



CONSUMER PREFERENCES

An Overview

TECHNEAU

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Title

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Measuring customer preferences for drinking water
services

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1 Introduction

1.1 Background and Rationale

This report takes an overview of the research that addresses the following general questions in relation to drinking water:

1. What do people expect from their water utility in the context of drinking water services?
2. What are consumers' priorities?
3. What do customers consider acceptable in terms of the product and the service they receive?
4. What are customers willing to pay for improved services, or what are they willing to accept for the current price they pay?

Water is in many senses unique among consumer products and it has a number of features that mark it out as different from other consumer goods or services. First, access to clean drinking water is now a human right. When the Universal Declaration of Human Rights was first drafted water and air were omitted as they were regarded as necessary preconditions for all other human rights and so were not explicitly mentioned. In November 2002 the UN Committee on Economic, Social and Cultural Rights finally affirmed that access to clean water was indeed a fundamental human right. Second, safe water supplies are a prerequisite for stable healthy societies. While wealthy consumers can choose to drink bottled waters to avoid health risks, this is not an option for large portions of the citizens of even in the most developed European nations. The current large populations and the success of the growing economies of Europe are fundamentally dependent on the existence of safe drinking water supplies and thus governments are motivated to ensure their continued existence and success.

Unlike electricity or gas supplies, which are increasingly the subject of competition between privatised suppliers, most European consumers have little choice over their tap water supplier. If they desire a better or different water supply they have to either purchase water in bottles or sachets or seek private well supplies if such are available locally. This is not a market in the traditional sense and indeed even in the UK, where the water supply system has been most fully privatised, consumers cannot choose a different supplier if they become dissatisfied with their provision.

In common with other utilities like gas and electricity supplies, European consumers generally take these for granted until there is some disruption in supply or price rises are proposed (e.g. Candidate Countries Eurobarometer, 2003; Consumer Council for Water, 2005). However, unlike gas and electricity, humans have an intimate physical relationship with their water and any health risks it might pose can vary over time. Electricity and gas remain consistently dangerous – the activities of the supplier cannot make

them more or less dangerous to the domestic consumer over time. In the case of water however failures in the supply system can prove catastrophic for the consumer (cf. the Camelford UK aluminium sulphate poisoning in 1988, Milwaukee US Cryptosporidium and Giardia contamination in 1993). We ingest water and, as with food, have a clear expectation that it should not harm us.

Given these special features of water much of the general literature on the behaviour of consumers exercising preferences in markets is of questionable relevance. We discuss some general models of the consumer but for most of this report we focus primarily on water-specific studies. The TECHNEAU project is concerned with technologies and systems that will provide safe drinking water for future generations. As such our concern is with consumer preferences in relation to domestic drinking water supplies and services and only to a lesser extent with waste water services (which are addressed in part by the EU SWITCH IP) and other non-potable uses such as irrigation.

This document should be read in conjunction with TECHNEAU reports *Consumer Trust and Confidence: An Overview* (D6.1.1) and *Customer Preferences For Drinking Water Treatment: Methods For Water Utilities* (D6.2.2) which give a broader overview of consumer issues and the methods best suited to researching them. Researching preferences in the water sector is a far from straight forward task. Consumers often cannot articulate their preferences or indeed may not have considered preferences for a product or service which they take for granted and rarely think about. In some situations they may even be motivated to misrepresent their preferences to researchers especially if they believe that their answers will have an effect on the prices they pay for their water. Thus some care is required in interpreting the various research reports discussed below.

Finally, we briefly discuss consumers' taste and odour preferences but do so only in the context of these as triggers for consumer complaints and use of bottled waters. We do not discuss particular threshold levels of contaminants as there are large in number and are already embedded in the EU Drinking Water Directive's and WHO standards. Most suppliers conduct their own sensory research relating directly to their own waters and supply circumstances and should be well aware of this aspect of consumer preferences.

1.2 Consumer Preferences and Related Concepts

As with much research on consumers, and indeed social science in general, there is a lot of terminological confusion and sometimes a lack of rigour. This is acknowledged within the academic literature and steps are being taken to rectify this situation. The following definitions of key terms are provided in the hope of clarifying the following discussion of the literature.

Consumer Satisfaction

Consumer satisfaction and acceptance are often considered in the literature to be closely linked yet these are distinct concepts. Satisfaction is the fulfilment and gratification of the need for a stated good or service, here, water.

