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Risk perception in participatory planning for water reuse

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Abstract

This paper focuses on how characterising and understanding the dissonance between stakeholder perceptions of risk could be of value when carrying out participatory planning of water reuse projects. Knowledge of the variation in stakeholders' concerns regarding risk from the onset of a participatory process, could breed insight and help guide the knowledge requirements of the stakeholder groups involved. The research input for this paper was generated from a questionnaire survey investigating stakeholders' views regarding wider participation in water resources management with particular regard to the following points: (1) What they considered to be the most important risks of a wastewater reuse project or scheme; (2) Individual expectations with regard to the coincidence level of risk perception between the stakeholder groups. Responses from four stakeholder groups (regulators, researchers, managers and domestic customers) are presented. Perspectives on the risks and uncertainties inherent in a project will probably vary from one stakeholder to another. The research findings suggest that levels of expected agreement regarding risk vary between different stakeholder groups. There is also a marked variability in expectations by risk type. Identification and characterisation of individual stakeholders' expectations and knowledge requirements with regard to risk could therefore help to form a sound basis for equitable deliberation, understanding and decision making within a social learning environment.

Keywords: Risk; Participatory planning; Stakeholder; Water reuse

1. Introduction

A number of international declarations regard public participation as essential in safeguarding water resources via adequate planning and management. For example, Article 14 of the EU Water Framework Directive [1] recognises the need for equitable allocation and the desire for wider participation regarding water resources. Article 7 of the Aarhus Convention [2] states that parties to

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the convention should 'endeavour to provide opportunities for public participation in the preparation of policies relating to the environment'. Despite this official recognition, the considerable variation in interpretation and practical application of these requirements has often led to disappointing results. Whilst official recognition has led to the formal identification of wider participation being both desirable and beneficial there is no recognised definition of what the participants involved in the process of water management view as just or fair [3]. In addition and irrespective of the conclusions which are drawn from scientific evidence, the impressions and attitudes of the general public can speedily and effectively bring a halt to any reuse scheme [4–6]. In this context, the successful strategic management of technology is not only dependent on cost or engineering performance attributes, but is also reliant on understanding and identifying the nature of the social environment to which it is applied, rather than merely anticipating the likely outcome of the response. The effective implementation of water resource management options is therefore dependent on the overall acceptance of such schemes by all involved, including the public.

Risk is one of the key areas of concern for stakeholders involved in water management [7]. While experts tend to define risk in terms of the high value placed by the public on health issues, the public viewpoint on what risk is and the value they attribute to their definition of risk is more complex [8]. How believable the public view any information conveyed to them about risk from any institution is also closely related to the level of credibility and trust they attribute to those institutions. This multidimensional social trust, or confidence, can be seriously diminished if national agencies or institutions are judged to be incompetent, biased or compromised, or seem to arrive at decisions without regard for public concerns. Erosion of the social dimensions of trust can seriously impair the ability of institutions to communicate with risk bearers [9]. People can base judgements regarding actions taken or technologies used not only on how they think about it but also on how they feel towards it. If they favour an activity then they tend to judge the risks as low and the benefits as high; conversely, if they feel unfavourable towards it then they will judge it as high risk and of low benefit [10]. People's risk perception and the potential severity of that risk is not based solely on numerical data. If the said risk is seen to be more under the direct control of an individual then it seems to be more acceptable than if the risk is controlled by others. Water resource management is typically perceived as the latter type of activity [11].

Bruvold [12] pointed out in his 1975 review of studies on public perception and attitudes to renovated waste water — that there was a need for research on actual usage and to inter-relate all the stakeholders' attitudes, beliefs and behaviour in a realistic manner. Kasperson [9, p. 280] also stated that part of the failure in the design and implementation of participation programs is due to them being 'rarely subjected to searching, ongoing and retrospective evaluation'. Uniting theory with practice in the context of the design, implementation and evaluation of public participation processes is therefore the key to the success of this field [13]. Regarding wider participation and the genuine engagement of the public in participatory planning, it has also been suggested that professionals, as well as the communities involved, need training and support to maximise effective engagement [14]. Evaluating elements of the participatory process through time could help assess and guide the engagement and knowledge requirements of all the actors involved.

