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## **Recycled water for consumer markets – a marketing research review and agenda**

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## Keywords

Recycled water; Consumer attitudes; Public acceptance

## Disciplines

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# Recycled water for consumer markets – a marketing research review and agenda

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## Abstract

A review of past marketing-related research in the area of recycled water has been conducted. Findings are reported within the main areas of past research: willingness to adopt different forms of usage of recycled water, concerns of the general public towards the use of recycled water, the socio-demographic profile of early adopters, strategies to increase acceptance and adoption of recycled water in communities, perceived benefits among users of recycled water. The limitations of prior studies are reviewed and gaps identified, leading to recommendations for a future marketing-related research agenda to support public acceptance of recycled water in communities.

*Keywords:* Recycled Water; Consumer Attitudes; Public Acceptance

## 1. Introduction

Marketing is the means by which the capabilities of a company are matched to the needs or wants of the consumer. Each company has different capabilities and it cannot maximize all market opportunities equally. However, all companies are similar in that they want to be as successful as possible. According to Saunders and Wong [1] this success is dependent on four elements: The product or service that is being provided (the core value), the production process (which relies on efficiency), the people (and their reactivity) and professional marketing (reliant on understanding market needs). One can therefore appreciate that marketing is important in creating a successful company or product. The basis of any marketing activity is the examination of the market environment so that a product can be created to best possibly satisfy the wants of the consumer. Alternatively, if the product cannot be modified, a market must be identified or created for the product.

The above principles of marketing can be applied to many products from consumer goods (like toothpaste) to services of non-profit organizations (like hours of volunteering work) and are ubiquitous. Consequently, such principles should be applicable to recycled water, a unique product that poses significant new challenges to marketing: firstly, it is a new product on the marketplace. Therefore, consumers have not yet developed firm opinions or attitudes about recycled water for their personal use. Secondly, water is essential for the survival of the human race and it is likely that our use of recycled water will one day be obligatory. It is therefore the marketer's responsibility to make this product attractive to the consumer. This requires, as a first step, the identification of a market segment of 'recycled water innovators' who are willing to purchase or consume the product at its early life cycle stage.

The importance of marketing in the context of recycled water has been pointed out by numerous researchers in the past: For instance, DeSena [2] reports on a failed potable reuse project in the USA stating explicitly that "One of the biggest factors contributing to the project's demise [...] was the difficulty building public consensus in several political jurisdiction (p. 18)." Dillon [3] conducted an expert study in this area on behalf of the Australian Water Association surveying one or two representatives for each state or territory about Australian water reuse research priorities. He found that 'factors affecting public acceptance of reuse' was ranked first of nine factors emerging. Lu and Leung [4] anchored the need for marketing planning in *Task 5* of their *Outline of wastewater reclamation and reuse plan*. Dishman, Sharrard & Rebhun [5] studied acceptance for direct potable use and conclude that "All [...] problems associated with potable reuse may be resolved, but the issue of public acceptance could kill the proposal." (p. 158)

The aim of this study is to: (1) review past marketing-related work in the area of recycled water, and (2) propose a research agenda for future studies.

Water recycling is typically defined as reclamation of effluent generated by a given user for on-site use by the same user. However, in recent years, there are other more general definitions in use, such as in the California Water

Code (State of California) [6], where it is defined to mean 'water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur'. The Australian community has come to realise that environmental resources are not infinite, and widely accepts recycling at a household scale. The term 'water recycling' has therefore been suggested by the Australian Academy of Technological Sciences and Engineering [7] as the preferred term to be adopted for generic water reclamation and reuse in Australia. We follow this recommendation throughout this article.

## **2. The starting point in Australia**

The ABS has collected a vast amount of information related to water and water use in Australia: between 2000 and 2001 24,909 Giga litres (GL) ( $10^9$  litres) of water were consumed in Australia. However, of this amount only 516, 264 mega litres (ML) was produced as recycled water, adding up to a mere 4 percent of total water consumption. Although this is an increase of 3 percent on the amount of recycled water used between 1996-97 it still remains a rather insignificant quantity. Agriculture is by far the largest consumer of water, using 16,660 GL (67 percent) of water in 2000-01 and 82 percent of the total recycled water produced, but this accounting for only 423,264 ML. The household is the second largest consumer of water, taking 9 percent (2, 181 GL) of the total water consumption in 2000-01. However, in 1998 only 0.4 percent of water used by households was recycled or grey water, 88.4 percent of the water coming from mains. Consequently, 44 percent of household water used is on gardens and a further 15 percent is by toilets, where recycled water would be more than sufficient. Furthermore, it must be recognised that despite the increasing amounts of expenditure on the recycled water industry in Australia (\$3.0 in 1996-97) there are very few signs that the product 'recycled water' is being adopted and accepted in a country where it is needed.