Consumer Acceptance

Acceptance describes consumer willingness to receive and/or to tolerate. For example, a customer might accept the occurrence of a certain number of yearly supply interruptions given a certain price. Consumer acceptance and satisfaction are related, as the first is a precursor of the latter. However, despite the fact that satisfaction and acceptance can be thought of as lying on a continuum, acceptance does not automatically lead to satisfaction (see Figure 1.1). Weighing needs or preferences against provided product or service attributes results in the balance of satisfaction pointing in a negative or positive direction, depending on whether interests are conflicting or corresponding. This determines the way in which people evaluate companies' or utilities' performance. Only when a consumer's needs for a stated good or service are met, i.e. when the service provided corresponds with their preferences, will they feel satisfied. Customer satisfaction can be enhanced when their needs are met (in terms of both quality and quantity) and accord with their preferences. At the other end of this dimension, where the service provided conflicts with the prevailing needs or preferences, customers may experience feelings of dissatisfaction.

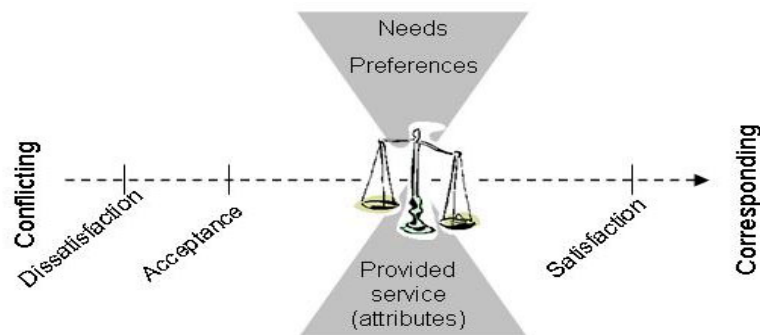


Figure 1.1 Schematic review of the concept of acceptance placed in the context of customer preferences and satisfaction

Acceptance is also used in the literature to mean an affirmative answer to a proposal. The distinction is subtle but there are occasions where consumers might not agree to a proposal yet accept the subsequent service in the sense of tolerating it.

Consumer Concerns

These are expressed anxieties or unease over an object broadly defined (e.g. discoloured tap water or a proposal to change the water pricing structure).

Consumer Preferences

This is used primarily to mean an option that has the greatest anticipated value among a number of options. This is an economic definition and does not tap into 'wishes' or 'dreams' (for e.g. that safe drinking water was free, that there should be world peace) but for all practical purposes is an appropriate definition. Preference and acceptance can in certain circumstances mean the same thing but it is useful to keep the distinction in mind with preference tending to indicate choices among neutral or more valued options with acceptance indicating a willingness to tolerate the status quo or some less desirable option.

Consumer Expectations

The distinction between expectations and preferences is often blurred though the concepts are distinct. Expectation is used in three slightly differing senses in the literature. One is the act of expecting or looking forward – a belief about what will happen in the future. Most consumers in Europe expect that clean and safe water will come out of their taps the next time they turn them on. A related but more technical use of expectation is to denote a more formal estimation of the probability of an event occurring. These first two definitions can be distinguished from preference in that preferences refer to some desired state and, as in the above definition, imply that more than one state is possible and that there are some options. Unfortunately expectation is also used more loosely to mean a requirement or demand for something and in this sense is a kind of strong preference. When reading the literature it is important to ascertain which definition is being used.

Consumer Awareness

Consumer awareness is the level of knowledge about, in this case, water which includes the water company, regulatory framework, supply system and service, or the water itself. In most research the adequacy or otherwise of this awareness is anchored against the service provider or regulator's perspective on the supply. Where consumer awareness does not equate with this industry perspective this is often termed a consumer (mis)perception. However, it should be noted that there is a distinction between holding factually incorrect knowledge about the supply system (for e.g. that the water comes from a river when it comes from an aquifer) and differing perspectives on, say, the safety of the supply. In the latter example assessments of safety are judgements made under uncertainty about the future and thus have a legitimately contestable truth status. What is acceptably safe is a matter of judgment (potentially based on 'good science' but a judgement under uncertainty nonetheless) and may or may not be a 'mis-perception'.

Risk Perception

This is a term used rather loosely in the literature to mean the level of risk associated with exposure to a hazard. Unfortunately a 'risk' is often used to

mean the specific hazard itself rather than a formal risk which is a combined assessment of the likelihood and magnitude of harm that may occur as a result of exposure to the hazard. In section 3 we discuss this concept further.