2. A conceptual model of the participatory process based on social learning

The inevitable spectrum of individuals within a stakeholder engagement process brings with it a whole set of problems. How do you manage the whole process in a way that remains equitable and

fosters trust, inclusion, transparency, openness and credibility, resulting in an overall outcome viewed as just by all involved? Evaluation of the similarities and the differences, or potential areas of dispute, encased within stakeholders' varying expectations of the process and the overall outcome, could be a useful starting point for guiding the required *content* and *management* of the process. Common ground needs to be created so that all parties can actively and confidently participate; where the dissemination of knowledge, ideas, goals and ultimately long term strategies, can benefit and satisfy all involved. Social learning — whereby the social origins of individual thought and action are influenced and transformed promotes self direction towards future goals and outcomes [15]. Such a model of reflexive interaction provides a useful framework for analysing participatory processes. The following paragraphs describe how a modified version of a well established collaborative learning model has been applied to the context of water recycling.

As Bosch et al. [16] critically and constructively point out, managers (or policy makers) and scientists who are involved within the same project typically work within independent cycles. Researchers acquire knowledge and managers or policy makers try to apply knowledge, without any feedback mechanism having been set up between the two groups. To give research and management the opportunity to share and compare the various outcomes from their activities Bosch et al. propose a framework that induces collaborative learning via an integrated knowledge base. The two central issues highlighted here are therefore social learning and knowledge management.

We propose that this collaborative learning framework provides a useful model for participatory processes relating to water reuse. (For the purpose of articulating and discussing the model described below, collaborative and social learning are interchangeable. Further references to social learning or collaborative learning can be found in [13], [15] and [16]). However, to be of practical use, it needs to be tailored to the specific context of water reuse projects. We achieve this by considering the stakeholder groups that may be engaged in such projects. There are four broad stakeholder groups involved in water reuse schemes: Research, Management, Regulatory and Lay Community. The integration of knowledge from these four groups into a common knowledge base, within the decision making framework, is suggested as a way towards recognising and implementing the essential items and the individual requirements that need to be addressed during the life of a water reuse project [17].

In addition to the managerial and research cycles, which comprise the original Bosch et al. model, two further constituencies (lay public and the regulatory bodies) are introduced and incorporated into the framework. The lay public cycle comprises the components 'information', 'attitude' and 'action'. The information that the public receive may affect their attitudes and consequently influence the action they take towards a project. Regulatory bodies transmit policy guidelines and may need to highlight the project requirements from a governmental perspective. Consequently, the components pressure, state and response [18] are incorporated into the regulatory cycle, as they (i) address the pressures of human society on the environment; (ii) the state or condition of the environment due to this pressure; (iii) society's response to these conditions to prevent further impact resulting from this pressure

The four individual cycles (constituency processes) feeding into the process of relationships and social learning help fuel and power knowledge transfer and understanding (constituency concerns). This in turn helps clarify the individual issues (livelihood, management strategies, research questions and governance) pertinent to the four stakeholder groups. The revised model is shown in Fig. 1.

Within the model depicted in Fig. 1, effective collaboration is dependent on the ability of the various constituencies to develop a common

