furthermore, that significant change can be achieved by changing the dominant cost perspective. I demonstrated this by examining the worldviews and perspectives on cost of three economic positions – neoclassical economics (NCE), ecological economics (EE) and Buddhist economics (BE).

I argued that the dominant NCE perspective, although pertinent and useful for many types of goods and services, is not useful for urban sanitation in developing Asian countries. Firstly, it promotes 'full cost pricing' as the preferred mechanism for recovering all costs, underpinned by its worldview that favours free markets for the exchange of goods and services where behaviours are determined by price, and the distancing of governments from the provision of public welfare. Since sanitation has significant public benefits or positive externalities, the distancing of governments from responsibility for sanitation-related welfare is not appropriate: distributive justice would not be achieved with 'full cost pricing' where the 'users' pay all the costs and others benefit.

NCE recommends that environmental and social costs be addressed by translating them into monetary equivalents within estimations of the full cost – a subjective and value-laden process of pricing intangibles whose legitimacy is disputed (Söderbaum 2003). Furthermore, NCE addresses these costs only to the extent that they impact on the economic actors involved, which would not extend far enough to achieve sustainability in terms of wider society, let alone environmental sustainability. Critics see this as NCE's failure to sufficiently recognise the economy's dependence on a finite environment (Daly & Farley 2003). Finally, the NCE model is ineffective in serving the interests of poor people, who make up a significant proportion of the population in cities of developing Asian countries.

As alternatives to the dominant but inadequate perspective of NCE, I examined EE and BE, and showed that they are both explicitly concerned about sustainability, that encompasses economic, environmental and social cost 'recovery'. Thus, they can offer general guidance applicable to move to sustainable sanitation in developing Asian countries. They emphasise values and ethics in economics, in contrast to NCE's alleged 'value free' stance, and expressly include the interests of the poor within their models.

EE locates economics within the constraints of a physical and finite planet and a value-loaded context of society. It emphasises decisions underpinned by democracy and an accommodation of multiple values and perspectives, which abide by the precautionary

principle when scientific facts are uncertain. Consistent with this, EE calls for the physical scale of sanitation systems to be determined democratically with the goal of keeping impacts within the carrying capacities of ecosystems. I argued that EE thus addresses environmental costs of sanitation sufficiently to be consistent with sustainability. EE's advocacy of democratic participation improves the opportunities for identifying social costs so they may explicitly be addressed. Finally, EE highlights low-entropy matter-energy as the ultimate resource, so that sustainability is aided by processes that seek to keep its degradation low. This indicates sanitation arrangements that recycle nutrients, reduce dilution in water, reduce the mixing of different waste streams, and recycle what water is used, using technologies with low demand for energy.

BE is concerned with human wellbeing achieved through moral development, and stresses the relational nature of all things. It teaches wellbeing is achieved through the 'right amount' of consumption, ethical actions driven by 'right motivation', and human activity that causes 'no harm' to others or the environment. I argued that this implied sanitation infrastructure that used as few material resources as possible, and stayed well within the ecological limits of the environment – factors that lead to environmental cost 'recovery'. Furthermore I proposed that participatory decision making about sanitation has the potential to draw out a collective 'right motivation', that would simultaneously consider social costs.

While EE and BE address the shortcomings of NCE, they complement rather than replace NCE, allowing them to indicate a collective set of guidelines for sanitation that is sustainable, and limits NCE to its domain of applicability. I offered four principles on the basis of BE, EE and NCE perspectives, applicable to designing material systems and decision-making processes relating to sanitation. In summary, these are, that:

- Arrangements for sanitation should emphasise cooperation between stakeholders;
- Efficiency goals should include entropy considerations for the resources used, including water, nutrients, and energy;
- Society should manage sanitation to support living within its economic and environmental means; and
- Ethics and "goodness" should underpin decision processes and choices.

How these principles might be accommodated within a practical decision-making process is considered next.

5 An operational framework to aid planners decide on action

Success is determined retrospectively, so the emphasis in planning should be on process and collectively considered, context-related progress rather than on achieving remote targets. A key measure of progress is the maintenance of a creative learning framework for planning ... The new role for policy makers is to facilitate learning and seek leverage points with which to direct progress towards integrated economic, ecological and sociocultural approaches for all human activity.

Tony Meppem & Roderick Gill (1998)

5.1 Introduction

The aim of this chapter is to propose a framework for making decisions about resolving problematic sanitation that incorporate ideas discussed in earlier chapters, addressing my research question *"How can these concepts [for directing urban sanitation towards sustainability] be translated into a practical framework for decision-making?"* The aim here is to help resolve rather than solve the problem, consistent with my classification of urban sanitation in developing Asian countries as a messy problem that cannot be 'solved' in a conventional sense, but only 'resolved' using approaches and methods that match the task (Chapter 3).

To offer an approach for finding resolution that can be used in an operational sense is a necessary element of this thesis, since it aligns itself with the values of transdisciplinarity, the sustainability discourse and ecological economics. A commitment to resolving real world problems is one of the salient features these discourses have in common (Costanza et al. 1997; Söderbaum 2000; Wickson, Carew & Russell 2006). As such, I seek to translate the theoretical and philosophical ideas from earlier chapters into a practical framework that planners in developing Asian countries can use in planning for urban sanitation.

The trajectory that this PhD research has taken has meant that the framework proposed here has not been tested in practice. To address this limitation, I have adapted models that *have* been implemented in a variety of different situations as the basis of my framework. Furthermore, I have been in a position to think through the framework carefully in relation to a hypothetical case study in Colombo on the basis of knowledge gained through my interviews and my own experience of Sri Lanka, to begin the process of testing its tools, and to reflect on its strengths and weaknesses. The framework is thus offered as a guide for designing a process that others could refine and apply, tailoring it to their situations.

The operational framework for sanitation planning being proposed here has features in common with other decision frameworks that may potentially be applied to addressing problematic urban sanitation in developing Asian countries. The International Water

Association's *Sanitation 21* (IWA 2006b) is one such framework, whose broad approach agrees with mine:

> "…improving the quality and effectiveness of sanitation investments is not particularly about technologies (although the appropriate application of technology is important) rather it is about developing an explicit understanding of what the objectives of a system are and then designing a system which meets those objectives." (IWA 2006b, p. 6)

Renn et al.'s *Cooperative Discourse Model* (Renn 1999; Renn et al. 1993) is another, whose parallels usefully inform my model (Section 5.4.2).

The operational framework here is also novel and quite distinct from these other frameworks, as it takes on the idea of "sustainability as learning" (Section 3.3) as its basis. This is the proposition that a process for learning and accommodating a multiplicity of legitimate perspectives on a messy problem would reveal a reasonable course of action to those involved in the process at the time. More orthodox reductionist approaches to 'solving' a problem would largely assume complexities away, in contrast to a learning process that embraces the complexities relating to the interaction of humans and the environment in general, that includes the messy problem of urban sanitation in developing Asian countries in particular. While the IWA framework[103] reflects a move towards greater recognition of complexities, it is targeted for use by "technical planners and designers" as the central actors, and for *their* perspectives on "what the objectives of a system are" to be the basis for matching solutions to meet the objectives and the context (IWA 2006b, p. 6). While the framework emphasises the need to "understand how interests and incentives play out across the city", it does not require the participation of broader stakeholders in revealing these perspectives. Using planners and designers to interpret these complexities (ibid, pp. 15-18) is, I contend, a form of assuming complexities away. In contrast, the framework for a learning process proposed here seeks to incorporate *multiple perspectives* about the objectives and how they can be met, and to involve a broader range of actors in deliberation about the issues, with recommendations for planners about resolving urban sanitation as the outcome of the process.

Overview

Within the scope of the thesis, this operational framework is intended to guide the design of a potential research project whereby desirable and feasible actions for resolving problematic sanitation may be discovered (Figure 5.1), which can be presented as recommendations for planners. I have chosen this approach because it allows the process to take place within existing policy environments, while its framing as 'research' can allow implementation on an experimental basis where exceptions to policy rulings can be

[103] Broadly consistent with the Household Centred Environmental Sanitation approach (Section 2.5.2.3), the IWA framework seeks to account for the needs and interests of multiple stakeholders across all domains of the city, including the household, the neighbourhood, the city and beyond the city.

made[104]. This approach can provide invaluable learning experience and improve problematic situations without undue delays. At the same time, the research project can play a role of champion to the cause of sustainable sanitation, that was a gap identified by interviewees in Colombo [105].

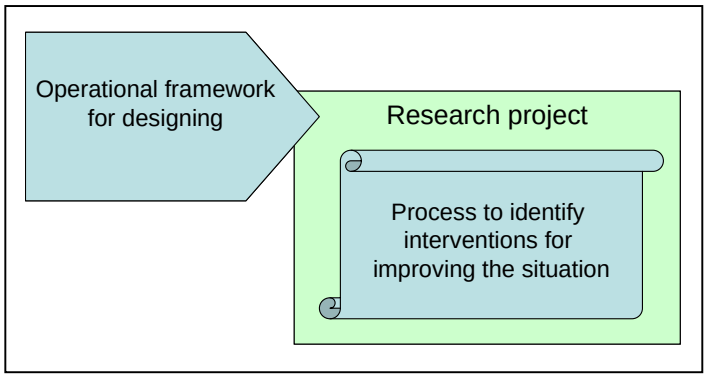

Figure 5.1: Operational Framework as a guide to designing a research project to address the problematic situation.

The research project is designed based on soft systems methodology (SSM) as a systemic learning device (Section 3.5). Checkland (2000) identifies a combination of three interacting elements in the generic use of SSM – or any systematic approach to resolving problems in general. These are: a situation perceived to be problematic; a process for tackling that situation so that some actions to improve it may be found; and a group of people involved in the process (Figure 5.2). The discussion of my proposed framework is structured around these elements.

[104] Precedents for such policy exceptions exist in Sri Lanka, where sanitation technologies impermissible under existing Municipal Ordinances have been implemented as 'special projects' under a separate Act (Wikramanayake & Corea 2003).

[105] As noted in Section 1.3.1, political championing can be critical for moving forward, especially in the case of sanitation which is traditionally "not a glamorous area for politicians to back…" (Interview 2003).

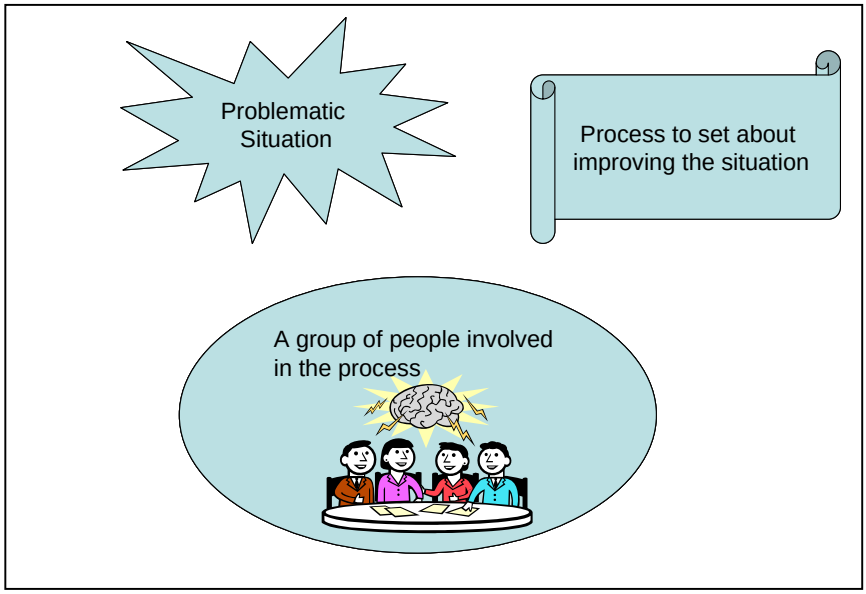

Figure 5.2: Elements that combine in a systematic approach to resolving a real-world situation perceived to be problematic (based on Checkland 2000)

The framework addresses each of these three elements and brings them together to aid the resolution of problematic urban sanitation in developing Asian countries. The scope of the undertaking would largely depend on the context of *the problematic situation*, where the prevailing political and policy-making landscapes would determine the kinds of influences that can be brought to bear. I have therefore selected a hypothetical case study of Colombo, Sri Lanka, in order to explicate the framework within the context of a particular problematic situation. A similar process can tailor the framework differently for use in other locations.

The location and scale of *the problematic situation* to be addressed by *the process* must first be defined, as it determines the shape of the process in terms of who the stakeholders and affected citizens might be, the contextual data, the costs, and other details. This might potentially be set at the level of a particular neighbourhood, or a municipal council ward, or a local government zone, or the metropolitan area, and so on. For Colombo, I propose that the scale for the research project be no larger than a local government zone, because this is the scale at which urban planning for the Colombo metropolitan area is now gazetted into policy[106], and therefore the largest scale at which approvals and/or special exceptions for implementation might most easily be obtained if necessary. Whatever scale is chosen, systems thinking would require the domain of the problem to be placed within its larger geographical and institutional context of the city and beyond, as well as its situation within a hierarchy of subsystems – local government wards, neighbourhoods and households.

[106] Most recently, urban plans in Sri Lanka have begun being gazetted into policy, municipal zone by municipal zone (UDA 2007). I see this as a strategy by apolitical planning bureaucrats for making progress and bypassing the stalemate that larger-scale planning seems to have met with in the past (Section 1.3.1).

The composition of the *group of people* needs to be such that the resultant recommendations reflect a combination of technical expertise, rational analysis and public values and preferences (Carson & Gelber 2001; Renn 1999; Riedy 2005). Renn (1999) argues that the necessary analytic-deliberative processes should therefore involve three groups of participants– 'experts', 'stakeholders' and 'citizens'. These three groups contribute different forms of knowledge – specialist knowledge based on technical expertise, knowledge derived from social interests and advocacy, and knowledge based on common sense and personal experience (Renn et al. 1993). I submit that the group would need to draw on a broader group of expert knowledge types as advocated by Max-Neef (2005) than usually associated with decision-making, in order to create space for transdisciplinary insights to emerge.

The discourses in this chapter theorise that dialogue that includes these groups of participants would enable multiple legitimate perspectives to be acknowledged and considered, draw on multiple types of knowledges beyond text-book knowledge, elicit higher motivations from individuals to seek communal interests rather than self-interest, and reveal resolutions to problems that all are willing to accommodate. While I acknowledge that what might be achieved in practice is likely to fall short of these ideals, I submit these as worthy ideals to aspire to in the design of the process.

The process to set about improving the situation is concerned with enabling the group of individuals above to *interact* constructively and usefully with each other as they action different elements of a *method* that leads to recommending a course of action to improve the problem. I have thus disaggregated my treatment of the process into (a) how to facilitate the group's dialogue to meet the ideals in the previous paragraph, and (b) develop the action elements in a potential method.

I argue that the type of dialogue advocated within the discourses used in this thesis coincides with 'deliberation' as defined by the Deliberative Democracy discourse. The chapter opens with a short literature review of deliberative democracy (Section 5.2) to make this argument and to identify critical factors that enable genuine deliberation. While the deliberative democracy discourse is primarily focused on deliberation that involves the public, it draws out important issues and principles that can also facilitate constructive dialogue amongst the other groups of people. Deliberation with the public has a particular set of pitfalls that the discourse addresses. How to secure a legitimate representation of the public that includes its powerless and often voiceless members and prevents the process from being dominated by special interest groups, is a distinguishing priority of the deliberative democracy discourse, and important for *the process* being explored here.

In Section 5.3, I draw on the reviewed deliberative democracy literature to define a *system for deliberation* as the basis on which the individuals within the groups of people would interact. In Section 5.4, I describe the action elements of a *learning system* based on SSM.

Together these two elements comprise the process, designed by this framework for operationalising the sustainability concepts of preceding chapters, which can lead to finding resolutions to urban sanitation in the *problematic situation* considered.

5.2 Deliberative participation in policy and planning design

The aim of this section is to identify parameters for creating dialogue between the people including the public in relation to policy-related decision-making, as advocated by the sustainability-related discourses in this thesis. By way of introduction, I briefly look at the different forms that 'public participation' can take, to locate the types of participation required by sustainability-related discourses. I then establish the alignment between the sustainability-related discourses and the deliberative democracy discourse. I clarify what is meant by 'deliberation' and by 'deliberative participation', and then compare deliberative public participation with other methods of decision-making. In Section 5.2.1, I turn to deliberative democratic theory to identify specific criteria that make for effective deliberative public participation.

Mechanisms for Public Participation:

A large number of mechanisms exist by which lay citizens can have a role in policy and decision-making that affects them, which I will refer to generically as 'public participation'[107] . The different mechanisms may be arranged along a spectrum or continuum based on the degree to which it engages the public in influencing decisions (Arnstein 1969; IAP2 2006; Roberts 1995). Arnstein's "Ladder of Citizen Participation" proposed in 1969, remains a relevant and succinct summary of these processes and their locations on the continuum even today. The continuum is segmented into discrete ranges characterised by a participation 'type' represented by the rungs on a ladder (Figure 5.3); the elevation of the rung up the ladder corresponds to the extent to which the participation 'type' is able to influence outcomes (Arnstein 1969).

[107] There is some inconsistency in the terminology across the literature, where the terms public participation, public involvement, and public consultation are sometimes used interchangeably, while some authors use one of them to refer to a specific mechanism.

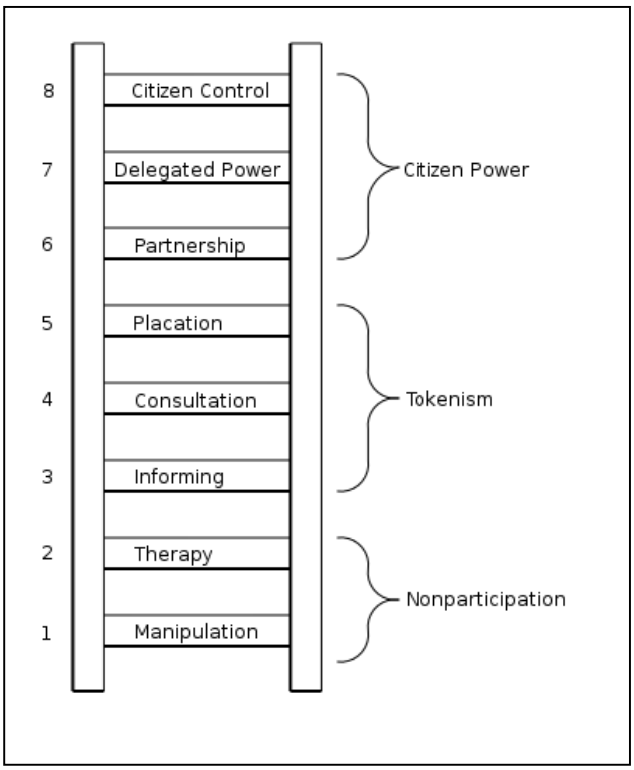

Figure 5.3: Arnstein's Ladder of Citizen Participation (Arnstein 1969)

At the bottom of Arnstein's ladder is 'Non-participation': mechanisms that manipulate public support through biased media coverage and public relations campaigns, or 'cure' the public into alignment with the values of the agents wielding power – where in reality the public has no influence on decisions at all. Next up the ladder is 'Tokenism', that describes the most commonly used mechanisms for public participation that focus on keeping the public informed through the dissemination of information and possibly providing the public an opportunity to respond to proposed decisions. The decision-makers in these instances make no commitments to take public views into account, although they may make slight modifications as a means of placating them. The mechanisms located in the upper region of the ladder give citizens authentic influence in the making of decisions.

The ideals of participation and stakeholder dialogue argued from the different perspectives in this thesis clearly require mechanisms located at the upper end of Arnstein's ladder. Advocates of post-normal science call for participation as an "extended peer group" that provides quality assurance in contemporary environment-related science, with its associated high uncertainties and high stakes, and for participation that complements the knowledge of experts by drawing out different knowledges and revealing multiple "legitimate presuppositions and commitments" (Section 2.5.2.1 and 3.2.1). Ecological economists make commitments to broad democracy that incorporates multiple perspectives in decisions, arguing that they are more likely to be more fair and survive time (Section 4.5). Participation in genuine democratic processes has the potential to achieve a collective 'right

motivation' for resolving problems from the perspective of Buddhist economics (Section 4.6.1.1).

Alignment of Deliberative Democracy

Deliberative democracy aligns with the sustainability-related discourses, as its aim is to facilitate public participation located in the upper regions of Arnstein's ladder where citizens are enabled to play "greater direct roles in public choices, or at least engage more deeply with substantive political issues and be assured that officials will be responsive to their concerns and judgments" (Cohen & Fung 2004).

Furthermore, ideological underpinnings of the deliberative democracy discourse resonate with those of the sustainability-related discourses. Fung and Wright (2003, p. 4) submit deliberative democracy as a transformative strategy that seeks to advance the values of

> "egalitarian social justice, individual liberty combined with popular control over collective decisions, community and solidarity, and the flourishing of individuals in ways which enable them to realise their potentials",

which coincide with values underpinning ecological economics in particular[108]. Deliberative democracy's potential to transform individual participants (Fishkin 2006; Mansbridge 2003) resonate with Buddhist economics' goal of transforming individuals towards ethical or 'right motivation' (Section 4.6.1.1):

> "Magic occurs in deliberative forums; people empathise when exposed to other's views and move quickly beyond self-interest to common ground" (Carson 2006b).

Mansbridge (2003, p. 182) argues that ideally, individual transformations through deliberation would lead to "self understanding, mutual understanding, and a useful understanding of the world", which further aligns with the Buddhist view of human existence as relational and occurring simultaneously within the spheres of the individual, society and the entire world (Section 4.6).

Defining 'deliberation' and 'deliberative participation'

Deliberation is a group process where participants discuss and reason together to resolve a problem. It can occur in many different spaces and involve different actors, for example,

[108] I see each of these values as having a parallel in ecological economics. Egalitarian social justice is aspired to in its goal for just distribution (Section 4.5.1.1). Retaining individual liberty to the greatest extent possible is stated as a principle for policy-design (Section 4.5.2). Popular control over collective decisions, community and solidarity is implied in it advocacy of democracy and its view of the individual as a "person in community" (Section 4.5). Finally, EE promotes 'development' that leads to qualitative improvement in the well-being of humans manifest in the realisation of their individual and collective potentials, as an alternative to the view of development in terms of quantitative growth of the economy (Section 4.5.1)

within families, within academic departments, or within institutions involving techno-bureaucratic decision makers (Mansbridge 2003). In deliberation as understood within the deliberative democracy discourse, participants express their different perspectives, and ideally seek to understand competing arguments and the concerns and values of others (Fishkin 2006). For Riedy (2005, p. 191), deliberation actively challenges unconsidered beliefs and values, provides space for individuals to change their views and preferences, and encourages individuals to reach defensible positions on an issue. Mansbridge (2003, p. 192) sees deliberation as ideally incorporating insights from each relevant perspective to help resolve problems. According to Fung and Wright (2003, p. 17) participants listen to each other, use reasoning to persuade one another, contemplate on the different arguments, and identify group choices after due consideration. Deliberation provides space for accommodations to be reached after considering a range of legitimate perspectives and interests, in order to resolve problems that are of interest to all.

The shifts in the practice of democracy through recent history have created a need for more participatory and deliberative styles of democracy. Fishkin (2006) observes that deliberation was a key element in the early American republic's vision of democracy, where chosen representatives of the public would "deliberate about public issues" to make policy. He notes that the rise of party politics, with its greater emphasis on competing for office than on deliberating about policy, has led to the erosion of these early ideals. Customary approaches of liberal democracy where decision making powers are held by elected representatives and techno-bureaucratic administrators, are seen to have deficits in capacity to tackle the challenges of the twenty first century (Fung & Wright 2003). The deliberative democratic movement is a response to this deficit by involving the public in deliberation.

Thus, deliberative participation is where ordinary members of the public participate in deliberation. Deliberative public participation (DPP) is the centrepiece of the deliberative democracy movement that advocates for "diverse groups of citizens – not just experts and professional politicians – to discuss public issues… Direct participatory democracy plays an important role in emphasizing and furthering public discussion, dialogue, or deliberation and thereby addressing public problems that respect diverse interests and values" (Gastil & Keith 2005). Thus, much of this section will be focused on deliberative public participation (DPP) which is highly relevant to *the process* that involves deliberation with the lay public; at the same time, its insights on creating genuine deliberation are equally relevant for the stakeholders and decision makers and experts in *the group of people* involved.

Other methods for decision making

Finally, to justify including deliberative participatory processes (DPP) for arriving at decisions through the framework being proposed here, I contrast DPP with other formats for decision-making that form the status quo. Fung and Wright (2003, p. 18) identify three

formats that largely describe the majority of familiar methods for decision-making, which they label 'command and control', 'aggregative voting' and 'strategic negotiation'.

'Command and control', or decision-making through centralised hierarchical institutional arrangements by techno-bureaucratic experts in whom power is vested, is the most familiar approach to planning and policy related decision-making in most parts of the world including developing Asian countries. The presumption is that such experts have the necessary professional training and competence and commitment to advance the public interest. While this might be the case, the effectiveness of these processes can be limited by the lack of depth of information and lack of fresh ideas and creativity, and can be thwarted by political patronage[109] and corruption (Gray & Kaufmann 1998; Mansbridge 2003).

In developing countries, foreign aid-assisted programs that impact on infrastructure policy and planning present an additional factor that decision-makers may have to take into account. Such assistance usually comes attached with conditions that may not always advance the local public interest (Section 1.3), presenting a conflict for decision-makers when their missions to meet benefactor conditions are not in alignment with their mission to serve the public interest. Decision-makers may be restricted to considering only those options that align with the interests and objectives of benefactor countries and institutions, instead of examining all options that may serve their constituents. Complementing 'command and control' decision-making methods with deliberative participatory processes can increase transparency and accountability, reduce the influence of political elites and foreign donor agencies, and reduce opportunities for political patronage (Mansbridge 2003).

'Aggregative voting', the second form of decision-making cited by Fung and Wright (2003), is the use of voting to make decisions that can be justified as an expression of collective democratic choice. The collective decision is determined as the aggregate of preferences of individuals comprising the group, who rank options according to their individual preferences. While the assumption is that the aggregate of individual preferences is equivalent to the preferences of the collective[110], this may not always be true, as illustrated, for example, by the famous 'prisoners' dilemma'[111] in gaming theory within classical economics. Aggregative voting might be used within a DPP when deliberation has not led to a consensual decision, but as noted by Fung and Wright (2003, p. 19), voting in this context is very different from the more common non-deliberative form of aggregative voting where "individuals simply vote according to their own self-interest, without

[109] Political patronage refers to decisions taken to mobilise political support such as catering to the interests of those who support particular political persons or parties.

[110] I have used this logic myself, to justify the examination of individual well-being as a proxy for examining the well-being of society constituted of individuals (Section 4.3)

[111] The prisoners' dilemma illustrates how one decision may be preferable from an individual perspective although it may adversely affect others, while a different decision may be preferable collectively.

necessarily considering the reasonableness, fairness, or acceptability of that option to others."

The third commonly used decision-making method is 'strategic negotiation', where agents bargain and negotiate with decision makers, using their resources and power to secure the best outcomes for themselves (Mansbridge 2003). Many high-cost infrastructure decisions that involve private sector entities are made using this method, which is often plagued by a lack of transparency (Flyvbjerg, Rothengatter & Bruzelius 2002) and alleged use of "threats, differential power, misrepresentation and "strategic talk"" that seeks to advance the entities' own self-interests rather than the interest of the public (Mansbridge 2003, p. 19).

Each method may be best suited to particular situations. While DPP may complement and improve transparency and accountability for all these methods, Fung & Wright (2003) point out that it may not necessarily be useful in all cases, especially in situations where current mechanisms work satisfactorily. I contend that DPP has much to offer in the case of dysfunctional situations like urban sanitation in developing Asian countries.

5.2.1 Literature review: criteria for effective deliberative public participation

Deliberative democratic theory sets out to discover the conditions and requirements for effective deliberation on the basis of observations on numerous empirical case studies; the theory is then able to inform practice, creating a cyclic process that develops both the theory and the practice (Mansbridge 2003, pp. 175, 186-187). The focus of this strand of democracy[112] is on developing more substantive, inclusive, engaged and empowered participation of citizens in the political process than currently occurs under liberal representative democracy dominant in the world today (Gaventa 2006). Deliberative democratic theory is normative, stating how things ought to be, consistent with its ideals. It explicates and tests the hypothesis that good deliberation can act as a "school for democracy" that develops the capacity of society to achieve these ideals (Mansbridge 2003).

Advocates of deliberative democracy generally agree about three criteria that are indicators for effective deliberative public participation (DPP): influence or empowerment;

[112] The term 'democracy' itself has radically different meanings and practical consequences of those meanings, as noted by Gaventa (2006). Consequently one may refer to different strands in the democracy debates and discourses – such as competitive representation (the most common form of liberal democracy), participatory deliberation, or neo-liberal forms of democracy aimed at reducing governance by an affirmative State (Fung & Wright 2003; Gaventa 2006).

deliberation; and inclusiveness or representativeness (Carson & Hartz-Karp 2005; Fung & Wright 2003; Levine, Fung & Gastil 2005) explicated further below. These criteria coincide with the two priorities identified by Gaventa (2004): strengthening the 'voice' of civil society and strengthening the receptiveness to this voice on the part of decision makers. The former requires that those giving voice are legitimate representatives of civil society, and that genuine collective preferences are reflected in the voice – as encompassed within 'inclusiveness' and 'deliberation' respectively; the latter fits with the 'influence' criterion.

Carson & Hartz-Karp (2005) note that deliberative participatory processes have had the greatest impact when their performance against all three criteria have been good, but that the simultaneous optimization of all three is often difficult in practice. Nevertheless, they observe that even where performance against the criteria is suboptimal, desirable progress and change can still result. Thus their key recommendation, relevant to my proposed framework, is for maintaining awareness of these criteria when designing a process, and evaluating its performance against realistic standards as appropriate to the circumstances.

5.2.1.1 Influence

Deliberative democrats argue that one measure of the effectiveness of deliberative public participation (DPP) would be the degree to which it is able to influence policy and decision making, or the degree of connection between discussion and consequent action (Carson 2005; Fung & Wright 2003)[113].

Who drives a DPP process often determines the nature of the relationship between DPP processes and decision-makers, which in turn would have a significant impact on the ability of DPP to influence outcomes. DPP might be community-initiated (Carson & Hartz-Karp 2005), with a potentially adversarial disposition towards decision-makers who are being held to account, where the participants present a countervailing power against prevailing decisions and decision processes. Alternatively, DPP may be supported within current decision processes, such as being commissioned by decision-makers (Carson & Hartz-Karp 2005; Gaventa 2006). When setting out to design a DPP process, seeking support for it within current institutions could increase the potential for influence. An adversarial process may be necessary in some circumstances, but typically creates 'winners' and 'losers', can require greater resources, and potentially increases the resistance of decision-makers if placed in a defensive position.

[113] It is arguable that the deliberative process can be rewarding in itself even if it does not lead to adoption within decisions, as noted by Bell and Morse (2003) (Section 3.5), so these can still be effective with respect to different criteria. Furthermore, the influence on decisions may not always be directly evident but may be lead to subtle shifts in bureaucratic thinking.

DPP processes with institutional support can be approached in several ways, which implicitly exert different levels of officially sanctioned influence. At the lowest level, Carson (2006b) identifies deliberative processes that are convened specifically to help resolve occasional contentious issues, which recognise that the public's recommendations might be useful, but still give decision-makers sole responsibility for decisions which may not necessarily take the public's recommendations into account. Carson (ibid) describes this as the 'status quo', as this is the most commonly found relationship between decision-makers and various types of public participation including DPP, which also locates them within 'tokenism' on Arnstein's ladder. A second approach has DPP integrated within customary institutional decision-making processes; decision-makers would routinely justify the inclusion or exclusion of DPP recommendations in their decisions (ibid). While this approach gives DPP a greater level of influence, critics point out that lines of accountability can become weakened when decision-makers are held liable for decisions long after influential public participant groups are dissolved (Carson 2006b; Renn et al. 1993).

Another form of DPP with institutional support is what Fung and Wright (2003) describe as "empowered participatory governance". Under this approach, administrative and political powers are devolved to local groups who are charged with devising and implementing decisions for which they are held accountable (ibid, p. 20). Gaventa (2004) cautions that such new collaborative forms of interaction between state and society may run counter to political cultures that have prevailed for decades or centuries, and should not be rushed or taken to scale quickly, but that time be allowed for development of "new attitudes, new forms of trust and collaboration, new skills and capacities, new models of leadership and power sharing" as well as new models for sharing risk.

The timeliness of DPP is another critical factor for the influence it can have on decisions (Carson 1999; Carson & Gelber 2001). A DPP process should occur early enough in a decision process that the public has a genuine opportunity to shape outcomes, rather than so late that outcomes are predetermined and public consultation represents a tokenistic formality for confirmation (Carson & Gelber 2001).

Being empowered to influence outcomes can act as an inducement for citizens to participate in a deliberative process, when they are given confidence that "their voices matter" (Carson 1999; Fishkin 2006; Fung & Wright 2003). Conversely, it can be difficult to attract citizens to participate in DPP processes unless they know they can influence outcomes. Carson (1999) points out that genuine empowerment can often be difficult to achieve because it requires "a level of trust and a willingness to share power that is generally lacking in today's decision-making arenas". Where possible, she proposes that commitment from decision makers to act on recommendations or publicly justify not doing so, could be formalised through contractual arrangements.

5.2.1.2 Deliberation

The effectiveness of a DPP process is strongly influenced by the quality of the discussion and reasoning that takes place when people gather together to deliberate. In this section, I review several issues that affect this quality. Mansbridge (2003, p. 179) provides a set of determinants of the quality of deliberation:

> "… among other things, … the degree of mutual respect, recognition and acknowledgement among participants, their open-mindedness and willingness to listen, the consistency in their arguments and the accuracy of their facts, their "economy" in disagreement (seeking rationales that minimize the rejection of an opposing position and avoid affronting the deepest commitments of others), their capacity to bring to light most of the relevant considerations, their capacity to discover or forge common interests and values, and the space … for the expression of authentic feelings."