Consumer Attitudes

An attitude is a positive or negative evaluation of a social object or action. A 'social object' in the present context might mean the water company, water regulations, supply system and service, or the water itself. Many theories of attitudes (e.g. the well-known theory of planned behaviour, Ajzen, 1985) have attitude as a factor involved in determining behavioural choices however there is considerable continuing debate about when, and in what circumstances, attitudes are important determinants of behaviour. An attitude toward something should thus not be taken to imply that attitude-consistent behaviour will automatically follow.

Consumers and the Public

While discussing definitional clarity it is worth acknowledging that 'the consumer' is not a representative of a single homogeneous group, 'the public'. Social scientists prefer to use the term 'publics' to reflect the idea that not all members of 'the public' share the same goals and values nor have the same relative power status within any society. A crude example we will return to later is that the poor/unemployed are unable to pay for some services and it would be a mistake to ignore the importance of this different status when studying preferences.

In the case of water consumption, all members of the population have to consume water from some source but some are the direct payers of water bills (customers), some pay indirectly (e.g. those living in care homes, or some forms of rented accommodation) and others are dependents of customers. These differing groups will have differing relationships with suppliers and may well have different preferences.

2 Consumer Preferences and the Water Industry

2.1 What are Consumers' Expectations and Priorities?

A recent survey of European consumer responses to the major utilities (Candidate Countries Eurobarometer, 2003) shows that satisfaction with water supplies is high compared with most other utilities with only postal services performing better over a range of service features (price, quality, access, contract conditions etc.). Across all countries (old EU15 and new accession countries) the quality of water supplies is rated at 3.31 (new states) and 3.26 (old EU15) on a 4 point scale where 4 indicated 'very good'. Only 1% of all EU citizens regarded the quality as 1, 'very poor'. Across the whole of the EU 90% are satisfied with the quality of the water they receive. Levels of satisfaction were particularly low, however, in Latvia, Lithuania and Estonia with between 18% and 23% of the populations of these countries feeling that the quality of their supplies was 'bad' or 'very bad'. People in these countries (and Slovakia) were the least happy with customer services provided by suppliers with Cypriots and the Maltese being happiest with them.

Given these general findings we now turn to look at specific expectations and priorities.

2.1.1 Water Quality and Safety

It will come as no surprise that most studies show that consumers' primary expectation is that their supplier will provide safe, clean drinking water (Bates, 2000). Burn, Tucker, Rahilly *et al* (2003) for example found that in the context of water companies' management of Australia's state water resources, the main priorities set by the consumers were, a) quality of water supply and b) continuity of water supply. In the UK, the Consumer Council for Water (2005) conducted a series of focus groups in order to explore which water supply issues affected consumers the most. They regarded the key responsibilities of water and sewerage companies to be:

- a) supply of clean water (often mentioned as the most important issue);
- b) reliable service (involving continuous uninterrupted supply, efficient sewerage services, and effective customer services);
- c) value for money.

Research carried out by the UK's Drinking Water Inspectorate also explored consumer preferences and issues of concern about drinking water. They found that consumers prioritised safe clean drinking water before reliability of supply (DWI, Consumer Consultation, 1998).

In all studies we have seen that ask consumers about expectations and break these down into specific aspects of the supply, safety always features strongly. What is less clear is precisely what 'safety' means to consumers. General research on perceptions of risk and the notion of uncertainty suggests that consumers would prefer the services provided to them to be 100% safe and present them with no probability whatsoever of experiencing harm in either the short or the long term. The idea that there is always some residual probability of harm from any system, however, small is not always acknowledged and it is not clear that this is because consumers really do not acknowledge this or, more likely, the way the studies have been conducted has not been conducive to exploring these issues.

Consumers undoubtedly *prefer* water supplies that are 100% safe but what is currently unclear is what proportion of the population accept some uncertainty and thus *expect* less than 100% safety, and what levels of risk are *acceptable* to which sets of consumers. Frewer, Miles and Brennan *et al.* (2002) found uncertainties related to the knowledge limitations of science to be more acceptable than those stemming from government regulatory activity - or lack of it. This is an under-researched area but is a topic which is beginning to be addressed in the willingness-to-pay literature.

