Title: Overcoming expertocracy through sustainable development: the case of wastewater.

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Abstract

This paper reviews the potential for taking a more holistic, interdisciplinary approach towards one of the less visible dimensions of the built environment: water and wastewater infrastructure. On a worldwide scale, there is an ever-increasing demand for water, along with an urgent need for improved sanitation. Conventional wastewater engineering fails to take into account many of the issues raised by the concept of sustainable development. As such more radical systems of approach need to be considered, concerning society as a whole. This paper will outline some of the main issues surrounding the subject of water and wastewater management, and will discuss the issue of public participation in water and wastewater planning. The influence of psychological factors on acceptance of wastewater technologies is also discussed. Tentative conclusions, along with possible implications for further research are then presented.

Introduction

This paper will firstly outline the background and some of the issues relating to domestic water and wastewater management. It will then place this in the context of sustainable development, as conventional engineering approaches fail to take into account many of the issues raised by the concept. For any process to be sustainable, it must be so from an environmental, economic, and social viewpoint. However, in the field of water and wastewater management, the social science perspective is often neglected in favor of technical judgement, hence the term 'expertocracy' in the title Agenda 21 calls for more efficient water management and also greater levels of public participation in local decision making. Hence this paper focuses on decentralised approaches to water and wastewater management from a social science perspective. It will then discuss some of the social and psychological factors that might serve as behavioural change motivators or barriers to acceptance in relation to such issues. Because sustainable technologies tend towards tackling the problem at source, greater involvement of end-users is often required. This assumption is technically simplistic, but for the purposes of this paper is thought to be a useful one. Given this to be true, it is argued that the social sciences will have a great deal to offer wastewater management in the transition towards a more sustainable future. Tentative conclusions, along with possible implications for further research are then presented.

Wastewater Management - The Context

The first sewers were constructed a long time ago to address problems of disease and flooding, which were prevalent at the time. In these traditional sewers, underground pipes simply transported our waste away from the cities, to the rivers[1], solving the immediate threats to human well-being. However, this soon became unsustainable as a solution, when the impact of sewage on the river ecosystem started to have adverse effects on people, such as odour and health problems (Balkema, 1999). Since then, sewage has been treated to ever increasing standards to ameliorate any potential health impacts, and has by and large been viewed as a success. However, there are growing concerns that there may be some missing pieces in the wastewater jigsaw when treatment occurs in this manner. Since the construction of most of our urban sewers, the content and quantity of society's aggregate wastewater has changed dramatically, due to population increases and industrial development, and subsequent technical engineering 'fixes' have tended towards inefficiency. Thus it seems a rethink is on the cards in terms of the way we view one of our most unglamorous, but most essential waste problems. Any moves away from the present 'pollution treatment' philosophy, towards a philosophy concerned with preventing 'pollution production' will be positive steps towards sustainability.

After the Earth summit in Rio, 1992, which cemented the definition of sustainable development as "*Development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs"* (UN, 1987*),* definitions of sustainability need to be operationalised within local contexts. As such, all countries should be implementing programmes of efficient water management, including water conservation measures. Moreover, the Agenda 21 document (UNEP, 1992) mentions the importance of '*treatment and safe reuse of domestic and industrial waste waters in urban and rural areas'* (Chapter 18, paragraph 50[2]). This, along with the suggestions that pertain to a decentralised approach regarding environmental problems, point to the need for research in this area.

Many of the lessons learned from experience with both solid waste management and energy efficiency can be appropriately applied to the study of water and wastewater management. Changes in policy and institutional preference are often nothing but token if change on the ground is not forthcoming, as has been found at times in both of the preceding examples. However, social scientists have been less successful in influencing policy and legislation, but have focussed instead on behavioural change studies and the like (Bechtel, 1997). Given that all technology assessment is in many ways a political activity (Barbour, 1980), potential attitudes and behaviour of the 'end-user' of various innovative technologies should always be seen as important tests of both feasibility and sustainability. Methodologies such as *Participatory Impact Assessment* (PIA) might provide a possible way of incorporating such factors into the assessment process (see for example Schlumpf et al., 1999).