There are several issues to consider in relation to the quality of deliberation. Perhaps the most critical is the issue of power inequalities amongst participants (Fung & Wright 2003; Mansbridge 2003; Riedy 2005). Power inequalities can arise from differences such as social class and material wealth, access to information, communication skills, capacity for argument stemming from education and occupation, articulateness and personal characteristics (Fung & Wright 2003; Riedy 2005), as well as gender and ethnicity. Left unmanaged, power inequalities can lead to domination or manipulation, with consequent failure to reveal some perspectives present in the group, undermining the legitimacy and usefulness of final recommendations from the DPP (Mansbridge 2003, p. 192).

Riedy (2005, pp. 390-391) sets out a number of strategies for *reducing* and *managing* power differentials. He proposes strategies to *reduce* power inequalities arising from unequal access to information and communication abilities. He suggests addressing the former by providing accessible information and relevant education and training, and the latter, by allowing multiple forms of communication that different participants are comfortable with, including verbal styles of argument, testimony, storytelling, or written forms, conditional only on their being non-coercive and relevant to the issues under deliberation. Secondly, he proposes *managing* power inequalities by good facilitation, "defusing unproductive conflicts and providing equal opportunities for expression to participants" (Riedy 2005, p. 391). Fung and Wright (2003, p. 23) observe that preventing manipulation and domination can increase the willingness of individuals to engage in genuine deliberation. The quality of deliberation would strongly depend on the degree to which the manipulative and dominative influences of power inequalities can be limited.

A second issue is the capacity for deliberation. Concerns that the general public is "neither sufficiently informed nor sufficiently reflective" to undertake public decision-making have existed as long as democracy itself (Fishkin 2006). Deliberative democrats need to address this issue when arguing for public involvement in decision-making, whether as a complement or supplement to decision-making on the public's behalf by techno-

bureaucratic experts with specialist knowledge and professional competencies. This can be addressed partly through providing those involved in DPP with access to relevant unbiased information such as briefing material, enabling experts to be called in to answer questions, and providing training in any essential technical skills required (Carson 2006b; Fung & Wright 2003).

In the main, however, it is through *practice* that the capacity for deliberation improves (Mansbridge 2003). Dyrzek (2000, quoted by Riedy 2005, p. 391) suggests that practice would enable people to learn and embrace important values for deliberation, such as political equality, integrity and accountability, so that general rules for engagement beyond facilitation by a trained moderator would not be necessary: "the best way for people to learn these values is through the practice of deliberation, rather than through being told". On the other hand, the "paradox of participatory democracy" is highlighted by Mansbridge (2003, p. 177), namely, that

> "although participation in democracies helps people increase their capacities, those who have not yet had the experience of participation will sometimes not have sufficient capacity to bring off a successful democracy. What they need is precisely what, because of their need, they cannot get."

Practical manifestations of the paradox are the cases where decentralisation and increased public empowerment have eventually resulted in incompetence and corruption in those newly decentralised units (ibid). Such risks in deliberation can be reduced by developing public empowerment slowly and not taking it to scale too soon (Gaventa 2004).

I contend that people with little practice in deliberation can benefit from extra support that exceeds facilitation by well-trained moderators as proposed by Dyrzek above. Ryfe (2005) proposes that individuals can learn to deliberate through "apprenticeship learning" by being guided by others who have experience and skills in deliberation. In addition, procedures and norms and rules of engagement can "prop up" deliberation (ibid). Rules of engagement would include civility, listening with respect, offering reasons to persuade others, considering other perspectives different from their own, and seeking common ground – rules which aid participants to make reflective judgements based of a wide range of information (Fung & Wright 2003, p. 17; Ryfe 2005).

Transformation of individuals through deliberation

Another quality issue of particular interest to this thesis relates to individual transformations that can occur through the process of deliberation, as it seeks to forge common interests to resolve common problems. The transformations through deliberation can include increasing capacity for thought, feeling and action, moving beyond self-interest to common ground, changing values and perspectives, changing the habits of a life time, and increasing technical skills and competency for deliberation (Carson 2006b; Fishkin 2006; Fung & Wright 2003; Mansbridge 2003; Riedy 2005). I contend that such

transformations reflect development of the human potential that simultaneously shifts participants towards more "ethical motivations" as the driver of decisions, strengthening *chanda* as the motivator meeting the ideals of Buddhist economics (Section 4.6.1.1). The nature and/or degree of transformation of individuals is thus another indicator of quality in deliberations.

It is therefore of interest to consider how such transformations of individuals may be facilitated. Carson & Gelber (2001) and Fung and Wright (2003) advocate that DPP procedures have a community focus that asks participants to consider what is most reasonable to them in their roles as citizens rather than what they might want personally in their self interest. Mansbridge (2003, pp. 179-193), on the other hand, sees this as a very limiting focus, and argues for expanding it to include the recognition and assertion of self-interest. For her:

> "deliberation promotes self-understanding, mutual understanding, and a useful understanding of the world only when individuals can try to understand not only what common interests can be forged, but also their own and others' self-interest." (Mansbridge 2003, p. 182)

She argues that recognising and asserting self-interest enhances the deliberative process. It helps individuals to identify each other's individual needs and wants, helps participants to be understood and accepted for what their needs are, and reveals subtle forms of oppression that may be masked within hegemonic understandings of the common good. Recognising and asserting self-interests may also advance distributive justice[114] in the recommendations that come out of the process (ibid). For example, in a distribution of scarce goods where more for one segment of a group means less for another, such as budgets, Mansbridge (2003) argues that the different segments must be able to articulate what they need in order for just allocations to be made, rather than suppress their own interests for the sake of what they perceive to be the collective position.

Mansbridge (ibid) therefore advocates that the deliberative process should incorporate several elements. Firstly, it should facilitate individuals' discovery of what it is they really want and need in relation to the issues being deliberated, which may not be the same as what they *think* they want. The process would also expose and raise awareness of what others really want and need. Three further elements are deliberation and reflection that aims for: discovering the implications of everyone's wants and needs; recognising indissoluble conflicts between different individuals' wants or needs; and forging commonalities between their wants or needs and those of others. She emphasises that deliberation should raise awareness of potential commonalities through a path that raises awareness of individual interests and potential conflicts with those of others.

[114] Distributive justice refers to the distribution of resources to individuals in proportion to their relative needs and their contributions to society.

> "Ideally, only *after* these considerations have been brought to light and to the table should one ask the participants to vote "not for the option that best advances his self interest, but rather for the choice that seems most reasonable."" (Mansbridge 2003, p. 183).

5.2.1.3 Inclusiveness

Inclusiveness refers to the extent to which participants represent the diversity of the public's perspectives and values. Frequently, the alleged 'public' that comes forth for public participation is dominated by a minority of "the incensed and the articulate" (Carson & Hartz-Karp 2005, p. 121). The inclusiveness criterion seeks representation of the public that includes its powerless and often voiceless members, and prevents the process from being 'hijacked' by special interest groups. If representation of the public were necessary, the inclusiveness criterion would determine the legitimacy of the participation.

How can organizers of a DPP process increase representation and inclusion in the participants? Recruitment of participants has commonly been made through advertisement and open invitation that allows participants to self-select. This allows anyone interested in the issues being considered to participate, but can lead to a homogeneous or like-minded group of participants (Ryfe 2005), and/or special interest groups with little inclination for genuine deliberation. Deliberative democrats propose that where it is important that participants represent broader views of the public, organisers should select them through a representative sampling procedure so participants reflect a cross section of their community (Carson & Gelber 2001; Ryfe 2005).

Random representative sampling is a recent innovation in community consultation, and a favoured procedure for recruiting participants free from bias or conflict of interest (Carson 1999; Fishkin 2006; Ryfe 2005). As with randomly selected juries in the judiciary systems of most democracies, it is argued that a representative random sample of participants in DPP would possess the "recommending force of the public's considered judgements" (Fishkin 1995, quoted by Ryfe 2005), which gives legitimacy to their recommendations. There are several techniques for random representative sampling (Carson 1999), which typically consist of three steps. A demographic profile of the community is developed along characteristics seen relevant to the issue (eg., gender, age, socioeconomic status, education, political orientation, locality); a number of individuals are identified as potential participants through random selection from electoral rolls, municipal rates registers, approaching people on the street or other means; the individuals who agree to participate are 'filtered' on the basis of their demographic characteristics, established through surveys or questionnaires they fill. A group of potential participants that match the composition of the relevant community are identified through this process.

Because participation is voluntary, Carson & Gelber (2001) note that a random sampling process cannot guarantee that groups that have traditionally been uninvolved in public

participation would become involved. In Renn's (1999) experience, the acceptance rate among those invited to participate typically ranges from 5% to 40%. Ryfe (2005) observes that high stakes can be a motivating force for participation in deliberation, so that those directly affected by a problem are more likely to be willing to participate. Thus, gathering participants that are inclusive of a wide range of perspectives and preferences can be difficult in practice. To encourage participation, incentives such as payments for attendance, payments to employers to release employees on full pay[115], reimbursement of travel and childcare expenses, and refreshments are common (Carson & Gelber 2001; Fishkin 2006; Renn 1999). Yet, even if a small group cannot be truly representative of the views of a community, policy decisions made by random samples of citizens have advantages over those made by elected representatives or self-selected representatives of special interest groups (Fishkin 2006; NPPD 2002; Ryfe 2005). They are independent and free to make recommendations in the long-term interest of the community

> "without worrying about the implications for their re-election … [or being] subject to party discipline. They can offer their sincere views at the end of the process without worrying about social pressures from other participants for consensus." (Fishkin 2006)

Summary

The three criteria of influence, deliberation and inclusiveness synthesise the insights about quality deliberative public participation from empirical and theoretical research, and provide useful guidance for organisers of deliberative processes. Ultimately, the extent to which DPP can be influential, deliberative and inclusive would be limited by time, resource and institutional constraints (Cohen & Fung 2004). DPP can increase the time taken for decisions to be made, relative to the more familiar decision-making methods, although the former are more likely to be accorded legitimacy and public support, potentially making implementation quicker and easier, as well as leading to more long lived decisions (Costanza et al. 1997). Time and budgets need to be committed for preparing briefing materials, training moderators, recruiting participants, and keeping the public informed, amongst others things. Thus, in practice, tradeoffs between the three criteria may be necessary. Nevertheless, the discussion above leads me to include its key messages within my proposed operational framework.

5.3 A system for deliberation and dialogue

The operational framework I propose here is designed to have the elements noted in the introduction interacting as illustrated in Figure 5.4. The focus of this section is to describe a **system for deliberation** (element (a) in Figure 5.4) that would overlay the **learning system**

[115] Financial compensation also indicates to participants that their role is serious and that dedication to the task of participation is expected (Renn et al. 1993).

within the context of the proposed process. The learning system will be considered separately in Section 5.4.

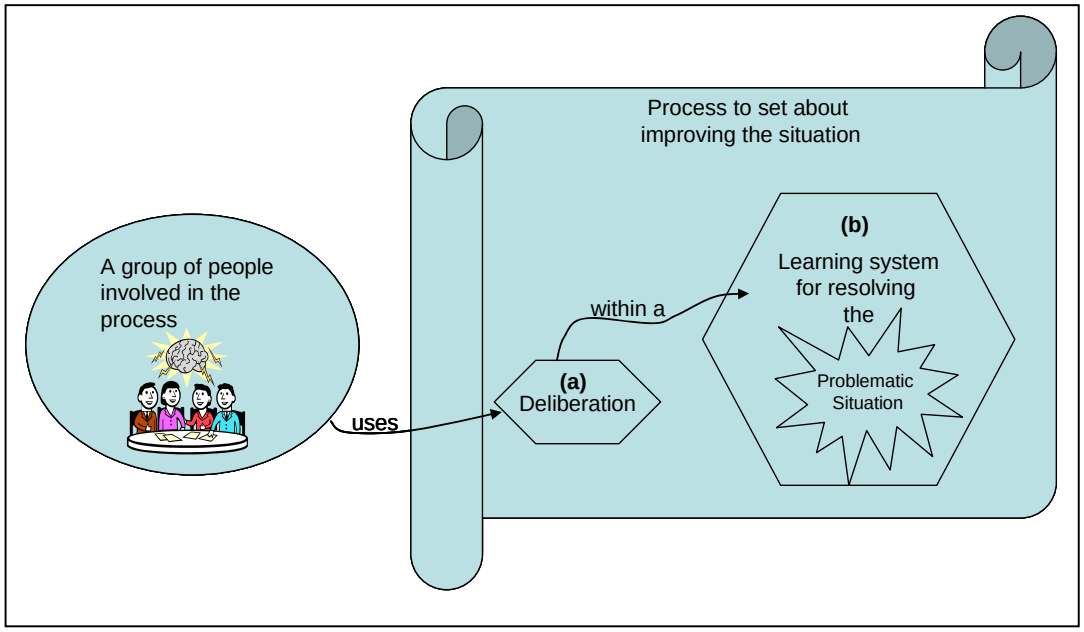

Figure 5.4: Interaction of systemic-approach elements (from Figure 5.2)

I have utilised SSM's CATWOE tool (Table 3.2, shown again in Fig. 5.5 below) as a thinking aid in structuring the *system for deliberation*. While SSM's learning cycle is not required to design the *system for deliberation*, the systems-based modelling is useful as a way of identifying key facets of the system.

C: 'customers'	The victims or beneficiaries of the transformation T
A: 'actors'	Those who would perform the transformation T
T : 'transformation process'	The conversion of input to output
W: 'weltanschauung'	The worldview which makes the transformation T meaningful in context
O: 'owner/s'	Those who could stop the transformation T
E: 'environmental constraints'	Elements outside the given system which it takes as given

Figure 5.5: CATWOE mnemonic

The CATWOE developed below draws on the deliberative democracy literature reviewed in the preceding section while maintaining alignment with the values of the sustainability-related discourses.

Transformation:

The first step in using the CATWOE tool is to articulate the perceived purpose of the system in terms of a transformation, from a particular worldview, that then allows the other elements of the mnemonic to be identified (Checkland 1999). The transformation is not unique, but depends on the observer's ideological orientation and worldview (Section 3.5.2). For me, the transformation T in a desirable 'system for deliberation' would be the enablement of participants to collaborate as a group seeking the public interest, as illustrated in Figure 5.6 below.

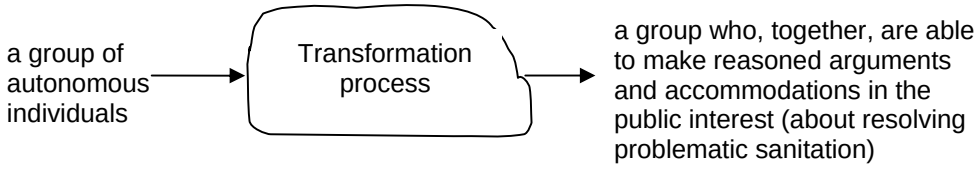

Figure 5.6: The transformation process of the 'system for deliberation'

Weltanschauung:

The transformation is based on the weltanschauung (worldview) that the application of deliberative democratic theory can increase the capacity of the group to find out and learn about the problem and find resolutions that are desirable and feasible in an economic, social and ecological sense.

Customers:

Who benefits or loses from the system for deliberation? Firstly I submit that decision-makers would benefit and hence be 'customers', because the products of the process are intended to make defensible contributions to the resolution of problems that the decision-makers have responsibility for[116]. Such decision-makers in the hypothetical case study in Colombo would primarily include the local government of the study location, the Urban Development Authority who make the planning decisions, the NWSDB[117] and the Health Department[118]. Secondly, the transformational experience of deliberation, as highlighted in the literature, implies that all those who participate in the deliberation would be 'customers' – in particular the 'actors' explicated below.

[116] Decision-makers could also be seen as customers from a perspective of being 'losers' from the process in terms of a perceived dilution of their power.

[117] National Water Supply and Drainage Board or 'Water Board', charged with responsibility for sewerage.

[118] Responsible for sanitation policy.

Actors[119]**:**

I identify the participants who engage in deliberation as the central 'actors' in the transformation T, along with the moderators who facilitate deliberation (Figure 5.7). Informed by Renn et al. (1993) as noted in Section 5.1, three types or sub-groups of people are needed within *the group* – experts, stakeholders and citizens.

- *'Experts'* would firstly include decision-makers who have primary responsibility for urban sanitation-related decisions in the status quo for most developing Asian countries – that include public administrators, techno-bureaucratic experts and institutional decision makers[120]. In the hypothetical research project in Colombo, these would include representatives from relevant government organisations and their technical advisors.
  In addition, in order that the process be aligned with transdisciplinarity, I propose the 'expert' group include practitioners from a wider range of disciplines than usually associated with planning. Max-Neef (2005) argues that transdisciplinarity requires collaboration and coordination of knowledges from all of the four levels of disciplinary knowledge: the values disciplines (e.g., philosophy, ethics), normative disciplines (e.g., planning, politics, law), pragmatic disciplines (e.g., engineering, commerce) and empirical disciplines (e.g., ecology, physics, chemistry) (Section 2.7.1). Their interaction within a deliberative space can facilitate transdisciplinary insights to emerge. For Colombo, this could include academics drawn from relevant areas of universities and research institutions as well as ethicists, human rights lawyers, and religious leaders bringing explicit perspectives, amongst others. Finally, this group would ideally include practitioners from transdisciplinarity itself.

- '*Stakeholders'* would be the group of self-selected participants who respond to public invitations to participate – including those who are directly affected (as beneficiaries or victims) by the problem and its possible resolutions (Costanza et al. 1997), and "all those with a desire to participate in the resolution of the issue" (Ravetz 1999). Their inclusion is consistent with the call for decision-making that involves dialogue and discourse with a broader group of participants, made from the sustainability discourse including post normal science (Section 2.7.1 and 3.2.1.3), ecological economics (Section 4.5), and Buddhist economics (Section 4.6.1.2).
  The stakeholder group allows people with specific interests and concerns to have an input into the process, bringing a different set of perspectives from the experts. They are also more likely to have spent more time considering the issues than the typical citizen. However their perspectives cannot be relied upon as being

[119] Customers, actors and owners do not need to be different and could in some cases be one and the same (Checkland & Scholes 1999).

[120] A note on terminology: Where it is not critical to distinguish between different actors involved with making public decisions (elected representatives and institutional bureaucrats at different levels of government, amongst others) I will refer to them as 'decision makers' for the sake of brevity.

representative of the broader community (Riedy 2005), especially because there is opportunity for domination by special interest groups who might appear to seek diversion of the process to serve their own ends.
In the case study of Colombo, this group would potentially include invited NGOs and environmental and other activist groups, in addition to participants who respond to public invitation.

- '*Citizens'* would be members of the public that are chosen to counter the risk of diversion by stakeholders with special interests, as well as to include a wider range of perspectives from the community. As advocated by deliberative democrats, they are selected randomly through a representative sampling procedure to reflect a cross section of their community (Carson & Gelber 2001; Ryfe 2005), to align with the criterion for inclusiveness (Section 5.2.1.3). While there could be some overlap between citizens and the other two groups, they would in theory represent the community's broader interests, perspectives and preferences.
  For Colombo, this group might be primarily drawn from residents of the local government area under study[121].

The moderators, the second key 'actor' group, are "a neutral, professional staff that helps participants work through a fair agenda" (Levine, Fung & Gastil 2005). Ideally, they would be experienced with deliberation so 'apprenticeship learning' could occur for participants without prior experience (Ryfe 2005). In order to play their critical role, the deliberative democracy literature highlighted a number of characteristics they would need to have, including leadership and neutrality, the ability to manage power dynamics within a group, diffuse conflict and maintain focus on the task at hand. In addition, in the Colombo context, small group deliberations would need to be conducted in the English, Sinhala or Tamil languages to enable participation in the language of fluency[122], so moderators may need to be multilingual – an added complexity. The inclusion of women's perspectives is critical since they are generally more affected by sanitation and have different experiences of it than men (WSSCC 2006) – requiring moderators to manage gender-based power dynamics[123].

[121] A complicating issue is that urban development (potentially driven by sound sanitation planning) can bring new residents and change the demographics of the area. While some accommodation of this possibility may be made by including citizens residing outside the study area, actors may be specifically asked to specifically consider this likelihood in their process of learning and making accommodations within the SSM cycle, to recommend "what seems sensible" to them at the time (Checkland 2001).

[122] Fluency in the English language itself is seen as a commodity of power in Sri Lanka (often referred to as a metaphorical sword or *kaduwa*), another power dynamic to be managed by moderators.

[123] In some cases when power inequalities between participants are inseparable from social or cultural norms, it may be preferable to separate participants along divisive lines such as language and gender, rather than attempting to manage the conflicts – making a trade-off between inclusiveness and quality of deliberation within the small groups.

It may be necessary to identify potential moderators and develop their skills through training where there has been little prior experience with deliberation. The number of suitable moderators available might well be one of the determining factors for the total number of participants that can be involved in deliberation and for the scope of the process.

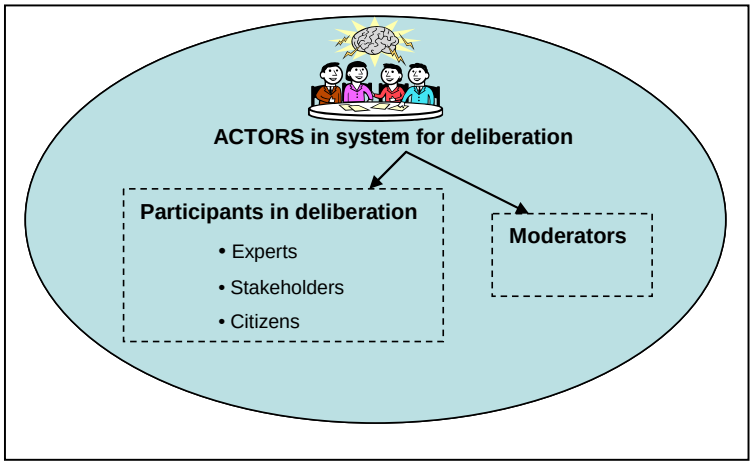

Figure 5.7: 'Actors' in CATWOE

Owners:

Those driving the transformation T and having the ability to stop it, would 'own' the system for deliberation. I see two groups, identified by Renn (1999), as the 'owners': a research team and a sponsor.

The research team would be the driving force behind the design of the process – the 'someone' in the following description:

> "To achieve high-quality deliberation, someone must organize a discursive process, choose a topic, recruit the participants, prepare background materials or invite speakers, provide facilitators, and raise the funds that are necessary to do these things." (Levine, Fung & Gastil 2005)

In the case of the case study of Colombo, the research team could potentially be a collaboration of individuals and agencies who together have a keen interest in resolutions on the ground as well as in testing more widely applicable methods and tools. A core group of passionate individuals may invite participation of local and international academics from areas such as sanitation, urban planning, sustainability and human rights, and international development agencies and local planning authorities.

The research team would, within the context of the *process to set about improving the situation* (of problematic sanitation), plan the specifics of the system for deliberation, such as:

- Decide on the scope of deliberation – number of‟ ‘citizen’ participants in total, number in each deliberating group[124], mechanism for recruitment, compensation for their participation; publicity mechanisms for inviting stakeholders, accommodation of stakeholders in deliberative groups; accommodation of bureaucratic and scientific experts in deliberative groups;
- Identify, recruit and train individuals capable of being moderators to facilitate deliberation within each group. The requirements from moderators was discussed under ‘actors’;
- Agree on a preliminary set of deliberating rules and norms in collaboration with moderators (to be confirmed and accepted by participants);
- Organise the preparation and dissemination of balanced and accurate information [125] by qualified experts, for circulation amongst participants so they may be appropriately informed on facts and issues. Qualified experts would ideally include holders of traditional knowledge and those with specific perspectives[126];
- Plan timelines for deliberation in collaboration with decision makers, ensuring that stakeholder and public participation can occur early in the planning cycle so the process can influence its direction;
- Estimate costs and gain necessary financial support (as research grants from international donors, philanthropists, government agencies or others);
- Play the role of ‘secretariat’ for facilitating deliberation within the larger context of the problem solving process (Riedy 2005, p. 394). This includes organising plenary meetings and other forms of liaison between groups, reporting on key outcomes and key themes that have emerged at different milestones of the process (Carson & Hartz-Karp 2005; Riedy 2005) and liaising with the media to maintain transparency. In this role, the research team may also be viewed as ‘actors’ in the CATWOE.

The sponsor is needed to increase the credibility of the project and the influence that it can have on decision making – such as a high profile government agency or personality can do. Such sponsorship would affect the ‘influence’ criterion of an effective deliberative process

[124] There is no definitive number of participants for a deliberative group beyond the need to keep them small enough that each participant’s voice matters (Fishkin 2006). Renn (1999) recommends groups of 5, while citing the use of groups of 20-25 and 8 participants in different case studies. Fishkin (2006) describes using groups of 15.

[125] It can take many iterations before all parties holding conflicting positions on the relevant issues can agree that balanced and accurate information is being provided – Fishkin (2006) cites an example where a document underwent 19 revisions on this account.

[126] For example, women’s issues related to sanitation.

(Section 5.2.1.1). The exact hierarchy in the relationship between the research team and sponsors can vary, as one of them initiates the process as a whole and identifies and recruits the other[127].

Environmental Constraints:

The system for deliberation would exist in a cultural, social, institutional and political environment that would impose various constraints that need to be accommodated, managed or overcome. In Colombo, for example, language barriers impose constraints on the range of participants that can deliberate together, which may be heightened by ethnic tensions and prejudices. Socio-economic class stratification introduces different power dynamics and can constrain the willingness of participants to engage with each other. Organisational or experiential viewpoints can be in conflict[128]. Gaining a political 'champion' in Sri Lanka would add momentum and influence, as noted earlier, but conversely, a change in government can stymie or reverse advances made[129].

The CATWOE tool allows the systematic identification of key factors to be considered in the *system for deliberation*. While the above description has been adequately illustrative for the purpose of this thesis, the SSM modelling could be taken a step further to help specify the *system for deliberation* in greater detail. A root definition of the system, such as "a system for learning about problematic sanitation, that engages participants in deliberation to collaboratively discover resolutions to the problem" could be the basis for elaboration in a model, constructed as a collection of activity sub-systems (as in Section 3.5.2 B). Each sub-system in the model (for example, 'a system to gather and disseminate balanced information', 'a system to recruit citizen participants' and so on) could then be deconstructed with its own CATWOE, to specify each element further.

A *system for deliberation* explicitly requires that the dialogue that occurs within the process is consistent with 'deliberation' as defined by the deliberative democracy discourse. It is apparent, from the descriptions of dialogue and its effects occurring within soft systems methodology (for example, in Checkland 2000), that such consistency is implied. The

---

[127] There are several examples where government ministers have convened the process as sponsor, and appointed a 'steering committee' as research team (for example, in Carson & Hartz-Karp 2005). Where such high-level initiative is lacking, however, as is likely to be the case for urban sanitation in many developing Asian countries, an initial research team of concerned individuals may identify and canvass for the involvement of influential sponsors.

[128] For example, an official in Colombo (Interview 2003) stressed that planning for preservation of marshes and wetlands as natural assets was valued within this official's organisation, which was often in conflict with the *Land Reclamation and Development Corporation* whose organisational brief is to "reclaim land" using engineering interventions, which prioritised the filling of marshes to fulfil its organisational brief.

[129] This was evident in the history of Master Planning for Colombo, confounded by successive changes in government (Section 1.3.1).

explicit definition of a system for deliberation to overlay the learning system gives this greater emphasis as a key feature of the process.

5.4 A learning system

The notion of seeking resolutions to problems through *a learning process* was discussed in Section 3.3 as a constructive approach for messy problems such as urban sanitation in developing Asian countries. I introduced Soft Systems Methodology (SSM) as one such learning process that was based on systems ideas – a systemic "process of inquiry" (Checkland 1999, pp. A9-A10). I have chosen SSM as the basis for *the process to set about improving the situation* (Figure 5.2), because it provides a structured and defensible way of approaching messy problems, while, as a methodology, it is flexible for adaptation to different contexts. SSM has space to adopt methods and concepts from elsewhere to supplement its own set of devices and tools (described and used in Section 3.5.2):

> "That *mouldability* by a *particular user* in a *particular situation* is the point of methodology. That is why a methodology is so much more powerful than mere method or technique" (Checkland & Scholes 1999, p. 58).

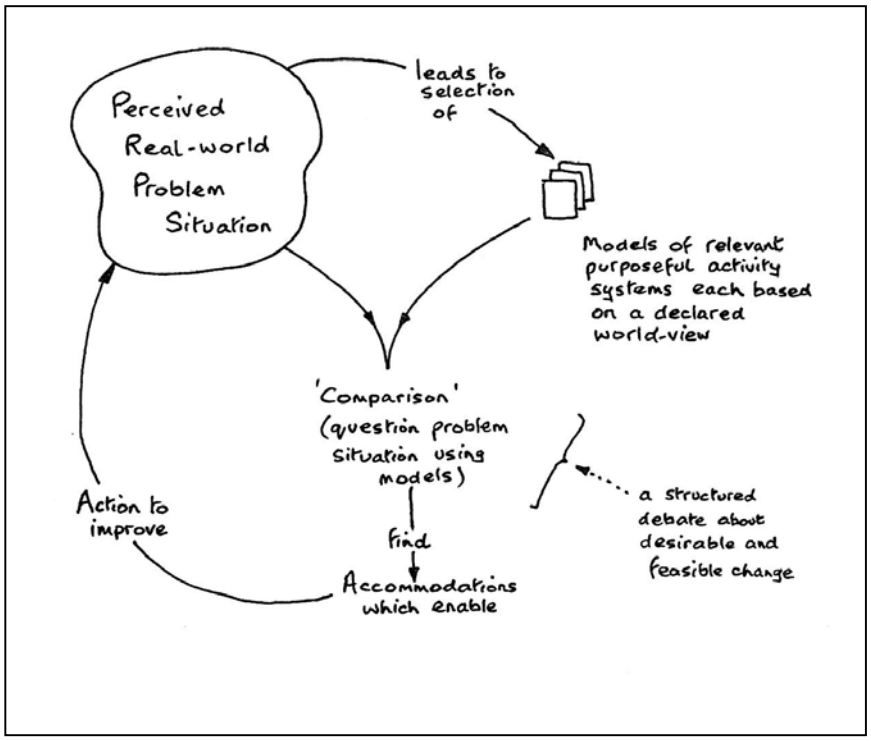

Figure 5.8: The SSM cycle (Checkland 1999, p. A9)

The core set of linked activities that characterise SSM is shown again in Figure 5.8. For *the process to set about improving the situation* on the basis of SSM, the following core activities are therefore needed:

- Perceiving the problem situation – finding out and reflecting on *'what is'*
- Modelling relevant systems – conceptualizing or visioning *'what could be'* from multiple perspectives.
- Comparing – deliberating on the differences between *'what is'* and *'what could be'* to reach accommodations about *'what is possible'* – feasible and desirable.
- Action – making recommendations to planners about interventions to improve the problem situation.

The precise shape of the activities is open to "mouldability".

The action elements in *the process to set about improving the situation,* based on SSM, might be represented as in Figure 5.9, where each action element also sits within the deliberative space of the *system for deliberation*. The overlaying of a *system for deliberation* on the *learning system*, that in combination make up *the process*[130] (Figure 5.4) reflects a 'moulding' of SSM to allow participant interaction to be explicitly deliberative, as was argued in the preceding section.

The 'prepare for deliberation' element would consist of participants engaging with the relevant information, education and training organised by the research team, and agreeing on ground rules for engaging in deliberation, as a means to limit knowledge-related power inequalities, and increase capacity for deliberation on the particular problem (Section 5.2.1.2). The information could potentially include a brief history of urban sanitation and discussion about characteristics, benefits and concerns associated with a range of sanitation arrangements (Chapter 2), an emphasis of taking a holistic systems perspective (Chapter 3); and guiding principles for sustainable urban sanitation policy based on combined perspectives of neoclassical, ecological and Buddhist economics (Section 4.7). The information may be disseminated in the format of written material, lectures, panel discussions, audiovisual media, and/or field trips (Renn 1999; Renn et al. 1993) delivered at appropriate points in the process (i.e., not necessarily having all delivered at the beginning of the process).

The remaining elements of the *learning system* as depicted in Figure 5.9 are explicated further below, highlighting opportunities for 'moulding' SSM.

[130] The disaggregation of *the process* into a 'system for deliberation' and a 'system for learning' was made for the sake of clarity of argument. Alternatively, *deliberation* could have been viewed as one transformation and CATWOE in a set of potential transformations and CATWOEs describing *the process*.