2.1.2 *Water Quality - Taste and Odour and other Aesthetic Judgements*

Immediate sensory perceptions of tap water are most likely to govern levels of concern, satisfaction and trust in the water supply (in the sense of confidence in its quality and safety). In general, research suggests that European consumers are relatively satisfied with their tap water. For example, the UK's Drinking Water Inspectorate (DWI, 2000) demonstrated that most respondents were relatively satisfied with their drinking water. Similarly, Dutch research has demonstrated that consumers are not particularly concerned about water quality issues (Martijn, de Rooy & Piriou, 1998) and this seems to be a general finding across the EU (Candidate Countries Eurobarometer, 2003).

In cases where consumers have expressed concern or dissatisfaction it is clear that these concerns emanate from two sources. In the UK Drinking Water Inspectorate's study (DWI, 2000), concerns were firstly related to the physical properties of water - such as taste and odour, appearance, hardness, freshness and temperature, and secondly in relation to the composition and/or the provenance of the water. Here, concerns were often expressed as questions and doubts about:

- a) What drinking water contained (both 'natural' ingredients and any additives)
- b) What was done to the water before it arrived at their taps, and
- c) Where it came from (for example, was it recycled waste water?).

Studies have found that concern tends to be raised when the physical

qualities of water differ from the norm (e.g. Martijn, de Rooy & Piriou, 1998). Consumers' sensory perceptions of their water are quite well tuned (cf. Falahee & MacRae, 1995) and thus aesthetic estimations of tap water quality (e.g. taste and odour and colour) will have an impact upon judgements of apparent quality and safety. Taste and odour while being interlinked, tend to relate to different factors, with the sense of taste being most attuned to the inorganic constituents of water, with the sense of smell relating more to organic constituents of water (Health Canada, 1995; WHO, 1997). Much lower concentrations of substances can be detected by odour than can by taste, with taste, odour and temperature all contributing to complex sensation of flavour (Health Canada, 1995).

Studies have also shown that chlorine is not effective at masking the odours in drinking water, such as the earthy or musty odours that result from the presence of geosmin or 2-methylisoborneol in drinking water (Oestman *et al*, 2004). Chlorine odour itself is of particular concern to consumers (CSIRO Land and Water, 1999). The taste of chlorine in tap water is a leading cause of customer complaints and dissatisfaction with drinking water although perceptions are influenced by the chlorine practices of the customers' country of residence (Piriou, *et al*, 2004).

The residual level of chlorine in water has been correlated with increased consumer dissatisfaction with water quality and an increased perception of risk associated with drinking water (Turgeon, *et al*, 2004). This perception occurs despite the fact that the real health risk associated with drinking water may be inversely proportional to the residual level of chlorine in tap water, with chlorine levels decreasing with increasing residence time of water in the distribution system and the distance from the water treatment plant. Turgeon *et al* (2004) also found that socio-economic factors influenced satisfaction with drinking water quality, with younger respondents, those on lower incomes, and those without university education more likely to be satisfied with their drinking water supply.

McGuire (1995) reported that, if consumers detect an 'off-flavour' in their drinking water, they are likely to believe that it is unsafe to drink. Thus changes in the system and/or water source can have a large impact upon perceived water quality and resultant levels of expressed concern. Owen *et al* (1999), for example, describe an incident where a water company in the south east of England changed one local water supply source and subsequently many customers noticed the change and called the company for information. It transpired that consumers had detected the change in water supply by seeing deposits in kettles and 'scum' on the surface of hot drinks. However, due to the company staff being ill prepared to deal with questions about the source change, some customers became suspicious which in turn lead to beliefs that the water was harmful even though it met all extant safety standards. This is a case of consumer complaints/enquiries not being dealt with efficiently leaving doubts in consumers' minds about the trustworthiness of their supplier and supplies.

Changes to the water system may thus have an impact upon perceptions and behaviour. Biswas, Jayatilaka & Tortajada (2005) carried out research in Colombo, Sri Lanka, where nine towns near Colombo had recently gained potable piped water as part of a programme to fulfil the Millennium Development Goals. However, inhabitants continued to use polluted well water for drinking and cooking purposes, while using the piped water for bathing and washing. Inhabitants judged the water according to physical characteristics, such as taste and odour and colour. It was found that the underlying basis for their behaviour was the disliked chlorine odour of the piped water. Furthermore, in addition to not drinking the new 'clean' water, after the introduction of the pipes, more people complained about their health, suggesting heightened levels of perceived risk in response to the change. Changes in taste and odour not surprisingly provide a signal and act as a warning that care should be taken.