Sustainable domestic water and wastewater management

In terms of the domestic setting, wastewater is transported via sewerage to either a centralised sewage treatment plant, or one of a variety of decentralised sewage treatment options, be they ecological or conventional (for a full review of treatment techniques, see Grant et al., 1995 or Burkhard, 1998). In terms of different sewage treatment options, even with the more ecological and decentralised options, an 'out of sight, out of mind' approach is more often than

[1] In old English, the word sewer means 'seaward': i.e. waste is diverted towards the sea, via rivers (Balkema, 1999).
[2] See also, UNEP, section 7.5(D)

not taken by the general public (Shields, 1999). Centralisation, with all its advantages, seems to have created a potential psychological barrier to the successful implementation of sustainable water and wastewater management. Moves towards sustainability on the other hand, require an increasing focus on source control, and hence pollution production, rather than treatment. Some possible steps towards amelioration of water and wastewater problems are discussed below.

a) Reduce the volume of potable water required

In some parts of the UK, water use often exceeds the regionally sustainable water supply (National Trust, 1996). In the UK, standards have long been in place governing the quality of water, regardless of the use to which the water is put. These regulations and standards (e.g. bathing water and drinking water standards) are crucial for health and hygiene reasons, and are strictly regulated (e.g. by DWI & SEPA[3]) for this very reason. However, treating water to potable (i.e. drinkable) standards is costly in terms of finance, energy, and infrastructure. Seen in this context, potable water is clearly a very valuable resource, but also one which we regularly waste without thought. At present, households account for 64% of all treated water use (Staufer, 1996). Installation of water saving devices in the home (e.g. low flush toilets, aerating taps, and suchlike) go some way to addressing this problem. Also, given that about a third of our total water usage is used for flushing toilets (Griggs et al., 1997), collection of 'greywater'[4] for use in toilet cisterns makes sense in terms of sustainability and economics, although payback periods can sometimes be large (see Sayers, 1998; Naisby, 1997; Environment Agency, 2000). However, there are sometimes concerns voiced about the perceived safety of greywater (Olson & Bruvold, 1982; Shifflett, 1997; Naisby, 1997) with preference often tending towards rainwater harvesting, which can also provide a viable alternative to potable water.

b) Reduce the volume and content of wastewater from the house

Recycling of greywater as mentioned above goes some way towards reducing the amount of potable water required by domestic dwellings. However, from the point of view of waste produced, in terms of BOD[5] and SS[6] (two of the main measures used by regulators to assess the organic matter and pathogens in water), the wastewater content still remains high, if a little less diluted. In order to reduce the content of organic matter and pathogens in the wastewater, separation of waste would have to occur at source, which would invariably mean a change in behavioural patterns, as different toilets and plumbing would be required. Of course, if separation of waste were to take place at source (e.g. urine separation and dry toilets), then the aforementioned greywater would need to be put to some other use (e.g. washing or watering gardens). Given the cultural significance of the flushing toilet (Palmer, 1973), and the taboos surrounding human bodily functions (see for example Warner, 1999), it is likely that any radical changes in toilet design and corresponding behaviors will produce a negative reaction among many people. Behavioural patterns and corresponding attitudes regarding toilet practices such as

[3] DWI = Drinking Water Inspectorate. SEPA = Scottish Environmental Protection Agency
[4] Greywayer = Water from handbasins, baths, showers, washing machines and dishwashers (NOT toilets)
[5] BOD = Biochemical Oxygen Demand: Indicator of Organic matter content of a body of water, measuring by how much oxygen is being removed by decomposition.
[6] SS = Suspended Solids: Particles of grit, sand or organic matter suspended in a body of water

flushing and then hearing the waste being 'flushed away' are deeply entrenched in western society (Fismer and Wendler, 1996) and thus sensitive to change[7].

c) Recycle the nutrients that are traditionally lost in conventional treatment processes

As well as reducing the concentrations of organic matter and pathogens in wastewater dramatically, dry toilets and urine separation toilets also have the potential to provide for a variety of uses such as nutrient recycling or methane production (for transport). Burkhard et al. (1999) note that such techniques can also be very cost effective alternatives to traditional systems, given appropriate tariff structures. This idea is however, still seen as fairly radical within the UK.