A number of trends highlight the necessity to increase broader public acceptance of recycled water: (1) The global water consumption increased six fold between 1900 and 1995. This represents a growth rate that is more than twice as high as the rate of population growth. (2) As late as 1998 the only household use of recycled or grey water was in the garden. Yet, the proportion of recycled water for garden use amounted to no more than 0.4 percent. Hurliman & McKay [8] come to the same conclusion based on an empirical study conducted in Australia finding that recycled water is used only for toilet flushing, garden watering and car washing. (3) The amount of recycled water used in Australia amounted to 134,424 ML in 1996/1997 and increased to 516,563 ML in 2000/2001. This increase is, however, due largely to an increased adoption in agriculture with a change from 38,118 ML to 423,264 ML in the same time period of time. (4) There is a market of environmentally aware citizens in Australia: 95 percent recycle their solid waste, 83 percent state to reuse it. The challenge is to extend the environmentally sustainable behaviour to the concept of recycled water.

### **3. Marketing recycled water – prior work**

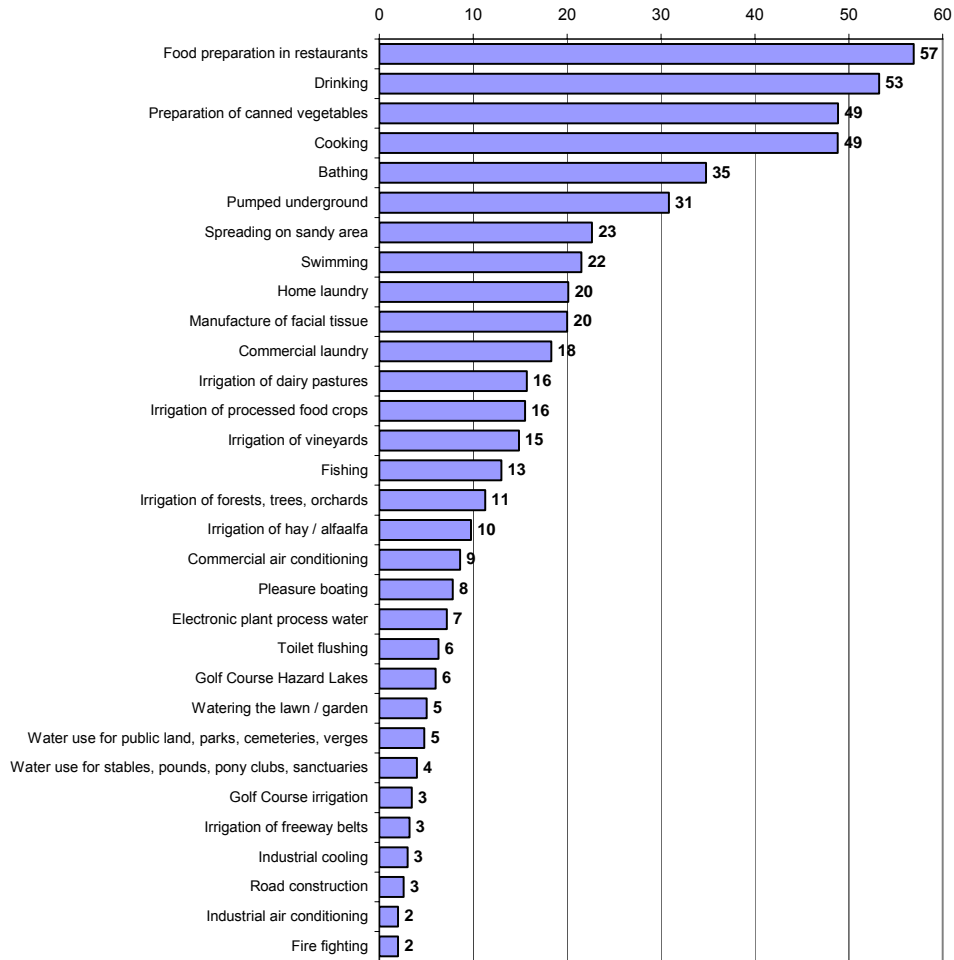
A number of studies have been conducted in various scientific disciplines in the past that can be classified as marketing-related research, the majority of which has been conducted in the late sixties and seventies in the USA. Past contributions can broadly be categorised in five main areas: (1) willingness to adopt different forms of usage of recycled water, (2) concerns of the general public towards the use of recycled water, (3) the socio-demographic profile of early adopters, (4) strategies to increase acceptance and adoption of recycled water in communities, (5) perceived benefits among users of recycled water. A summary of all reviewed empirical studies is provided in Table 1 the Appendix.