Sensory perceptions of tap water which may or may not relate to the underlying quality or safety of the water, can lead to modifications in behaviour and in some cases individuals may seek alternative sources. For example, in the DWI (2000) study some participants who felt concerned about the physical properties of their tap water modified their behaviour by filtering their tap water before drinking it. Others opted not to drink the water at all on the grounds that it looked, smelt or tasted unpleasant.

Many studies find that consumption of filtered or bottled water reflects aesthetic preferences (e.g. taste and odour) rather than overt concern for risks associated with tap water (DEFRA, 2002; IFEN, 2000; Means *et al.*, 2001; DWI, 2000), although some studies (Doria, 2006; Dupont, 2005) find both aesthetic preferences and health concerns can lead consumers to opt for bottled water, with consumer trust in the water company also influencing consumption choices. Some consumption of bottled water may also occur because of consumer preferences for water that is chilled or sparkling. Certainly the growth in bottled water consumption in developed countries is largely independent of objective tap water quality (UNDESA, 2006). A survey of 1846 people across England and Wales found that, compared with the risk of consuming food items such as chicken and beef, drinking tap water was perceived to be of low risk (DWI, 2000). The study found that 69% of respondents were satisfied with their tap water quality. The main reasons cited for dissatisfaction were related to aesthetic qualities of the water. Eighty-six percent of those surveyed said they regularly drank tap water, whilst only 6% drank bottled water only. Here, bottled water consumption was attributed to a dislike of the taste and odour of tap water.

Consumers have a finely attuned sense of taste where water is concerned. Falahee & MacRae (1995) carried out a study using untrained members of the public to evaluate preferences for different types of drinking water. They found that bottled waters were preferred to distilled or tap waters by the majority of assessors, with waters of higher mineral content being preferred. Similarly Koseki and colleagues (Koseki, Nakagawa, Tanaka, Noguchi, & Omochi, 2003; Koseki, Fujiki, Tanaka, Noguchi, & Nishikawa, 2005) found

clear preferences for alkaline electrolysed waters over tap waters (and, indeed, some bottled waters). These kinds of findings lend some credence to consumers' claims to be choosing bottled waters because they can taste the difference.

In slight contrast to the above, a survey conducted amongst 400 residents of Georgia, USA (Adote Abrahams, Hubbell, & Jordan, 2000) found that consumers who were dissatisfied with the taste, odour, and/or appearance of tap water were willing to pay for bottled water but claimed that they were also doing so to avoid health risks from tap water. These authors found that use of water filters tends to be higher amongst consumers who had experienced problems with their municipal tap water. People who felt their water was 'unsafe' were also more likely to use treatment devices, whereas the aesthetic qualities of water did not feature as significant determinants of use of these devices though they were significant in the case of bottled water use. They state that the use of water filters is an averting behaviour undertaken to reduce the risks associated with drinking tap water. Bottled water use in this study seems to be both a risk avoiding and taste enhancing behaviour.

2.1.3 Water Pricing and Metering

We deal with willingness-to-pay (WTP) studies which involve a set of particular econometric methods to determine monetary values consumers are prepared to pay for specific services in section 2.3. Here we are concerned with more general consumer responses to pricing issues.

Surveys of the concerns of the European citizenry such as the Eurobarometer surveys suggest that the majority of consumers regard the price of their water supplies (including waste water services) as 'fair' which is second highest degree of satisfaction with utility prices after postal services. Only 8% of EU15 citizens regard water prices as 'excessive' with the figure being higher at 17% among new accession countries (Candidate Countries Eurobarometer, 2003). As is the case for all questions of service pricing those who regard prices as excessive are those who are generally least able to afford to pay their bills (e.g. the unemployed, the old, manual workers) so the figures of those regarding prices as 'excessive' probably reflects low ability to pay rather than a negative response to water prices specifically.

In the case of the fully privatised supply system in the UK, participants in the study conducted by the Consumer Council for Water (2005) raised concerns about fairness and perceived lack of clarity in terms of charges. Many found it difficult to reconcile the large differences in charges paid for water and sewerage services according to where people lived. Issues of water charging were also mentioned on a larger-scale, national basis according to perceived differences in the quality and cost of services between water companies across England and Wales. There was an understanding amongst consumers that there should be "equitable provision and that customers should not be penalised according to where they live" (Consumer Council for Water, 2005).

This reflects a common theme in the literature that water is an essential natural product that should be readily available to all irrespective of their circumstances.