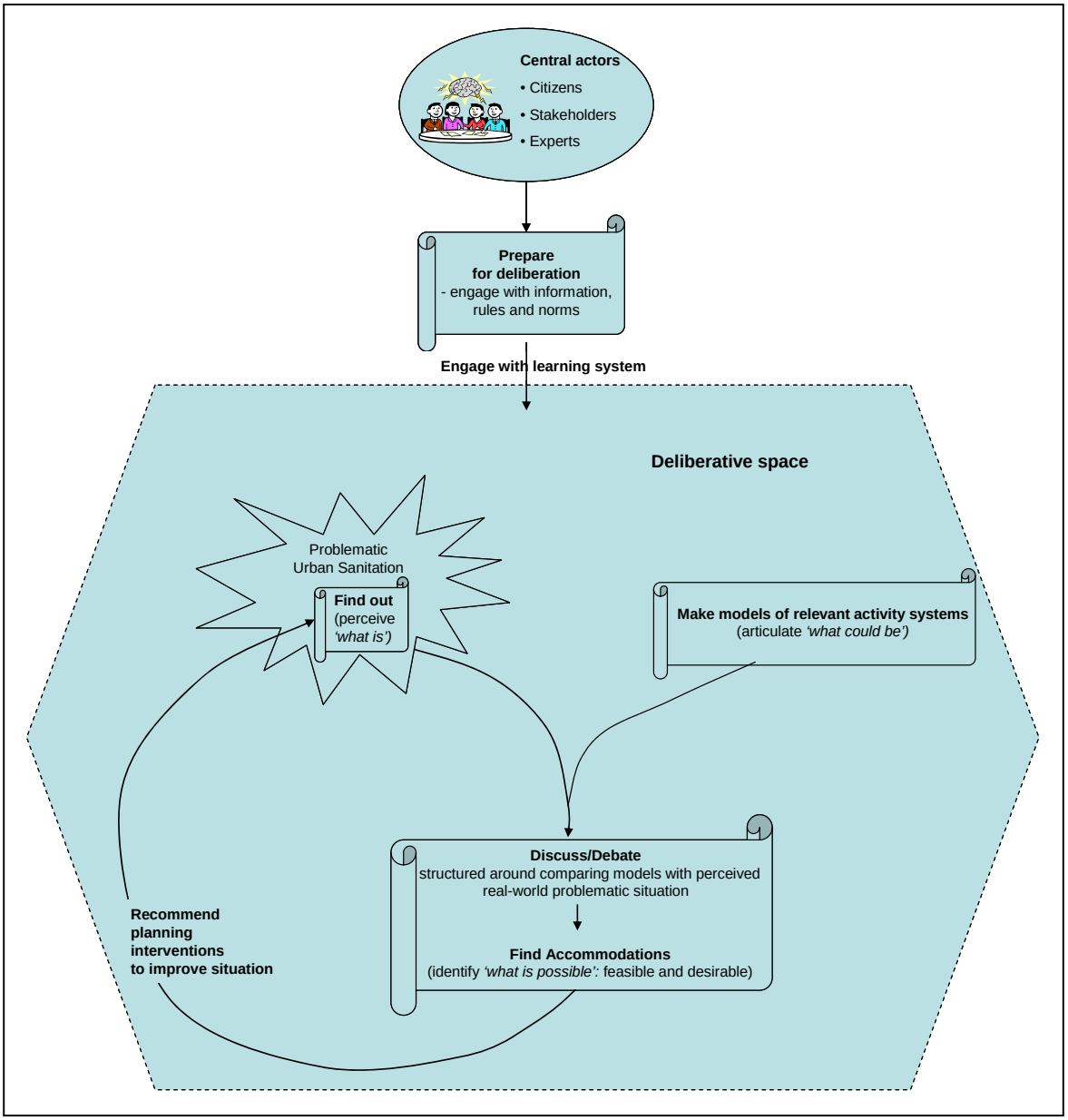

Figure 5.9: Elements of a *learning system* within the process to improve problematic sanitation

5.4.1 Finding out

'Finding out' in SSM is aided by rich pictures, and social and political analyses examining *roles*, *norms* and *values* and expressions of power (Section 3.5.2 Part A). These can often be quite fluid and 'fuzzy' processes, which Checkland & Scholes (1999, p. 66) acknowledge can be "too uncertain a process for some". There is opportunity to introduce other tools to decrease this 'uncertainty' – tools in the operational framework that may be seen as another 'moulding' of SSM in its application to the problem here.

I present the STEEP framework as such a tool for drawing out contextual factors as an aid to 'finding out'[131]. The STEEP framework was created by Futures planners for 'environmental scanning', an activity for identifying drivers of changes in the external environment that have implications for their sectors of interest. It is a taxonomy used to break down the otherwise gigantic task of scanning, into Social, Technical, Economic, Environmental and Political categories (Morrison 1992). I have extended this framework by combining it with the 'SWOT'[132] analysis tool, breaking it down into a matrix to identify both existing conditions and constraints, i.e., strengths and weaknesses; and trends that have the potential to influence future directions, i.e., opportunities and threats.

I have explored the potential of STEEP by applying it illustratively to the case of Colombo (Table 5.1) and thinking through the implications of the contextual factors it drew out (analysis below). Clearly, the use of this tool by citizens, stakeholders and experts within the proposed research project context would reveal a far richer array of contextual factors and their implications. My aim here is to demonstrate the STEEP framework as a defensible, systematic process for 'finding out' about *the problematic situation,* to aid the identification of relevant contextual factors that inform and set limits for potential interventions.

In my application of the tool, as presented in Table 5.1, contextual factors have been separated and placed into particular boxes in the table to aid thinking; the factors can in fact interact and influence each other across the columns and rows of Table 5.1. The STEEP categories are intended to absorb other possible categories, for example, cultural factors under the 'social' category, and institutional or organisational factors under the 'political' category. The STEEP factors I have identified in Table 5.1 are largely based on interviews held with government officials in Colombo, supplemented with publicly known facts.

Analysis of STEEP factors of Table 5.1

The implications of my illustrative identification of contextual factors with the STEEP tool discussed below should be read in conjunction with Table 5.1.

---

[131] This section is substantially based on my paper titled "Cost Recovery for Urban Sanitation in Asian countries: insurmountable barrier or opportunity for sustainability?" co-authored with my PhD research supervisors Associate Professor Cynthia Mitchell and Dr. Juliet Willets (Abeysuriya, Mitchell & Willetts 2005).

[132] SWOT is a commonly used strategic planning tool to identify Strengths, Weaknesses, Opportunities and Threats.

The social factors indicate some disjunction. On the one hand, I note the potential for social attitudes towards water and environmental resources to be deeply grounded in ideals of sustainability arising from Buddhist ethical frameworks, aided by high levels of literacy and ancient cultural traditions. On the other hand, there is the reality of irresponsible actions that have led to degraded water resources and sanitation services. This highlights an opportunity to use cultural and religious arguments to promote more appropriate attitudes and behaviours to create change in the desired direction. The tangible increase in public vigilance of environmental violations, attributed to the increasing influence of Non Governmental Organisations (Interview 2003) is a further factor that can force and reinforce such changes.

With respect to technology, there is a tension between foreign aid commitments that promote conventional centralised solutions and popular enthusiasm for 'appropriate technologies' suited to the circumstance of Sri Lanka, which could be directed towards positive solutions. Since there are several scales of existing technology (on-site systems, estate-scale sewerage systems and centralised sewers), the opportunity for innovative solutions at several scales is indicated. Not having commitments to an extensive sewerage network presents the opportunity for new developments both within and outside the sewered area to introduce sustainable best practice and to adopt sanitation technologies that anticipate future directions (for example, to invest in distributed technologies).

In the economic realm, the factors of low labour costs and the financial constraints of community and government, as well as potentially decreasing foreign aid, indicate solutions that favour operational costs in terms of labour inputs over large capital costs. Arguments from both the global move towards socially responsible investment and Buddhism may be used to draw new entrants to the sanitation sector from business groups that are prospering in other sectors (Section 6.3; 6.4).

In environmental terms, the STEEP analysis shows Colombo to be highly constrained. The blank box for environmental opportunities is an indication that opportunities here are dependent on opportunities elsewhere, rather than an indication of pessimism. For example, changed social attitudes can reduce environmental weaknesses, such as ceasing the practice of dumping wastes into waterways. Technological innovations can reduce wastewater volumes by concentrating it or improving water efficiency, or even avoiding water use altogether[133], thereby reducing both the space requirements for treatment facilities and the likelihood of groundwater contamination. The analysis highlights the need for the social, technological, economic and political opportunities to be developed in order to address the environmental constraints.

[133] Such innovations also reduce entropic expansion, identified as a sustainability principle (Section 4.7).

The existing political desire for keeping up with international environmental best practice is evident in the environmental standards and regulations, while the past record of poor implementation may in fact be a benefit in that investment in inappropriately large scale sanitation solutions has been limited. The opportunity to adopt leading edge policy and standards that are feasible within the existing constraints is consistent with existing political aspirations, and could be more implementable because it is better suited to Colombo. The research project itself could potentially raise the profile of the sanitation cause while acknowledging that much is needed to address systemic weaknesses.

By considering the range of contextual factors identified through a STEEP analysis, key directions emerge. For example, technology solutions that are intensive in terms of requirements for energy, space, water volumes, and capital expenditure are excluded. Instead, it suggests a high labour component and physically compact infrastructures requiring low capital inputs, utilising vegetation and local treatments where possible. So, rather than one uniform solution for the entire area of Colombo, a range of options at different scales is suggested. These kinds of solutions provide opportunities for strengthening linkages between a proud history (advanced hydraulic and sanitation practices), Buddhist principles (e.g., innovative opportunities to create 'right livelihood'), and political aspirations for world best practice policies (environmental protection and sustainable development).

In summary, the STEEP framework and analysis demonstrates how it may be used to identify specific weaknesses, constraints, tensions, and disjunctions, and then to address them through specific innovative strategies that build on existing opportunities to facilitate higher likelihood of actual implementation. It aids 'finding out' by highlighting the limits to options that might be considered for resolving problematic sanitation in its context.

The research team designing the process may include additional tools, 'moulding' SSM as they see appropriate. For example, a tool described in the IWA *Sanitation 21* framework, that aids the understanding of context along the lines of interests and objectives in different decision-making domains (household, neighbourhood, ward/district, city, and beyond-city) (IWA 2006b, pp. 15-19), might also be included for 'finding out'.

	SOCIAL	TECHNOLOGICAL	ECONOMIC	ENVIRONMENTAL	POLITICAL
Strengths	Majority professing Buddhism	Popular enthusiasm for adapting 'appropriate technologies' to suit Sri Lanka	Low labour cost	Warm climate supporting vigorous vegetation	Environmental standards and regulations generally keep abreast of developments in industrialised countries
Weaknesses	Lack of respect for water and environment Low willingness to pay for sewerage Rampant illegal dumping of waste	Scarce energy – imported fossil fuels, insufficient hydro electricity Inadequate transport infrastructure Existing settlements (limiting potential for green fields development) Existing septic tanks: poor performance, no monitoring or regular maintenance regime	Low average income level of community Government highly constrained for finances, at both national and local government levels	High water table Contaminated groundwater Polluted surface water bodies Urban encroachment into wetlands Small house lot size Little physical space for sewage/organic waste treatment facilities. Solid waste dumping into water ways	Poor implementation and enforcement of regulations, standards and planning decisions Little political commitment to the non-glamorous cause of sanitation and waste No political champion Demarcation of responsibilities not always clear between water agencies Mainly poor organisational arrangements for local government services
Opportunities	Ancient history of advanced hydraulic civilisation and sanitation practices High literacy rates Increasing public vigilance on violations of environmental requirements	Limited sewer network – little commitment needed for sunk investment Increasing international interest in developing new decentralised technologies	Strong growth in some business sectors Wealthy class growing Post-tsunami aid spin-off benefits Potential influence of Socially Responsible Investment movement		'Sustainable development' rhetoric Millennium Development Goals
Threats	Increasing individualism	Foreign aid commitments promote conventional piped sewerage	Widening gap between wealthy and poor Decreasing foreign aid	Increasingly serious impacts from climate change, weather events, natural disasters	Corruption at many levels throughout organisations Ethnic conflict and terrorism

Table 5.1: Illustrative use of the STEEP framework applied to Colombo

5.4.2 Modelling relevant activity systems, and identifying feasible and desirable resolutions

The remaining elements of the learning system (Figure 5.9) are discussed here: making models of relevant activity systems; having discussions and debate to reach accommodations about feasible and desirable directions for resolution of problematic sanitation, and making recommendations to decision-makers.

The discussion here is centred around the need for the different actors in the process to contribute technical expertise, rational analysis and public values and preferences into their recommendations for planners and decision-makers of urban sanitation, which have technical, economic, social, public health, political, ecological and ethical implications. Each actor group of experts, stakeholders, and citizens has different strengths and capabilities, so their contributions are likely to be stronger in some areas and weaker in others. This discussion reflects another 'moulding' of SSM for application here. In much of the SSM literature, the people involved in the activities tend to be stakeholders who are already familiar with the general issues and are treated as equals in their capacity to participate in all of the SSM action elements[134]. For the application here, the transdisciplinary context demands a diverse range of participants, whose capacities for contributing to all the action elements may be perceived to be unequal.

The emphasis of this section is consequently on exploring how the various tasks can be allocated appropriately to the diverse groups of participants with disparate capabilities. For this, I am informed by Renn et al.'s cooperative discourse model (Renn 1999; Renn et al. 1993), which seeks to create an analytic-deliberative process for combining technical and specialist knowledge of experts, particular interests of stakeholders, and public values and preferences of citizens in policy-related decision-making. Renn et al. describe their model as consisting of three steps, that I have associated with activities within SSM they have some resonance with (Table 5.2). I use this resonance as a basis of using Renn et al.'s model to justify my arguments for allocating tasks to the different actor groups.

[134] While there is space for additional participants to be brought in for the activity of discussion/debate around comparing models with perceived reality, as noted in Section 3.5.2, the majority of case studies of SSM (Checkland & Scholes 1999) typically use participants who are employees within the affected organisations.

	Steps in Renn et al.'s model	**Resonant activity in SSM**
Step 1	Identify objectives, goals, concerns and values	State desired purpose of activity system, in terms of a set of transformations and weltanschauung and root definitions
Step 2	Identify and assemble decision options that align with objectives and values	Build conceptual models of activity systems relevant to situation on the basis of root definitions and CATWOEs
Step 3	Evaluate options and their likely consequences	Compare/evaluate conceptual models against real world and engage in dialogue and debate

Table 5.2: Steps in Renn et al.'s (1993) cooperative discourse model and parallel or resonant activities in SSM

While I propose a particular allocation of tasks in the learning system in what follows, this is meant to be illustrative rather than prescriptive. The research team designing the learning system could equally decide on a different allocation, since any such decision is based on what appears "sensible to those concerned at the time" (Checkland 2001). Alternative views would be

> "... quite consistent with the systems view that the variable perceptions of different stakeholders in a problem context are legitimate *but need to be justified*." (Bell & Morse 1999, p. 88, emphasis added).

The key requirement, highlighted above, is that the allocation needs to be made on the basis of arguments that can be justified.

To make a justifiable match between actors and tasks, I take guidance from Renn et al.'s cooperative discourse model (Renn 1999; Renn et al. 1993). Renn et al.'s model has been applied to several case studies (ibid), and been adapted by others for different contexts (Carson & Gelber 2001; Riedy 2005). I explore how these ideas can be related to the systems approach of SSM to allow these groups to participate in *the learning system* for seeking resolutions to problematic sanitation.

The cooperative discourse model

The essence of the cooperative discourse model, relevant to my discussion, is a reasoned allocation of the various tasks to different actors. The actors include experts, stakeholders and citizens as well as sponsors and a research team (Renn 1999; Renn et al. 1993). The tasks in the model are grouped into key steps, with one group playing the central role at each step in Renn et al.'s model. The other actor groups play supporting or complementary

roles at each step[135] – such as adding to a list of outputs, making suggestions for potential policy options, and giving witness to the central actors.

Each step of the original cooperative discourse model, along with the adaptations made by Carson & Gelber and Riedy, is outlined below (in italicised text). Connections and implications for SSM-activities are then made. It should be noted that the activities in SSM are qualitatively different from the activities in the cooperative discourse model. For example, SSM's modelling activities corresponding to steps 1 and 2 are not attempts to describe the 'real world', but to make idealised conceptual systemic models that can be *compared* with the real world situation in order to create discussion and learning.

Step 1: Elicit values and objectives (create CATWOES and Root definitions)

The first step for Renn et al. (1993) is the elicitation of values, objectives and evaluative criteria for the process, a set of tasks they allocate to stakeholders, "since their interests are at stake and they have already made attempts to structure and approach the issue". In Carson & Gelber's (2001) adaptation, vision-creation is added to the first step, for which citizens are assigned the central role. Riedy (2005) argues that both stakeholders and citizens should be involved equally in this first step to represent a broader set of interests and values. A set of visions that reveal different values and objectives and evaluative criteria is the output of this step for Riedy's particular context.

This first step of eliciting a set of visions and objectives based on different values is, for me, reminiscent of the naming of transformations and their underlying worldviews in a set of CATWOEs and root definitions in SSM (Section 3.5.2). Since the purpose of assigning each task explicitly to an actor group is intended to match a task to a group's knowledge potential, I agree with Riedy that both stakeholders and citizens can participate in this step separately in complementary ways. Furthermore, I contend that the experts group has the capacity and legitimacy to also be active in this step. Having different disciplinary backgrounds consistent with the framework's alignment with transdisciplinarity, the experts group would bring a set of worldviews and values different from the other groups. Active participation of the experts group in this step would provide the opportunity for these perspectives to be exposed, shared and potentially integrated, as well as provide valuable practice in deliberation for the experts group, and the opportunity for them to develop ownership of the process.

[135] Even when groups perform the same task, they are kept separate to avoid problems of perceived unequal competence. For example, when citizens and experts are placed together, practitioners of deliberative democracy observe, citizens usually defer to the views of experts(Carson 2006a). Likewise, "incensed and articulate" stakeholders are likely to dominate citizens if placed together.

Thus, for the task of defining CATWOEs and root definitions within SSM modelling, I recommend the participation of citizens, stakeholders and experts in this SSM activity. The task would begin with participants within each group proposing desired objectives for sanitation systems in the study location, using the language of transformations T (Section 3.5.2B), and the worldviews or weltanschauung underlying them. The deliberative discussions around seeking the purpose of the sanitation system and the worldview from which such a purpose is desirable/undesirable would be the occasion for uncovering and acknowledging different interests on the path to seeking to serve community interests. CATWOEs and root definitions corresponding to these purposes (as transformations) and worldviews would be created by each group, reflecting the multiple perspectives on the objectives of an urban sanitation system for the context under discussion. Each group would reach accommodations on a small number of CATWOEs and root definitions that encapsulate the essence of the perspectives[136].

Step 2: Operationalise objectives (make conceptual models to meet objectives)

Performance profiles for a set of policy options are gathered in the second step of Renn et al.'s model. Options are assembled on the basis of their alignment with the goals and values identified in the first step, and their performance and impacts are evaluated using the criteria from the first step. The expert group is allocated this task because "the desired outcome is a specification of the range of scientifically plausible and defensible expert judgments and a distribution of these opinions among the expert community …" (Renn 1999). This step is broadly seen by Carson & Gelber as "operationalising" the visions and goals from the first step into potential action plans. Carson & Gelber and Riedy agree that the expert group should play the central role here.

A parallel to this step of operationalising and building action plans can be drawn with the SSM activity of building conceptual models of activity systems on the basis of root definitions and CATWOEs from the previous step. Conceptual models focus on "unpacking and displaying the *concept of the root definition*" (Checkland 1999, p. A25), tracing logical dependencies and hierarchies (Section 3.5.2). Checkland suggests that:

> "assembling an activity model ought not to be too difficult: simply a matter of assembling the activities required to obtain the input to T, transform it, and dispose of the output, ensuring that activities required by the other CATWOE elements are also covered; then link the activities according to whether or not they are dependent upon other activities" (Checkland 1999, p. A25).

[136] There is no fast rule about how many CATWOEs should be modelled. In one SSM case study, 26 thematic objectives were represented holistically within a single CATWOE/root definition, which was then expanded into a handful of relevant systems (Checkland & Scholes 1999, pp. 63-66), while in another, 12 separate root definitions were modelled (ibid, p. 133). Given time and other constraints, however, it would be pragmatic to seek a minimum number of models.

Although emphasising logic, Checkland notes that logic alone is insufficient for constructing models: "real-world knowledge *does* inform model building".

I contend that the group of experts, with diverse disciplinary backgrounds spanning all levels consistent with Max-Neef's (2005) requirements for facilitating transdisciplinary insights (Section 2.7.1), would bring a sufficient range and depth of experiential "real-world knowledge", to complement the logical activity of translating CATWOEs and root definitions into conceptual models. I thus propose that the experts group should be the central actors in this task, in agreement with Renn et al.'s cooperative discourse model and Carson & Gelber's and Riedy's versions of it. Although it is arguable that citizens and stakeholders can contribute other experiential knowledges, I argue that, since this activity is based on logical systemic thinking informed by experience (particularly associated with public planning and decision making), citizen and stakeholder values and perspectives are not critical for this activity.

Step 3: Evaluate options (compare models against real world)

In the third step of Renn et al.'s model, each profiled policy option is evaluated, and policy recommendations are made to the legal decision makers. Randomly chosen citizens are assigned this task, because "citizens are the potential victims and [beneficiaries] of proposed planning measures; they are the best judges to evaluate the different options available on the basis of the concerns and impacts revealed through the other two groups" (Renn et al. 1993). Carson & Gelber describe this step as 'testing' the acceptability of the options on the basis of citizen values. They make two modifications to Renn et al.'s model here: they open the 'testing' process to "the community as a whole", and, if the options are found to be unacceptable, they allow the process to return to Step 1. In contrast, Riedy recommends that the same citizens who were involved in the visioning in Step 1 be the central actors in the 'testing', so that the options can be tested against the values, objectives and criteria elicited earlier (Riedy 2005, p. 398). He concurs with Carson & Gelber's modification that allows the process to return to earlier steps if the group is unable to align policy options from Step 2 with their values and preferences in order to make policy recommendations.

This step of evaluation and 'testing' has its parallel in two activities within SSM. First, there is the evaluation of the conceptual models, to check that all the activities in the model are consistent with the purpose and CATWOE. If there are inconsistencies, the process returns to the beginning of the modelling process (Checkland & Scholes 1999, p. A27). This process can be iterative until the conceptual models fulfil the intentions of their definitions[137]. Consistent with my proposition that the set of conceptual models be constructed by the group of experts on the basis of their own root definitions/CATWOEs

[137] The space for iteration is similar to Carson & Gelber's and Riedy's versions of this step.

and those made separately by the citizens and the stakeholder groups, it stands to reason that this evaluation should involve the citizens and stakeholder groups from Step 1, each group in collaboration with the expert group, to evaluate their collective models.

Once the conceptual models are accepted, it moves to the next step of evaluation and testing: the comparison of conceptual models with the perceived real world problematic situation (or testing the models against the real world) that forms the basis for debate and reaching accommodations about action to be taken to improve the situation (in this case, making recommendations to decision makers about planning directions for improving problematic sanitation). Again I submit that this activity should be undertaken by the citizens and stakeholder groups, each group in collaboration with the expert group, who in this instance would present all the models they created (i.e., citizens would evaluate models based on their own, the experts' *and* the stakeholders' root definitions and CATWOEs, and vice versa). While Renn (1999) assigns experts a supporting role in this step that is analogous to that of witnesses to a jury in a judicial trial, I argue for a more collaborative relationship between the experts and the others. The expert group might be seen to be in partnership with the other groups, whose CATWOEs and root definitions they have modelled with their own; this step opens up their collective models for debate and discussion. At the same time, I suggest it would be preferable to keep citizens and stakeholders separate in order to avoid their deliberations becoming complicated by possible power dispositions[138].

The outcomes of the deliberations and accommodations could be collated into a list of recommendations for policy. The research team could potentially take a facilitating role in compiling the recommendations.

Step 4: Maintain accountability and learning

While Renn et al. describe their model as consisting of the three steps above, Carson & Gelber add a fourth step they label 'evaluation', consisting of communicating the outcomes of the process to the public: "this allows for community evaluation of the plan and the plan-making process. It also ensures that those making the final decisions are accountable to the community" (Carson & Gelber 2001, p. 15). The participant groups also separately evaluate the process so that learning for the future can occur. Riedy recommends this evaluative step as one that leads to "social learning" for both the community and the participants (Riedy 2005, p. 399).

[138] While the same charge may be made against combining citizens with experts, Carson (2006a) observes that when citizens and experts deliberate together, citizens tend to defer to the experts *unless citizens are charged with a specific task*. Since citizens have a specific task here, of judging and comparing models with the real world from the earlier 'finding out' task, this deference is thus less likely to happen. The presence of moderators is critical to mitigate unequal competence in deliberation.

Drawing on the theme of accountability, I observe two levels of accountability for the SSM-based process. Firstly, there is accountability in terms of meeting Checkland's (1999, p. A25) criteria for efficiency, efficacy and effectiveness ("the E's"), ethicality or any other criteria considered important by the participants (Section 3.5.2). This is incorporated within the SSM requirement that concept models include monitoring and controlling action to meet these criteria within the model-building activity, and would be put in place by the expert group as argued in Step 2. There is also opportunity for discussion and evaluation against the E's by the other actors, within the process of comparing models with the real world and deliberating about accommodations.

Secondly, as highlighted by Carson & Gelber and Riedy, there needs to be accountability to the public: that the accommodations reached through the process, and the planning recommendations that result, be exposed to public scrutiny. Ryfe (2005) argues that public scrutiny can act as a motivator that increases the commitment by participants to the deliberative process. I therefore recommend the inclusion of communication of process and outcomes to the public within the process – a task that could be undertaken by the research team. A separate evaluation by participants, of their experience of participation in the process, and a reflective space for the research team, can be included within the project to add to the learning for both participants and the research team. Riedy (2005) argues that in combination, the accountability addressed in this step contributes to social learning: for the public through education about the process and results, and for the participants and research team through the reflective evaluation process.

Finally, I submit that in order to offer the opportunity for further iterative learning in the SSM cycle, reflections and evaluation of the process could be captured after some significant space of time has elapsed, to consider the longer-term outcomes and learning and transformations that may have occurred. At this time, it can be determined whether a second phase of the project, returning to the beginning of the cycle with fresh eyes developed through the experience of learning from the first cycle, should be developed.

Thus, a moulded form of SSM may be represented as in Figure 5.10, which identifies the actors assigned to carry out each task. That Renn et al., Carson & Gelber, and Riedy held sometimes-divergent views about tasks and their allocation to different actors, as noted above, illustrates my point at the beginning of this section, that multiple legitimate views on the allocation of tasks are possible. This framework demonstrates a possible set of arguments to support the allocation in Figure 5.10.

Reflections

The framework proposed here outlines a broad learning process that can lead to recommendations for action through the creation of appropriate planning measures for sanitation. It has sought to incorporate ideas from earlier chapters, so that the recommendations and decisions about sanitation for the project location have the potential to be technically, economically and institutionally feasible, socially and environmentally desirable, appropriate to the context, and accommodating the values and interests of those involved. Admittedly, these are idealistic aspirations, which I nevertheless put forward as the vision behind this framework. Meadows (1996) emphasises the need for vision in order to reach the world we want:

> "… we could occasionally take the social risk of displaying not our skepticism but our deepest desires. We could declare ourselves in favor of a sustainable, just, secure, efficient, sufficient world (and you can add any other "value word" you like to that list), even at the expense of being called idealistic. We could describe that world, as far as we can see it, and ask others to develop the description further. We could give as much credit to the times when we exceed our expectations as to the times when we fall short. We could let disappointments be learning experiences, rather than fuel for pessimism." (Meadows 1996).

Holding the vision, I have proposed a step-wise research project format above, with its activities and actors chosen to facilitate outcomes that broadly align with transdisciplinarity, deliberative stakeholder participation with potential to draw out 'right motivation' in serving community interests, and sustainability as a learning process – elements I have identified through this thesis as important for sustainability. That implementation may lead to some disappointments could be part of the learning process. In this section, I reflect on how the vision and the process might meet at a mid-way point in order that the risk of at least some disappointments may be reduced.

One of the advantages of Renn et al.'s model (Renn 1999; Renn et al. 1993) is that each sequential step is well defined and intended to produce specific outcomes. It makes it possible to specify time allocations for each activity (necessarily with margins to accommodate the unpredictability of deliberative processes), thereby improving accuracy for estimating budgets and thus the chances of securing the necessary resources for the project. Its limitation, as I see it, is its alignment with a 'problem solving' intent (using a deliberative participatory process), similar to a systems analysis approach (Figure 3.4).

I have argued for and designed the process proposed here emphasising it as a process for learning. Learning requires space for iteration, for being able to return to earlier points in the learning cycle. For example, the *learning system* provides space for iteration with testing conceptual models against the root definitions and CATWOEs, and for return to earlier steps from other locations in the SSM cycle (Figure 5.10). One drawback of creating such a system for learning is that there is a high degree of unpredictability about the amount

of time required, compared to Renn et al.'s 3-step model: unpredictability associated with possible iterations, the number of root definitions and CATWOEs and therefore conceptual models that might be created, and the amount of time these as well as the dialogue and debate might require. To allow adequate flexibility raises practical difficulties in estimating the amount of time required[139]. While Checkland and associates seem to implement SSM within tight timeframes with good result, I submit that this is made possible by the vast experience they have accrued over the years (Checkland & Scholes 1999). In comparison, there would be little experience with applying SSM-like learning processes in the context of urban sanitation in Colombo or any other developing Asian countries.

A second drawback of allowing unlimited room for iterative learning is that the cycle could risk becoming trapped within an iterative loop seeking to 'perfect' some aspect of learning, without making progress towards decisions about resolving the problem. This would lead to disappointment with the project as a whole. While iterations are possible and helpful, it is essential that progress is made towards intervening in problematic sanitation through planning measures, so some trade-off may be necessary.

I therefore propose that the *learning system* be constrained to a series of steps more akin to Renn et al.'s model, with a limitation on the space for iterations. The number of iterations denoted by the dotted arrows in Figure 5.10 may be negotiable with respect to available funds and project timing: it may be limited to one return each, or some iterations may even be omitted if necessary to address practical difficulties with planning a research project. This would allow such a project to get off the ground so that practical experience can start building up gradually. Furthermore, I recommend that the project be designed at a very small scale to begin with, so that the consequences of potential disappointments are also small.

Reflecting on the practicalities of achieving the theoretical possibilities of the vision is a necessary first step, before the proposed framework could be tested in practice. It recognises and accommodates a degree of compromise between theoretical possibilities articulated in a vision for the framework, and its implementation is practice.

[139] It is possible however that this difficulty may be less significant in the context of developing Asian countries: anecdotal evidence suggests that 'Eastern' cultures are more flexible about time – a flexibility that frequently proves a source of frustration for 'Westerners' with their tighter conceptualisations of time.

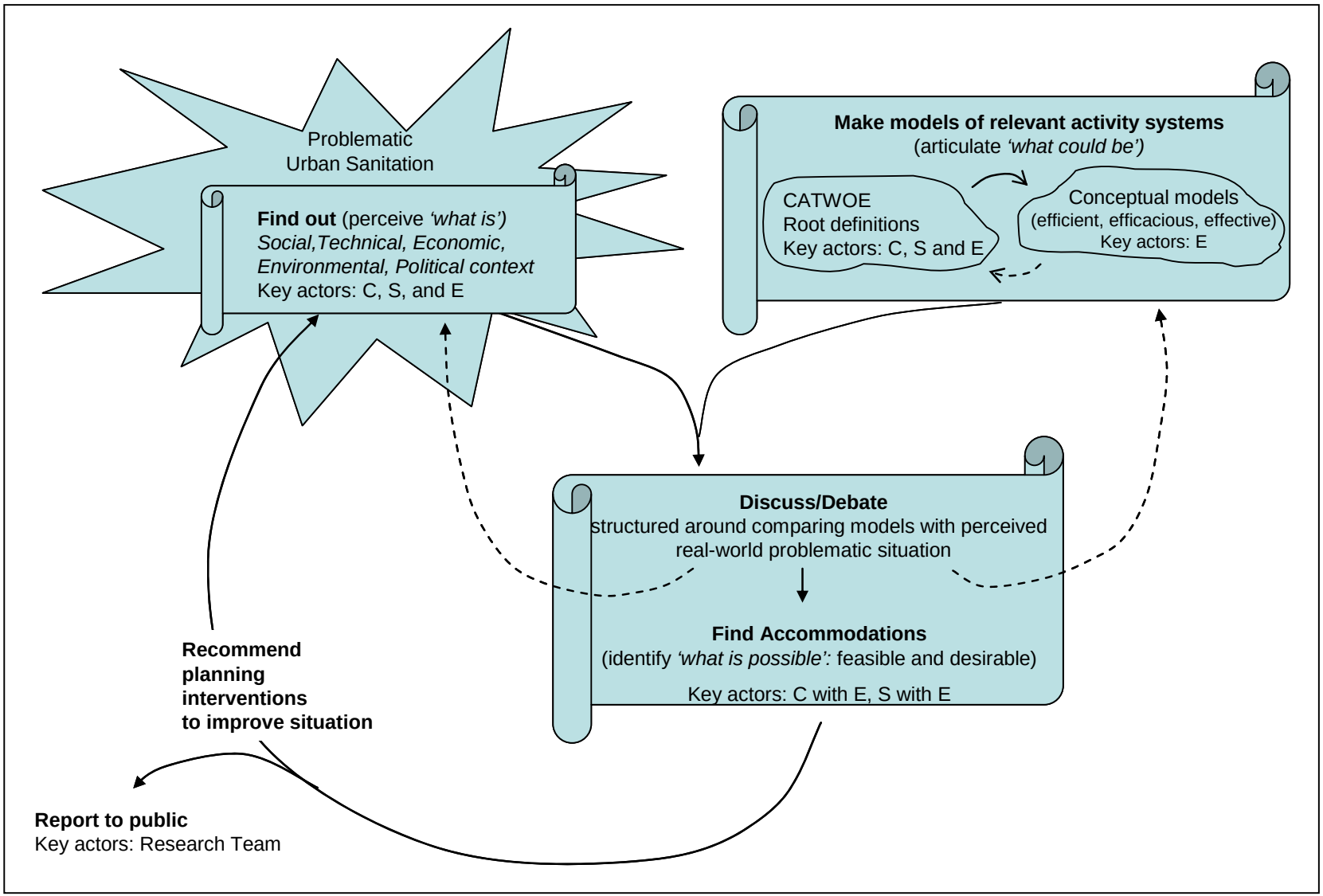

Figure 5.10: Activities and Actors in the *learning process* based on SSM informed by the cooperative discourse model

5.5 Conclusions

To contribute to the resolution of problematic urban sanitation in developing Asian countries is a key motivator of this research. Making a practical proposition towards this has been the goal of this chapter.

One of the key concepts that emerged earlier in this thesis has been that, to be aligned with sustainability, decision-making processes need to involve broad participation. Furthermore, that :

> "In a democracy, scientists (economists) have no right to dictate correct values for societal resource allocation. The purpose should instead be one of illuminating an issue for actors of different ideological orientations."(Söderbaum 2003)

Thus, as a thesis seeking alignment with sustainability, a practical proposition could not defensibly be the identification of explicit recommendations about technical or institutional arrangements towards resolving the problem. Therefore, I have chosen to make a practical proposition in the form of a framework for creating collaboration between a broad range of actors – experts, stakeholders and citizens – in making these decisions about sanitation.