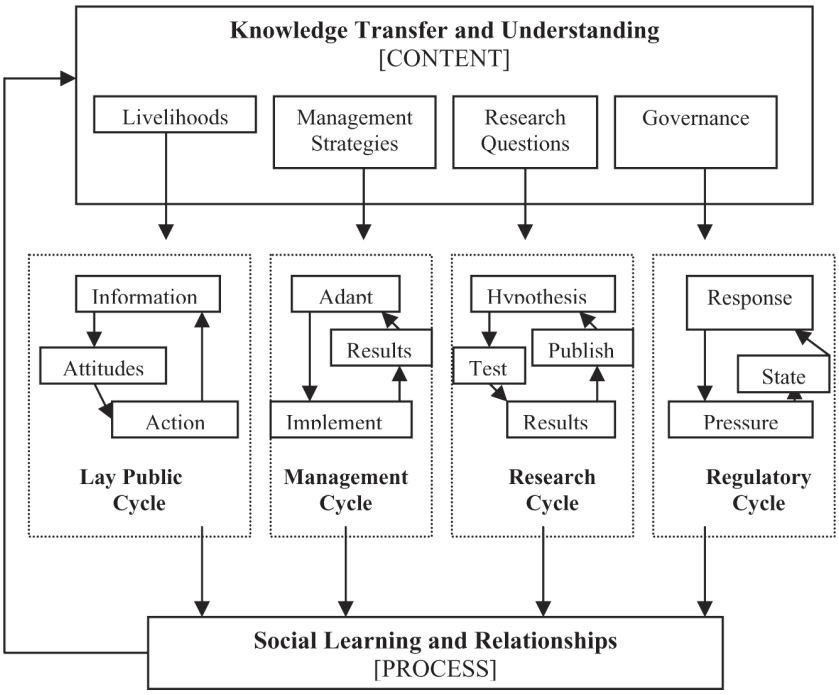

Fig. 1. Linking the research, management, regulatory and lay public stakeholder cycles.

language and share understandings. Characterising the dissonance between constituencies in terms of key elements of understanding may therefore help us target resources to support interaction.

3. Method

The objective of the survey reported here was to identify the levels of knowledge and understanding between and within stakeholder groups in relation to water resource management projects. Understanding this will allow us to generally comment on the knowledge needs and participation management requirements of the stakeholders. The basis of the questionnaire is therefore to ascertain and identify the perceptions, knowledge and participatory needs and requirements of the identified stakeholder groups. As noted above, we concentrate on the questions concerning the risks involved when reusing wastewater and the extent to which stakeholders would expect other groups to agree with their views on the risks they identified.

A dedicated web page was chosen as the primary elicitation vehicle for the survey. Launch of the website and requests for a web link to the survey site was promoted to a wide base of water orientated organisations that were likely to be in contact with the four main stakeholder groups to be investigated, namely: regulators, academic researchers, managers within the water industry and the general public. It was decided that the questionnaire would also be made available as an MS Word document on request and paper copies were also distributed at targeted conferences and meetings. All survey data collected was transcribed and stored in a database using MS Excel. Ethical research practice was adhered to throughout the survey [19]. The survey start date was 12th of July 2004, terminating on 28th August 2004.

The aim of the questionnaire was to explore respondents' views regarding wider participation of the public and other stakeholders in the planning and implementation of water resource management projects. This paper concentrates on the elements of the survey concerning :(i) what the respondents considered to be the potential risks regarding wastewater reuse (ii) the extent to which they would expect other stakeholder groups to agree with their views on risk and the (iii) levels of trust they attributed to different stakeholder groups.

4. Results

The results reported below are based on 78 completed questionnaire returns. Table 1 shows the self classification chosen by the respondents.

The responses given by the regulation, management, research and domestic customer stakeholder groups regarding the questions on risk are looked at in greater detail from here on. It should be noted that the regulator and manager response rates to date are low in comparison to those of the research and domestic customer groups.

4.1. Risks identified by respondents

The respondents were asked what they considered to be the two most important risks of a wastewater reuse scheme. The highlighted risks from the open, non prompted responses given by all the respondents were coded and grouped resulting in Table 2.

Table 1
Respondents self classification

Stakeholder class	Number of respondents
Regulation	9
Management	4
Research	27
Community representative or lobbying	0
Other	11
Domestic customer	24
Industrial customer	2
Agricultural customer	1

4.2. Stakeholders' expected levels of agreement regarding risk

Respondents were also asked to what extent they would expect other specified stakeholder groups to agree with what they considered to be the two most important risks regarding wastewater reuse. A five point Likert scale was used ranging from strongly agree (1) to strongly disagree (5). Table 3 shows the mean ratings for the responses to this question. The lower the mean ratings shown in Tables 3–8 the higher the expectation by the respondent that the corresponding stakeholder group will be in agreement with their own view.

Tables 4–7 provide a breakdown of each response group's perspective regarding anticipated levels of agreement for their top two risks. Figures given in parenthesis denote the percentage of that particular stakeholder group who identified the risk. Risk denotations refer to Table 2. Domestic customer respondents and researcher respondents risk selection resulted in more than one risk having equal second ranking regarding selection percentage. The range value for each risk is also given.