There remains quite a bit of residual disquiet about the profits of the UK's privatised suppliers particularly as prices are seen to be rising above the rate of inflation and supplies are threatened by both drought and leakages leading to hosepipe bans and calls to save water (Consumer Council for Water, 2006a). Complaints about water supplies rose 11% during 2005-6 with the biggest category of complaint being about billing (36.2% of all complaints).

Many European consumers are charged for their water via the use of a meter and in general water metering is seen as desirable for the implementation of efficient water pricing policies and encouraging conservation (OECD, 2003). The installation of meters normally has an impact on consumption though this is not usually even across all sectors of any given society. For example Ochoa, *et al*, (1990) found that while responses to new meters were generally positive in their Mexican sample middle income groups made the greatest savings over the trial period. Similarly differing pricing structures provide incentives for different levels of conservation behaviour and occasionally, as in the case of Japan recently, consumption can be so reduced that revenues from water charges drop substantially.

Whether metering is seen as desirable largely depends on the prevailing culture and metering history. In France and Germany where there is a relatively long history of metering it is accepted as a reasonable way to charge for water. In the UK metering is as yet not widespread. Whilst many were happy to have saved money using meters, non-users were concerned that "paying for what you use" might mean paying more than charges based on rateable value". In general, people said that they wanted to know more about the potential benefits and savings associated with metering. Participants were often unaware of how to have a water meter fitted, whether they could have it removed at a later stage and whether they would incur any costs by doing so. This suggests poor communication on behalf of the water industry about water meters since there were generally no charges associated with removing meters. In general customers did express a degree of willingness to have a water meter, since they would "like to be able to better work out how much they would be paying if they were billed for what they use" (Consumer Council for Water, 2005).

In the case of water company profits, UK consumers were concerned that water companies are overly interested in making profits and awarding bonuses to shareholders and 'fat cats'. People regarded this as a conflict of interests between water companies making profits for shareholders and bonuses for board members, and protecting the interests and rights of water consumers. They stated that they would prefer "more of a balance between water companies rewarding themselves, while still offering fair prices, a well maintained infrastructure and good customer services" (Consumer Council for Water, 2005).

2.1.4 *Environmental Issues*

The Consumer Council for Water (2005) focus groups also generated discussion about environmental issues in relation to the scarcity of water, increases in population and irregularities of weather. However, many of these UK consumers found the issue of water scarcity difficult to reconcile in what they regarded as 'such a wet country', whilst others referred to media stories concerning water companies' poor record on leakages and water conservation. Indeed, many people were concerned that the costs of poor management by water companies were being passed on to them as the consumer, often leading to debates about water company profits and issues of fairness.

There is some evidence that where water stress is widely understood by the population they are prepared to accept alternative measures to improve supplies. In Adelaide consumers have responded positively to the to a proposal to introduce desalinated water supplies after a recent public tasting of desalinated water and the publication of reports indicating the likely degree of water shortage in the near future (The Advertiser (Australia), 1.2.07). However the South Australian government remains sceptical that consumers will accept the likely increases in prices required to fund a sufficiently large desalination plant and no firm proposals have yet been implemented.

2.1.5 *Information about Water Quality and Other Performance Indicators*

Although the idea that suppliers ought to provide information on their performance to consumers is widely supported by consumer groups there is little clarity about what information consumers actually want or whether the indicators deemed relevant by the industry address consumers' information needs. Given that the water supply is rarely a matter of concern for most consumers simply providing information for the sake of it may serve very little purpose and indeed may even create anxieties by making it clear that tap water contains more than merely H₂O (cf. McGregor, Slovic & Morgan, 1994).

Most suppliers define and monitor various indices of performance (e.g. Couibaly and Rodriguez, 2004; Marques and Montiero, 2001) but there is relatively little research on what this information means to consumers. Johnson (2003) reports a study of New Jersey customers who received different versions of a water quality report ranging from a purely qualitative report, through a minimal quantitative one that met USEPA guidelines to a more fulsome quantitative report. The findings suggest that overall assessments of supply quality and supplier performance did not change as a result of receiving the reports although the fulsome quantitative report was slightly more successful at conveying information than the qualitative report. Subsequent questioning of the participants suggested that some had not read the materials particularly carefully and, generally, that prior general beliefs

about risks dominated judgements of performance irrespective of the content of the reports.

This could be interpreted as suggesting that consumers do not really want or understand information on supplier performance but this would probably miss the point. Southern California Water Recycling Projects Initiative, (2004) report a number of cases where provision of timely information has been crucial to the success or otherwise of proposals to change the nature of supplies. The research shows that consumers do want this kind of information but they need it when they want it and they should to be able to get it quickly in a format that can be readily understood.