I have espoused the concept of sustainability as a learning process (Section 3.3), rather than taking a normative stance on sustainable urban sanitation. The process is one for discovering resolutions to the problem that reflect multiple perspectives and interests, encapsulated in recommendations for sanitation planners and policy makers as an outcome. This provides a lead into the next chapter, which identifies actors who can implement the planning policies by their investment in physical and institutional infrastructures that meet the objectives intended by the policy.

The proposed operational framework is founded on the premise that for sustainability, multiple legitimate perspectives consistent with transdisciplinarity need to be accommodated in policy, rather than the perspectives of specialist 'experts' alone. It proposes a novel 'moulding' of soft systems methodology (SSM) to involve people with diverse capabilities in an explicitly deliberative process to discover resolutions to the problem. The adaptation of SSM was presented as a composite of a *system for deliberation* and a *learning system*, in order to explicate the two objectives of the process. The 'system for deliberation' emphasised that, in order to reach outcomes aligned with values of the sustainability-related discourses, dialogue between participants need to be based on deliberation as defined by the deliberative democracy discourse. The *learning system* described a series of activities that are allocated to different actors, to foster learning that would potentially lead to resolution of the problem. The overlay of these two systems would lead to each activity in the learning process being performed in a deliberative form.

In order to better explicate the process, I described it in reference to a hypothetical case study of a local government area in Colombo. The potential actors in the research project were identified within the description of the *system for deliberation*. The research team and sponsors were the key actors driving the research project, who design and enable the process and accord credibility and legitimacy to the project. The deliberative process for reaching accommodations about desirable and feasible policy had as its key actors: moderators for facilitating deliberation, groups of citizens, stakeholders and experts as participants in deliberation, and various experts for compiling and presenting balanced information to participants.

The 'learning system' set out the activities within the process, and proposed how each activity might be performed and by whom. With reference to the moulding of SSM as set out in Figure 5.10, these tasks were:

- To gain understanding about the problem context – engaging experts, stakeholders and citizens. The STEEP framework was proposed as a tool to complement SSM's toolbox in this regard.
- Next, to conceptualise the objectives of the system as root definitions of a desirable system, articulating the worldviews that form the basis of these objectives. Reaching accommodations through deliberation would limit or condense these objectives into a handful of root definitions reflecting the interests of the community. I proposed that experts, stakeholders and citizens be involved in this activity.
- Building conceptual models that can in theory meet the objectives encapsulated within the root definitions, including efficiency, efficacy and effectiveness. I allocated this task to the group of experts.
- Deliberating about feasible systems, on the basis of comparisons between the conceptual models and the 'real life' context of the problematic situation as identified in the first step. Identifying policy that can support achievement of these feasible systems. I argued that two collaborative groups consisting of experts and stakeholders, and experts and citizens, undertake this activity.
- Expressing these potential policies as recommendations to policy makers. The research team was allocated this task. Communicating the resulting recommendations to the public and decision-makers was part of this role.
- Reviewing the process for learning. Everyone's feedback and perspectives about the process was argued to contribute to learning, that could be applied to future processes.

While such a research project is not guaranteed to achieve sustainable resolutions for sanitation, as perceived by different experts, I contend that such a process is necessary for consistency with the values of the different discourses used in this thesis – post-normal science, ecological economics, Buddhist economics and transdisciplinarity. Furthermore, the approach proposed here could lead to qualitatively different resolutions than 'solutions'

that conventional expert-led approaches would offer. Its alignment with the values of the sustainability discourse improves the likelihood of meeting sustainability criteria in the long term.

6 Implementing sustainable sanitation: who, how and why?

Must we assume that people will overuse the earth's resources and sinks despite all warnings as long as they can make an immediate profit, that change will only come when there is nothing left? No! We do not believe that is inevitable. There is always a chance that the right combination of ideas and leadership will strike the right chords at the right time.

Herman E. Daly and John B. Cobb (1994)

6.1 Introduction

In earlier chapters, I have presented concepts and principles for sustainability in urban sanitation for developing Asian countries, and a process for decision-making that could potentially adopt these concepts and principles. These have the potential to create a landscape for sanitation planning that is aligned with achieving sustainability.

In this chapter, I explore another issue for moving to sustainable sanitation, namely: given a sustainability-friendly planning environment, who would bring this planning into reality in terms of investing in capital infrastructure, and managing and operating the systems; under what conditions and safeguards would they operate; and what might motivate them.

In theory, there are three potential actor groups for this implementation role – government (national, regional and/or local government) or government-owned service utilities; private sector service providers; or communities that might take responsibility for their own arrangements. I exclude this last group from consideration in this chapter for several reasons. Self-organised community arrangements in line with Demand Responsive Approaches that have been applied to low income communities tend to exclude the poorest members of the community, while their reliance on volunteers could threaten the long term viability of these arrangements (Ariyabandu & Aheeyar 2004; Hoering & Schneider 2004), as discussed in Section 4.4.2. As well, having professional monitoring and management of decentralised sanitation systems is becoming accepted best practice for ensuring adequate performance (Section 2.5.2.2). Thus, I consider only government and private sector service providers here.

In either case, I contend that government necessarily has the role of overseer and regulator, to protect the public interest and to ensure that some defined minimum standard of essential services to maintain life, health and dignity are available and affordable to all. Quite separately, government or its representative may also be directly involved in providing services; or they may enter into arrangements with private sector participants to provide services.

Whether government or the private sector is best able to provide urban water and sanitation services has been a subject of shifting debate. The chapter therefore begins with a review of literature on this issue, and examines the experiences with private sector participation in the water sectors of other developing regions (Section 6.2). This provides some historical perspective on the issue, and allows several lessons to be drawn about how government and private service providers might work together to provide sanitation services in developing Asian countries.

Opportunities and barriers to urban sanitation investment by the private sector are explored next (Section 6.3). I argue that opportunities for profitable private sector participation exist, particularly from the emerging use of small and medium scale distributed technology options. Yet significant obstacles can prevent these opportunities from being taken up by the private sector. To draw on fresh means to overcome these barriers, I consider moral arguments as internal motivations for the private sector to appropriately invest in sanitation.

Thus, in the final section (Section 6.4) I look to the corporate social responsibility (CSR) discourse, and to Buddhist Economics' potential to inform and enrich CSR by providing a moral framework for corporate behaviour, as a way of pushing past the perceived barriers. This allows me to align sanitation service provision with the ethics and 'caring' I argued as critical for sustainable sanitation (Section 1.2). These arguments are made with the optimism expressed in the opening quote above, in the hope that these ideas may "strike the right chords" (Daly & Cobb 1994, p. 380) and motivate the necessary investment and participation.

6.2 Public or private provision of sanitation?

In this section, I review the literature on private sector participation (PSP) in general, and in the water sector in particular, to argue that participation of the private sector in the delivery of sanitation can be beneficial under certain conditions. I examine the pressures and economic arguments that have catalysed the trend of increased private sector participation, the different modes for private sector participation, and a range of negative experiences with private sector participation in water services in developing countries. The section concludes with a set of conditions that can reduce the potential for negative outcomes and increase the benefits from private sector participation in sanitation.

6.2.1 Historical context and catalysts for private sector involvement in infrastructure services

Urban sanitation services provided by governments have been fundamental in transforming urban public health, and underpinned development in industrialised countries as discussed in Chapter 2. Although the system of market economics that promotes a 'small' role for government has driven much of the economic development that has occurred in the industrialised world[140] (Section 4.4), the so-called father of market economics, Adam Smith, saw a role for government in providing large-scale capital-intensive infrastructure services:

> "the sovereign has only three duties to attend to; three duties of great importance, indeed, but plain and intelligible to common understandings: first, the duty of protecting the society from violence and invasion of other independent societies; secondly, the duty of protecting, as far as possible, every member of the society from the injustice or oppression of every other member of it, or the duty of establishing an exact administration of justice; and, thirdly, *the duty of erecting and maintaining certain public works and certain public institutions which it can never be for the interest of any individual, or small number of individuals, to erect and maintain; because the profit could never repay the expence to any individual or small number of individuals, though it may frequently do much more than repay it to a great society*." (A. Smith [1776]1904, I, XI,264, emphasis added)

Through much of the twentieth century, governments provided infrastructure services such as water services, electricity, public transport and telecommunications under a public service ethos towards "a great society" in line with Adam Smith's views. Service providers prioritised extending geographical coverage to promote economic and demographic growth and to generate employment (Guy, Marvin & Moss 2001; Tisdell, Ward & Grudzinski 2002). Under this model, pricing for services such as water supply was designed to meet objectives of universal provision and equitable access rather than to recover the costs of supply (Bakker 2001).

Impetus for change from government provision of services

The model of government provision of water services could not be sustained in the long term, consistent with the notion that, to be sustainable, resources used must be replenished or full costs recovered (Chapter 4). Similar to other infrastructure services, changes to the government-provision model became essential in the water services sector, due to an increasing discrepancy between governments' capacity to subsidise the cost of water-related services and the costs of providing the services. Governments everywhere face

[140] Referring to economic development as reported in its ubiquitous GDP terms. Other perspectives on economic development, such as a Buddhist economic perspective, may dispute this measure of progress.

increasing fiscal pressures as they confront competing demands for public spending under limited availability of public funds (Flyvbjerg, Rothengatter & Bruzelius 2002, p. 92). Water supply costs have risen due to higher incremental cost of supply with rising demand[141], rising costs for the operation and maintenance and replacements of aging infrastructure, and stricter regulatory requirements for water and wastewater quality (Seidenstat 2000; Tisdell, Ward & Grudzinski 2002).

At the same time, for governments to provide services costed and priced in alignment with commercial principles highlighted a potential conflict of interest where government is both the financier and producer of commercial services, and the protector of the public interest (Flyvbjerg, Rothengatter & Bruzelius 2002, p. 90). Nellis (2006) notes that the mixing of social, political and economic objectives resulted in practices such as goods and services being provided at prices less than cost, choices being made in order to generate employment, plant locations being chosen on political rather than commercial criteria, and only state-sanctioned suppliers being used for procurements – practices that conflicted with the goal for "commercial, efficient and profitable" operation. The need to separate the two roles was thus seen to be important.

The reforms of infrastructure services that began in the 1970s were aimed at creating institutions that (a) provided services in a commercial manner with an emphasis on economic equity, i.e., where users pay[142] the costs they impose on the system, to the extent possible (Bakker 2001), and (b) were autonomous from government. Britain, and its commonwealth of industrialised and developing countries ranging from Australia to Sri Lanka, witnessed public bodies being corporatised and managed by independent boards of directors charged with delivering services efficiently and at least cost.

Drivers for private sector involvement in infrastructure services

Fiscal pressures experienced by most governments meant it was necessary to tap new sources of finance capital, namely private sector finance. For much of the twentieth century, large scale centralised infrastructure projects were financed by public funds[143], i.e.

---

[141] With rising demand, additional water resources from more distant/costly sources are needed when existing resources are insufficient, raising the incremental cost of supply.

[142] The 'user pays principle' identified by Bakker is consistent with the concurrent rise of neoclassical economics, which assumes that 'users' are identical with 'beneficiaries'. In section 4.4.3 I highlighted that where there are significant public benefits, the 'user pays principle' is less defensible for achieving economic equity or distributional justice.

[143] In the nineteenth century, there was a higher degree of private capital involved in infrastructure investment and service provision, particularly in water supply services. Concerns relating to water quality and fire fighting capacity led to the public takeover of these systems by the end of the nineteenth century. (Flyvbjerg, Rothengatter & Bruzelius 2002; Seidenstat 2000).

through tax revenues, or by private funds backed by government guarantee (Flyvbjerg, Rothengatter & Bruzelius 2002; Lux 1990); in both cases the high risks associated with such mega-projects were borne by taxpayers (Flyvbjerg, Rothengatter & Bruzelius 2002). By the end of the century it was seen to be desirable that the high risks and problems associated with large scale infrastructures, such as cost overruns, market risks (e.g., incorrectly estimated demand), political risks (e.g., changes in laws and regulations, or industrial action by employees), currency risks (e.g., large changes in exchange rates) and force majeure risks (e.g., wars, natural disasters), should not be borne solely by taxpayers, but shared with capital markets (Flyvbjerg, Rothengatter & Bruzelius 2002; Haarmeyer & Mody 1998). The case for private sector participation is summarised:

> "Transferring part of the responsibility for infrastructure management to private partners, so bringing in capital, spreading risk and gaining from typical private sector virtues in management and operation is a potentially promising solution"
> (UNEP/WHO/HABITAT/WSSCC 2004)

The pressures faced by governments in developing Asian countries make the imperative for the private sector to become involved in sanitation particularly strong. Water and sanitation infrastructure has not been able to keep up with the rapid population growth in cities in developing countries (Biswas et al. 2004), while cash strapped governments are faced with competing infrastructure investment needs. Furthermore, current levels of international aid for urban infrastructure to some developing Asian countries may decrease in the future, as the international community seeks to target its available funds to countries most in need (Section 1.3). The private sector, as a significant contributor to the economic growth and development in middle-income developing Asian countries in particular, can similarly contribute to filling the gap in government's capacity to provide services. Through contracts let to the private sector, financially constrained governments are able to obtain services for the public that in some cases they themselves are unable to provide[144].

Neoclassical economic ideology in the promotion of private sector participation:

The rising influence of neoclassical economics has been a further factor in driving government policy changes around the world for facilitating the private sector to enter the public infrastructure services sector. Economic theories predict that, when there is competition in capital and output markets, privately owned entities would perform more efficiently than comparable publicly owned entities (Renzetti & Dupont 2003). Therefore, industry reforms since the mid-1980s have in many cases also aimed to stimulate economic efficiency by introducing competition into sectors that had previously operated as monopolies, and by the sale of assets and privatisation. Competition has often both

[144] To illustrate: a local government (LG) official I interviewed in Sri Lanka related how investment in mechanical road sweepers was beyond the economic means of the LG, but their services were nevertheless obtained by specifying them in the contract for urban street cleaning let to the private sector through competitive tender.

catalysed and been enhanced by new technologies, leading to lower prices for improved products and services, notably in the telecommunications industry – results that may be seen to substantiate the economic theories.

Theoretical predictions about potential efficiency improvements through privatisation have become transformed into an ideology, with the idea that private enterprises are intrinsically more efficient than government enterprises (Daly 1999; Stiglitz 2002). The spread of this ideology within multilateral financial institutions such as the IMF and World Bank (Stiglitz 2002) led to the pro-active promotion of privatisation through clauses tied to loans to developing countries (Grusky & Fiil-Flynn 2004). Nellis (2006) observes that enthusiasm for privatisation of public utilities, while substantiated by some performance improvements through private sector participation in industrialised countries, largely originates in "expectations based on hope and theory, rather than on hard empirical evidence of the superiority of private participation and ownership in non-industrialised economies".

Studies on the costs and benefits of privatisation, more numerous than studies on any other reform, fail to provide consistent findings on the relative impacts and utility of private sector participation (Nellis 2006). Empirical studies in the USA, UK, France, and a number of Asian countries show that privately owned water utilities do not necessarily outperform public utilities (Estache & Rossi 2002; Pieper & Taylor 1998; Renzetti & Dupont 2003; Seppälä, Hukka & Katko 2001). They highlight that the private ownership of utilities, on their own, will not lead to better performance: instead, good performance is predicated on other factors, most notably the presence of competition (Estache & Rossi 2002; Renzetti & Dupont 2003).

Competition is a cornerstone of the proposition of 'the market' as an efficient mechanism for allocating scarce resources[145]. The creation of competition in output markets (giving consumers choice in market products) is credited for the wide ranging benefits from reforms in the telecommunication industry, for example (Birdsall & Nellis 2002). While neoclassical economics encourages private ownership where the pursuit of self interest and profit acts as a vehicle for development, the common tendency to equate 'market economics' with private control is indicative of neoclassical ideology rather than economic theory: the fundamental question is

> "not whether facilities are owned or even operated by public or private providers [but] rather … whether the structure of the market can be made more competitive so that the technically and economically feasible outcomes are achieved" (Seidenstat 2000).

It is widely acknowledged that centralised urban water systems are natural monopolies and that "the scope for introducing competition in the supply of water is far more limited than

[145] Competition has even been described as a 'force' in the economic world analogous to gravitation in the physical world (McNulty 1968).

in other network utilities" (Kessides 2004). In some cases it is possible to 'inject' competition into industries that have been historically structured as monopolies. The restructuring of the electricity industry in the South Eastern states of Australia is an example of such injected competition. Here, the creation of a non-physical 'national pool' for electricity and a 'common carrier network' for transmission and distribution facilitate competition; many producers can compete to supply electricity to the pool, and many retailers can compete to re-sell electricity purchased from the pool to customers (NEMMCO 2005). The commoditisation of electricity, that enables such a market, is possible because a unit of electricity produced by any generator is identical to that produced by any other generator, and furthermore, because the 'quality' of electricity (determined by voltage profile and power factor) is readily and instantaneously measured and maintained or corrected.

Although a corresponding mechanism for creating competition in the water industry may appear theoretically feasible, technical and administrative obstacles prevent it in practice (Seidenstat 2000). The quality of drinking water supplies is costly, time consuming and generally indirect to test, and difficult to maintain or correct once released from a water treatment plant, unlike electricity. For wastewater, treatment costs are largely determined by the quality or characteristics of the wastewater, so that mixing all types of wastewater raises costs. Although it may be technically feasible to manage a uniform water quality across an urban water system and create a competitive market-parallel with electricity, its prohibitive cost would defeat the purpose of a competitive market – namely to allocate economic resources efficiently.

6.2.2 Types of Private Sector Participation

In the urban water and sanitation sector, a number of different modes for private sector participation have been created in order to attract private investment, and to "inject competition" into this industry (Seidenstat 2000). An understanding of these arrangements is necessary in order to assess how these have influenced outcomes and whether some arrangements are preferable to others.

I see the arrangements for private sector participation as belonging to one of two main classes: where the private sector *controls and manages the entire system*, and where the private sector *provides some elements of the services* to a publicly owned utility that retains overall responsibility for the service. I will use the terminology "privatisation" to refer to the former and "Public Private Partnerships" (PPP) for the latter. I have chosen this terminology to be consistent with the popular meanings associated with the terms (for example, in D'Monte 2005) since there is inconsistent use of terminology in the field[146].

[146] Consistency appears to be emerging in recent literature, towards 'privatisation' to cover all situations where ownership and/or operational control of public services are transferred to a private company (Hall &

6.2.2.1 Privatisation: private sector management of the entire system:

Privatisation occurs under two types of arrangement: the *privatisation of assets*, and *full utility concessions*. Since capital-intensive centralised water & sanitation networks are natural monopolies (where competing networks are not economical), these types of 'market' arrangements necessitate government intervention and regulation to prevent rent seeking behaviours, to scrutinise service quality and ensure efficient technical operation. Thus, the presence of strong regulatory capacity is particularly important for implementing these arrangements (Gutierrez et al. 2003).

Privatisation of assets means a full sale of public water and sewerage assets, with commercial operations subject to service quality and price regulation by government agency. Globally, only ten regional water authorities in England and Wales have this type of arrangement (Bakker 2001; Haarmeyer & Mody 1998)[147] , whereby services have been provided by large privately-owned regional monopolies since 1989, with regulations to correct for market failures and to ensure technical efficiency (Bakker 2001).

Concession arrangements have been the more common form of privatisation. In a concession, a private firm enters into a long-term contract (25-30 years or longer) to manage the entire infrastructure system, with exclusive service-provider rights to the contracted service area. The contract typically includes commitments and targets to increase service access by financing and building network extensions. Concessionaires are subject to service quality requirements and price regulation by a government agency (Haarmeyer & Mody 1998; Renzetti & Dupont 2003). Such arrangements have had a very long history of success in France (Haarmeyer 1992) including variations where the cost for investments in existing networks and in new extensions are differentiated and allocated between the contractor and government (affermage contracts). Concessions have been promoted in developing countries since the 1990s, and concessionaires involving multinational water utilities have been formed in several countries of Asia and Latin America including Malaysia, Indonesia, Philippines, Argentina, Bolivia, and Puerto Rico, amongst others (Haarmeyer & Mody 1998; Hall 2002; Shofiani & Gustafsson 2004).

Lobina 2006; Nellis 2006) – or private sector participation in my terminology. I have nevertheless chosen to retain the popular interpretations of the terms because ambiguity in terminology is likely to persist: "Donors and the private companies themselves prefer to avoid the term privatisation, except for the sale of assets, and use instead the phrase Private Sector Participation (PSP) or Public Private Partnership (PPP)" (Hall & Lobina 2006).

[147] Seidenstat (2000) also notes a small number of sales of small-scale water utilities in the USA.

6.2.2.2 Public Private Partnerships (PPP): private sector provision of some elements of services:

Centralised urban water and sanitation service can be disaggregated into many smaller functions, such as the construction and/or operation of water treatment plants and wastewater treatment plants, management, operation and maintenance of water and wastewater transmission systems (pipes and pumps), billing and collection of fees, meter maintenance, meter reading, and other specialised services. In Public Private Partnerships (PPP), the public utility retains overall responsibility for the service to customers, and performs a coordinating role, while the disaggregated functions may be contracted or outsourced to the private sector– creating a range of opportunities for private sector participation under these arrangements.

There are numerous different commercial arrangements for PPP described in the literature (for example, see Lee & Jouravlev 1997; vanGinneken, Tyler & Tagg 2004). They may be classed broadly as service contracts, management contracts and lease contracts (Lee & Jouravlev 1997). The term of the contract can range from 2-3 years to 25 years or more, depending on the level of capital investment required from the contractor to deliver the service. Lease contracts are similar to concession agreements but applied to parts of the system: typically, the lessor (service provider) takes responsibility for the design and construction, finance, operations, maintenance and commercial risks associated with the project for a fixed period, and the lessee (water utility) commits to purchase the services for an agreed charge for a fixed period (AusCID 2005; Lee & Jouravlev 1997). A number of variations of lease contracts exist, including the well known build-own-operate (BOO) and build-own-operate-transfer (BOOT) arrangements.

PPP is very common in all types of infrastructure services in most parts of the world, and a large number of publicly owned infrastructure projects have been designed and constructed and/or operated by the private sector, using varying degrees of public and private finance. For example, four water-filtration plants in Sydney are operated by the private sector under such agreements (Haarmeyer 1992), while the publicly owned Sydney Water Corporation retains responsibility for urban water and sanitation services as a whole.

6.2.2.3 Private Sector Participation and competition in water services:

Centralised urban water systems are natural monopolies where it is not rational to have more than one service provider, but it is argued that benefits equivalent to the benefits from competition in the product market may nevertheless be achieved by 'injecting' competition through the entry of private sector participants in different ways (Seidenstat 2000). Lee & Jouravlev (1997) observe that in the water industry, the modes for contracting (concessions or various PPP contracts) create *competition for the access to a monopoly market,* where many agents capable of providing the service compete to become the monopolistic supplier.

They argue that the benefits of competition still accrue when the supplier is selected through a fair and competitive process and when bids are made on the basis of service level, quality and price; the process would "increase efficiency and bid down price of the product" and in effect, "hold in check the potential monopoly power" of the winning firm. In the British model of privatisation with the sale of public assets, Bakker (2001) observes that competition in output markets has been substituted by *competition in the performance of managers* whose actions influence share price, where the performance of the utility is measured by share price movements.

In practice, these alternatives do not automatically result in benefits that are equivalent to competition in the product market. Perverse behaviours surrounding the selection process for concessionaires and contractors, such as collusion and corruption (Hall 2002; Lobina & Hall 2001), have thwarted the integrity of the process and restricted competition. Furthermore, although well-run utilities may gain significant benefits from improved efficiency and reduced operating costs aided by effective regulatory instruments (such as the price caps regime of the British regulator OFWAT), Seidenstat (2000) notes that the lack of rate competition in regional monopolies means that these benefits are not shared with consumers through lower prices. For example, the ten British private regional water utilities' increased profits by 147% between 1990 and 1997, and the average remuneration packages for company executives increased five fold, but prices for consumers doubled in the same period, and disconnections for non-payment of water bills tripled by 1994 (Lobina & Hall 2001; Martin 1996; Public Citizen 2003).

6.2.3 Experiences with private sector provision of water-related services in developing countries

A number of privatisations of public water utilities have occurred in Latin America, Asia, Africa and transitional economies in Europe since the late 1990s, largely due to multilateral financial institutions' active promotion of these arrangements[148] (Alexander 2003; Grusky & Fiil-Flynn 2004). In most cases, the privatisations occurred before adequate regulatory frameworks were in place, so that processes for dispute resolution and addressing issues such as independent contract review and transparency were lacking (Gleick et al. 2002; Gutierrez et al. 2003).

Some fifteen years since the earliest privatisations of urban water systems, assessments show that the promised benefits of private capital providing increased investment and access to water services have largely not been realised. Although the World Bank reports that investment in water and sewerage did increase in developing countries during the 1990s peaking around 1997, others observe that much of these reported investments were

[148] However on a global scale, private provision of water services is quite small, amounting to only about 5% of the global population (Budds & McGranahan 2003).

publicly financed under the particular contracting arrangements with the private sector, and do not demonstrate that additional private finance of any significance was accessed through privatisations (Budds & McGranahan 2003; Hall & Lobina 2006). The number of additional service connections in sub-Saharan Africa and Asia through private investment since 1997 are estimated at 600,000 – around 0.3% of the connection rate required from 2006 on to meet the Millennium Development Goals for these regions by 2015[149] (Hall & Lobina 2006).

Privatisation of urban water systems internationally has become synonymous with the participation of multinational utilities – with the market dominated by the French multinationals Vivendi (operating in the water sector internationally as Veolia), Suez (Ondeo), and Bouyges/SAUR; British firm Thames Water (RWE); and the US firm Bechtel (IWL) (Hall 2002). In this overview I will use the term 'multinational companies' or 'multinationals' to refer to the consortia that have been formed amongst these and other organisations including local partners.

There have been various economic, social, environmental and political consequences of water privatisations, which have been the subject of extensive research by others (including Budds & McGranahan 2003; Gleick et al. 2002; Grusky & Fiil-Flynn 2004; Gutierrez et al. 2003; IWA 2006a; and the research of the Public Citizen 2003; and Public Services International Research Unit 2003). I focus on the sense of disillusionment with privatisation of urban water systems in developing countries that these studies uncover, in order to support my arguments that follow. Significantly, these messages of disillusionment come from the public, and more recently, from multinational companies that entered the sector in developing countries.

Public perspective on experiences

Where urban water systems have been privatised in developing countries, generally with no public consultation, the public have experienced excessive price increases and social costs such as job losses often accompanied by low water quality, poor achievement of targets for technical and service standards, poor transparency and allegations of corruption and collusion (Birdsall & Nellis 2002; Hall 2002; Public Citizen 2003). Public opposition has been fanned by the publicity around the negative experiences of populations elsewhere. One such experience was the infamous 'water war' in Cochabamba, Bolivia where street rioting in protest of unaffordable tariffs forced the government to revoke the generous concession given to the multinational consortium under the World Bank's guidance, within months of privatisation (Budds & McGranahan 2003; Lobina 2000; Public Citizen 2003). Another example was the separate outbreaks of typhoid and cholera in the sub-Saharan

[149] Hall and Lobina estimate the private sector has provided access to 900 people per day over the last 9 years. To achieve the Millennium Development Goals requires access to be given to 270,000 people per day.

countries of Gabon and Chad respectively, when the public had no alternative but to seek unsafe water sources due to breakdowns in the distribution systems that resulted from underinvestment and cost-cutting maintenance by the multinationals involved (Hall & Lobina 2006).

The experiences of developing Asian countries further exemplify the disillusionment with water privatisations in the region. There have been few privatisations of public urban water systems in developing Asian countries excluding China – just one in Malaysia, two in the Philippines and two in Indonesia (Hall & Lobina 2006) [150].

The Malaysian concession awarded in 1995 was renationalised less than four years later, following very poor services and low achievement of targets (Hall & Lobina 2006). More recently, the Malaysian government has pledged to exclude foreign participants from its water sector in the future because water "is considered a basic utility and should not be opened for international market forces to determine" (IWA 2006a).

In the Philippines, two concessions [151] awarded in 1997 were the biggest privatisations in the world (Public Citizen 2003). One concessionaire is associated with the lay-off of 2750 workers, and debts of US$240 million. After wrangled negotiations and contract renegotiations, in January 2006 the multinational sold the majority of its shares back to the Philippine government – effectively shifting its debt to the public and renationalising the company (Hall & Lobina 2006; Public Citizen 2003). The other Philippine concessionaire has attracted less attention in the literature. Hall and Lobina (2006) report that the multinational partner in the consortium sold its shares in 2003 and exited the market – an indication of its disenchantment with operating in developing Asia.

In Indonesia, two concessions for water supply in Jakarta were let in 1998, by direct appointment "governed by vested political interest" instead of a competitive bidding process (Shofiani & Gustafsson 2004). In 2004, water tariffs had increased by over 250%

---

[150] Hall and Lobina (2006) note the low level of privatisations in Asia as a "dramatic illustration" of how multinational corporations set the agenda about where to operate based on commercial judgments rather than the need for services. While this may be a contributing factor, multinationals' entry to sub-Saharan Africa suggests that other factors may also be at play. My interviews with Water Board officials in Sri Lanka offered another possible reason: local confidence in local competence, when accompanied by an absence of political interference. They noted:

> "donors can dictate terms if we are weak, as we were in the 70s – if we are timid and listen to whatever they say. … With the ADB, we talk to them one-to-one [on an equal basis] and debate with them …about privatisation or corporatisation or management contracts… They have nothing to say about it. If you take our abilities, our people are as qualified as these people coming as experts." (Interview 2003)

[151] This excludes concessions providing services to industrial estates.

above pre-privatisation levels, while renegotiated contracts allowed the concessionaires to lower their targets for investment (ibid). The renegotiated contractual arrangements include payment of a "water charge" from the water authority to the concessionaires to cover the gap between their costs and revenues from tariffs – providing the concessionaires a guaranteed 22% rate of return on capital and leaving the public water authority to carry the revenue shortfall (Hall & Lobina 2006; Shofiani & Gustafsson 2004). Public outrage has increased further because the companies occupy "posh new offices in Jakarta's business district" instead of the older spaces used by the former public supplier, and because foreign executives were paid significantly higher salaries than local officials in the company (Public Citizen 2006).

The public's disillusionment with water privatisation, perceived as being generally unfair, is summarised by Birdsall & Nellis (2002):

> "… hurting the poor, the disenfranchised, and in some cases beleaguered workers, and benefiting the already rich, powerful and privileged. Privatization is seen as throwing large numbers of people out of work or forcing them to accept jobs with lower pay, less security and fewer benefits; as raising the prices of goods and services sold; as providing opportunities for the enrichment of the agile and corrupt, and generally making the rich richer and the poor poorer."

Multinationals' perspective on experiences

Investors regard infrastructure investments in general (Flyvbjerg, Rothengatter & Bruzelius 2002, p. 78), and in developing countries in particular, as risky, and generally expect a rate of return of 20% or more on investments (Flyvbjerg, Rothengatter & Bruzelius 2002; SIWI 2004). The pro-active enthusiasm of multilateral financial institutions for the privatisation of urban water systems in parallel with other infrastructure services has been a driving force in the creation of a policy climate attractive to foreign companies (Budds & McGranahan 2003). Sharing this enthusiasm, multinationals saw lucrative markets for water services in developing countries; for example, Vivendi (Veolia) projected in 2000 that it would own or manage 20% of Asia's water market by 2010 (Grusky & Fiil-Flynn 2004).

The reality of operating in developing countries has produced neither the anticipated profits nor a satisfied customer base. The nature of buried water distribution assets is such that it is difficult to assess their condition and estimate the investment required (Haarmeyer & Mody 1998); after securing contracts, multinationals have in many cases realised that the quality and/or coverage of infrastructure had been underestimated, and sought to renegotiate contracts (Budds & McGranahan 2003). A majority of contracts in Latin America and sub-Saharan Africa have been terminated or are embroiled in disputes over the agreed levels of investment (Hall & Lobina 2006). Suez (Ondeo) made a loss of 500 million euros as a result of Argentina's currency collapse in 2001, resulting in a net loss to its worldwide business (Hall 2002).

By 2002 multinationals began to express their disillusionment, with J.F.Talbot, chairman of SAUR International, conceding that privatised water services in developing countries were not viable or profitable because "service users can't pay for the level of investments required for social projects" (Hall 2002; Hoering & Schneider 2004). Talbot stated that multilateral financial institutions needed to coordinate subsidies and soft loans without which multinationals "will end up being forced to stay at home", noting that "even Europe and the US subsidise services" (Hall 2002).

Multilateral financial institutions have lately been forced to shift in their rhetoric. While they have been pro-active in promoting privatisation to developing countries, with statements such as:

> "privatisation *is the only way* to get the investment that [poor] countries need…" (Hall & Lobina 2006, emphasis added)

they have taken a more muted stance over the last year:

> "clearly there needs to be significantly increased public investment…There needs to be a recognition private sector investment may have a role too" (ibid).

Agencies such as the World Bank now concede "privatisation was not the only answer – there was the full spectrum of public-private mix of investments instead" (D'Monte 2005).

6.2.4 Conclusions for private sector participation in urban sanitation

The previous section highlighted that in developing countries, there have been many negative experiences with privatisations in the water sector, where 'privatisation' has become synonymous with the participation of multinational utilities and centralised infrastructures. Some of the key factors that have contributed to the problems have been: competition restricted through corrupt practices; regulation too weak; the public in revolt; and the utilities unable to realise the anticipated profits.

At the same time, governments in developing Asian countries struggle to provide sustainable sanitation services to their cities, and the private sector *can* contribute to the resolution of problems if the factors above can be addressed. Thus in this section I draw on the literature to identify conditions that would allow private sector participation in sanitation that would be beneficial to all. I have identified four conditions as necessary – that: strong regulatory frameworks are required; PPP is preferable to privatisation (as defined here) with a public utility in a coordinating role; genuine public engagement is crucial; and participation in the sector should be profitable to the private party. To these necessary conditions I add a recommendation: that participation by local firms is preferable to multinationals. These are elucidated below.