4.3. Levels of trust in other stakeholder groups

Levels of trust allocated by the respondent to their own and other stakeholder groups, regarding the protection of their interests in the planning or management of a water management project was also investigated. The issue of trust in relation to risk was covered briefly in Section 1. A five point Likert scale was used ranging from strong trust (1) to no trust (5). The lower the mean ratings shown in Table 8 the higher the trust allocated by the respondent to that group.

Tables 9–12 compare and rank responses to the two questions on (i) anticipated agreement from other stakeholder groups regarding the risks

Table 2
Risks identified by respondents

Risk number*	Risks identified by respondents
1	Public health/workers health/environmental health/spread of disease/sanitary protection.
2	Cost outweighs benefits/adoption costs/running costs/cost overrun/not profitable.
3	Uncontrolled reuse/inappropriate reuse/misuse/cross contamination.
4	Soil damage/agronomic risks/high amounts of trace elements.
5	Perceptions of risk.
6	Catastrophe planning.
7	Reliable technology/design of facilities/design errors/inappropriate technology.
8	Insufficient support from public or stakeholders/public acceptance/over reaction by uninformed individuals or media.
9	Detract attention from other issues.
10	River or groundwater pollution/deterioration of water quality/risk to natural environment/contamination.
11	Lack of appropriate monitoring or control over wastewater quality.
12	Meeting regulatory requirements but not fulfilling customer expectations. Regulatory approval required.
13	Effect on areas where located/impact on local community, smell etc.
14	Fraud and corruption.
15	Inability to meet demand.
16	Disagreement or misunderstanding regarding aim of reuse project/scheme.
17	Lack of knowledge transfer on health risks/lack of public information on wastewater reuse sites/ not preparing people.

* The risks listed in Table 2 are not in any particular order.

Table 3
Overall expected agreement levels on types of risk regarding wastewater reuse

	Stakeholder groups*			
Respondent's perspective	Water suppliers	Academic researchers	Regulators	Public
Managers	1.63	1.88	1.63	1.88
Researchers	2.07	1.91	2.02	1.88
Regulators	2.50	2.72	2.17	2.22
Domestic customer	2.63	2.47	2.47	1.77

*As per Fig. 1.

Table 4
Respondent's perspective — domestic customer group

	Stakeholder groups				
	Water suppliers	Academic researchers	Regulators	Public	Range value
Risk 1 (15.6%)	2.17	2.17	2.00	1.67	0.5
Risk 2 (20.0%)	2.33	2.78	2.78	2.56	0.45
Risk 10 (15.6%)	3.33	2.67	2.50	2.00	1.33
Risk 11 (15.6%)	2.71	2.43	2.14	1.00	1.71

Table 5
Respondent's perspective — researcher

	Stakeholder groups				
	Water suppliers	Academic researchers	Regulators	Public	Range value
Risk 1 (22.7%)	2.11	1.78	2.11	1.56	0.55
Risk 8 (13.6%)	1.66	1.83	1.83	1.83	0.17
Risk 10 (13.6%)	2.83	1.83	2.33	1.50	1.27

Table 6
Respondent's perspective — manager

	Stakeholder groups				
	Water suppliers	Academic researchers	Regulators	Public	Range value
Risk 1 (37.5%)	1.67	1.67	1.33	2.33	1.00
Risk 8 (25.0%)	1.50	2.50	2.00	1.00	1.50

Table 7
Respondent's perspective — regulator

	Stakeholder groups				
	Water suppliers	Academic researchers	Regulators	Public	Range value
Risk 1 (27.8%)	1.8	2.4	1.6	1.8	0.8
Risk 2 (16.7%)	1.33	3.33	2.33	2.67	2.0

Table 8
Levels of trust attributed to other stakeholder groups with regard to protecting the respondent's interests

Respondent's perspective	Stakeholder groups			
	Water suppliers	Academic researchers	Regulators	Public or representatives
Regulators	2.67	2.22	1.78	2.78
Researchers	2.55	1.85	2.07	2.33
Domestic customer	3.18	1.61	2.55	2.09
Managers	1	1.33	1	1.67