2.2 What are Consumers Prepared to Accept?

2.2.1 Service Interruptions

A number of studies have addressed consumer preferences and acceptance when supply systems fail. CSIRO (2002) conducted a study in Australia which investigated consumer preferences regarding interruptions to their water supply. People were asked what they would and would not consider acceptable. Overall, the results demonstrated that people could cope with short interruptions without complaint. Consumers deemed the most salient qualities of interruptions to be:

- a) duration of the interruption;
- b) notification in advance;
- c) time of day the interruption happened; and
- d) number of interruptions per year (planned and unplanned).

The study revealed several thresholds of acceptance or rejection, suggesting that there are phases between what is considered to be acceptable and unacceptable, particularly with regard to the number of interruptions per year, their duration and timing. In the case of frequency, up to two planned interruptions in a year were deemed as acceptable to most participants. At five interruptions per year there was a dramatic increase in people who did not consider this acceptable anymore. More than half responded they were able to accept up to two unplanned interruptions, but no more than five. In terms of the duration of interruptions, most consumers could cope with interruptions of up to five hours, with the ability to cope steadily decreasing as the number of hours exceeded seven hours. With respect to the timing of the interruption, there was clear indication that, as long as the interruptions did not coincide with key times in their daily lives, they were acceptable. Participants suggested they could cope with interruptions occurring between 9 am and 5 pm and between 10 pm and 6 am during weekdays. However, they indicated that they could not cope with interruptions that occurred on weekdays between 5 pm to 10 pm.

Generally, people had a greater sense of tolerance for planned interruptions than for unplanned ones. About two thirds of the respondents did not believe they should be compensated for either planned or unplanned interruptions. Here, customers stated that they would rather have the problem fixed than any form of rebate. They accepted that the interruption was necessary to provide better services. Some respondents did feel compensation could be given if the interruption was excessive, or if they weren't notified in advance. Overall, participants prioritised the following actions on behalf of the water company:

1. Fix the problem efficiently
2. No discount but invest more money to improve the system
3. Compensating households financially per interruption or per hour
4. Waiving the next quarterly bill
5. Public apology from the Authority

In the case of a failure in supply, the focus group discussions revealed that people could cope with short unplanned interruptions. However, in cases of unplanned interruptions, consumers preferred as much feedback as possible about the cause, whether repair crews were in attendance, and some estimate of the likely duration of the interruption. Aspects of interruptions that were considered most important to customers were: number of interruptions per year, duration of the interruption, time of day, how to handle the interruption, and quality of water supplies after the interruption.

A related theme was that of response or communication. Consumers stated that they expected immediate rectification in the case of unplanned interruptions. Consumers wanted as much feedback as possible and a telephone number they could use in case of an unplanned interruption. The water utility should be contactable and informative at the time of an unplanned interruption. People wanted quick responses from the water utility and they expected them to take steps to prevent the same thing from happening again (e.g. by presenting an evaluation report).

Issues of accountability were also considered important. The CSIRO study termed the first form of accountability as *prospective*, in that the public should be included in the setting of customer standards for water interruptions. Involving the public can be realised by representation of the general community by someone from the local government, conducting community surveys and/or discussion groups. Customers certainly felt that there was a need for monitoring the water company's performance (by a government body or regulator to ensure the provision of acceptable levels of service). Notification cards for planned interruptions were deemed acceptable (preferably at least 2 days in advance). *Retrospective accountability* referred to the aftermath of water supply episodes. Consumers did not expect compensation unless extreme hardship or extra expense had been incurred. Reimbursement was only expected if extra expenses had been incurred. Customers believed that any form of compensation would be paid for out of their own water rates anyway. Consumers also stated that they wanted

feedback in terms of the corrective actions taken by the water company to resolve water supply issues.

A similar measured consumer response to supply interruptions is reported by Joshi, Talhande, Andey & Kelkar (2002) who surveyed consumers in Ghaziabad and Jaipur areas in India. Most consumers made some attempt to store water in case of interruptions which were relatively common compared to the Australian example above. They had developed routines for dealing with intermittent supplies but nonetheless had no complaints about water tariffs and continued to be in favour of a piped continuous supply.