#### *3.1. Willingness to adopt recycled water*

The vastest amount of research work has undoubtedly been conducted in the area of surveying the general public about their willingness to adopt certain forms of usage of recycled water. Fig. 1 contains the average opposition percentages resulting from up to eight original studies (Bruvold & Ward [9]; Bruvold [10]; Stone & Kahle, 1973; Sims & Baumann [11]; Kasperson et al. [12]; Olsen, Henning & Rigby [13]; Bruvold, [14]; Milliken & Lohman [15];) and a meta-analysis by Po, Kaercher & Nancarrow [16].

A number of other studies have investigated the willingness to adopt or acceptance levels of different forms of water reuse without asking respondents for evaluations of each of the uses included in the table. For instance, Dishman, Sharrard & Rebhun [5] summarised a number of studies in the area of potable use only, resulting in average opposition levels of 54 percent and ranging from 44 to 63 percent.

However, single studies investigating very specific regions find opposition rates which strongly deviate from these numbers. For instance, Alhumoud, Behbehani & Abdullah (2003) report much lower levels of acceptance with 96 percent of the respondents stating to be strongly opposed against using reclaimed water for human use in Kuwait. On the other hand, a statewide telephone survey carried out by the Queensland Government [17] concluded that 91 percent of respondents stated that they would be willing to use recycled water if it were made available. These studies demonstrate that – while results seems to generally demonstrate similar levels of opposition – geographical differences have been insufficiently studied so far. Also, most of the original studies in this area are from the sixties and seventies. It may well be questioned whether similar opposition levels would be achieved even in the same regions if replication studies were to be conducted today.



**Figure 1 Average opposition percentages towards particular uses of recycled water**

Interestingly, price increases in conventional water sources did not have any impact on peoples' willingness to use recycled water (Kasperson & Baumann [18]; Bruvold [19]). This finding is in compliance with the generally low price elasticity for water as determined by Thomas & Syme [20]. However, the results are contradictory to focus groups results reported by Kaercher, Po & Nancarrow [21] as well as survey findings reported by Marks et al. [22] according to which "cost benefits" are the most important benefit users of recycled water state. On the opposite end of the spectrum, Alhumoud, Behbehani & Abdullah [23] find that Kuwaitis would be willing to pay more for their water in order to avoid having to use recycled water.

The interaction of willingness to adopt recycled water and pricing strategies has not led to conclusive results so far and would be of great value in future research.