6.2.4.1 Strong regulatory frameworks

It is crucial that strong regulatory capacity is built up to complement private sector participation. Failures in privatisation are attributed to reforms being rushed through while regulatory capacity was weak (Gutierrez et al. 2003; Stiglitz 2002). The corollary, that gradual building of regulatory capacity is a significant factor in successful privatisations, is exemplified in the case of Chile:

> "Chile has done a good job of privatization, particularly in infrastructure… the Chileans took their time. Years were spent on building regulatory bodies and subjecting the natural monopoly firms to regulatory supervision, well in advance of ownership change. Ultimately, they decided that private ownership was still required to tap private capital markets for network expansion. But by the time the new private operators came on board, the Chilean regulators were experienced and ready to deal with them" (Center for Global Development 2005).

From the perspective of a neoclassical economic system, regulatory intervention to correct malfunctioning of the market mechanism is considered one of the handful of tasks for government (Edwards-Jones, Davies & Hussain 2000; J.W. Smith, Lyons & Sauer-Thompson 1999). In the absence of competitive market forces to generate economically efficient outcomes, urban water and sanitation corresponds to a market malfunction or failure (Bakker 2001; Lee & Jouravlev 1997). There is broad consensus that private sector participation in monopoly markets needs to be strongly regulated to protect the public interest – and that successful cases of privatisation have always been underpinned by strong regulation (Birdsall & Nellis 2002; Gutierrez et al. 2003; Kessides 2004; Lee & Jouravlev 1997). Compliance with appropriately designed regulatory instruments such as price caps, service quality standards and environmental performance standards have achieved great improvements in drinking water quality, environmental performance of water utilities and controlling operating costs (Bakker 2001; Seidenstat 2000).

Thus, strong and effective regulation and oversight are essential ingredients for private sector participation in urban sanitation for developing Asian countries. They need to ensure transparency and integrity in contract negotiation, to set out clear processes for dispute resolution, to protect the public through independent review of contracts and independent monitoring of performance on economic, social and environmental fronts (Gleick et al. 2002). Effective regulation limits the potential for corrupt practices to occur and thus enables public confidence in private sector participation, in turn necessary to gain public support and cooperation. Without these, private sector participation is likely to fail to benefit private organisations, the public and government.

6.2.4.2 A public utility in a coordinating role

I argue that private sector participation through PPP arrangements, where a government owned utility remains in an overall coordinating role, is better able to bring the benefits while reducing the risks of private sector participation than other alternatives. Seppälä et al. (2001) argue that PPP enables the public provider to maintain overall coordination and responsibility, and to integrate social, economic, environmental and political values into service objectives. There is greater political acceptance of PPP (Seidenstat 2000), and with a strong regulatory environment as discussed above, can be used to build greater public trust for private firms involved.

The impacts of mistakes with PPP are likely to be less widespread and less irreversible than privatisation, so mistakes can help with learning and building regulatory capacity in parallel with PPP. Gleick et al (2002) points out that the long duration of contracts that come with privatisation arrangements can erode the internal skills in the public domain, effectively making privatisation irreversible. Contracts for PPP are typically of shorter duration than concessions, thereby reducing this risk. In addition, the shorter duration of contracts enable fresh bidding for contracts to occur regularly, that can hold in check any monopoly powers, as discussed in Section 6.2.2.3.

Not surprisingly, PPP contracts such as some Build-Own-Transfer which have lengthy contract periods have been problematic in developing countries where unaffordable prices have often been built into contracts (Hall et al. 2004). In response, Hall et al. (2004) propose that existing lease contracts should be re-appraised and a moratorium held on new long-term lease agreements until lessons for avoiding failures are explored, including lessons for the design and implementation of strong regulatory frameworks.

Seppala et al (2001) assert that PPP outperforms privatisation, on the basis of the successful use of PPP in Finland where publicly owned municipal authorities have overall responsibility and perform the core operations, while the private sector provides a variety of non-core services. They demonstrate that, with proper procedures and processes, PPP has been able to provide viable services in the long-term. By keeping relatively short PPP contract periods, near-continuous competition for contracts amongst potential service providers can be maintained (ibid).

Thus, retaining a public utility in a coordinating role would allow all elements of the service to be provided in a coordinated manner. Private sector participation through PPP with frequent contract renewal would maintain a competitive environment, increasing the likelihood of achieving the efficiencies predicted by neoclassical economics.

6.2.4.3 Genuine engagement with the public

There is a strong case for public participation in decision-making in relation to services that affect them, a case already made at many levels in this thesis and elsewhere. In practice, the public has generally been excluded in decision-making relating to private sector participation in the water sector which has typically involved planners, local authorities and service providers (Gutierrez et al. 2003), facilitated by multilateral finance institutions (Grusky & Fiil-Flynn 2004). The exclusion of the public from the decision-making process has been objected to in principle, on the grounds of the lack of democracy and failure to acknowledge their role as stakeholders rather than passive recipients of services (Gutierrez et al. 2003). I would go further here, to argue that decision-making that excludes consumers is *illegitimate* when they are required to pay for the decisions made by others, especially when the 'user-pays principle' is evoked within institutional reforms promoting private sector participation.

The exclusion of service users has practical ramifications. It can lead to investment decisions that do not take users' needs and context into account adequately (Gutierrez et al. 2003), and ultimately lead to services that consumers are unwilling or unable to pay for, affecting the long-term viability of services. Furthermore, the support and cooperation of the public is central to the success of private sector participation: the demise of several privatisations in the water and energy sectors have been the result of public opposition (Hall, Lobina & Motte 2005).

Irrespective of whether privatisation results in efficiency gains or not, the perception that it results in exacerbation of inequalities in the distribution of wealth, income and political power lie at the root of much of the public's objections (Birdsall & Nellis 2002). Public opposition can manifest itself covertly even where privatisation has been implemented relatively smoothly. In Britain, for example, during a drought in the Yorkshire region, the privatised regional water utility's appeals for water conservation by the public met with customers' non-cooperation, with some even being deliberately wasteful, forcing the utility to tanker water in from another region; these same customers had cooperated with their public water utility's appeals in similar circumstances earlier (Guy, Marvin & Moss 2001).

One of the key recommendations made by Flyvbjerg et al. (2002) for the avoidance of problems related to private sector participation in infrastructure projects, is for performance specifications to be determined through a participatory process involving stakeholders. While their arguments are made with respect to large scale 'megaprojects' which they associate with uncertain facts, high decision stakes and values in dispute, their resolution, consistent with a post normal science approach suitable to such contexts, is applicable to any scale or element of resolution to a messy problem such as urban sanitation (Section 2.7.1; 3.2.1.3).

In summary, the enrolment and participation of the public as stakeholders or partners in private sector participation is necessary to give legitimacy to private sector participation in sanitation, to provide services that meet the needs of users and that they are willing to pay for, and to elicit their cooperation in times of crisis.

6.2.4.4 Prospect for profit to the private party

To be beneficial to all, private sector participants need to have a strong economic case for being able to raise revenues to cover capital and operating costs and generate a profit while providing a service as wanted by users. Where the private sector has been involved in infrastructure 'megaprojects', Flyvbjerg et al. (2002) observe that cost overruns and failures in economic and social terms have been the result of inadequate rigour in the estimation of costs and deliberation about risks. The practice of governments providing guarantees and underwriting these projects is seen as a significant contributing factor in most of these cases. The prospect for profit should exist quite independent of government guarantee. The expectation of high returns of 20% or more appears to be the norm in private investment in water systems (Flyvbjerg, Rothengatter & Bruzelius 2002; SIWI 2004), which are justified only where high risks, or perceptions of high risk, prevail. High returns are unreasonable and unconscionable where government underwriting has reduced risks to near-zero.

In the case of water supply, the objectives for private service providers to cover capital and operating costs and generate a profit can conflict with the social objective of providing an affordable water service. The private water service providers of the nineteenth century limited their clientele to the affluent, and seceded to public providers when required to serve the less affluent:

> "as local governments sought to extend public water supply to areas outside the more affluent enclaves of the city that could afford water service, most early companies could not manage to simultaneously cover the cost of extending service while maintaining affordable rates to full-paying customers and earning a profit. Thus, by the end of the nineteenth century, more than 200 communities had shifted from private to public ownership..."(Seidenstat 2000)

Whether water services are public or private, the disjunct between the need to recover the high cost, and the need to provide services affordable to all, poses an intransigent problem for service providers in developing countries. A development industry 'rule of thumb' defines affordability for water-related services to mean a cost of "no more than 5% of household income"[152] (McIntosh 2003). Since average household incomes are low in developing Asian countries, the total possible revenues from providing 'affordable' water services are too low to cover the cost of supplying the service. As a result, investment in urban water infrastructure is an unattractive business proposition:

> "The private sector does not generally find investment in water infrastructure an attractive proposition because the risks involved are too great, pay-back periods are too long, and many projects are financially not viable in that they are unable to sustain the level of returns needed by the private sector, (…) [since] few customers are in a position to pay [the necessary] high tariffs". (SIWI 2004, pp. 9, 21)

The use of high cost physical infrastructure limits the scope for the private sector to provide quality services and operate at a profit. This dominant technology paradigm is assumed in the literature on private sector participation, with the discussions on sanitation typically stapled to discussions on water supply. In his assessment of privatisations covering infrastructure services in general, Nellis (2006) concludes that privatisation of natural monopoly segments of infrastructure services in low income countries are less likely to produce benefits, even though "in the main and on average", privatisation has produced positive microeconomic outcomes (at the level of the firm)[153]. In particular, the costs associated with water infrastructure are very high in comparison to other infrastructures. Haarmeyer (1992) cites a study comparing several infrastructure services in the USA that concludes that the required capital investment per dollar of revenue for water services was 3-4 times greater than for electricity and telecommunications. Thus, with the exception of a handful of functions, the scope for private sector participation in centralised urban water systems in developing Asian countries is fairly limited.

Urban sanitation presents a very different set of opportunities for profit compared with urban water supply, since sanitation is quite different, although closely linked with water supply (Chapter 1). The intractable problem of cost recovery for urban water supply services does not therefore necessarily translate into the same for sanitation[154]. For urban water supply in developing Asian countries, there is no dispute about the need for

---

[152] It is difficult to locate the origin of this 'rule' or proposition, which is attributed in the literature to the WHO or the World Bank.

[153] He notes that because privatisation is implemented simultaneously with other liberalising policy measures, it is more difficult to conclusively identify a relationship between privatisation and macroeconomic benefits (wider economic growth).

[154] As noted previously, my discussion of urban water supply has included sanitation in a general way, since the dominant paradigm of water-based sanitation is dependent on water supply. However they may be decoupled since water-based sanitation can use alternatives to drinking water supplied by the urban water supply system.

"extending the network to households which have previously been unconnected" (Hall & Lobina 2006), particularly where the opportunities for alternative drinking water supply resources are limited. Sanitation, on the other hand, offers many technological alternatives to piped sewerage, as discussed in Chapter 2, and costly rehabilitation and/or extension of sewerage networks is not necessarily the best way to provide services to urban households that lack adequate services. This differentiation of sanitation from water supply may offer a resolution of the profitability dilemma for private sector participation in sanitation.

Thus, opportunities for designing more contextually appropriate options for urban sanitation, that can integrate with other income-generating activities to supplement affordable tariff-revenues, can develop profitable ventures that invite participation by the private sector.

6.2.4.5 Local firms are preferable to multinationals

I have included a recommendation that participation by locally owned and managed firms is preferable to multinationals or international service providers in this discussion, as a way of increasing the likelihood of beneficial participation by the private sector. However, I note that this is not a necessary condition for participation by the private sector – as are the previous four conditions. Rather, it is more an observation that local firms may be better able to relate to their contexts in providing services.

I have argued that, to foster sustainability, firms need to be in relationship with their wider communities of stakeholders – a perspective common to both ecological economics and Buddhist economics (Chapter 4). I submit that local firms are more likely to feel a greater stake in the wellbeing of their local society, to feel in relationship with their local communities and to act in ways that earn public trust, than multinationals whose actions have historically proved the opposite, as discussed earlier. Stiglitz (2002, p. 57) notes, for example, that "domestic firms may at least be attuned to the social context and be reluctant to fire workers if they know there are no alternative jobs available" and be willing to bear a marginal increase in costs. He proposes that foreign investors may feel "a greater obligation to their shareholders to maximise stock market value by reducing costs, and less of an obligation to what they will refer to as an "overbloated labor force"", and thus not hesitate to shed employees to cut costs.

Local firms may also be able to manage some types of risk better than foreign firms, for example foreign exchange risk, or anticipating political and other contextual risks. They can contribute local knowledge about the commercial realities and business context, amongst other things, to a deliberative decision-making process such as described in Chapter 5.

My proposition that local firms are preferable to multinationals does not, however, mean that they would necessarily be more caring about the wellbeing of their communities simply because they are local firms. This was demonstrated by British-owned private water utilities in Britain, who disconnected water supplies to their low-income customers for non-payment of bills – plunging them into appalling sanitary conditions[155]. I contend that additional factors are needed, and in Section 6.4, explore a potential moral framework that could provide a supplementary guide for the behaviour of local firms.

One of the difficulties in applying this recommendation could come from international donors who provide infrastructure aid with conditions that contracts be given to the private sectors of donor countries[156]. As noted in Chapter 1, such aid can pose an obstacle to developing Asian countries deciding on contextually appropriate resolutions to their problems using deliberative processes as advocated in this thesis. Further concerns about the participation of foreign investors are raised by Ayine et al. (2005), on the basis of their wide ranging study of how contracts are negotiated with host governments in developing countries. They observe that confidentially negotiated 'deals' are made, where governments keen to attract foreign investment regularly sacrifice sustainable development to provide for the interests of these investors.

In conclusion, the question of whether urban sanitation services should be provided by a public or private entity has no dichotomous 'either/or' answer. In many cases, there is no inherent advantage of private provision over public provision. Budds and McGranahan (2003) argue that the kinds of problems that have arisen with privatisation of water related services can also be encountered with public provision, while the improvements gained through privatisation can also be achieved by appropriately reformed public services. Seppälä et al. (2001) observe that most sources of financing that the private sector has access to are equally accessible to the public sector. Thus, it might appear that, provided other conditions such as a strong regulatory environment exist, it should not matter whether it is the public or private sector that provides sanitation. I have argued however that on a whole of society basis, cooperation between the two is likely to provide better outcomes than either could provide alone. The public service provider is essential to play an integrative coordinating role, in particular to ensure services to the economically deprived where the opportunity for the private sector to make a profit is generally perceived to be low. At the same time, the private sector can bring skills and commercial disciplines into some elements of the service, facilitating improvements while generating a profit.

---

[155] Disconnections led to an increase in the number of cases of dysentery in most urban centres (Lobina & Hall 2001; Public Citizen 2003). Low income housing residents, unable to flush their toilets, are reported to have been "defecating in stairwells and throwing excrement out of the window" (The Guardian 22 September 1992, quoted in Martin 1996). The British government had to intervene by passing a Water Industry Act in 1999 to prohibit disconnection for non-payment of bills (Public Citizen 2003).

[156] A recent invitation to tender for a wastewater project in Colombo funded by the Swedish International Development Cooperation Agency (SIDA), for example, was open only to "Tenderers from the European Union Countries" (NWSDB 2006).

6.3 Opportunities and barriers for private sector participation

For the private sector to enter a market, it needs to see a market opportunity to fulfil a need while generating a profit, and be motivated to overcome any barriers to doing so. That there is a need to be fulfilled with respect to improved urban sanitation in developing Asian countries has been the argued in this thesis. In order that the private sector consider participating in this sector, I need to demonstrate that there are opportunities for commercial venture, to identify barriers and to indicate how they may be overcome, including addressing public distrust towards the private sector in general.

While the opportunity for private sector participation in centralised sanitation services in developing Asian countries may be limited (Section 6.2.4.5), a fresh set of opportunities are presented by emerging trends in distributed infrastructure occurring around the world. Graham (2000) describes this trend as the appearance of differentiated infrastructure services across different enclaves within cities. Most notable amongst these is the emergence of 'premium' network spaces catering to corporate and upper-income segments of urban populations all around the world – such as financial enclaves, business estates and gated communities that bypass public infrastructure services to cater to their particular requirements. Graham (2000) sees this as part of a shift in urban planning towards pragmatism in addressing perceived local problems, leading to "a collage of highly differentiated spaces and settings", rather than "utopian or visionary frameworks for re-engineering metropolitan regions according to idealized blueprints of desired urban forms". The trend towards 'premium' network spaces could represent a withdrawal of the more affluent members of the public from the uniform services delivered through costly centralised infrastructure for the general urban population – a trend that would put further pressure on recovering costs from the centralised model.

I see this trend of differentiated infrastructure services distributed across a city as a further opportunity for departure from a centralised model, especially for cities in developing Asian countries that lack infrastructure. It could provide an opening for the emergent ways of thinking discussed in Chapter 2, that promotes the evaluation of diverse technological options of different scales on an equal basis, with the emphasis on matching the service with the needs in context – replacing the customary 'predict and provide' approach with an 'end-use, integrated resource planning approach' (Mitchell & Campbell 2004). This approach opens the opportunity for a range of sanitation technologies and services to be chosen for different urban localities, which the private sector may provide. Although it may be feasible for privatised entities to provide high-cost services profitably in the most affluent enclaves, I contend that public-private partnerships are still preferable: the public service provider should play a coordinating role, to take an integrative approach to distributed urban water services (water supply, sanitation, stormwater management), and to

capture synergies from differentiated spaces such as implementing water quality cascades[157] across the city, thereby reducing costs for society as a whole.

A clarification of terminology is in order, as I make a distinction between the terms 'distributed' and 'decentralised' which are frequently used interchangeably by others. I define distributed sanitation as the application of a number of different intermediate-scale technological systems to different 'enclaves' or urban spaces within a city. My definition of decentralised sanitation as distinct from centralised sanitation is based on Crites and Tchobanoglous' (1998) definitions of these terms:

> "Decentralized wastewater management (DWM) may be defined as the collection, treatment, and disposal/reuse of wastewater from individual homes, clusters of homes, isolated communities, industries, or institutional facilities, as well as from portions of existing communities at or near the point of waste generation";
>
> and,
>
> "Centralized wastewater management …consists of conventional or alternative wastewater collection systems (sewers), centralized treatment plants, and disposal/reuse of the treated effluent, usually far from the point of origin" (Crites & Tchobanaglous 1998, p. 2).

I extend Crites and Tchobanoglous' definition beyond water-based sanitation technologies (i.e., 'wastewater') to include all sanitation technologies. The crucial difference between decentralised and centralised sanitation is the proximity between where waste is produced and where it is treated and disposed/reused. Decentralised sanitation is concerned with treatment and disposal/reuse "*at or near the point of waste generation*". Distributed sanitation can include all decentralised options as well as conventional piped sewerage systems that are focussed on transporting waste far from the enclaves for treatment and disposal/reuse if their context determines this to be the best option[158].

Opportunities for the private sector in sanitation are identified in the section that follows, within the context of distributed urban sanitation in cities comprising of differentiated spaces, and as partnerships with public service providers who retain responsibility for services overall. The lack of extensive investment in centralised sanitation infrastructure in developing Asian countries gives them a greater opportunity to consider distributed options, compared to industrialised countries that are committed to maintain their enormous investments and sunk costs in centralised and neo-centralised infrastructures.

---

[157] Water quality cascade is a progressive re-use of water where the 'waste' water from one task is used for another task that can use a lower quality of water. For example, rainwater may be used for laundry, grey water from laundry may then be used by industries such as tanneries.

[158] Conventional sewerage as distributed sanitation is distinguished from centralised sanitation on the basis of relative scale: centralised sanitation would have this technology applied across an entire city; distributed sanitation would use this for smaller urban spaces.

6.3.1 Opportunities for PSP in distributed urban sanitation[159]

Three elements to the business opportunity in distributed services in sanitation are identified and elucidated: the potential for market growth, opportunities for new products, services and investors, and improvement on the existing service provision modes (Berry et al. 2004).

Potential for market growth:

Distributed infrastructure services for other utilities such as electricity and information and communication technology (ICT) are already growth industries (Gas Research Institute 1999; Jones & Petrie 2000), with distributed water supply markets at its early stages (Berry et al. 2004). These have spawned a range of new technologies and service industries and continue to gain maturity as a services market. The distributed wastewater industry is in its embryonic stages, but identified as an important growth market in industrialised countries in North America, Europe and Australasia, supported by initiatives such as the National Decentralized Water Resources Capacity Development Project in the USA (NDWRCDP 2004) and many pilot and estate scale examples (Dietzmann & Gross 2003; West 2003).

Opportunity for new products, services and investors:

The distributed infrastructure technologies and services require designers, component manufacturers, component importers, manufacturers, assemblers, installers, managers, maintenance and repair personnel. The associated efficiency technologies and services require a similar range of agents for designing, installing and maintaining retrofits as well as for audit and monitoring services. The reuse and recycling focus brings another group of actors to provide the services for processing biosolids, transporting and distributing agricultural nutrients, and producing energy, including equipment manufacturers, health and safety personnel, distributed energy service providers, labour contractors and others. Finally the emergent era can attract new investors such as ethical investment funds to enter this arena.

[159] This section is largely based on the paper titled "Can Corporate Social Responsibility resolve the sanitation question in developing Asian countries?" co-authored with Associate Professor Cynthia Mitchell and Professor Stuart White (Abeysuriya, Mitchell & White 2007).

Improvement on the existing service provision modes:

In addition to the opportunities for PPP arrangements with centralised technologies that currently exist, the emergent approaches bring new opportunities for the participation of many actors in an industry with a 'retail and service' focus. Recent Australian studies show that decentralised systems for densely populated areas can be as cost effective as centralised systems that are commonly associated with economies of scale, when evaluated on the basis of whole of society costs or life cycle costs, and the benefits from effluent re-use are included for integrated water supply systems (Fane & White 2001; Mitchell & White 2003). A German study (Peter-Fröhlich et al. 2003) concludes that decentralised systems that include nutrient recycling and energy generation can cost less than conventional sewerage services that connect to existing centralised infrastructure. Decentralised or intermediate scale sanitation systems are generally less resource intensive and have lower environmental impacts, and are regarded as better able to meet broad sustainability criteria than centralised systems (Lens, Zeeman & Lettinga 2001; Newman 2001). Failure risk from distributed systems is decreased, since the consequences of failure are limited to smaller geographical areas rather than causing collapse of the whole system (Wilderer & Schreff 2000). Shorter lead times between planning and commissioning, greater adaptability to meet changing needs, and less risk or need for excess capacity are amongst other advantages listed (Beecher 1996; Lovins 2002; Pinkham et al. 2004). The emergent stage, for both decentralised and conventional technological configurations, present possibilities for resource reuse, energy generation and recycling, which also offer benefits in terms of avoided imports of fertilizer and fossil fuels and their attendant environmental impacts.

The 'leap frog' necessary to take developing Asian countries from the current situation of inadequate urban sanitation to the emergent era described in Chapter 2 is facilitated by the entry of the private sector, and creates new opportunities for private sector participation. However, the presence of barriers, explored in the following section, means that opportunities alone are insufficient incentive for attracting the required levels of private investment in sanitation.

6.3.2 Barriers to PSP in urban sanitation

A number of issues act as barriers to the creation of and participation in an emergent era sanitation industry. Current social norms reflect a phobia towards discussing or confronting our own defecations, which can act as an obstacle to perceiving sanitation as a business opportunity. While there may be certain first-mover advantages, there are inherent risks in entering a brand new market. There is a paucity of data to base estimates of costs and potential profits outside of pilot-scale examples (Peter-Fröhlich et al. 2003). Haarmeyer and Mody (1998) observe that small size projects often find it more difficult to attract finance,

because transaction costs are proportionately higher than for larger projects[160]. Investors regard infrastructure investments in general (Flyvbjerg, Rothengatter & Bruzelius 2002, p. 78), and in developing countries in particular, as risky, and are reluctant to invest (SIWI 2004). At the same time, the government guarantees underwriting private investment in infrastructure projects in both industrialised and developing countries, has often resulted in situations where the public has had to bear a much higher cost for the investment than if the government itself had invested in them (Flyvbjerg, Rothengatter & Bruzelius 2002; Lux 1990; Shofiani & Gustafsson 2004), contributing to distrust and intense public opposition to private infrastructure service provision in general, in addition to the issues identified in Section 6.2.3 for the water sector.

Given these barriers and opportunities, what will it take to move towards the emergent stage in urban sanitation consistent with sustainability? Inayatullah (2002) proposes that the future is shaped by an interplay of *pulls*, *pushes* and *weights,* where *pulls* are images of the future or factors that attract movement towards the desired futures, *pushes* are factors that drive or force movement in the desired direction and *weights* are factors that hold back movement. Increasing the strength of pulls and pushes, and reducing the weights can aid movement towards a desired future. The business opportunities described earlier represent one possible set of 'pull' factors – others can include government incentives. Commonly, 'push' factors might be provided through external interventions such as government legislation or conditions imposed by external agencies such as international lenders. The mindsets and attitudes described as barriers above can act as 'weight' factors that hold back private sector interest in participation in sanitation.

The urgency with which sanitation needs resolution means that we should draw on all other available means for creating the additional factors that act as 'pushes' or reduce 'weights'. For this, I therefore turn to seeking factors that are more *internal*, to motivate the private sector to appropriately enter the solution space of this problem through moral arguments. Drawing upon moral arguments is consistent with the sustainability discourse's explicit commitment to ethics and morality, and therefore with the emergent approach to sanitation, as identified in Section 2.7.1. I have identified the corporate social responsibility discourse as a potential line to follow, because it has been a motivating force for questioning some of the fundamental assumptions that form the basis for business practice. In what follows, the relationship of corporations with society is examined, and a moral framework to surmount the barriers is explored. This framework calls corporations to action that deserves and earns public trust, beyond simply acting within the law.

[160] They suggest that banks find projects requiring smaller investment less attractive because the costs of structuring finance – such as due diligence and legal fees – can be as high as for a larger project which brings higher fees to banks.

6.4 Using the Corporate Social Responsibility discourse to identify ways to surmount barriers [161]

The corporate social responsibility discourse is of relatively recent origin, although most large corporations have always included some aspects of caring social activity within their management practices (Wilson 2001). There are many understandings of what corporate social responsibility means, resulting in a spectrum of motivations, with diverse positions taken and a number of alternative labels including socially responsible investment (SRI), corporate engagement with communities (CE) and corporate community involvement (CCI) and several others (Roy 1999; Weiser & Zadek 2000). I use the term CSR to loosely refer to all of these concepts, defined by their common purpose for facilitating the move towards a socially and ecologically sustainable future through voluntary business activities. I will henceforth refer to all private business entities as corporations, noting that these include an array of different legal and operating structures.

The conversations around CSR have taken place in a context where CSR is viewed as the 'missing link' in resolving the disjunction between economic growth under market economics and its negative consequences (Freeman & Liedtka 1991). A growing body of research suggests that capitalism, industrialisation, globalisation and market economics may have been carried too far, with too much emphasis on economic development based on growth in material consumption, and not enough attention on ecological limits or social constraints, that has resulted in increased poverty, injustice, and ecosystem degradation as a consequence of economic development (Daly 1990; Hamilton 2003; Saul 2005; J.W. Smith, Lyons & Sauer-Thompson 1999). International organisations, society, and corporations themselves, are increasingly seeing a role for corporations in mitigating the negative consequences of economic development and in aiding sustainable development (J. Nelson & Prescott 2003; SIWI 2002; Wilson 2001).

There are many issues debated within the CSR discourse (Weiser & Zadek 2000); I identify two of relevance here. The first relates to the question, 'to whom does a corporation owe its primary responsibility?' At one extreme of the range of possible answers, it is argued that shareholders own the corporation, and its managers are employed expressly for the purpose of maximising the value for them: it is the fiduciary duty of corporations to maximise value for its shareholders (Friedman 1970; Porter & Kramer 2002). At the other extreme it is argued that the success of a corporation crucially depends on the contributions from other stakeholders – employees, suppliers, customers and others who have something at stake; therefore maximising value for *all* its stakeholders ought to be the corporate priority. Some see the creation of value for these wider stakeholders as the *means* by which shareholder value is created (Johnson & Johnson undated). The debate is fuelled by the recent wave of

[161] This section is substantially based on the paper titled "Can Corporate Social Responsibility resolve the sanitation question in developing Asian countries?" co-authored with Associate Professor Cynthia Mitchell and Professor Stuart White (Abeysuriya, Mitchell & White 2007).

downsizing and shedding of employees as a mechanism for increasing short term shareholder value (Kennedy 2000; Lazonick & O'Sullivan 2000), bringing the interests of shareholders and other stakeholders directly into conflict. The shareholders in this context are perceived as 'pitted against' the other stakeholders, creating winners and losers.

The second relevant debate in CSR relates to the question, 'to what extent should a corporation expect to benefit from its CSR activities?' Early in the discourse, Friedman (1970) argued that engagement in CSR amounts to giving away shareholders' money, which is beyond the mandate given to managers. This reflects an interpretation of CSR as something equivalent to corporate altruism that returns no tangible benefit to a corporation. Thus he argues that CSR investments that directly or indirectly benefit a corporation, and are therefore justifiable from self interest, may be fraudulent or "hypocritical window-dressing" (Friedman 1970). More recently, others have taken the position that CSR should be an element of good business practice that strategically chooses ways to benefit both society and the corporation (Porter & Kramer 2002), driven by a sense of 'enlightened self interest'(UN 2005). Consensus appears to be building around the latter position as the way to ensure that corporations take CSR seriously and remain committed to it for the long term (Roy 1999; SustainAbility 2004).

A shared understanding of the relationship between corporations and wider society offers a point of resolution of the above issues. The debate reflects the different perspectives on this relationship. At one end of the spectrum, neoclassical economic ideology sees a profit-maximising corporation as isolated and in competition with other corporations, with government and with the labour force (Bowie 1991). At the other end of the spectrum is the stakeholder view of a corporation, as a network of relationships and stakeholder interests – of managers, other employees, shareholders, customers, suppliers, local communities, government regulators and legislators, political groups and activists (Donaldson & Preston 1995; Freeman & Liedtka 1991; J.A. Nelson 2004; Söderbaum 2003). The former view supports the pursuit of the sole objective of increasing shareholder wealth, assuming that benefits for society as a whole would follow through the action of Adam Smith's famous metaphorical 'invisible hand'. Lazonick and O'Sullivan (2000) argue that this is not borne out empirically; the maximization of shareholder value as the sole driver of corporations has come at the cost of national prosperity in the USA. The perspective of corporations as co-constituents of the network of relationships is promoted as one that will facilitate the necessary shifts in thinking needed for sustainability (Söderbaum 2003). I adopt this latter view, which is explored further in the following section.

6.4.1 A moral framework for a corporation as a relational metaphorical person

In society, relationships are fostered within a framework of social and moral codes that underpin social norms that dictate the behaviour of individuals in society. Social norms extend behaviours beyond the minimum required by law, and are essential for protecting

the social fabric and sharing resources without high enforcement costs. Dasgupta (1997, p. 12) notes that social norms are "self-enforcing behavioural strategies" which are "a way the rule could be enforced without the community's having to rely on the coercive powers of a higher authority (for example, the state)." It is appropriate that legal systems should not stipulate social behaviours beyond a minimum necessary for the orderly functioning of society. More exacting legal stipulations are likely to represent the ideals of particular power groups, and their enforcement is likely to be oppressive, whereas the minimum requirements are more likely to overlap the diverse ideals of wider society. A gap between what is legally required and socially desired preserves natural liberties; it allows individuals the 'freedom to offend' and earn social censure, or to act with benevolence and earn social esteem[162]. In this section, I propose that a moral code for corporations could elicit performance from corporations that better reflect their co-constituency in the relational network of society, than the minimum required by law.

Corporations' law treats a corporation as a metaphorical person with rights that correspond to those of real people, such as the right to autonomy and economic freedom (Dunn 1991). Bakan (2005) suggests that the metaphorical person that is a corporation, when it sees its sole purpose to be serving the financial interests of its shareholders, may be inclined to behave in ways comparable to a pathological psychopath: being singularly self-interested, manipulative, lacking empathy and disregarding social obligations. Corporate conduct that Bakan likens to psychopathy represents a disregard for the moral codes and behavioural norms of society, which suggests the perpetrator's sense of disconnection from other members of society. I submit that corporations' law reinforces this disconnection and facilitates the metaphorical person to limit its moral responsibility to the minimum, of simply abiding by the law. The legal frameworks treat a corporation as quite separate even from its managers (Dunn 1991; Velasquez 2003); although it is the managers who drive a corporation's activities and therefore define its character, legal safeguards allow them not to be held responsible for this character. Since a corporation itself lacks the intentionality to be morally responsible for its actions (Velasquez 2003), the law facilitates the moral expectations from this metaphorical person to be set lower than what is expected of real people in society. Thus, society appears to tolerate behaviours from corporations that would be unacceptable from real people.

In the stakeholder view of a corporation, this metaphorical person is in relationship with other members of society. Since the legal frameworks do not adequately acknowledge this connectivity, I argue that behavioural norms based on a moral code would be needed to foster this relationship. What moral code might be applied to this metaphorical person as a member of a sustainable society, which would also be consistent with a corporation's need to remain financially viable?

[162] The comments of an anonymous referee of the journal *Ecological Economics* are gratefully acknowledged in the development of this point.

I have identified Buddhist economics as a potential moral framework for corporations as metaphorical persons, complementing its perspectives on economic cost recovery explored earlier (Chapter 4). This choice is particularly apt for corporations, because Buddhism is described as a moral philosophy that actively encourages seeking and possessing material wealth within certain ethical boundaries (Payutto 1992), consistent with its advocacy of a 'middle way' that avoids both extremes in self-indulgence and in self-mortification (Rahula 1996, p. 45). Interestingly, there are several consistencies between a Buddhist economy and the wealthy society that Adam Smith envisaged – though this should not be surprising when considering the likely influence of Smith's role as professor of moral philosophy on his ideas on economics (Alvey 2000).