Table 9
Domestic customers — ranking of (i) anticipated agreement on risk issues and (ii) trust to protect interests

Ranking	Risk	Trust
1	Public	Academic researchers
2	Academic researchers and regulators	Public
3	Water suppliers	Regulators
4		Water suppliers

Table 10
Researchers — ranking of (i) anticipated agreement on risk issues and (ii) trust to protect interests

Ranking	Risk	Trust
1	Public	Researchers
2	Academic researchers	Regulators
3	Regulators	Public
4	Water suppliers	Water suppliers

Table 11
Managers — ranking of (i) anticipated agreement on risk issues and (ii) trust to protect interests

Ranking	Risk	Trust
1	Water suppliers	Water suppliers
2	Regulators	Regulators
3	Academic researchers	Academic researchers
4	Public	Public

Table 12
Regulators — ranking of (i) anticipated agreement on risk issues and (ii) trust to protect interests

Ranking	Risk	Trust
1	Regulators	Regulators
2	Public	Academic researchers
3	Water suppliers	Water suppliers
4	Academic researchers	Public

identified by the respondent and (ii) the levels of trust the respondent attributed to other stakeholder groups regarding protection of their interests.

5. Discussion

The remit of this paper has been to identify the risk perceptions of the survey respondents and their expectation of levels of agreement regarding the risks they associate with water reuse. The overall levels of expected agreement regarding risk vary between the different stakeholder groups. However there is also a marked variability in expectations by risk type which may reflect how much effort a specific stakeholder group would expect to be required to reach consensus with other parties on that identified risk. To conclude therefore, the data suggest the following for each stakeholder group.

The domestic customers group regarded Risk 11 (lack of appropriate monitoring or control over wastewater quality) followed by Risk 10 (river or groundwater pollution/deterioration of water quality/risk to natural environment/contamination) as the risks that would have the broadest level of disagreement. Regarding the protection of their interests in the planning or management of a water project they have a high level of trust in academic researchers, the lowest level of trust being attributed to water suppliers. The rank order for anticipated agreement and levels of trust attributed to stakeholder groups are similar with anticipated agreement from and trust in academic researchers ranked second and first respectively, while water suppliers were ranked last for both.

The researcher group regarded Risk 10 followed by Risk 1 (public health/workers health/environmental health/spread of disease/sanitary protection) as the type of risks that could lead to the broadest level of disagreement. They trust their own stakeholder group the most for protecting their own interests in water management with the least trust attributed to the water suppliers. The rank order for anticipated agreement and levels

of trust attributed to the stakeholder groups are not clear cut, however, although water suppliers were once again ranked last for both.

The managers group identified Risk 8 (insufficient support from public or stakeholders/public acceptance/over reaction by uninformed individual or media) and Risk 1. The highest level of trust was attributed to their own group and the regulators, with the public viewed with least trust. However, caution should be exercised when interpreting results for managers as there were only four respondents.

Regulators identified Risk 2 (cost outweighs benefits/adoption costs/running costs/cost overrun/not profitable) and Risk 1. This group allocated themselves the highest levels of trust regarding protection of interests and their anticipation of agreement was also highest for their own group, however their overall anticipation of disagreement over risk was from the academic researchers with the public being the least trusted regarding protection of their group's interest.

In relation to the conceptual model shown in Fig. 1 the survey results so far seem to demonstrate that the dissonance between different stakeholders (for example as illustrated in Table 4) can be identified and characterised, which in turn could help to illustrate the requirements of individual stakeholders and help focus efforts to improve social learning between the stakeholder groups. Sztompka [17] speaks of social praxis and how it can affect change through self amplification, via either a self enhancing 'virtuous loop' of trust, or a 'vicious loop' where a culture of distrust results in trust being withheld and further generates a culture of suspicion. Levels of trust attributed to stakeholder groups (for example in Table 9) seems to have some bearing on the level of dissonance or expected disagreement, although this was not so clear cut in all cases. The output of this study therefore supports and informs the process of participation and the need to understand the knowledge requirements of the stakeholders involved. Early assessment of risk perception and the impact it may have on the other stakeholders could benefit projects long term.

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