### 3.2. *Concerns of the general public towards the use of recycled water*

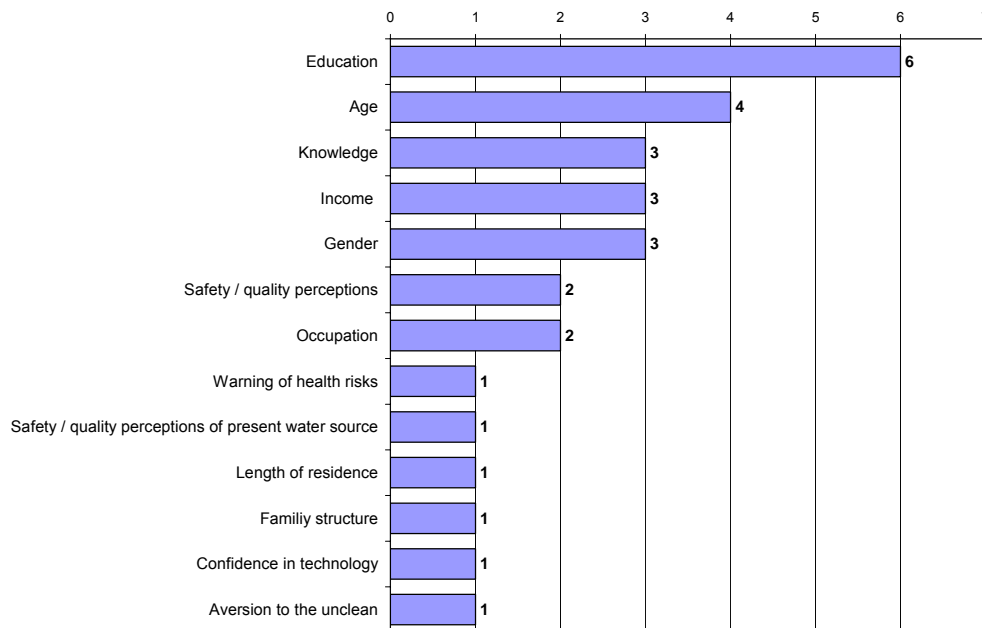
Although much fewer studies have centred on consumer's concerns, it seems that the main obstacles are revealed repeatedly. Bruvold [24] found

that – besides personal objections - people were worried about possible negative environmental, economic and health problems from a wider perspective. Dishman, Sharrard & Rebhun [5] focused on direct potable use only, identifying the main hindrances to be public health concerns. The main concerns raised by respondents surveyed by Higgins, Warnken, Sherman & Teasdale [25] in an Australian context were “public health and the environmental effect of microbiological agents” (p. 5050). Marks et al. [22] identified quality and cost as the two main concerns among users at an Australian site.

A very different but intriguing dimension has been proposed by Hamilton [26] who concludes that opposition to potable reuse schemes was due to suspicion towards politicians and organization involved in the projects. A finding that is of high relevance when developing measures to increase acceptance in the general public.

### 3.3. *The socio-demographic profile of early adopters*

A number of studies have investigated the association of socio-demographic descriptors and the acceptance of recycled water. Table 1 in the Appendix contains the statistically significant associations reported by the empirical studies reviewed. Fig. 2 provides a summary of significant factors derived from ten empirical studies (Hanke & Athanasiou [27]; Johnson [28]; Gallup [29]; Carley [30]; Sims & Baumann [31]; Kasperson et al. [12]; Olsen et al. [13]; Hurliman & McKay [8]; Alhumoud, Behbehani & Abdullah [23]).



**Figure 2** Number of studies that found significant associations of socio-demographic characteristics and acceptance levels of recycled water



As can be seen in Fig. 2, the single factor that has been most frequently found to be associated with the acceptance levels of recycled water is the education of the individuals expressing their opinion, followed by age and knowledge about reuse, income and gender having been identified as associated in one third of the studies.

#### 3.4. *Strategies to increase acceptance and adoption of recycled water*

A few authors draw conclusions from their studies with regard to optimal ways of increasing public acceptance. Baumann & Kasperson [18] suggest that a successful strategy would be to associate the water reuse program with pleasant things the public enjoys and approves, for instance, to “put the reclaimed water in an attractive setting and invite the public to look at it, sniff it, picnic around it, fish in it , and swim in it.” (p. 670). A suggestion that is backed by the studies conducted by Bruvold & Ward [9] as well as Bruvold [31] finding that opposition against recycled water drops significantly after swimming in it.

Athanasiou & Hanke [32] base their recommendation on the repeated finding that socio-demographic characteristics of the population are associated with acceptance rates for recycled water and consequently propose the introduction in high-status communities first. Dishman, Sharrard & Rebhun [5] suggest a behavioural modification approach and recommend as simple strategies as prize draws for volunteers to drink recycled water in order to decrease the level of prejudice against recycled water. Po, Kaercher & Nancarrow [16] recommend community involvement, community empowerment and accurate and complete information policies as central success strategies for assuring public acceptance.

A conclusion of different nature can be drawn from the studies conducted by Comrie et al. [33] and Mobley et al. [34]. Comrie et al. conducted blind water tests with 120 Western Water customers in Australia and found that emotional associations with the water brand played a major role in evaluating water. The same findings emerge from the experiment conducted by Mobley et al. with facial tissues. The fact that facial tissues were recycled or not was less influential on the attitude than the brand name of the facial tissue was. Although both studies were not conducted in the context of recycled water, two relevant conclusions can be drawn: (1) emotional barriers have to be taken into consideration to increase public acceptance even if the recycled water quality is indeed of highest quality, (2) branding might be a powerful way of increasing the feeling of trust and security in the general public.