I contend that a sustainable society is necessarily a 'wealthy' society, in that it is fair and just and meets human rights including rights to a standard of dignified living – which requires meeting socio-political and material needs using economic resources. Material welfare has a moral purpose in Buddhist economics, as the necessary precondition that enables the pursuit of higher spiritual goals. Therefore poverty is discouraged and the possession of wealth is praised (Payutto 1992). The ethical basis for possessing wealth originates in the karmic law of cause and effect that links all things in an interacting chain (Payutto 1992; Rahula 1996). This view overlaps with the systems perspective that characterises the sustainability discourse (Peet 1992, p. 78), which Buddhism extends by including mind and intent into the system. Accordingly, in the Buddhist economic system, the ethical quality of intentions and actions *define* the outcomes that result, so that ends can never justify the means (Section 4.6). This sets the ethical boundaries to the seeking and possession of wealth. Firstly, wealth should be acquired through ethical methods and with 'good' intentions behind them; second, wealth should be used to improve the welfare of oneself and others without causing any harm; and third, wealth should be possessed without mental attachment, so its holder is not enslaved by it, nor under an illusion that it may be an end in itself (Payutto 1992).

Individual wealth is meant to serve a greater societal purpose. Payutto (1992) interprets the Buddhist teaching thus:

> "When the wealth of a virtuous person grows, other people stand to gain…"
>
> and,
>
> "Although it belongs to one person, it is as if it belonged to the whole community".

Alvey (2000) points out that Adam Smith similarly connected a moral purpose to the wealth of individuals for the improvement of nations. Smith stated that it is wealth founded on "private frugality and good conduct of individuals… [that] …maintained the progress of England towards opulence and improvement", and preventing abject poverty from driving people to the immorality of "abandoning their infants, their old people, and those afflicted with lingering diseases" (A. Smith [1776]1904, II.III.36 and I.I.4).

Alvey (2000) argues that Smith never advocated unfettered self interest, but rather, a system of natural liberty underpinned by morality. The societal purpose of wealth was articulated more radically by millionaire philanthropist Andrew Carnegie, one of the originators of the notion of CSR, that wealthy individuals and businesses should see themselves as stewards of their property, held in trust for the rest of society (Freeman & Liedtka 1991):

> "Holding it in trust for society as a whole, they can use it for any purpose society deems legitimate. However, it is also a function of business to multiply society's wealth by increasing its own through prudent investments of the resources that it is caretaking." (as quoted by Freeman & Liedtka 1991)

How may a corporation achieve this societal purpose without bankrupting itself? For the individual, Buddhist economics instructs how to serve this purpose through allocating one's income to each of four areas in accordance with one's means (Payutto 1992; Rahula 1996), which I submit may be translated to apply to the metaphorical corporate person. The areas of allocation for the individual, and their extension for corporations, are set out in Table 6.1.

The relational stakeholder view of corporations is consistent with the Buddhist view of humans' (and metaphorical person's) existence within the simultaneous spheres of the individual, society and the environment (Payutto 1992). This view is reinforced by Adam Smith thus:

> "Man, according to the Stoics, ought to regard himself, not as something separated and detached, but as a citizen of the world, a member of the vast commonwealth of nature. To the interest of this great community, he ought at all times to be willing that his own little interest should be sacrificed" (A. Smith [1759]1790, III.I.53).

The interconnected and relational nature of individuals and society should align the interests of the metaphorical person with society's interests; in cases when they may be in conflict, Smith is clear on the order in which their relative interests should be prioritised.

Allocations for an individual's income	Allocations for a corporation's income
Spend a portion[163] for meeting the needs of one's self and dependents	Make returns to shareholders, pay fair wages to employees, pay fair prices to suppliers
Spend a portion generously on friends	Invest in serving the interests of stakeholders, others who have contributed to the success of the corporation, directly or indirectly
Re-invest a portion to create more wealth	Make prudent investments to ensure continued success in business
Spend a portion on good works to increase well being in society.	Engage in philanthropic works

Table 6.1: Buddhist economics' recommended areas for allocation of a person's income, and their translation for a corporation as a metaphorical person

Based on the above moral perspectives, I conclude that corporations have a key role to play in bringing about the economic prosperity of *societies* that they are connected with, and not just their shareholders. This provides a moral imperative for corporations to seek ways to resolve society's problems in ways that bring profit to it within the ethical boundaries of this moral framework. This requires commitment to strong business ethics and sound business decision-making processes to underpin its corporate citizenship (Roy 1999, p. 54).

The moral purpose of corporations as the enablers of societal prosperity provides a 'push' over the barriers to market entry. A corporation that sees itself as connected to society places a value on societal returns such as improved human health and dignity, societal well-being, and public amenity. Counting non-monetary returns from social investments can be viewed as 'additive' to the monetary returns, consistent with strategic CSR. Governments

[163] Although the Buddhist scriptures refer to the 'portions' as 'quarters', suggesting equal allocation of spending in the four areas, I submit that its intended message is the principle that individuals (and corporations) *should not neglect support to any one of the areas*, rather than to prescribe the level of commitment to each area. Such prescription appears common amongst many 'traditions', such as Christian and Jewish traditions to tithe 10% of one's income to support religious institutions. Gardiner (2004) argues that such prescriptive rules may not produce the best outcomes. To allocate a prescribed 10% or 25% portion of their income to other uses can be oppressive to the poor (and poorly performing corporations) if their total income is barely sufficient to meet their immediate basic needs. At the same time, the wealthy (and corporations making high profits) may be able to meet the needs of themselves and their dependents quite comfortably using a smaller fraction of their large incomes, and be able to allocate larger portions to the other areas. For this reason, I have used the more flexible and contextually interpretive term 'portion' instead of 'a quarter'.

can play a key role in reducing the risk for corporations at the initial stages of a fledgling industry, through initiatives such as investing in distributed sanitation infrastructure themselves and providing third party access to corporations. The 'weights' of societal taboos associated with sanitation may also be reduced through the moral imperatives, drawing new actors to this essential service that underpins public health, human dignity and environmental resource protection.

The difficulty of attracting finance for relatively small distributed systems (Haarmeyer & Mody 1998) may be overcome by morally motivated financial institutions without contradicting their need to remain profitable, as has been demonstrated by the Grameen Bank – "the embodiment of a successful capitalist enterprise that combines both the concept of financial returns and of social returns" (Yunus 1998). Finally, engagement between the companies, the public and government as partners in achieving the moral purpose of increased wellbeing for individuals, society and the environment by resolving problematic sanitation can build relationships and trust between the stakeholders.

6.5 Conclusions

The aim of this chapter was to identify who should take responsibility to deliver the urban services broadly specified through sanitation planning as discussed in the previous chapter; what broad sorts of institutional arrangements should be used; and what motivations might drive these actors in this task. This addressed my third research question: *How might planning decisions for sustainable sanitation be implemented: who might be involved and what might motivate them?*

Publicly owned utilities and profit-motivated private firms were identified as the two candidates to deliver services. Examining the experiences with private sector participation in the water sector led me to draw several lessons that inform the design of institutional arrangements for a sustainable sanitation service. This led me to identify four conditions as necessary for reducing potential problems arising in a collaboration between the private and public sectors. These were the necessity for: a strong regulatory framework; a public service provider to retain overall responsibility for coordination, with the private sector participating through public-private partnerships (PPP) arrangements; genuine engagement with the public about specifying the services they require; and prospects of profit to the private agent without government underwriting of risk. A fifth condition was identified as not necessary but desirable: that the private partners be local firms rather than international or multinational consortia. I concluded that cooperation between public and private actors could provide better outcomes than either one alone, made complete with government oversight and public support in a four-way relationship.

The scope for profit is limited in developing Asian countries when high cost infrastructures are used, notably with conventional centralised urban sewerage systems. The emerging

trend towards a growing market in distributed utility services provides a range of fresh opportunities for the private sector to design and deliver profitable services, in addition to the limited opportunities for profitable provision of non-core elements of a centralised service. While these opportunities may be attractive 'pull' factors inviting the private sector to invest in sanitation, significant barriers remain. In the final section of the chapter, I explored the corporate social responsibility discourse supplemented by explicitly moral arguments as a means to create the necessary 'push' factor to overcome these barriers, to supplement more traditional regulatory factors.

The Corporate Social Responsibility discourse offers a bridge between the profit motives of market economics and the social and ecological effects, including human rights, that have been neglected in the market economy as manifested. The commitment to corporate citizenship and social accountability founded on strong business ethics and sound business decision-making processes, has the potential to provide the necessary 'push' and 'pull' factors as well as reducing 'weight' factors, to facilitate the successful participation of businesses in meeting the human right to sanitation.

The CSR discourse may be strengthened by a broad acknowledgement of the relationship between business and society. Businesses are not natural entities but are given 'substance' through the legal and social context in which they are created. Thus, they are co-constituents of their social context and the network of relationships it comprises. Building on this relational view is crucial for the involvement of businesses in the delivery of sanitation – both in capturing the benefits and overcoming the barriers.

Moral codes and social norms can be effective in achieving conduct that is consistent with society's values and needs. I have argued that a moral code on the basis of Buddhist economics could guide managers of businesses to shape the conduct of the businesses they manage in ways that meet social values and needs while remaining profitable. Adherence to a moral code has the potential to achieve goals that go beyond the minimum demanded by the law, to display conduct that goes 'beyond compliance'.

An orientation of corporate citizenship founded upon a relational view of themselves and a moral code could catalyse businesses to take these opportunities and calculated risks for the benefit of themselves, the public and the environment.

7 Conclusions

7.1 Summary of thesis arguments

The aim of this thesis has been to contribute to the resolution of problematic urban sanitation in developing Asian countries in ways that are consistent with ideas about sustainability.

The first step on this journey was to find out what the current situation was, and how it came to be – or what Meadows calls "[to] get the beat":

> "Before you disturb the system in any way, watch how it behaves…learn its history. Ask people who've been around a long time to tell you what has happened (…) direct one's thoughts to dynamic, not static analysis. Not only to "what's wrong?" but also to "how did we get there?" and "what behaviour modes are possible?"…" (Meadows 2002)

Through interviews with institutional stakeholders in Sri Lanka, I characterised urban sanitation as a complex problem with multiple perspectives on its causes and long-term resolutions, underpinned by certain worldviews. I examined the history of the dominant model for urban sanitation as it developed in industrialised countries, and the range of alternatives that have developed, which I interpreted against Kuhn's theory of paradigm revolutions (Kuhn 1970).

These led me to I argue that conventional approaches to urban sanitation planning modelled on industrialised countries are not necessarily the most appropriate to the contexts of developing Asian countries. The high cost of installing and operating the associated piped sewerage networks, and their environmental consequences, raise questions about both their feasibility and their desirability for these countries. While the emerging range of alternative technological approaches is promising, there are associated concerns with these as well. The 'answer' is then not simply a matter of replacing conventional technology with an alternative technology, but a possible move to distributed systems where a range of different technologies are chosen to suit the range of different local contexts that work in coordination to provide sanitation for a city as a whole.

Urban sanitation in developing Asian countries is a seemingly intractable problem as highlighted in Chapter 1, and seems to fail to capture political imagination and will, so that decision-makers are more likely to prioritise other urgent but less intractable urban problems above sanitation. Thus, I have seen my research task to be, to indicate a less intractable path to resolving the problem. As I see it, the main challenge is about making *planning decisions,* which would then determine and shape feasible technical and management choices for urban sanitation systems. Seeking to address complex,

interconnected and rapidly escalating problems related to the interaction of humans with each other and the environment – of which sanitation is one aspect – is the aim of the sustainability discourse. Therefore, this was a natural recourse to turn to for guidance.

I characterised the sustainability discourse as a loose collection of discourses concerned with sustainability, defined by commitments to transdisciplinarity, democracy and ethics. I have therefore woven these three strands into my research. Transdisciplinarity has been the overarching methodology used to integrate a wide range of subjects into this work. I proposed a decision-making process that stresses democracy and transdisciplinarity by bringing the public, stakeholders and a wide range of disciplinary experts into the process. And I have drawn on Buddhist moral philosophy to highlight ethics and 'right motivation' in making decisions (about sanitation) as well as in providing a rationale for 'caring' which I contend to be the underlying ethic for sustainability.

To resolve problematic sanitation with an alignment with sustainability, questions needed to be addressed at a range of levels. In order to elucidate my questions, I draw on the 3-level structure provided in management literature, namely the strategic, tactical and operational levels that deal with the long term, medium term and short term respectively. These levels may be associated with Checkland's (1999) evaluation criteria based on the "3Es": effectiveness, efficacy and efficiency. The effectiveness question is asked at the strategic level: 'what is the right thing to do?' The efficacy question is at the tactical level, addressing how the aims and objectives (determined at the strategic level) should be met. The efficiency question is addressed at the operational level, about getting as much desired outputs with as few input resources as possible.

To be internally consistent, the strategic questions needed to be addressed first, and tactical questions needed to be addressed next, while maintaining alignment with strategic intentions. Operational or efficiency questions aligned with the strategic and tactical goals are the last to be addressed. Since I advocate democratic decision-making processes, I cannot legitimately provide definitive 'answers' to form the basis of operational level questions; the prescription of specific 'solutions' was thus left outside the scope of this thesis (Section 1.4). However, my analysis of the history and current status of technological and institutional practices of sanitation is able to inform questions at the operational level.

My first research question was thus located at the strategic level: *What intellectual contribution can the sustainability discourse make to provide direction for heading towards sustainability in urban sanitation planning for developing Asian countries?* Its intent was to uncover '*what is the right thing to do*?' when sustainability is a core value.

Key sustainability concepts for sanitation

My review of sustainability literature to answer my first question led me to a number of interrelated elements that I identified as central to planning for sustainability in sanitation. The overarching notion for this thesis has been the requirement for according legitimacy to, and accommodating or integrating, multiple perspectives. Several other key elements from the discourse may be argued to be overlapping with this notion. For example, an aspect of transdisciplinarity is to seek to accommodate and integrate multiple disciplinary perspectives. Deliberative democracy is a practical tool for giving voice to multiple perspectives and for accommodating them within decision-making. A systems perspective may be interpreted as a holistic view of interrelations between different perspectives. An explicit commitment to ethics and morality may be seen as a way of respecting needs from different perspectives in time and place.

A second key idea from the sustainability discourse was the framing of sustainability as "a learning concept" (Meppem & Gill 1998). Complex or messy problems are embedded in ideas about complex systems, whose behaviours are difficult to predict or control. Sustainability as a learning concept is the proposition that efforts to "explain and learn" would be more fruitful in gaining improvements to problems, than efforts that seek to predict and control complex planning situations. I identified Soft Systems Methodology (SSM) as a useful problem-structuring tool based on complex systems ideas that centred on iterative learning through dialogue, for addressing my problem of interest.

Through experimenting with using SSM, I identified cost, and cost recovery, as an influential leverage point from which to approach the sustainability of urban sanitation systems. Holding the insight that there can be different legitimate perspectives on cost, I considered three: those of neoclassical economics, ecological economics and Buddhist economics. Neoclassical economics is the dominant paradigm in economics that currently shapes policy; ecological economics is explicitly concerned with sustainability and thus a constituent of the sustainability discourse; Buddhist economics is explicitly concerned with ethics and has goals that are consistent with ecological sustainability.

I argued that the three economic perspectives are complementary; each is concerned with achieving certain ends with given means that coexist within different domains of a spectrum of means and ends. Buddhist economics is concerned with the entire spectrum of ends and means, from the ultimate-ultimate means in economic action which is *intentions*, to the ultimate ends which is spiritual well-being as defined by Buddhism. The domain of ecological economics ranges from low-entropy matter-energy as the ultimate means, to ultimate ends acknowledged but dimly perceived as the "highest good, to which all other good is instrumental and derivative" (Daly & Farley 2003, p. 49). Neoclassical economics is concerned with a middle range of the spectrum, where economic values can meaningfully be assigned to given means that can be allocated to different ends through the market (ibid).

I used the complementarity of the economic perspectives to integrate and draw out a set of high level 'principles' applicable to sanitation planning, that responds to the first research question. These were, that

- Arrangements for sanitation should emphasise cooperation between stakeholders
    - Decisions about sanitation planning would incorporate cooperative and deliberative processes that bring the diverse knowledges and interests of planners, professional experts, stakeholders and the public together.
    - The relationship between sanitation service providers, service recipients and the government would be seen as a cooperative partnership that provides for the wellbeing of individuals, society and the environment.
- Efficiency goals should include entropy considerations
    - Efforts would be made to design material flows as closed loops using as little energy and non-cycling materials as possible. For sanitation, this means returning nutrients to agriculture in a sanitised and useable form, decreasing or even eliminating the use of water in sanitation, and treating any water that is used so its quality and quantity cause no ecosystem degradation, using technologies that have low requirements for energy and other resources.
- Society as a whole should live within its means
    - Sanitation services would be designed to be within the economic means of the community – of appropriate financial scale so costs are recoverable.
    - Physical systems would be designed to be within the carrying capacity of local and global ecosystems.
    - The physical scale of the service would consider keeping system-wide costs as low as possible, cognisant of the tradeoffs between economic services and environmental services in a finite planet.
    - Efficiency would be sought, that increases individual, societal and environmental wellbeing with fewer input resources. It means multiple use of resources – such as re-use of wastewater.
- Ethics and "goodness" should underpin decision processes and choices
    - The goal of sanitation would be to enhance the quality of life of individuals in the community without causing harm to others
    - The precautionary principle would be observed when science is uncertain, so that excessive costs are avoided rather than imposed on future generations
    - Decision making processes would raise awareness of individual motivations, and seek to reach accommodations about preferences based on 'right motivation'
    - The issue of distribution would be addressed: no individual would be excluded from having access to sanitation

Implementation aligned with sustainability concepts

The need to address the tactical issue encompassed in the second research question followed from the above strategic-level objectives: *How can these concepts be translated into a practical framework for decision-making?* In addressing this, I focussed on the *process* by which planning decisions could be made, that could take multiple perspectives into account within a learning environment, and potentially accommodate decisions that align with the strategic principles above.

To operationalise cooperative decision-making with respect to sanitation planning, a framework for involving planners, professional experts, stakeholders and citizens was devised. It drew on the deliberative democracy discourse and soft systems methodology (SSM) to propose a decision-making framework based on dialogue and learning. The framework's *system for deliberation* has the potential to draw out 'right motivation' from the participants through their engagement in reasoned argument and dialogue towards decision-making in the public interest. While there is no guarantee that a democratic process would deliver decisions consistent with the strategic objectives, the opportunity for them to consider the underlying sustainability issues through examining balanced information prepared for the purpose, can potentially lead to such consistency.

The decision-making framework's *learning system* is founded on SSM that draws on additional tools from elsewhere. I adapted the futurists' STEEP tool as a means of drawing out relevant contextual issues in a structured way. This would aid the SSM step of perceiving the problematic situation and articulating 'what is' – crucial for filtering 'what is feasible' in the given context from all the options for 'what is possible' . A step-by-step process for decision making combines SSM's 'logical stream of inquiry' with Renn et al's (1993) cooperative discourse model, to enable integration of technical expertise, rational analysis, public values and preferences. The framework is presented as a guide for designing a research project, whereby sanitation planning decisions can be made for a study location. Framing it as a research project allows such a planning process to be explored and potentially implemented even when the existing institutional context is not yet conducive to such decision-making processes more generally. Experience elsewhere suggests transformational shifts happen for at least some participants in such deliberative processes (Carson 2006b; Fishkin 2006). If institutional decision-makers either witnessed or experienced such transformations, then they could well be interested for the research project to be repeated in other locations, and for the learning from each practice to inform and be adapted in subsequent applications.

A second tactical issue was addressed by the third research question: *How might planning decisions for sustainable sanitation be implemented: who might be involved and what might motivate them?* I examined the literature to resolve the question whether government utilities (or local government) or private sector actors would be the 'better' of the two potential actors identified. While concluding that neither was better or worse *a priori*, I

argued that cooperation between them could create better outcomes than either one alone – concurring with the earlier finding of a strategic objective in favour of cooperative relationships between stakeholders (government, service providers and service recipients). I identified four pre-conditions as necessary for the success of such relationships: a strong regulatory framework; a coordinating role played by government utilities/local governments, with private sector actors providing elements of services through Public-Private Partnership arrangements; trust-enhancing engagement with the public; and profitability for private sector actors. I proposed a fifth condition as a recommendation rather than a necessary condition: a preference for local firms as private sector partners, arguably better able to foster a cooperative relationship with the community than foreign investors.

I argued that distributed approaches to urban sanitation offered particular opportunities for profitable private sector participation – with potential for market growth, and new products and services and potential to attract new investors, as well as opportunities for improvements in cost efficiency, adaptability and risk management, amongst other benefits, relative to conventional centralised sanitation services.

While I proposed the four pre-conditions are necessary, I noted that they might not be sufficient for achieving the strategic goal of cooperation between stakeholders leading toward sustainable sanitation. In considering how to better facilitate change towards better cooperation, and how to surmount the inevitable barriers, it is useful to consider the futures planners' concept of a *futures triangle* (Inayatullah 2002), which identifies three types of factors that can affect the achievement of desired futures: *push* factors that drive or force movement in the desired direction, *pull* factors that attract movement towards the desired futures, and *weights* that present obstacles or inertia against movement and change. Movement towards sustainable sanitation would require strengthening of push and pull effects and weakening of weight effects. While the four pre-conditions offer some of these influences, I saw the strategic objective for ethics and 'goodness' as potentially offering a further push factor towards cooperative relationships worth examining.

The corporate social responsibility discourse offered a potential entry point for exploring the place of ethics and relationships with wider society for private sector actors. The legal identity of private businesses as metaphorical persons in society led me to seeking an additional avenue to better draw out the capacity for ethics and caring relationships. This was the proposition that the metaphorical person might use a moral framework for guiding corporate behaviour that parallels those used by real people. Buddhist economics offered such a framework that combined a rationale for profit-making with ethics and caring. As an ancient moral philosophy with Asian roots, Buddhism's arguments have the potential to be well received by developing Asian countries – creating the opportunity for caring to be brought to the centre of discussion on resolving sanitation. Caring was identified by both the sustainability discourse and interviewees in Sri Lanka as a necessary ingredient for sustainability in general, and sustainable sanitation in particular.

7.2 Key research contributions

One of the key research contributions of this thesis has been the novelty of applying a transdisciplinary approach to urban sanitation. As noted in Chapter 1, this has involved an integration of a range of existing research to synthesise new insights and principles for creating changes in sanitation aligned with sustainability, which allows my scholarly contribution to conform with Boyer's scholarship of integration.

Other contributions include:

- The application of Kuhn's thesis on paradigm revolutions to the history of urban sanitation, mapping stages in sanitation to the stages in paradigm evolution/revolution;
- Identifying cost as a leverage point for creating change in sanitation, and integrating neoclassical economics, ecological economics and Buddhist economics to articulate principles for sanitation aligned with sustainability;
- Describing how to set up a *system for deliberation* to explicitly facilitate the deliberative dialogue and engagement that is implied in Soft Systems Methodology literature;
- Defining a *learning system* as a synthesis of Soft Systems Methodology and Renn et al.'s cooperative discourse model
- Demonstrating how the STEEP framework can be adapted for use as a tool to draw out contextual issues of relevance, with a novel integration of the SWOT analysis tool;
- Proposing a moral framework for profit-motivated private sector actors as metaphorical persons, to elicit behaviours that parallel those of real persons in social relationships.

An emerging idea from research into the distinguishing characteristics of transdisciplinary research is that it creates change through contributions to a distinct set of domains (Mitchell 2007, citing ongoing research collaboration between Carew, Wickson, Willetts and herself). Carew, Mitchell et al. propose three domain categories as necessary and sufficient in transdisciplinary research: a 'peer-learning' domain that accounts for academic and theoretical contributions; a 'problem resolution' domain where pragmatic level contributions to problem resolution are located; and a 'transformational learning' domain that accounts for concepts and ideas that transform the stakeholders having an interest in the research. While acknowledging that contributions can only be assessed retrospectively, I note that identifying the potential domains of my contributions allows me to establish the relevance of my research.

All of my contributions listed above contribute to 'peer-learning', as should be expected of PhD-related academic research. Many of these contributions have already been the subject of academic papers (Abeysuriya & Mitchell 2007; Abeysuriya, Mitchell & White 2007; Abeysuriya, Mitchell & Willetts 2005, 2006).

The STEEP tool and the participatory process consisting of the *system for deliberation* and the *learning system* have the potential to contribute to the 'problem resolution' space for messy problems in general, and for problems such as urban sanitation and waste management in developing Asian countries in particular. Aid agencies reconsidering how to ensure adequate outcomes from aid projects could potentially adopt these contributions either in the research project format proposed in Chapter 5, or utilise them as specific tools in other contexts.

Finally, the research 'journey' as a whole has contributed to 'transformational learning' for me as the primary stakeholder in this research, as I have stepped outside the boundaries of disciplines I felt competent in, to explore and gain expertise in different types of knowledge and philosophies and epistemologies. It has transformed me from a positivist seeking to 'solve' problems, to a more inclusive, accommodating and modest 'learner' with a greater appreciation of our world as a complex system – a transformation that is influencing all aspects of my life. Such 'transformational learning' conforms with transdisciplinary research envisaged by Max-Neef (2005), where an integrating synthesis needs to occur within each individual stakeholder in the research. Related discussions with my co-travellers on this journey – my thesis supervisors and my post-graduate colleagues in particular –has contributed to mutual transformations.

7.3 Opportunities for further research

The notion of sustainability as learning reveals the iterative and ongoing nature of research in sustainability – highlighting that this thesis marks but a milestone on a continuing journey. The immediate opportunity for further research would be in gauging interest from stakeholders in developing Asian countries – beginning with Colombo – about establishing a research project of the genre proposed in Chapter 5, to begin the cycle of learning between theory and practice. Such research has the potential to contribute to mutual transformation of stakeholders involved, as well as contribute to problem resolution.

My thesis has addressed questions at the strategic and tactical levels, leaving aligned research at the operational level outside my scope. Research at the operational level would be essential to enable greater adoption in practice. Research topics at this level include risk assessment and risk management, and methods and tools for costing different technological and management options – contributing to problem resolution and peer learning.

Of particular interest would be to explore the potential for "tunnelling through the cost barrier" (Hawken, Lovins & Lovins 1999) for urban sanitation in developing Asian countries. This is the idea that considering the system as a whole, and integrating design to capture multiple benefits, can lead to total cost reduction and higher returns on

investments[164]. I have identified the potential for sanitation to be multifaceted, to provide a cluster of services such as generating biogas through co-digestion with municipal organic waste, producing fertiliser and recycled water (Section 3.4), that may potentially be associated with additional elements such as urban farming. More research into the whole-of-system costs and benefits of such an approach would be invaluable for identifying ways to make it feasible in practice.

'Caring' has been a recurrent theme through the thesis, which I have explored little beyond noting its presence and suggesting it as critical for quality and sustainability. Others note the connections and consistencies between sustainability and holism and spirituality (Bell & Morse 2005; Kumar 2004; Wilbur 2005). Further research into this idea of 'caring' as the overarching ethic of the sustainability discourse, without taking on moralistic tones, has the potential to contribute to peer learning and transformational learning[165].

[164] The concept has been well demonstrated in superefficient passive buildings. The cost barrier to investments in better thermal insulation in the building envelope, for example, can be 'tunneled through' when sufficient investment in thermal insulation eliminates the need for a heating/cooling system, thereby reducing the system-wide costs (Hawken, Lovins & Lovins 1999).

[165] I am indebted to my colleague Tanzi Smith with whom I have had many conversations about the place of ethics and caring within complex systems theory and sustainability, which has been the beginning of mutual transformational learning.

References

A Dictionary of Sociology 2005, '"welfare"', in John Scott & Gordon Marshall (eds), *A Dictionary of Sociology*, Oxford University Press, Oxford Reference Online. Oxford University Press. University of Technology, Sydney. 18 June 2007.

Abeysuriya, K. & Mitchell, C. 2007, 'Creating Change through Deliberation and Learning Systems', *Conference of the Australia New Zealand Society for Ecological Economics (ANZSEE)*, Noosa, Australia, July 2007.

Abeysuriya, K., Mitchell, C. & White, S. 2007, 'Can Corporate Social Responsibility resolve the sanitation question in developing Asian countries?' *Ecological Economics*, vol. 62, no. 1, pp. 174-183.

Abeysuriya, K., Mitchell, C. & Willetts, J. 2005, 'Cost Recovery for Urban Sanitation in Asian countries: insurmountable barrier or opportunity for sustainability?' *2005 Conference of the Australia New Zealand Society for Ecological Economics (ANZSEE)*, Palmerston North, New Zealand.

Abeysuriya, K., Mitchell, C. & Willetts, J. 2006, 'Kuhn on sanitation: dignity, health and wealth for the children of the revolution', *Ninth Biennial Conference of the International Society for Ecological Economics*, New Delhi, India.

ABS 2004, 'Australian Bureau of Statistics: Measuring Australia's economy', viewed 22 July 2004 <http://www.abs.gov.au/Ausstats/abs@.nsf/0/6babb5d9f4a37b85ca256cbf00172171?OpenDocument>.

ADB 2001, *Water For All: The Water Policy of ADB*, <http://www.adb.org/Documents/Policies/Water/default.asp#contents>.

Alesina, A. & Dollar, D. 2000, 'Who gives foreign aid to whom and why?' *Journal of Economic Growth*, vol. 5, no. 1, pp. 33-.

Alexander, N. 2003, *The Expansion of The World Bank Group's Infrastructure Agenda*, Citizens' Network On Essential Services (CNES), Takoma Park, Maryland, USA, http://www.servicesforall.org/html/otherpubs/Expansion_WB_print.shtml.

Alvey, J.E. 2000, 'An introduction to economics as a moral science', *International Journal of Social Economics*, vol. 27, no. 12, pp. 1231-1252.

Alvey, J.E. 2003, *Adam Smith's Globilization (But Anti-Secularization) Theory*, Department of Applied and International Economics Discussion Paper No. 03.06, Massey University, <http://econ.massey.ac.nz/publications/discuss/dp03.06.pdf>.

Ariyabandu, R.d.S. 2005, 'National water resources policy - why can't we achieve consensus?' Serving Sri Lanka Web Log, <http://servesrilanka.blogspot.com/2005/02/national-water-resources-policy-why.html>.

Ariyabandu, R.d.S. & Aheeyar, M.M.M. 2004, *Secure Water through Demand Responsive Approaches: The Sri Lankan Experience*, Overseas Development Institution, http://www.securewater.org/mainphase/Sri%20Lanka/RR_3_SriLanka_SecureWater.pdf.

Ariyaratne, A.T. 1999, *Schumacher Lectures on Buddhist Economics*, Sarvodaya Vishva Lekha.

Arnstein, S.R. 1969, 'A Ladder of Citizen Participation', *Journal of the American Institute of Planners*, vol. 35, no. 4, pp. 216-224.

AusAID 2002, *AusAID Strategic Plan: Improving Effectiveness in a Changing Environment*, Australian Agency for International Development, http://www.ausaid.gov.au/publications/pdf/strategic_plan.pdf.

AusCID 2005, *Delivering for Australia:A Review of BOOs, BOOTs Privatisations and Public-Private Partnerships 1988 to 2004*, The Australian Council for Infrastructure Development, www.auscid.org.au/home/downloadproc.php?dir=2&id=125.

Australian Senate Estimates Hearings 2006, *Foreign Affairs Defence and Trade*, 16 February edn, Hansard, Canberra, <http://www.aph.gov.au/hansard/senate/commttee/S9104.pdf>.

AWWA 2001, *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure*, American Water Works Association, Denver, CO.

Ayine, D., Blanco, H., Cotula, L., Djiré, M., Gonzalez, C., Kotey, N.A., Khan, S.R., Reyes, B., Ward, H. & Yusuf, M. 2005, *Lifting the Lid on Foreign Investment Contracts: The Real Deal for Sustainable Development*, Report Number Sustainable Markets Briefing Paper (01), International Institute for Environment and Development.

Bakan, J. 2005, *The Corporation : The Pathological Pursuit of Profit and Power*, Free Press, New York.

Bakker, K.J. 2001, 'Paying for Water: water pricing and equity in England and Wales', *Transactions of the Institute of British Geographers*, vol. 26, pp. 143-164.

Barlow, M. 2001, 'Commodification of water - the wrong prescription', *Water Science & Technology*, vol. 43, no. 4, pp. 79-84.

Bawden, R. 2000, 'Valuing the epistemic in the search for betterment: the nature and role of critical learning systems.' *Cybernetics & Human Knowing*, vol. 7, no. 4, pp. 5-25.

BBC 2006, 'Historic Figures: Joseph Bazalgette (1819 - 1891)', British Broadcasting Corporation, viewed 24 January 2006 <http://www.bbc.co.uk/history/historic_figures/bazalgette_joseph.shtml>.

Beder, S. 1990, 'Early Environmentalists and the Battle Against Sewers in Sydney', *Royal Australian Historical Society Journal*, vol. 76, no. 1, pp. 27-44.

Beder, S. 1993, 'Pipelines and Paradigms: The Development of Sewerage Engineering', *Australian Civil Engineering Transactions, IEAust.*, vol. CE35, no. 1, pp. 79-83.

Beecher, J. 1996, 'Avoided Cost: An Essential Concept for Integrated Resource Planning', *Water Resources Update - Universities Council on Water Resources*, pp. 28-35. <http://www.ucowr.siu.edu/updates/pdf/V104_A7.pdf>.

Bell, S. & Morse, S. 1999, *Sustainability indicators : measuring the immeasurable?*, Earthscan Publications, London.

Bell, S. & Morse, S. 2003, *Measuring sustainability : learning by doing*, Earthscan Publications Ltd, London ; Sterling, VA.

Bell, S. & Morse, S. 2005, 'Holism and Understanding Sustainability', *Systemic Practice and Action Research*, vol. 18, no. 4, pp. 409-426.