Having identified some of the ways in which the wastewater management problem can be tackled in a more sustainable manner, the following section will introduce the issue of public participation in water and wastewater planning. This issue is relevant as it is considered to be a crucial part of the drive towards sustainability, as defined within Agenda 21. Moreover, it is also an issue frequently neglected by those advocating changes in the field of water and wastewater management.

Public participation in water and wastewater planning

Any planning process is, by its very nature a social process, feeding ultimately into the 'goals of society' (Parker & Penning-Rowsell, 1980). Public influence on the planning process[8] is one of the basic pillars of a participatory democracy, given that in theory, '*individuals and their institutions cannot be considered in isolation from one another*' (Pateman, 1970, pp.42). Thus, a diverse range of opinions should be accommodated and considered within any planning decision. However, all too often this is not the case, and the process suffers from both institutional problems, public indifference, and a basic lack of trust between stakeholders from the outset.

Syme and Nancarrow (1992) note that public participation in water planning often caters only for an interested minority, which is arguably unrepresentative of the general public. Given that water management decisions are dependent more on human values rather than technical judgement (Syme & Nancarrow, 1992), methods for ascertaining public values and perceptions are crucial in gaining a full understanding of society's goals regarding water management. The situation where only an educated, affluent minority participates in such matters might be viewed as a failure of the participatory process rather than as a failure of the seemingly disinterested, who may instead be uncomfortable with the process itself.

Syme and Nancarrow (1992) found that public involvement in the water planning process could be predicted by a) perceived levels of desirable power for the water authority, and b) intrinsic interest in particular water issues[9]. The use of questionnaires and other survey methodologies can sometimes be used as an alternative, more user-friendly way of gauging public opinion. Once this 'public opinion' has been ascertained however, it is important that it is at very least 'seen to be' taken into account. Indeed, research has shown that it is better to treat public involvement as a negotiation process, rather than as a '*procedure with relatively unvarying sequence*' (Syme & Eaton, 1989, pp 104).

[7] See Fittschen & Niemczynowicz (1997) for an interesting case study of the implementation of dry toilet systems in an eco-village in Sweden.
[8] For an interesting account of citizen participation in planning, see Fagence (1978)
[9] It should be noted however that, unlike earlier studies, no relationship was found in this study between education, income, age, and participation.

Another factor influencing water planning decisions is the procedural fairness (see Lind & Tyler, 1988) perceived by participants in the water planning process. All too often participants take the view that the participation process is unfair, which can result in discussions about procedural issues (such as procedural justice and political efficacy) rather than the original topic. Thus issues become 'framed' and thereby redefined by the participants. It is also likely that perceptions of distributive justice play a strong part in public attitudes towards water management issues, given that water and wastewater infrastructure is by it's nature a resource allocation problem. Clayton (1996) suggests that we should '*think through the effects of any policy and evaluate it from a number of different justice perspectives*' (p 208) in order to maximise the collective welfare. From this perspective, it is clear that environmental decision making is no longer a matter of simply weighing up the economic costs and benefits, but a complex problem requiring the consideration of such issues as procedural and distributive justice. Syme et al. (1999) found that on the whole, the public base their decisions on more complex dimensions than would be expected by many social-psychological theories. Examples include: Moral obligation towards other human users, obligation for involvement in decision making, and the 'rights' of the environment.