An area of research that is closely related to water reuse and has been studied more extensively is solid recycling. A number of studies have investigated ways to predict and ultimately increase recycling behaviour (Oskamp, Geller, Winett & Everett [35]; Dwyer et al. [36]). Oskamp [37] summarized ways of encouraging recycling behaviour. Options which could be investigated in the context of recycled water include: monetary rewards, making actions easier to carry out, persuasive communication strategies, public commitment, personal goal setting, feedback to individuals about their performance.

### 3.5. *Perceived benefits among users*

Only one study was identified that investigated this issue. Marks et al. [22] identified three perceived benefits among users at an Australian site: cost savings, positive effect on the environment and the nutritional value of reclaimed water.

## 4. Limitations of past research

Baumann (1983) criticises past studies in the area as being poorly designed in particular due to the facts that control groups are not used and questions are typically asked in a hypothetical manner. Further complications for fieldwork in the area of water reuse arise from the importance of the physical appearance of the water, in particular taste (Comrie et al, [33]; Alhumoud, Behbehani & Abdullah [23] and colour (Alhumoud, Behbehani & Abdullah [38]). These central evaluation components are typically omitted in empirical work evaluating public acceptance levels.

Russell [39] states four major limitations of past empirical studies in the area of water recycling: the assumption that attitudes are stable, the interference of results with parallel events at the survey time period, the inability to generalise beyond the particular context of the study and the influence of study designs.

The most comprehensive critical review of past research, however, remains Bruvold's (1975) report in which he critically evaluates the contributions made before 1975. Thirty years later, most of his criticism remains valid, as do the limitations stated by Baumann and Russell.

In addition there seems to be a significant gap in the area of longitudinal research. One of the few longitudinal studies that investigated resident perceptions of water reuse before and after the scheme was introduced was conducted by Sydney Water [40, 41]. Hurliman & McKay [8] published the results of a study before introduction of a dual water system and state that another survey after the implementation is planned.

Another interesting phenomenon related to the lack of longitudinal studies is that – despite the vast amount of recommendation that have emerged from the published research on public acceptance of water reuse - nobody has attempted to measure the effectiveness of any one of those proposed measures.

## 5. Conclusions

Some of the future work recommended by the pioneers of research into public acceptance of water reuse remain valid. Bruvold [42] stated that the aim should shift towards explaining the relationships consistently identified in survey research, understanding the process of community adoption, understanding community responses to uses of recycled water and gaining more insight into actual using behaviour rather than hypothetical evaluations by respondents. Baumann [43] identified the following research needs in the

area of acceptance of recycled water: (1) overcoming the limitation of hypothetical questions, (2) identifying the most cost effective public information programs, and (3) understanding the professional and personal biases of officials involved in reuse projects better.

Dishman, Sharrard & Rebhun [5] suggest a shift towards project based rather than general research endeavours by proposing the Strategy to Gain Public Support. This strategy includes a market analysis, grouping individuals into segments that are in favour, slightly in favour, slight opposed and opposed and developing antecedent and consequence procedures to alter their behaviour.

The authors of this review suggest – in addition to the abovementioned point - an extension of research into the following areas: (1) Longitudinal studies to gain insight into the process of attitudinal and behavioural change as well as to assess effectiveness of measures taken to increase public acceptance; (2) Comparative studies into the effectiveness and costliness of various proposed schemes for increasing public acceptance; (3) Studies assessing the level and nature of perceived risk by consumers with regard to recycled water; (4) Replication studies to evaluate the validity of work that has been conducted thirty years ago; (5) Replication studies on continents other than North America to evaluate generalisability of findings; (6) Investigations into the interaction of willingness to adopt recycled water and pricing strategies; (7) Credibility studies of different sources of messages supporting adoption of recycled water including branding research; (8) Research into heterogeneity of consumers regarding their willingness to adopt recycled water.

Findings could be used to develop an optimised stepwise program to increase public acceptance, which represents the single most frequently suggested measure by authors on conceptual basis.