Berry, T., Campbell, S., Riedy, C. & White, S. 2004, *Discussion Paper: A New Distributed Infrastructure and Services Market: Assessing Australia's Future Market Potential*, Institute for Sustainable Futures, Sydney.

Bio-Lux 2003, 'Bio-Lux: Environmentally friendly Eco-Bio-Toilet', viewed 10 October 2006 <http://www.seiwa-denko.co.jp/biolux/>.

Birdsall, N. & Nellis, J. 2002, *Winners and Losers: Assessing the distributional impact of privatization*, Report Number Working Paper No. 6, Center for Global Development.

Biswas, A.K., Tortajada, C., Lundqvist, J. & Varis, O. 2004, 'The Water Challenges of Megacities', *Water Front*, June 2004. <http://www.siwi.org/downloads/WF%20Magazine/Water_Front_June_2004.pdf>.

Blackburn, T. 1971, 'Sensuous-intellectual complementarity in science', *Science*, vol. 172, pp. 1003-1007.

Boland, J.J. 1993, 'Pricing Urban Water: Principles and Compromises', *Water Resources Update - Universities Council on Water Resources*, vol. Summer, no. 92, pp. 7-10.

Borton, G. 2003, 'Water Recycling Case Study : Water Mining', *OZ-AQUAREC Workshop II: Technical Limitations in Water Recycling Processes*, http://www.uow.edu.au/~schaefer/pdfs/borton.pdf, Wollongong.

Boulding, K.E. 1956, 'General Systems Theory - the Skeleton of Science', *Management Science*, vol. 2, no. 3, pp. 197-208.

Bowie, N. 1991, 'New Directions in Corporate Social Responsibility', *Business Horizons*, vol. 34, no. 4, pp. 56-65.

Boyer, E. 1990, *Scholarship Reconsidered: Priorities of the Professoriate*, The Carnagie Foundation for the Advancement of Teaching (imprint Jossey-Bass Publishers, 1997: San Francisco).

Brocklehurst, C., Pandurangi, A. & Ramanathan, L. 2002, *Tariff Structures in Six South Asian Cities*, World Bank, Public–Private Infrastructure Advisory Facility and Water and Sanitation Program, Washington D.C., http://web.mit.edu/urbanupgrading/waterandsanitation/resources/pdf-files/.

Budds, J. & McGranahan, G. 2003, 'Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America', *Environment&Urbanization Vol 15 No 2 October 2003*, vol. 15, no. 2, pp. 87-113.

Carson, L. 1999, *Random Selection: Achieving Representation in Planning, Alison Burton Memorial Lecture*, Royal Australian Planning Institute, Canberra, ACT, http://activedemocracy.net/articles/03_randomselection.pdf.

Carson, L. 2005, 'Citizens and governments: Stroppy adversaries or partners in deliberation?' <http://www.australianreview.net/digest/2005/04/carson.html>.

Carson, L. 2006a, 'Citizens Juries', *Internal Workshop at the Institute for Sustainable Futures, 23 November 2006*.

Carson, L. 2006b, *Democratic Deliberative Processes (DDPs): Briefing Document for Small Group Discussion*, 'Government and International Relations' - course notes, University of Sydney.

Carson, L. & Gelber, K. 2001, *Ideas for Community Consultation: A discussion paper of principles and procedures for making consultation work.*, Department of Infrastructure, Planning and Natural Resources, http://www.planning.nsw.gov.au/planfirst/pdf/principles_procedures_final.pdf.

Carson, L. & Hartz-Karp, J. 2005, 'Adapting and Combining Deliberative Designs: Juries, Polls and Forums', in J. Gastil & P. Levine (eds), *The Deliberative Democracy Handbook: Strategies for Effective Civic Engagement in the Twenti-First Century*, Jossey-Bass, San Francisco, pp. 120-138.

Cartwright, T.J. 1973, 'Problems, solutions and strategies: A contribution to the Theory and Practice of Planning', *Journal of American Institute of Planners*, vol. 39, pp. 179-187.

Center for Global Development 2005, 'Q & A with John Nellis on Reality Check: The Distributional Impact of Privatization', viewed 24 April 2006 <http://www.cgdev.org/content/opinion/detail/4540/>.

Central Bank of Sri Lanka 2003, *Recent Economic Developments - Highlights of 2003 and Prospects for 2004*.

CESMA 2003, *Western Region Megapolis Resource Development Masterplan - Draft Report 1*.

Chadwick, E. 1842, 'Inquiry into the Sanitary Conditions of the Labouring Population of Great Britain', <http://www.victorianweb.org/history/chadwick2.html>.

Chaplin, S.E. 1999, 'Cities, sewers and poverty: India's politics of sanitation', *Environment and Urbanization*, vol. 11, no. 1, pp. 145-158.

Checkland, P. 1981, *Systems Thinking, Systems Practice*, John Wiley & Sons.

Checkland, P. 1999, *Systems thinking, systems practice*, John Wiley, Chichester.

Checkland, P. 2000, 'The Emergent Properties of SSM in Use: A Symposium by Reflective Practitioners', *Systemic Practice and Action Research*, vol. 13, no. 6, pp. 799-823.

Checkland, P. 2001, 'Soft Systems Methodology', in J. Rosenhead & J. Mingers (eds), *Rational analysis for a problematic world revisited : problem structuring methods for complexity, uncertainty and conflict*, 2nd edn, Wiley, Chichester ; New York, pp. xvi, 366 p.

Checkland, P. & Scholes, J. 1999, *Soft Systems Methodology in Action : a 30-year retrospective*, [New edn, Wiley, New York.

Chowdhry, K. 2003, *Achieving Millennium Development Goals: A View from Gandhi's Window*, The World Faiths Development Dialogue, <http://www.wfdd.org.uk/articles_talks/chowdhry.pdf>.

CIRET 1994, 'Charter of Transdisciplinarity', International Center for Transdisciplinary Research, viewed 29 January 2007 <http://nicol.club.fr/ciret/english/charten.htm>.

Cohen, J. & Fung, A. 2004, 'Radical Democracy', *Swiss Journal of Political Science*, vol. 10, no. 4, pp. 23-34.

Consigny, S. 1977, 'Rhetoric and Madness: Robert Pirsig's Inquiry Into Values', *Southern Speech Communication Journal*, vol. 41, pp. 16-32.

Cordell, D., Fane, S.A., Mitchell, C., Riedy, C., Robinson, J. & White, S. 2002, *Yarra Valley Water Sustainable Urban Water Futures: Literature Review*, Institute for Sustainable Futures.

Costanza, R., Cumberland, J., Daly, H.E., Goodland, R. & Norgaard, R. 1997, *An Introduction to ecological economics*, St. Lucie Press, Boca Raton, Fla.

Cowen, R. undated, *Course Notes for Geology 115, University of California at Davis*, <http://www.geology.ucdavis.edu/~cowen/~GEL115/115CH16fertilizer.html>.

Crites, R. & Tchobanaglous, G. 1998, *Small and Decentralized Wastewater Management Systems*, WCB/McGraw-Hill.

Crotty, M. 1998, *The foundations of social research : meaning and perspective in the research process*, Allen & Unwin, St Leonards, N.S.W.

Czemiel, J. 2000, 'Phosphorus and nitrogen in sanitary systems in Kalmar', *Urban Water*, vol. 2, no. 1, pp. 63-69.

Dagdeviren, H., Hoeven, R.v.d. & Weeks, J. 2001, *Redistribution Matters: Growth for Poverty Reduction*, Report Number Employment Paper 2001/10, Interlational Labour Organisation, http://www.ilo.org/public/english/employment/strat/download/ep10.pdf.

Daily, G.C. & Ehrlich, P.R. 1996, 'Socioeconomic Equity, Sustainability, and Earth's Carrying Capacity', *Ecological Applications*, vol. 6, no. 4, pp. 991-1001.

Daly, H.E. 1990, 'Toward some operational principles of sustainable development', *Ecological Economics*, vol. 2, no. 1, pp. 1-6.

Daly, H.E. 1992, 'Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable', *Ecological Economics*, vol. 6, no. 3, pp. 185-193.

Daly, H.E. 1999, *Ecological economics and the ecology of economics : essays in criticism*, Edward Elgar, Cheltenham.

Daly, H.E. & Cobb, J.B. 1994, *For the common good : redirecting the economy toward community, the environment, and a sustainable future*, 2nd edn, Beacon Press, Boston.

Daly, H.E. & Farley, J.C. 2003, *Ecological economics : principles and applications*, Island Press, Washington, D.C.

Daniels, P.L. 2003, 'Buddhist economics and the environment: Material flow analysis and the moderation of society's metabolism', *International Journal of Social Economics*, vol. 30, no. 1/2, pp. 8-33.

Dasgupta, P. 1997, *Environmental and Resource Economics in the World of the Poor*, Resources for the Future, Washington DC.

Dietzmann, E.M. & Gross, M.A. 2003, 'Phelps County Update: Case Study of a Public Water Supply District Providing Centralized Management of Decentralized Wastewater', *Small Flows Quarterly*, pp. 25-34. <http://www.nesc.wvu.edu/nsfc/nsfc_sfq.htm>.

Dissanayake, A. 2002, 'Sustainable sanitation programme in Sri-Lanka', *28th WEDC Conference*, Kolkata (Calcutta), India.

Dix, S. 2001, 'Are Cluster Treatment Systems the Key to Implementing Effective Decentralized Wastewater Management?' *NOWRA Conference*, Virginia.

Dixon, F. 2004, 'Gross National Happiness: Improving Unsustainable Western Economic Systems', *GNH Conference*, Thimphu, Bhutan.

D'Monte, D. 2005, 'World Bank shifts gear on water privatisation', InfoChange Analysis, viewed April 19 2006 <http://www.infochangeindia.org/analysis67.jsp>.

Donaldson, T. & Preston, L.E. 1995, 'The Stakeholder Theory of the Corporation: concepts, evidence and implications', *Academy of Management Review*, vol. 20, no. 1, pp. 65-91.

Dunn, C.P. 1991, 'Are corporations inherently wicked?' *Business Horizons*, vol. 34, no. 4, pp. 3-8.

Eawag 2005, *Household-Centred Environmental Sanitation : Implementing the Bellagio Principles in Urban Environmental Sanitation - Provisional Guideline for Decision-Makers*, Eawag: Swiss Federal Institute of Aquatic Science and Technology, http://www.wash-cc.org/pdf/publication/hces.pdf.

Eccleshall, R., Finlayson, A., Geoghegan, V., Kenny, M., Lloyd, M., MacKenzie, I. & Wilford, R. 2003, *Political Ideologies: An Introduction*, 3rd edn, Routledge, London and New York.

EcoSanRes 2003, 'Closing the Loop on Phosphorus', EcoSanRes, viewed April 26 2003 <http://www.ecosanres.org/PDF%20files/Kyoto/Closing%20the%20Loop%20on%20Phosphorus.pdf>.

EcoSanRes 2005, 'The Main Features of Ecological Sanitation', EcoSanRes Fact Sheet 2, viewed 20 February 2006 <http://www.ecosanres.org/PDF%20files/Fact_sheets/ESR2lowres.pdf>.

Eden, C. & Ackermann, F. 2001, 'SODA - The Principles', in J. Rosenhead & J. Mingers (eds), *Rational analysis for a problematic world revisited : problem structuring methods for complexity, uncertainty and conflict*, 2nd edn, Wiley, Chichester ; New York, pp. xvi, 366 p.

Edwards-Jones, G., Davies, B. & Hussain, S. 2000, *Ecological economics : an introduction*, Blackwell Science, Malden, Mass.

Ekins, P. & Max-Neef, M.A. 1992, 'Human needs and aspirations', in P. Ekins & M.A. Max-Neef (eds), *Real-life economics : understanding wealth creation*, Routledge, London ; New York, pp. xxi, 460 p.

England, R.W. & Harris, J.M. 1998, 'Alternatives to Gross National Product: A Critical Survey', in F. Ackerman, D. Kiron, N. Goodwin, J. Harris & K.P. Gallagher (eds), *HUMAN WELLBEING AND ECONOMIC GOALS*, Island Press.

ERA 2004a, *Inquiry into Urban Water and Wastewater Pricing*, Economic Regulation Authority (Western Australia), www.era.wa.gov.au.

ERA 2004b, *Inquiry on Urban Water and Wastewater Pricing*, Economic Regulation Authority, Western Australia, http://www.era.wa.gov.au/water/content/waterInquiry/default.cfm.

Esrey, S.A., Gough, J., Rapaport, D., Sawyer, R., Simpson-HÈbert, M., Vargas, J. & Uno Winblad (ed) 1998, *Ecological Sanitation*, Swedish International Development Cooperation Agency, Stockholm.

Estache, A. & Rossi, M.A. 2002, 'How different is the efficiency of public and private water companies in Asia?' *The World Bank Economic Review*, vol. 16, no. 1, pp. 139-148.

Evans, B. 2005, *Securing Sanitation: The Compelling Case to Address the Crisis*, Stockholm International Water Institute, with World Health Organisation and Norwegian Agency for Development Cooperation, www.siwi.org/downloads/Reports/CSD_Sanitation.pdf.

Faber, M., Petersen, T. & Schiller, J. 2002, 'Homo Oeconomicus and Homo Politicus in Ecological Economics', *Ecological Economics*, vol. 40, no. 323-333.

Falkenmark, M. & Rockström, J. 2006, 'The New Blue and Green Water Paradigm: Breaking New Ground for Water Resources Planning and Management', *Journal of Water Resource Planning and Management*, vol. 132, no. 3, pp. 129-132.

Fane, S.A. 2005, 'Planning for sustainable urban water: Systems-approaches and distributed strategies', PhD thesis, University of Technology, Sydney.

Fane, S.A. & White, S.B. 2001, 'What are the Implications of Distributed Wastewater Management in Inner Sydney?' *International Ecological Engineering Conference*, Lincoln University, New Zealand.

Fane, S.A., Willetts, J., Abeysuriya, K., Mitchell, C., Etnier, C. & Johnstone, S. 2004, 'Evaluating Reliability and Life-Cycle Cost for Decentralised Wastewater within the Context of Asset Management', *Proceedings of 6th Specialist Conference on Small*

Water & Wastewater Systems and 1st International Conference on Onsite Wastewater Treatment & Recycling, Freemantle, Australia.

Feacham, R.G., Bradley, D.J., Garelick, H. & Mara, D.D. 1983, *Sanitation and disease : health aspects of excreta and wastewater management*, Chichester [West Sussex] ; New York : Published for the World Bank by Wiley.

Fenner, R. & Sweeting, L. 1999, 'A decision support model for the rehabilitation of "non-critical" sewers', *Water Science And Technology*, vol. 39, no. 9, pp. 193-200.

Fernando, S. 2000, 'Can Water Marketing Prevent A Crisis', <http://www.geocities.com/monlarsrilanka/publications/documentsandstatements/documentsandstatements.htm>.

Fisher, R. 2006, 'Why altruism paid off for our ancestors', *New Scientist*, 7 December 2006. <http://www.newscientist.com/channel/being-human/dn10750-why-altruism-paid-off-for-our-ancestors.html>.

Fishkin, J.S. 2006, 'The Nation in a Room: Turning public opinion into policy', *Boston Review*, March/April 2006. <http://bostonreview.net/BR31.2/fishkin.html>.

Fittschen, I. & Niemczynowicz, J. 1997, 'Experiences with Dry Sanitation and Greywater Treatment in the Ecovillage Toarp, Sweden', *Water Science & Technology*, vol. 35, no. 9, pp. 161-170.

Flyvbjerg, B., Rothengatter, W. & Bruzelius, N. 2002, *Megaprojects and risk : an anatomy of ambition*, Cambridge University Press, New York.

Foley, J., Kasper, T. & Cameron, D. 2004, 'BioWater decentralised wastewater management for a small community in the Southern Moreton Bay Islands', *Proceedings of 6th Specialist Conference on Small Water & Wastewater Systems and 1st International Conference on Onsite Wastewater Treatment & Recycling*, Freemantle, Australia.

Foster, V., Gomez-Lobo, A. & Halpern, J. 2000, 'Designing Direct Subsidies for the Poor—A Water and Sanitation Case Study', *Public Policy Journal - World Bank*, no. Note 211.

Freeman, R.E. & Liedtka, J. 1991, 'Corporate social responsibility: A critical approach', *Business Horizons*, vol. 34, no. 4, pp. 92-98.

Friedman, M. 1970, 'The Social Responsibility of Business is to Increase its Profits', *New York Times Magazine*, September 13, 1970. <http://lst-kieser.bwl.uni-mannheim.de/Downloads/SS05/Text_Friedman.pdf>.

Fung, A. & Wright, E.O. 2003, 'Thinking about Empowered Participatory Governance', in A. Fung & E.O. Wright (eds), *Deepening democracy : institutional innovations in empowered participatory governance*, Verso, London, p. .

Funtowicz, S. 2001, 'Peer Review and Quality Control', in, *International Encyclopedia of the Social &Behavioral Sciences 2004*, pp. 11179-11183.

Funtowicz, S. & Ravetz, J. 1993, 'Science for the post-normal age', *Futures*, vol. 25, no. 7, pp. 739-755.

Funtowicz, S. & Ravetz, J. 2003, 'Post-Normal Science', in, *Online Encyclopaedia of Ecological Economics*, International Society for Ecological Economics. http://www.ecoeco.org/publica/encyc.htm.

Gallagher, R. & Appenzeller, T. 1999, 'Beyond Reductionism', *Science*, vol. 284, no. 5411, p. 79.

Gallopín, G.C., Funtowicz, S., O'Connor, M. & Ravetz, J. 2001, 'Science for the twenty-first century: from social contract to the scientific core', *International Social Science Journal*, vol. 53, no. 168, pp. 219-229.

Gardiner, G. 2004, *Sermon on the Widow's Mite (Luke 21:1-4)*, West Epping Uniting Church, Sydney.

Gas Research Institute 1999, *The Role of Distributed Generation in Competitive Electricity Markets*, Distributed Generation Forum, http://www.distributed-generation.com/Library/GRI_Role_of_DG.pdf.

Gastil, J. & Keith, W.M. 2005, 'The Nation That (Sometimes) Likes To Talk: A Brief History of Public Deliberation in the United States', in J. Gastil & P. Levine (eds), *The deliberative democracy handbook : strategies for effective civic engagement in the twenty-first century*, 1st edn, Jossey-Bass, San Francisco.

Gaventa, J. 2004, 'Strengthening Participatory Approaches to Local Governance: Learning the Lessons from Abroad', *National Civic Review*. <http://www.ncl.org/publications/ncr/93-4/Gaventa.pdf>.

Gaventa, J. 2006, *Triumph, Deficit or Contestation? Deepening the 'Deepening Democracy' Debate*, Report Number IDS Working Paper 264, Institute of Development Studies, Logolink and the Citizenship DRC.

Gayman, M. 1996, 'A Glimpse Into London's Early Sewers', *reprinted from Cleaner Magazine*. <http://www.swopnet.com/engr/londonsewers/londontext1.html>.

Gijsen, H. 2006, 'Can the Millennium Development goal for Sanitation be Achieved?' *Source Bulletin 44 (Reader's Opinion)*, Wednesday 24 May 2006, <http://www.irc.nl/source>.

Gleick, P.H., Wolff, G., Chalecki, E.L. & Reyes, R. 2002, 'The Privatization of Water and Water Systems', in, *The World's Water 2002-2003: The biennial Report on Freshwater Resources*, Pacific Institute for Studies in Development, Environment, and Security, Oakland, California.

Glibert, P.M., Landsberg, J.H., Evans, J.J., Al-Sarawi, M.A., Faraj, M., Al-Jarallah, M.A., Haywood, A., Ibrahem, S., Klesius, P., Powell, C. & Shoemaker, C. 2002, 'A fish kill of massive proportion in Kuwait Bay, Arabian Gulf, 2001: the roles of bacterial disease, harmful algae, and eutrophication', *Harmful Algae*, vol. 1, no. 2, pp. 215-231.

Goddard, N. 1996, '"A mine of wealth"? The Victorians and the agricultural value of sewage', *Journal of Historical Geography*, vol. 22, no. 3, pp. 274-290.

GPOC 1999, *Investigation into the cost-effectiveness of local councils implementing two-part pricing for urban water services and the implementation of other local government urban water reforms required under the CoAG water reform agenda*, Government Pricing Oversight Commission, Tasmania, http://www.dpac.tas.gov.au/divisions/lgo/services/publications/kelly.pdf.

GPOC 2003, *Urban Water and Wastewater Pricing Guidelines consistent with the CoAG Water Reforms for Local Government in Tasmania*, Government Prices Oversight Commission, Tasmania, http://www.dpac.tas.gov.au/divisions/lgo/services/publications/uwpJan03xls.pdf.

Graham, S. 2000, 'Constructing Premium Network Spaces: Reflections on Infrastructure Networks and Contemporary Urban Development', *International Journal of Urban and Regional Research*, vol. 24, no. 1, pp. 183-200.

Gray, C.W. & Kaufmann, D. 1998, 'Corruption and Development', *Finance & Development*. <http://www.worldbank.org/fandd/english/pdfs/0398/020398.pdf>.

Grusky, S. & Fiil-Flynn, M. 2004, *Will the World Bank Back Down? Water Privatization in a Climate of Global Protest*, Public Citizen, http://www.citizen.org/documents/worldbank2004.pdf.

Gupta, A. 2006, 'Roundtable on Philosophical Roots of Ecological Economics - Gandhi and Beyond', *Ninth Biennial Conference of the International Society for Ecological Economics*, New Delhi, India.

Gutierrez, E., Calaguas, B., Green, J. & Roaf, V. 2003, *New Rules, New Roles: Does PSP Benefit The Poor?*, WaterAid, http://www.wateraid.org.uk/site/in_depth/current_research/157.asp.

Guy, S., Marvin, S. & Moss, T. 2001, *Urban Infrastructure in Transition: Networks, Buidings, Plans*, Earthscan Publications Ltd, London.

Haarmeyer, D. 1992, *Privatizing Infrastructure: Options for Municipal Water Supply Systems*, Policy Study No. 15, Los Angeles: Reason Foundation, October 1992, http://www.reason.org/ps151.html.

Haarmeyer, D. & Mody, A. 1998, 'Tapping the private sector: approaches to managing risks in water and sanitation', *Journal of Project Finance*, vol. 4, no. 2, pp. 1-28.

Hall, D. 2002, *The Water Multinationals 2002 - financial and other problems*, Public Services International Research Unit.

Hall, D., Corral, V., Lobina, E. & Motte, R.d.l. 2004, *Water Privatisation and Restructuring in Asia-Pacific*, Public Services International Research Unit, University of Greenwich, www.psiru.org/reports/2004-12-W-Asia.doc.

Hall, D. & Lobina, E. 2006, *Pipe dreams: The failure of the private sector to invest in water services in developing countries*, World Development Movement, http://www.psiru.org/reports/2006-03-W-investment.pdf.

Hall, D., Lobina, E. & Motte, R.d.l. 2005, 'Public resistance to privatisation in water and energy', *Development in Practice*, vol. 15, no. 3 & 4, pp. 286-301.

Halliday, S. 2002, 'William Farr, The Lancet and Epidemic Cholera', *Medical Science Monitor*, vol. 8, no. 6, pp. LE18-19.

Hamilton, C. 1997, *The Genuine Progress Indicator: A new index of changes in well-being in Australia*, The Australia Institute, http://tai.org.au/Publications_Files/DP_Files/DP14SUM.pdf.

Hamilton, C. 2003, *Growth fetish*, Allen & Unwin, Crows Nest, N.S.W.

Hanaeus, J., Hellstrom, D. & Johansson, E. 1997, 'A Study of a Urine Separation System in an Ecological Village in Northern Sweden', *Water Science & Technology*, vol. 35, no. 9, pp. 153-160.

Harremoes, P. 1999, 'Water as a transport medium for waste out of towns', *Water Science & Technology*, vol. 39 (5), no. 5, pp. 1-8.

Hawken, P., Lovins, A.B. & Lovins, H. 1999, *Natural capitalism : creating the next industrial revolution*, Little Brown and Co. ;Earthscan, Boston & London.

Heijs, J., Wilkinson, D. & Couriel, E. 2002, 'Project CARE: reducing wet weather overflows to improve beach water quality', *Water Science & Technology*, vol. 46, no. 6-7, pp. 35-46.

Hird, W. & Standen, G. 2003, 'Water Recycling Case Study : BHP Pt Kembla', *OZ-AQUAREC Workshop II: Technical Limitations in Water Recycling Processes*, http://www.uow.edu.au/~schaefer/pdfs/standen_and_hird.pdf, Wollongong.

Ho, G. 2004, 'Technology for Sustainability: the role of onsite, small and community scale technology', *Proceedings of 6th Specialist Conference on Small Water & Wastewater Systems and 1st International Conference on Onsite Wastewater Treatment & Recycling*, Freemantle, Australia.

Hoering, U. & Schneider, A.K. 2004, *King customer? : the World Bank's "new" water policy and its implementation in India and Sri Lanka*, Brot für die Welt and WEED, Stuttgart / Berlin, Germany, http://www2.weed-online.org/uploads/KingCustomer_engl.fullversion.

House, M.A. 1996, 'Public participation in water management and the promotion of environmental education', *Lakes and Reservoirs: Research and Management*, vol. 2, no. 1-2, pp. 1-5.

Houtart, F. 2005, 'Why Should Small Rice Farmers in Sri Lanka Disappear?' in A.A. Boron & G. Lechini (eds), *Politics and Social Movements in an Hegemonic World Lessons from Africa, Asia and Latin America*, Buenos Aires http://bibliotecavirtual.clacso.org.ar/ar/libros/sursur/politics/Politics.htm.

Howe, C. & White, S.B. 1999, 'Integrated Resource Planning for Water and Waste Water: Sydney Case Studies', *Water International*, vol. 24, no. 4, pp. 356-362.

IAP2 2006, 'IAP2 Public Participation Spectrum', International Association for Public Participation, <http://www.iap2.org/associations/4748/files/spectrum.pdf>.

Inayatullah, S. 1998, 'Causal Layered Analysis poststructuralism as method', *Futures*, vol. 30, no. 8, pp. 815-829.

Inayatullah, S. 2002, 'Teaching Futures Studies: From Strategy to Transformative Change', Metafuture.org, viewed 28 March 2007 <http://www.metafuture.org/Articles/teachingfuturestudies.htm>.

Interview 2003, *From interviews with officials in Sri Lanka conducted by author, compliant with requirements of the Human Research Ethics Committee of University of Technology Sydney (Approval Number 03/44A). July/August 2003. Compliance includes protection of identity of interviewee/s.*

IWA 2004, *Bonn Charter for Safe Drinking Water*, International Water Association, <http://www.iwa2004marrakech.com/uploads/Bon%20Charter%20Document.pdf>.

IWA 2006a, 'MALAYSIA: Minister warns of no further liberalisation', *Water21 Global News Digest*, 16 May 2006, <http://www.iwapublishing.com/template.cfm?name=gndmay1606>.

IWA 2006b, *Sanitation 21: Simple Approaches to Complex Sanitation - draft framework for analysis*, International Water Association, http://www.iwahq.org/templates/ld_templates/layout_633184.aspx?ObjectId=639578.

Johnson & Johnson undated, 'Our Credo', <http://www.jnj.com/our_company/our_credo/credo_heading.htm>.

Jones, T. & Petrie, E. 2000, 'Spreading the Net - Distributed Power Generation and Creating a Virtual Utility to Manage It', *ABB Review*, pp. 13-21.

Jonsson, H., Stenstrom, T.-A., Svensson, J. & Sundin, A. 1997, 'Source Separated Urine - Nutrient and Heavy Metal Content, Water Saving and Faecal Contamination', *Water Science & Technology*, vol. 35, no. 9, pp. 145-152.

Kamenetzky, M. 1992, 'The economics of the satisfaction of needs', in P. Ekins & M.A. Max-Neef (eds), *Real-life economics : understanding wealth creation*, Routledge, London ; New York, pp. xxi, 460 p.

Kasrils, R. 2001, 'The Value and Price of Water (The women of Lutsheko)', *Water Science & Technology*, vol. 43, no. 4, pp. 51-55.
Kennedy, A.A. 2000, *The End of Shareholder Value*, Orion Business, London.
Kenny, M. 2003, 'Ecologism', in R. Eccleshall, A. Finlayson, V. Geoghegan, M. Kenny, M. Lloyd, I. MacKenzie & R. Wilford (eds), *Political Ideologies: An Introduction*, 3rd edn, Routledge, London and New York.
Kessides, I.N. 2004, *Reforming Infrastructure: privatization, regulation and competition*, World Bank.
Kiel, J.M. 1999, 'Reshaping Maslow's hierarchy of needs to reflect today's educational and managerial philosophies', *Journal of Instructional Psychology*, vol. 26, no. 3, pp. 167-168.
Kirkland, R. 2006, 'The real CEO pay problem', *Fortune*, vol. 154, no. 1 - July 10.
Kuhn, T.S. 1970, *The structure of scientific revolutions*, 2nd edn, University of Chicago Press, Chicago.
Kumar, S. 2004, *You are, Therefore I am*, Green Books.
La Via Campesina 2006, 'People's caravan: solutions to the paddy and rice crisis', La Via Campesina - International Peasant Movement, viewed 17 July 2006 <http://www.viacampesina.org/main_en/index.php?option=com_content&task=view&id=118&Itemid=29>.
Laporte, D.-G. 2000, *History of shit*, MIT Press, Cambridge, Mass.
Larsen, T.A. & Gujer, W. 1996, 'Separate Management of Anthropogenic Nutrient Solutions (Human Urine)', *Water Science & Technology*, vol. 34, no. 3-4, pp. 87-94.
Larsen, T.A. & Gujer, W. 1997, 'The Concept of Sustainable Urban Water Management', *Water Science & Technology*, vol. 35, no. 9, pp. 3-10.
Larsen, T.A., Peters, I., Alder, A., Eggen, R., Maurer, M. & Muncke, J. 2001, 'Reengineering the toilet for sustainable wastewater management', *Environmental Science and Technology*, vol. 35, no. 9, pp. 192A-197A.
Lawrence, R.J. & Despres, C. 2004, 'Futures of Transdisciplinarity', *Futures - Transdisciplinarity*, vol. 36, no. 4, pp. 397-405.
Lazonick, W. & O'Sullivan, M. 2000, 'Maximizing shareholder value: a new ideology for corporate governance', *Economy and Society*, vol. 29, no. 1, pp. 13-35.
Lee, T.R. & Jouravlev, A. 1997, *Private Participation in the Provision of Water Services: Alternative means for private participation in the provision of water services*, Report Number LC/L.1024, Economic Commission for Latin America and the Caribbean.
Lens, P., Zeeman, G. & Lettinga, G. (eds) 2001, *Decentralised Sanitation and Reuse - Concepts, Systems and Implementation*, IWA Publishing, Cornwall, UK.
Levine, P., Fung, A. & Gastil, J. 2005, 'Future Directions for Public Deliberation', *Journal of Public Deliberation*, vol. 1, no. 1.
Lienert, J., Haller, M., Berner, A., Stauffacher, M. & Larsen, T.A. 2003, 'How farmers in Swizerland perceive fertilizers from recycled anthropogenic nutrients (urine)', *Water Science & Technology*, vol. 48, no. 1, pp. 47-56.
Lobina, E. 2000, 'Cochabamba - water war', *Focus (Journal of Public Services International)*, vol. 7, no. 2.
Lobina, E. & Hall, D. 2001, *UK Water privatisation - a briefing*, Public Services International Research Unit, University of Greenwich.

Lovins, A.B. 1979, *Soft energy paths : toward a durable peace*, Harper & Row, New York.
Lovins, A.B. 2002, *Small is profitable : the hidden economic benefits of making electrical resources the right size*, Rocky Mountain Institute, Snowmass, Colorado.
Lubchenco, J. 1998, 'Entering the Century of th Environment: A New Social Contract for Science', *Science*, vol. 279, pp. 491-497.
Lux, K. 1990, *Adam Smith's Mistake: How a Moral Philosopher Invented Economics & Ended Morality*_____, SHAMBHALA, Boston & London.
Mansbridge, J. 2003, 'Practice-Thought-Practice', in A. Fung & E.O. Wright (eds), *Deepening democracy : institutional innovations in empowered participatory governance*, Verso, London, pp. viii, 310 p.
Markham, A. 1995, *A Brief History of Pollution*, Earthscan, London.
Martin, B. 1996, 'From the Many to the Few: Privatization and Globalization', *Ecologist*, vol. 26, no. 4, pp. 145-155.
Martinez-Alier, J. 2005, 'Social Metabolism and Ecological Distribution Conflicts', *2005 Conference of the Australia New Zealand Society for Ecological Economics (ANZSEE)*, Palmerston North, New Zealand.
Maslow, A.H. 1970, *Motivation and personality*, 2nd edn, Harper & Row, New York.
Maurer, M., Schwegler, P. & Larsen, T. 2003, 'Nutrients in urine: energetic aspects of removal and recovery', *Water Science & Technology*, vol. 48, no. 1, pp. 37-46.
Max-Neef, M.A. 1992, 'Development and human needs', in P. Ekins & M.A. Max-Neef (eds), *Real-life economics : understanding wealth creation*, Routledge, London ; New York, pp. xxi, 460 p.
Max-Neef, M.A. 2005, 'Foundations of transdisciplinarity', *Ecological Economics*, vol. 53, no. 1, pp. 5-16.
McAfee, R.P. 2006, *Introduction to Economic Analysis Version 2.0*, California Institute of Technology.
McGranahan, G., Jacobi, P., Songsore, J., Surjadi, C. & Kjellen, M. 2001, *The Citizens at Risk : from Urban Sanitation to Sustainable Cities*, Earthscan, London ; Sterling, VA.
McIntosh, A.C. 2003, *Asian Water Supplies: Reaching the Urban Poor*, Asian Development Bank and IWA Publishing.
McNeill, D. 1998, 'Water as an economic good', *Natural Resources Forum*, vol. 22, no. 4, pp. 253-261.
McNulty, P.J. 1968, 'Economic Theory and the Meaning of Competition', *Quarterly Journal of Economics*, vol. 82, no. 4, pp. 639-656.
Meadows, D. 1996, 'Envisioning a Sustainable World', <http://www.sustainabilityinstitute.org/pubs/Envisioning.DMeadows.pdf>.
Meadows, D. 1999, *Leverage Points: places to intervene in a system*, Sustainability Institute, http://www.sustainabilityinstitute.org/pubs/Leverage_Points.pdf.
Meadows, D. 2002, 'Dancing With Systems', *Systems Thinker*, vol. 13, no. 2 (March), pp. 2-6.
Meadows, D., Randers, J. & Meadows, D. 2004, *A synopsis of Limits to Growth: The 30-Year Update*, http://www.sustainer.org/pubs/limitstogrowth.pdf.
Meppem, T. & Gill, R. 1998, 'Planning for sustainability as a learning concept', *Ecological Economics*, vol. 26, pp. 121-137.
Metcalf & Eddy Inc 1991, *Wastewater Engineering: Treatment, Disposal and Reuse*, Tata McGraw-Hill Inc.