Values, Attitudes, and Behaviour

Rousseau's political theory asserts that through participation in the decision making process, individuals become able to understand a given situation from the perspectives of both public and private interests (Pateman, 1970). Thus, public demands eventually converge with private wishes through the participatory process. Prior to the participation process[10], it is considered useful to have an understanding of the general values and attitudes of the potential participants, and thus the nature of 'public opinion'. Given that many decentralised wastewater management systems might require behavioural changes, a change in attitudes may also be required, especially if the attitudes and beliefs of potential users are inconsistent with the required behaviours.

Research into the link between attitudes and behaviour seems to suggest that action or motivation to act is influenced primarily by our beliefs about a situation in any given context. However, these beliefs are influenced by our attitudes (more stable structures, less context dependent than beliefs) which we hold about 'attitude-objects' (see Stern & Dietz, 1994). The attitudes that we hold about a given 'attitude-object' are determined largely by our value structure - a set of "*single belief[s] that transcendentally guides actions and judgements across specific objects and situations*" (Rokeach, 1972, p. 160)

Given that values are more stable than beliefs, changes that take place within a persons value structure will be more robust, and therefore more likely to motivate action than attitudes alone. Blamey (1998) suggests that acceptance of policy initiatives plays an important part in motivating willingness to participate in environmental behaviour changes. While this might seem obvious, it points to the importance of understanding the factors governing the potential acceptance of such policy initiatives. If the achievement of sustainability with regard to water and wastewater management is potentially reliant on end-users changing their behaviour, then the emergence of environmental value orientations might be fundamental to achieving the goal of sustainability (see Stern & Dietz, 1994). Generally speaking, people who support environmental action tend to adhere to the 'self transcendent' value cluster identified by Schwartz (1992) and also acceptance of Dunlap and Van Liere's(1978) 'New Ecological Paradigm' (Stern et al., 1994).

[10] It would also be interesting to examine the educative effect of participation in the context of such novel systems (see e.g. Schlumpf et al., 1999).

If this is the case, it is likely that those with environmental value orientations will be more likely to support the more ecological forms of wastewater management, given that more behavioural change is usually required.

Influences on acceptability of sustainable wastewater management

As well as the above-mentioned influence of participatory procedures and individual value orientations, there are also various other factors that can influence the degree to which the public will be accepting of innovative water and wastewater technologies. One such influence is that of present water quality[11] (Olson & Bruvold, 1982). The influence of this, however will depend on geographical differences, and local water use patterns.

Knowledge and past experience of water recycling systems may also have an influence on their acceptance, although there is some suggestion that this influence has been overestimated (Olson & Bruvold, 1982). Faith in technology has also been found to influence (positively) acceptance of renovated wastewater[12] (Johnson, 1971).

Age, gender and level of education are other factors that may influence acceptability. Studies (e.g. Olson & Bruvold, 1982) have shown that age is correlated negatively with acceptance of renovated wastewater. Generally speaking, women appear to be less accepting than men (although this is specific to the populations studied). Also, those with a higher level of education appear to be more accepting than those with a lower level, although this may be confounded with the measures used to assess acceptability (willingness to pay might better reflect a respondents economic status than their acceptance). The issue of age is also important to study in light of recent predictions about demographic changes. For example, Aberdeen and Aberdeenshire Councils predict that between 1999 and 2016, the ageing population will rise by about a third, whereas the younger age groups will decline in numbers (Structure Plan Area Forecasts, 1999).

The degree of bodily contact with wastewater required of end-users also seems to be directly associated (negatively) with the degree of acceptance. Thus, non-potable uses will be more acceptable to the general public than potable uses. Watering the garden is likely to be more acceptable than washing clothes for this reason. However, studies have shown that attitudes toward body elimination (*sic.*) are affected to a large degree by occupation (Adams & Templer, 1980), suggesting that people who are in regular contact with human wastes (e.g. sewage workers, nurses) may show less disgust, and therefore be more accepting of renovated wastewater for potable uses than those in non-contact occupations (e.g. bankers).