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## 7. Appendix

**Table 1 Prior marketing-related empirical studies on consumer level**

authors	Year	n=	Sample	Region	Aim	Design	Willingness to drink	Associated descriptors	Other findings	Limitations	Recommendations
Bruvold & Ward	1970	50	quota sample within communities with water reclamation projects	USA	use of recycled water facilities attitude to potential uses	rigorously tested interview and scaling procedures	46%			Not applicable as it was declared as pre-study.	
Hanke & Athanasiou	1970	291	probability sample		attitude to potential uses	hypothetical questions no details on questionnaire design	na	Income Education Occupation Knowledge of reuse projects Safety perception of recycled water		Sample note representative beyond towns included. One point in time only.	
Johnson	1971	221	convenience & quota sampling	USA	attitude to potential uses	hypothetical questions after having read a positive article about water recycling	77%	Education Prior knowledge on recycled water Perception of quality of present water source	49% willing to pay more to keep current water source	Sample not representative Respondents actively biases. No unbiased control group. One point in time only.	

Bruvold & Ward	1972	972	systematic sample within communities with water reclamation projects and twin communities without such projects	USA	evaluation of existing facilities attitude to recycled water uses	hypothetical questions on evaluation of recycled water rigorously tested interview and scaling procedures	40-50%		Reasons for opposing: purity-concerns, psychological repugnance	Sample note representative beyond towns included. One point in time only.	Begin with low contact uses and move up step by step.
Gallup	1973	2927	probability sample	USA	water related matters	hypothetical questions no details on questionnaire design	45%	Education Gender Occupation Age Income		Crucial methodological information not disclosed → strength if findings cannot be evaluated. One point in time only.	
Carley	1973	447	probability sample	USA	acceptance of recycled water	hypothetical questions pre tested interview and procedures	50%	Knowledge Length of residence Age Social guides		One point in time only.	Begin with low contact uses and move up step by step.
Stone and Kahle	1974	1000	probability sample	USA	attitude to potential uses recommended treatments	hypothetical questions pre tested interview and scaling procedures				Sample note representative beyond towns included. One point in time only. No high contact uses evaluated.	
Sims & Baumann	1974	400	probability sample	USA	attitude to potential uses	hypothetical questions no details on questionnaire design	66	Age Quality perception of present water course		Sample note representative beyond towns included. One point in time only.	Public information program.

Kasperson, Baumann, Dworkin, McCauley, Reynolds & Sims	1974	220	not specified	USA	community adoption of water reuse systems		49%		Not applicable as it was declared as pilot study.
Kasperson, Baumann, Dworkin, McCauley, Reynolds & Sims	1974	400	not specified		community adoption of water reuse systems		49%	Education Awareness Gender Age Confidence in technology	Crucial methodological information not disclosed → strength if findings cannot be evaluated. One point in time only.
Olson, Henning, Marshack & Rigby	1979	244	users and nonusers probability sample	USA	attitude to potential uses socio-demographic correlates	pre tested questionnaire and scaling procedures	45% and 47%	Education Gender Aversion to the unclean Warning of health risks	Sample note representative beyond towns included. One point in time only.
Marks, Cromar, Fallowfield, Oemcke & Zadoroznyj	2002	80	users (residents of sites with reclaimed water systems) probability sample	USA, Australia	perceived benefits forms of usage	no details on questionnaire design		Quality and cost are the main concerns.	Qualitative only. Different data collection techniques in the two countries. Users only → note representative. One point in time only.



Hurliman & McKay	2003	136	residents of dual water system site, BEFORE use sampling strategy not specified	Australia	benchmark study in a community before introduction of a dual water scheme	no details on questionnaire design	Family structure Income	No information on testing procedures for attitudinal differences, multiple tests on the same data set without correction of p-values. One point in time only.
Higgins, Warnken, Sherman & Teasdale	2002	108	recycled water stakeholders (providers and users) sampling strategy not specified	Australia	identify recycled water quality concerns and research needs	no details on questionnaire design	79 % raised concerns about quality issues	Respondents with high levels of prior experience only → not representative. One point in time only Report aggregates over providers and users.
Alhumoud, Behbehani & Abdullah	2003	1641	probability sample	Kuwait	evaluation reaction to introduction of recycled water	no details on questionnaire design	Education Consumers willing to pay more to avoid using recycled water.	One point in time only. Descriptive analysis only.