Metcalf, W.J. 1995, *From utopian dreaming to communal reality : cooperative lifestyles in Australia*, UNSW Press, Sydney.
Miles, I. 1992, 'Indicators of Development', in P. Ekins & M.A. Max-Neef (eds), *Real-life economics : understanding wealth creation*, Routledge, London ; New York, pp. xxi, 460 p.
Millennium Campaign 2006, United Nations, viewed 22 January 2006 <http://www.millenniumcampaign.org/site/pp.asp?c=grKVL2NLE&b=186389>.
Millennium Ecosystem Assessment 2005, *Ecosystems and Human Wellbeing: Synthesis*, Island Press, Washington, DC., http://www.millenniumassessment.org/en/Products.Synthesis.aspx.
Mingers, J. & Rosenhead, J. 2004, 'Problem structuring methods in action', *European Journal of Operational Research 152 (2004) 530–554*, vol. 152, no. 3, pp. 530-554.
Mitchell, C. 2007, *Transdisciplinarity: Buyer Beware?*, Roundtable at the Institute fror Sustainable Futures 21 February 2007.
Mitchell, C. & Campbell, S. 2004, 'Synergy in the City: making the sum of the parts more than the whole', *2nd IWA Leading Edge Conference on Sustainability in Water Limited Environments*, Sydney.
Mitchell, C., Fane, S., Willetts, J., Plant, R. & Kazaglis, A. 2007, *Costing for Sustainable Outcomes in Urban Water Systems :A Guidebook*, Report Number 35, ISBN 1876616601, CRC for Water Quality and Treatment Research.
Mitchell, C., Mitchell, G., Shipton, R., Speers, A., Turner, A. & White, S. 2002, *Edmondson Park Feasibility Study*, CSIRO Urban Water and the Institute for Sustainable Futures.
Mitchell, C. & White, S. 2003, 'Forecasting and backcasting for sustainable urban water futures', *Water*, pp. 25-30.
Morano, M. 2003, 'Flush Toilets Called 'Environmental Disaster'', CNSNews.com, <http://www.cnsnews.com/Culture/archive/200306/CUL20030612b.html>.
Morrison, J.L. (ed.) 1992, *Environmental scanning*, The Association for Institutional Research, Tallahassee, Florida. http://horizon.unc.edu/courses/papers/. <http://horizon.unc.edu/courses/papers/>.
Mumford, L. 1961, *The City in History*, Harcourt, Brace and World.
NDWRCDP 2004, 'National Decentralized Water Resources Capacity Development Project', viewed May 2004 <http://www.ndwrcdp.org/>.
Nellis, J. 2006, *Privatization—A Summary Assessment*, Centre for Global Development, http://www.cgdev.org/content/publications/detail/6928/.
Nelson, J. & Prescott, D. 2003, *Business and the Millennium Development Goals: A Framework for Action*, International Business Leaders Forum and UNDP.
Nelson, J.A. 2004, *Beyond Small-Is-Beautiful: A Buddhist and Feminist Analysis of Ethics and Business*, Report Number 04-01, Global Development and Environment Institute, http://ase.tufts.edu/gdae/publications/working_papers/04-01BeyondSmall.pdf.
NEMMCO 2005, *An Introduction to Australia's National Electricity Market*, National Electricity Market Management Company.
Newman, P. 2001, 'Sustainable urban water systems in rich and poor cities--steps towards a new approach', *Water Science And Technology*, vol. 43, no. 4, pp. 93-99.
Newman, P. & Mouritz, M. 1996, 'Principles and opportunities for community scale systems of water and wastewater management', *Desalination*, vol. 10, pp. 339-354.

Niemczynowicz, J. 1999, 'Urban hydrology and water management : present and future challenges', *Urban Water*, vol. 1, pp. 1-14.

NOVAQUATIS 2004, Swiss Federal Institute for Environmental Science and Technology (EAWAG), viewed 20 June 2004. http://www.novaquatis.eawag.ch/index.

NPPD 2002, *Western Region Physical Structure Plan*, Ministry of Western Region Development, National Physical Planning Department (NPPD), http://www.uda.lk/Physhical_pla/western_regio_main.htm.

NSW Dept. of Local Government 1998, *Environment and Health Protection Guidelines: On-site Sewage Management for Single Households*.

NWSDB 2001, *Feasibility Report on Provision of the Sewerage Infrasrtucture to Sri Jayawardanapura-Kotte*, National Water Supply and Drainage Board.

NWSDB 2006, 'Tender for Wastewater Disposal Systems for Ratmalana/Moratuwa and Ja-Ela/Ekala Areas (Plant and Design – Build)', National Water Supply and Drainage Board, Sri Lanka, viewed 7 June 2006 <http://www.waterboard.lk/scripts/ASP/Tender.asp>.

Odum, H.T. & Odum, E.C. 2001, *A prosperous way down : principles and policies*, University Press of Colorado, Boulder, Colo.

Otis, R.J. 1998, 'Decentralized wastewater treatment: A misnomer', *Proceedings of The Eighth National Symposium on Individual and Small Community Sewage Systems*, Orlando, Florida.

Otterpohl, R., Albold, A. & Oldenburg, M. 1999, ' Source control in urban sanitation and waste management: Ten systems with reuse of resources', *Water Science & Technology*, vol. 39 (5), no. 5, pp. 153-160.

Otterpohl, R., Braun, U. & Oldenburg, M. 2002, 'Innovative Technologies for Decentralised Wastewater Management in Urban and Peri-Urban Areas', *IWA Conference on Small Water and Wastewater Treatment Systems*, Istanbul, Turkey.

Otterpohl, R., Grottker, M. & Lange, J. 1997, 'Sustainable Water and Waste Management in Urban Areas', *Water Science & Technology*, vol. 35, no. 9, pp. 121-133.

Pahl-Wostl, C., Schönborn, A., Willi, N., Muncke, J. & Larsen, T.A. 2003, 'Investigating consumer attitudes towards the new technology of urine separation', *Water Science & Technology*, vol. 48, no. 1, pp. 57-65.

Palmer, N., Lightbody, P., Fallowfield, H. & Harvey, B. 1999, 'Australia's Most Successful Alternative To Sewerage: South Australia's Septic Tank Effluent Disposal Schemes', *Australian Water Association National Conference 1999*, Adelaide.

Payutto, P.A. 1992, 'Buddhist Economics: A Middle Way for the Market Place', viewed 28 April 2005 <http://www.urbandharma.org/udharma2/becono.html>.

Peet, J. 1992, *Energy and the ecological economics of sustainability*, Island Press, Washington, D.C.

Perkins, R. 2003, 'Technological "lock-in"', in, *Online Encyclopaedia of Ecological Economics*, International Society for Ecological Economics.

Perry, C.J., Rock, M. & Seckler, D. 1997, *Water as an economic good: A solution, or a problem?*, Report Number Research Report 14, International Irrigation Management Institute, Colombo, Sri Lanka, http://www.iwmi.cgiar.org/pubs/PUB014/Report14.pdf.

Peter-Fröhlich, A., Kraume, I., Lesouëf, A. & Oldenburg, M. 2003, 'Separate Discharge and Treatment of Urine, Faeces and Greywater Pilot Project', *World Water & Environmental Resources Congress*, Philadelphia.

Pieper, U. & Taylor, L. 1998, *The Revival of the Liberal Creed: The IMF, the World Bank, and Inequality in a Globalized Economy*, Report Number CEPA Working Paper Series 1:Globalization, Labor Markets, and Social Policy, Center for Economic Policy Analysis, http://www.newschool.edu/cepa/papers/archive/cepa0104.pdf.

Pinkham, R. 1999, *21st Century Water Systems: Scenarios, Visions, and Drivers*, W99-21, Rocky Mountains Institute, http://www.rmi.org/sitepages/pid172.php.

Pinkham, R., Ferguson, B. & Collins, T. 1999, *Re-Evaluating Stormwater: The Nine Mile Run Model for Restorative Redevelopment*, Report Number WW-22, Rocky Mountain Institute.

Pinkham, R., Hurley, E., Watkins, K., Lovins, A.B., Magliaro, J., Etnier, C. & Nelson, V. 2004, *Valuing Decentralized Wastewater Technologies: A Catalogue of Benefits, Costs and Economic Analysis Techniques*, Rocky Mountains Institute, http://www.rmi.org/images/other/Water/W04-21_ValuWstWtr.pdf.

Pirsig, R.M. 1976, *Zen and the art of motorcycle maintenance : an inquiry into values*, Corgi, London.

Porter, M.E. & Kramer, M.R. 2002, 'The Competitive Advantage of Corporate Philanthropy.' *Harvard Business Review*, vol. 80, no. 12, pp. 56-69.

Postel, S. 2005, *Liquid Assets: The Critical Need to Safeguard Freshwater Ecosystems*, Worldwatch Institute.

Public Citizen 2003, 'Water Privatization Fiascos: Broken Promises and Social Turmoil', Public Citizen, <http://www.citizen.org/documents/privatizationfiascos.pdf>.

Public Citizen 2006, 'Water for All', <http://www.citizen.org/cmep/Water/reports/index.cfm>.

Public Services International Research Unit 2003, viewed June 2003 <http://www.psiru.org/>.

PUCSL 2007, Public Utilities Commission of Sri Lanka website, viewed 20 March 2007 <http://www.pucsl.gov.lk/>.

Rafter, D. 2006, 'Taking on the Challenge of Katrina', *Onsite Water Treatment. The Journal of Decentralized Wastewater Treatment Solutions*. <http://www.onsitewater.com/ow_0601_taking.html>.

Rahula, W. 1996, *What the Buddha Taught*, Buddhist Cultural Centre, Dehiwala, Sri Lanka.

Ravetz, J. 1999, 'What is Post-Normal Science', *Futures*, vol. 31, pp. 647-653.

Renn, O. 1999, 'A Model for an Analytic-Deliberative Process in Risk Management', *Environmental Science and Technology*, vol. 33, no. 18, pp. 3049-3055.

Renn, O., Webler, T., Rakel, H., Dienel, P. & Johnson, B. 1993, 'Public participation in decision making: A three-step procedure', *Policy Sciences*, vol. 26, pp. 189-214.

Renzetti, S. & Dupont, D. 2003, 'Ownership and Performance of Water Utilities', *Greener Management International*, vol. 42 Summer.

Riedy, C. 2005, 'The Eye of the Storm. An Integral Perspective on Sustainable Development and Climate Change Response', PhD thesis, University of Technology, Sydney, Australia.

Rittel, H. & Webber, M.M. 1984, 'Planning Problems are Wicked Problems', in N. Cross (ed.), *Developments in Design Methodology*, John Wiley & Sons, New York, pp. 135-144.

Robert, K.-H., Schmidt-Bleek, B., Aloisi de Larderel, J., Basile, G., Jansen, J., Kuehr, R., Price Thomas, P., Suzuki, M., Hawken, P. & Wackernagel, M. 2002, 'Strategic

sustainable development - selection, design and synergies of applied tools', *Journal of Cleaner Production*, vol. 10, pp. 197-214.

Roberts, R. 1995, 'Public Involvement: From Consultation to Participation', in F. Vanclay & D. Bronstein (eds), *Environmental and Social Impact Assessment*, John Wiley and Sons.

Robinson, A. 2003, *Urban Sewerage and Sanitation: Lessons learned from case studies in the Philippines*, *Field Note June 2003*, World Bank Water and Sanitation Program, <http://www.wsp.org/publications/eap_urban_en.pdf>.

Rogers, P., Bhatia, R. & Huber, A. 1998, *Water as a Social and Economic Good: How to Put the Principle into Practice*, Global Water Partnership/Swedish International Development Cooperation Agency, Stockholm, Sweden, http://www.gwpforum.org/gwp/library/TAC2.PDF.

Rogers, P., de Silva, R. & Bhatia, R. 2002, 'Water is an economic good: How to use prices to promote equity, efficiency, and sustainability', *Water Policy*, vol. 4, pp. 1-17.

Røpke, I. 2005, 'Consumption in ecological economics', in, *Online Encyclopaedia of Ecological Economics*, International Society for Ecological Economics.

Rosenhead, J. & Mingers, J. 2001a, 'A New Paradigm of Analysis', in J. Rosenhead & J. Mingers (eds), *Rational analysis for a problematic world revisited : problem structuring methods for complexity, uncertainty and conflict*, 2nd edn, Wiley, Chichester ; New York, pp. xvi, 366 p.

Rosenhead, J. & Mingers, J. (eds) 2001b, *Rational analysis for a problematic world revisited : problem structuring methods for complexity, uncertainty and conflict*, 2nd edn, Wiley, Chichester ; New York.

Roy, D. 1999, *Corporate community involvement : philanthropy or self-interest?*, Charities Aid Foundation, West Mailing, England.

Ruth, M. 2006, 'A quest for the economics of sustainability and the sustainability of economics', *Ecological Economics*, vol. 56, pp. 332-342.

Ryfe, D.M. 2005, 'Does Deliberative Democracy Work?' *Annual Review of Political Science*, vol. 2005, no. 1, pp. 49-71.

Sanctuary, M., Tropp, H. & Haller, L. 2005, *Making water a part of economic development : the economic benefits of improved water management and services*, SIWI, Stockholm, Sweden, http://www.siwi.org/downloads/Reports/CSD_Economics.pdf].

Saul, J.R. 2005, *The Collapse of Globalism: and the Reinvention of the World*, Penguin Group, Australia.

Savenije, H.H.G. 2002, 'Why water is not an ordinary economic good, or why the girl is special', *Physics and Chemistry of the Earth*, vol. 27, pp. 741-744.

Schaefer, A. 2003, 'Endocrine Disrupting Chemicals – Risks and Opportunities in Water Treatment & Recycling', *OZ-AQUAREC Workshop II: Technical Limitations in Water Recycling Processes*, http://www.uow.edu.au/~schaefer/pdfs/schaefer.pdf, Wollongong.

Schertenleib, R. 2004a, 'From Conventional to Advanced Environmental Sanitation', *Proceedings of 6th Specialist Conference on Small Water & Wastewater Systems and 1st International Conference on Onsite Wastewater Treatment & Recycling*, Freemantle, Australia.

Schertenleib, R. 2004b, *From Conventional to Advanced Environmental Sanitation*, *Keynote presentation at the 6th Specialist Conference on Small Water &*

Wastewater Systems and 1st International Conference on Onsite Wastewater Treatment & Recycling, Freemantle, Australia.
Schönborn, A. 2000, 'Interview with Uno Winblad', *EcoEng Newsletter*. <http://www.iees.ch/EcoEng003/downloads/EcoEng003_Interv.pdf>.
Schraeder, P.J., Hook, S.W. & Taylor, B. 1998, 'Clarifying the Foreign Aid Puzzle: A Comparison of American, Japanese, French, and Swedish Aid Flows', *World Politics*, vol. 50, no. 2, pp. 294-323.
Schumacher, E.F. 1973, *Small is Beautiful : Economics as if People Mattered*, Harper torchbooks, TB 1778.
Schwartz, N.D. 2005, 'Prosperity without Peace: Israel Rises', *Fortune*, vol. 151, no. 10, pp. 46-51.
Seidenstat, P. 2000, 'Emerging Competition in Water and Wastewater Industries', *Water Resources Update - Universities Council on Water Resources*, no. 117, pp. 6-12.
Seppälä, O.T., Hukka, J.J. & Katko, T.S. 2001, 'Public-Private Partnerships in Water and Sewerage Services: Privatization for Profit or Improvement of Service and Performance?' *Public Works Management & Policy*, vol. 6, no. 1, pp. 42-58.
Sevanatha 2002, *Poverty Profile : City of Colombo*, http://www.ucl.ac.uk/dpu-projects/drivers_urb_change/urb_society/pdf_liveli_vulnera/Sevanatha_Poverty_Profile1.pdf.
Shofiani, N.E. & Gustafsson, J.E. 2004, 'Privatisation of Municipal Waterworks and Sustainability of Water: A Case Study in Eastern Jakarta, Indonesia', *2nd IWA Leading Edge Conference on Sustainability in Water Limited Environments*, Sydney.
SIWI 2002, *Corporate Responsibility to Facilitate Sustainablility in the Water Sector*, Report Number 16, Stockholm International Water Institute, http://www.siwi.org/downloads/Reports/Report%2016%20%20Founders%20Seminar%202002.pdf.
SIWI 2004, *Report on the Seminar on Financing Water Infrastructure*, Stockholm International Water Institute and World Bank, http://www.worldwatercouncil.org/fileadmin/Financing_water_for_all/Stakeholders_responses/2004_WWW_SIWI_World_Bank_Seminar_Final_Report.pdf.
Smith, A. [1759]1790, 'The Theory of Moral Sentiments', Sixth edition. Ed. A. Millar. Library of Economics and Liberty, viewed 23 November 2005 <http://www.econlib.org/library/Smith/smMS.html>.
Smith, A. [1776]1904, 'An Inquiry into the Nature and Causes of the Wealth of Nations', Methuen and Co., Ltd., Ed. Edwin Cannan, Library of Economics and Liberty, viewed 12 November 2005 <http://www.econlib.org/library/Smith/smWN1.html>.
Smith, D.I. 1998, *Water in Australia*, Oxford University Press.
Smith, J.W., Lyons, G. & Sauer-Thompson, G. 1999, *The bankruptcy of economics : ecology, economics and the sustainability of the earth*, Macmillan Press.
Söderbaum, P. 1999, 'Values, ideology and politics in ecological economics', *Ecological Economics*, vol. 28, pp. 161-170.
Söderbaum, P. 2000, *Ecological economics : a political economics approach to environment and development*, Earthscan, London.
Söderbaum, P. 2003, 'Ecological economics for water policy and management: a need for major shifts in thinking', *Water Science & Technology*, vol. 47, no. 6, pp. 33-41.

Söderbaum, P. 2004, 'Politics and Ideology in Ecological Economics', in, *Online Encyclopaedia of Ecological Economics*, International Society for Ecological Economics.

South West Water 2006, 'Don't Flush and Forget it', viewed 26 February 2006 <http://www.swwater.co.uk/index.cfm?articleid=1661>.

Standards Association of Australia 1995, *Risk Management AS/NZS 4360:1995.*, Standards Australia ; Standards New Zealand, Homebush NSW. Wellington, N.Z.

Stark, P. 2004, *Poverty has increased and Real Income has fallen since 2000*, US Senate Democrats Joint Economic Committe, http://jec.senate.gov/Documents/Reports/povertyfactsheet26aug2004.pdf.

Steen, I. 1998, 'Phosphorus availability in the 21st century Management of a non-renewable resource', *Phosphorus & Potassium*, no. 217, pp. 25-31.

Stiglitz, J. 2002, *Globalization and Its Discontents*, Allan Lane imprint of Penguin Press.

Stockholm Water Symposium Statement 2002, 'Urgent Action Needed for Water Security: 2002 STOCKHOLM STATEMENT', viewed 18 April 2003 <http://www.siwi.org/pdf/2002_Stockholm_Statement.pdf>.

Sundaravadivel, M., Trivedi, R.C. & Vigneswaran, S. 2003, 'Quality of Water Environment and Management of Urban Wastewater in India: Issues and Improvement Strategies', *The First International Symposium on Southeast Asian Water Environment*, Bangkok.

SustainAbility 2004, *Gearing up: from corporate responsibility to good governance*, <http://www.positiveoutcomes.com.au/uploads/files/1098421105072_0.5206623877156705.pdf>.

Sustainability Institute 2001, *Foundation Dynamics: Exploring the Leverage Points for Successfully Funding Sustainability*, Sustainability Institute, http://www.sustainabilityinstitute.org/pubs/FoundationDynamics.pdf.

Sydney Water Corporation 2002, 'Rouse Hill Recycled Water Plant', viewed 30 September 2006 <http://www.sydneywater.com.au/Publications/Factsheets/RouseHill.pdf>.

Sydney Water Corporation 2004, 'Water Conservation & Recycling Implementation Report 2003 – 2004', viewed 20 October 2006 <http://www.sydneywater.com.au/Publications/_download.cfm?DownloadFile=Reports/WaterConservationAnnualReport2004.pdf>.

Tapvong, C. & Kruavan, J. 1999, *Water Quality Improvements: A Contingent Valuation Study of The Chao Phraya River*, Economy and Environment Programme for South East Asia, http://web.idrc.ca/uploads/user-S/10536135510ACF23D.pdf.

The Free Dictionary 2007, 'Problematize', Farlex, <http://encyclopedia.thefreedictionary.com/Problematize>.

Tidåker, P. 2003, *Life Cycle Assessment of Grain Production Using Source-Separated Human Urine and Mineral Fertiliser*, Department of Agricultural Engineering Report 251, Swedish University of Agricultural Sciences, http://www.urbanwater.org/reports/urinrapport_abstract.pdf.

Tisdell, J., Ward, J. & Grudzinski, T. 2002, *The Development of Water Reform in Australia : Technical Report 02/5*, Cooperative Research Centre for Catchment Hydrology, http://www.catchment.crc.org.au/pdfs/technical200205.pdf.

UDA 1998, 'Colombo Metropolitan Regional Structure Plan', Urban Development Authority, Ministry of Housing and Urban Development, viewed 21 August 2002 <http://www.uda.lk/Uda/images/Genaral/Cmr_home.htm>.

UDA 1999, *City of Colombo Development Plan 1999 - Volume 2*, Urban Development Authority, Ministry of Urban Development, Housing & Construction.

UDA 2007, 'Urban Development Authority website', viewed January 28 2007 <http://www.uda.lk/>.

UN 1948, *Universal Declaration of Human Rights*, United Nations, http://www.un.org/Overview/rights.html.

UN 2001, *Indicators of Sustainable Development: Guidelines and Methodologies*, United Nations Division for Sustainable Development, http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf.

UN 2005, 'What is the Global Compact?' United Nations, viewed 20 November 2005 <http://www.unglobalcompact.org/Portal/Default.asp?>.

United Nations Millennium Declaration 2000 (8th plenary meeting).<http://www.un.org/millennium/declaration/ares552e.htm>.

UNDP 2006, *Human Development Report 2006*, http://hdr.undp.org/hdr2006/report.cfm.

UNEP 2000, *International Source Book On Environmentally Sound Technologies for Wastewater and Stormwater Management - Section 3 Regional Overviews and Information Sources: Asia (Pacific)*, United Nations Environment Programme (UNEP) Division of Technology, Industry, and Economics, Osaka, Japan, http://www.unep.or.jp/Ietc/Publications/TechPublications/TechPub-15/3-3AsiaPacific/3-0.asp.

UNEP/WHO/HABITAT/WSSCC 2004, *Guidelines on Municipal Wastewater Management*, http://www.gpa.unep.org/documents/wastewater/Guidelines_Municipal_Wastewater_Mgnt%20version3.pdf.

United Nations 1997, *Glossary of Environment Statistics. Studies in Methods: Series F, No. 67*, United Nations, New York, http://unstats.un.org/unsd/publication/SeriesF/SeriesF_67E.pdf.

Urban Water 2002, 'Sustainable Urban Water Management - Programme Plan Phase 2', MISTRA, http://www.urbanwater.org.

USEPA 1997, *Response to Congress on Use of Decentralized Wastewater Treatment Systems*, Report Number EPA 832-R-97-001b, US Environmental Protection Agency, http://www.epa.gov/owm/septic/pubs/septic_rtc_all.pdf.

USEPA 2002, *Onsite Wastewater Treatment Systems Manual*, Report Number EPA/625/R-00/008, Office of Water, Office of Research and Development, U.S. Environmental Protection Agency, http://www.epa.gov/nrmrl/pubs/625r00008/html/625R00008.htm.

USEPA 2003, *Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems*, Report Number EPA 832-B-03-001, U.S. Environmental Protection Agency, http://www.epa.gov/owm/septic/pubs/septic_guidelines.pdf.

USEPA 2005, *Handbook for managing onsite and clustered (decentralized) wastewater treatment systems*, Report Number EPA 832-B-05-001, US Environmental Protection Agency Office of Water.

USEPA 2006, ' How to Conserve Water and Use It Effectively', United States Environment Protection Agency, viewed 26 February 2006 <http://www.epa.gov/water/you/chap3.html>.

vanGinneken, M., Tyler, R. & Tagg, D. 2004, *Can the principles of franchising be used to improve water supply and sanitation services? : a preliminary analysis.*, Report Number Water Supply And Sanitation Sector Board Discussion Paper Series: Paper No. 2, The World Bank, Washington, DC, http://www.worldbank.org/watsan/pdf/WSS_Franchise.pdf.

Velasquez, M. 2003, 'Debunking Corporate Moral Responsibility', *Business Ethics Quarterly*, vol. 13, no. 4, pp. 531-562.

Vos, J.G., Dybing, E., Greim, H.A., Ladefoged, O., Lambré, C., Tarazona, J.V., Brandt, I. & Vethaak, A.D. 2000, 'Health Effects of Endocrine-Disrupting Chemicals on Wildlife, with Special Reference to the European Situation', *Critical Reviews in Toxicology*, vol. 30, no. 1, pp. 71-133.

Walker, I. 2003, 'PRC Wastewater Tariffs and Management Study', ADB, viewed 29 August 2005 <http://www.adb.org/Water/Seminars/blue_bag_11.asp>.

Warren-Rhodes, K. & Koenig, A. 2001, 'Escalating Trends in the Urban Metabolism of Hong Kong: 1971–1997', *AMBIO: A Journal of the Human Environment*, vol. 30, no. 7, p. 429–438.

Weiser, J. & Zadek, S. 2000, *Conversations with Disbelievers*, The Ford Foundation, http://216.65.35.60/pdf/convdisb.pdf.

West, S. 2003, *Innovative On-site and Decentralised Sewage Treatment Reuse and Management Systems in Northern Europe & the USA - Report of a study tour - February to November 2000*.

White, S. (ed.) 1998, *Wise Water Management: A Demand Management Manual for Water Authorities*, Water Services Association of Australia, Sydney 1998.

White, S. 2001, *Independent Review of Container Deposit Legislation in New South Wales*, Institute for Sustainable Futures, Sydney.

White, S. 2005, *The coast, the dam and in-between: issues for Manly's future*, *Manly Futures Forum*, Manly Council, <http://www.isf.uts.edu.au/publications/White_2005_presentation.pdf>.

White, S., Fane, S., Giurco, D. & Turner, A. 2006, 'Putting the economics in its place: decision making in an uncertain environment', *Ninth Biennial Conference of the International Society for Ecological Economics (ISEE)*, New Delhi, India.

White, S. & Fane, S.A. 2002, 'Designing cost effective water demand management programs in Australia', *Water Science and Technology*, vol. 7, no. 46, pp. 225-232.

Whittington, D., Boland, J. & Foster, V. 2002, *Water Tariffs and Subsidies: Understanding the Basics*, World Bank, Public–Private Infrastructure Advisory Facility and Water and Sanitation Program, Washington D.C., http://web.mit.edu/urbanupgrading/waterandsanitation/resources/pdf-files/.

WHO & UNICEF 2004, *Meeting the MDG Drinking Water and Sanitation Target: A Mid-term Assessment of Progress*, World Health Organization and United Nations Children's Fund Joint Monitoring Programme on Water Supply and Sanitation (JMP), http://www.unicef.org/publications/who_unicef_watsan_midterm_rev.pdf.

WHO & UNICEF 2005, *Water for Life*, WHO/UNICEF Joint Monitoring Programme (JMP), http://www.wssinfo.org/en/40_wfl_2005.html.

WHO & UNICEF 2006, *Coverage Estimates: Improved Sanitation - Sri Lanka*, World Health Organization and United Nations Children's Fund Joint Monitoring Programme on Water Supply and Sanitation, http://www.wssinfo.org/pdf/country/LKA_san.pdf.

Wickson, F., Carew, A.L. & Russell, A.W. 2006, 'Transdisciplinary Research: characteristics, quandaries and quality', *Futures*, vol. 38, no. 9, pp. 1046-1059.

Wikramanayake, N. & Corea, E.J.H. 2003, 'Alternative Technology for Urban Wastewater Treatment: Case Studies and Issues of Implementation and Sustainability', *World Water and Environmental Resources Congress*, American Society of Civil Engineers, Philadelphia.

Wilbur, K. 2005, 'Introduction to Integral Theory and Practice', *AQAL: Journal of Integral Theory and Practice*, vol. 1, no. 1.

Wilderer, P.A. 2001, 'Decentralized versus centralized wastewater management', in P.Lens, G. Zeeman & G. Lettinga (eds), *Decentralised Sanitation and Reuse - Concepts, Systems and Implementation*, IWA Publishing, pp. 39-54.

Wilderer, P.A. 2002, 'Decentralized sanitation and reuse: A new concept for economic water management worldwide', *Environmental Technology Symposium organised by Hans Huber AG*, Bavaria.

Wilderer, P.A. 2004, 'Applying sustainable water management concepts in rural and urban areas: some thoughts about reasons, means and needs', *Water Science & Technology*, vol. 49, no. 7, pp. 7-16.

Wilderer, P.A. & Schreff, D. 2000, 'Decentralized and centralized wastewater management: a challenge for technology developers', *Water Science and Technology*, vol. 41, no. 1, pp. 1-8.

Williamson, J. 2000, 'What Should the World Bank Think about the Washington Consensus?' *The World Bank Research Observer*, vol. 15, no. 2, pp. 251-264.

Wilsenach, J.A., Maurer, M., Larsen, T.A., van Loosdrecht, M.C.M. & Van Loosdrecht, M.e. 2003, 'From waste treatment to integrated resource management', *Water Science & Technology*, vol. 48, no. 1, pp. 1-9.

Wilsenach, J.A. & van Loosdrecht, M. 2003, 'Impact of separate urine collection on wastewater treatment systems', *Water Science & Technology*, vol. 48, no. 1, pp. 103-110.

Wilson, R. 2001, 'Corporation Social Responsibility: Putting the Words into Action', *RIIA-MMSD Conference on Corporate Citizenship*.

Winblad, U. & Simpson-Hébert, M. (eds) 2004, *Ecological sanitation – revised and enlarged edition*, Stockholm Environment Institute, Stockholm, Sweden. <http://www.ecosanres.org/pdf_files/Ecological_Sanitation_2004.pdf>.

Wingspread Statement 1998, *Wingspread Consensus Statement on the Precautionary Principle*, Wingspread Conference Centre, Racine, Wisconsin, January 1998.

Wolff, G. & Gleick, P.H. 2002, 'The Soft Path for Water', in, *The World's Water 2002-2003: The Biennial Report on Freshwater Resources*, Pacific Institute for Studies in Development, Environment, and Security, Oakland, California, pp. 1-32.

World Bank 1996, *Non Plantation Sector Policy Alternatives*, By Hung, R. & Lister, D, quoted by Houtart (2005) and La Via Campesina (2006).

World Bank 2000, 'Sewage Disposal Project Transforming Urban Environment and Improving Quality of Life in Mumbai, India', viewed 24/4/2004 <http://lnweb18.worldbank.org/sar/sa.nsf/Attachments/MbaiSewg/$File/MbaiSewg.pdf>.

World Bank Group 2004, 'Millennium Development Goals', viewed 25 November 2005 <http://www.developmentgoals.org/Goals.htm>.

World Commission on Environment and Development 1987, *Our common future*, Oxford University Press, Oxford.

World Vision Australia 2006, *Does Aid Work?*, http://www.worldvision.com.au/learn/policyandreports/files/DoesAidWork_2006_low.pdf.

World Water Council 2000, *World Water Vision*, http://www.worldwatercouncil.org/index.php?id=961.

WRI 1999, 'Access to safe water, adequate sanitation, and exposure to insect-borne diseases in developing countries', World Resources Institute, <http://pubs.wri.org/pubs_content_text.cfm?ContentID=1186>.

Wright, A.M. 1997, *Toward a Strategic Sanitation Approach: Improving the Sustainability of Urban Sanitation in Developing Countries*, UNDP-World Bank, Water and Sanitation Program, http://www.wsp.org/pdfs/global_ssa.pdf.

WSAA 2003, *WSAA Facts 2003*, Water Services Association of Australia.

WSSCC 2006, *For her it's the big issue: putting women at the centre of water supply, sanitation and hygiene*, Water Supply and Sanitation Collaborative Council, http://wash-cc.org/pdf/publication/FOR_HER_ITs_THE_BIG_ISSUE_Evidence_Report-en.pdf.

Yeager, T., Ehrhard, R. & Murphy, J. 2006, *Business attributes of successful responsible management entities*, Report Number Project No. 04-DEC-4SG., Prepared for the National Decentralized Water Resources Capacity Development Project, Water Environment Research Foundation, Alexandria, VA, by Kennedy/Jenks Consultants.

Yunus, M. 1998, 'Poverty alleviation: Is economics any help? Lessons from the Grameen bank experience', *Journal of International Affairs*, vol. 52, no. 1, pp. 47-65.

Zhang, F. 1999, *Marginal Opportunity Cost Pricing for Wastewater Disposal: A Case Study of Wuxi China*, Economy and Environment Programme for South East Asia, http://web.idrc.ca/uploads/user-S/10536117220ACF1C9.pdf.