Studies from research into risk perception (e.g. Star, 1969; Renn, 1990; Slovic, 1993) have found that people are more willing to accept risks if they are voluntary, of low catastrophic potential, familiar, and from a trustworthy source. This is important as water and wastewater technologies may be a focus of worry (see Macgregor, 1991), insofar as they may cause concern about deeply entrenched cultural beliefs regarding issues such as hygiene and safety.

Other psychological factors include 'Disgust Sensitivity' (Bixler and Floyd, 1997), aversion to the unclean, over-concern with health, and aversion to human waste, all of which have

[11] In other words, people who live in an area that has relatively low water quality might be more likely to accept innovative technologies, whereas those who have a high quality of water may feel that this may be threatened by such innovations.

[12] Renovated water is a general term for the re-use of wastewater. It is less specific than the term 'greywater', as it can also include blackwater (water from toilets).

been postulated as having a negative association with the acceptability of reusing water (Olson & Bruvold, 1982)[13]. Cultural factors such as religion may also play a large part in determining attitudes (see for example Warner, 1999).

Conclusions and suggestions for further research

This paper set out to outline the subject of water and wastewater management from the perspective of sustainability, and then place it within a social science context. It is clear that conventional wastewater treatment approaches are outdated with reference to the wastewater problem. Focussing solely on domestic wastewater treatment, this paper suggested several ways in which wastewater management could achieve greater levels of sustainability, by using a decentralised approach. Larger scale ecological treatment systems (e.g. reed beds) were not considered by this paper as the social impact of such systems is relatively negligible[14].

Three source control methods were outlined: a) *Reduce the amount of potable water required*; b) *Reduce the volume and content of wastewater from the household*; and c) *Recycle the nutrients that are traditionally lost in conventional treatment processes*[15]. Having identified some of the ways in which wastewater management could be approached in a more sustainable manner, the issue of public participation in water and wastewater planning was then discussed. It is concluded that public influence over the water and wastewater planning process is important; 1) politically; 2) for enabling the successful implementation of new innovative systems; and 3) for understanding public decision making from a justice perspective.

The influence of attitudes and value orientations was also discussed, and it was considered useful to have an understanding of these underlying processes before any participatory process occurs. If new policy initiatives are reliant on some form of behavioural change, it is concluded that the emergence of an environmental value orientation may be more powerful in influencing acceptance than specific individual attitudes towards the wastewater issue. Various other influences on acceptability of sustainable wastewater management were then discussed. These included faith in technology, age, gender, education level, risk perception and disgust sensitivity.

This paper has outlined some of the issues surrounding a social science perspective on water and wastewater management. There are clearly more potential avenues of enquiry in this field, and some of those mentioned will undoubtedly prove more practically useful than others. More importantly however, it illustrates the need for substantially more research in this area. Further research would benefit from studying the actual implementation of novel innovative systems. A recent study by the author found a surprising level of support for systems such as compost toilets, although this support was based on a hypothetical scenario. It would be interesting to study the extent of this support, were these systems to be installed in reality. Research in this area could add to the body of knowledge on environmental values, attitudes and behaviour with the added benefit of being an issue with which everyone is familiar to some degree or another. Whether or not people are comfortable talking about such a field is another question for another research project. In such an applied cross-disciplinary field as water and wastewater management, environmental psychologists have many skills to offer the ecological

[13] However, Olson & Bruvold (1982) found no association with faith in science and technology, aversion to change, or ecological concern.
[14] Although the results of a small scale study by the author suggested that people living close to these systems sometimes experienced unpleasent odours coming from them.
[15] This wasn't considered any further in this paper, but see Burkhard et al. (1999) for further details.

engineer or policy maker in achieving greater levels of sustainability, not only from an economic and ecological viewpoint, but also from a social one.

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