Owen (2000) reports a study of why and when people complained about their water supplies. Her UK study suggests that a major factor in determining whether a customer complains is their political orientation towards the privatised (this was a UK study) supplier. While many in her sample could have legitimately complained about, for example, discoloured tap water, during the period of the study people were more likely to have complained if they already had a negative attitude toward privatisation in principle and/or the privatised supply company in particular.

2.2.2 *The case of the Acceptance of Recycled Water*

Of all drinking water related consumer research by far most intensively studied area has been consumer acceptance of proposals involving waste water recycling (e.g. Bruvold, 1981, 1985, 1989, Marks, 2003; PIEOW, 2003; Southern California Water Recycling Projects Initiative, 2004; Ulhmann & Luxford, 1999; PIEOW, 2003; Southern California Water Recycling Projects Initiative, 2004; Po, Kaercher & Nancarrow, 2004; Stenekes, Colebatch, Waite & Ashbolt, 2006). A number of proposals have been made to introduce re-use schemes in the USA, Australia and Singapore and in all cases relationships between suppliers, regulators and consumers have been seen to play a key role in the outcomes of these initiatives.

The idea of recycling waste water, particularly sewage, is not generally regarded as an attractive solution to water shortages by most publics. It generates what has become known as the 'yuck factor' and a number of high profile campaigns have emerged to counter recycling proposals. Dolničar and Saunders (2006) argue that emotional barriers to recycled water usage need to be considered if there is to be consumer acceptance of recycled water, even if the recycled water is of the highest quality. Hartley (2006), however, notes that consumer concern about recycled water usage is tempered by an individual consumer's proximity to the wastewater source; consumers are more willing to use their own recycled wastewater than wastewater drawn from a common source.

Russell and Hampton (2006) caution that little is known in general terms about consumer reactions to recycled water usage and thus predicting consumer responses in relation to specific proposals is difficult; local factors

make the transfer of results from one area to another difficult. They note that general support for the use of recycled water does not necessarily translate into support for a specific project, and that the absence of explicit evidence of anxieties does not necessarily mean a true absence of concern.

Po *et al* (2005) conducted a study examining consumer acceptability of the use of recycled water in a variety of contexts in Australia. More than 90 percent of respondents in their study agreed that it was acceptable to use recycled water for the watering of public parks, golf courses, or the flushing of toilets, and more than 80 percent agreed that it was acceptable to use recycled water for watering home lawns and gardens or pasture land. Using recycled water was not considered acceptable for either drinking or cooking by a significant majority of respondents. The study found that only 13 percent of respondents would consider drinking recycled wastewater, with 73 percent indicating that the cost of the recycled water would make no difference to their decision.

There are successful recycling schemes which most notably include the implementation of Singapore's NEWater project. The Singaporean Public Utility Board recognised the need to find a comprehensive solution to develop public acceptance and support and created a Visitor Centre as a key focus of the public education and outreach strategy to address public awareness and acceptance. Since opening in February 2003, the NEWater Visitor Center has reportedly become a tourist destination, as well as a place of genuine interest for the community. Similarly in Namibia there has been a successful implementation of recycling at the Goreangab Water Reclamation Plant in 2002 and there have been few reports of public opposition or concern. Anecdotal evidence suggests that the community responded to the scheme with considerable pride towards their city's "ability to overcome environmental adversity and in its role as a world pioneer of direct potable reuse" (Khan and Gerrard, 2006).

Bronfman *et al* (2003) state that the more a country develops, the greater becomes its population's concern about hazards and the greater demand for their control and regulation. Moreover, an affluent society becomes more suspicious of new technologies, in that public attitudes to, and trust in science and technology can be low, whilst levels of public awareness of the hazards and potential benefits are varied.

2.2.3 *Willingness-To-Accept*

When looking at acceptance there is a special category of study that looks at willingness-to-accept (WTA) certain amounts in compensation for the loss of a service or acceptance of a 'bad' (the opposite of a 'good'). These draw on the same methods and conceptual frameworks of willingness-to-pay studies and are discussed in the next section.

2.3 What are Consumers Willing to Pay For?

Willingness to Pay (WTP) studies are presented in a separate section here as they reflect studies that share a common conceptual basis and are clearly rooted in advances in econometric methods. In WTP studies preferences are inferred from the relative monetary amounts that consumers are willing to pay for given sets or combinations of product/service features. While they can be considered as attempts to formally assess consumer preferences they usually assess relative preferences for product options that are defined by the service provider though some of the better studies allow consumers to have an input into the nature of these options.

WTP studies have an appeal since they can form a major part of a larger cost benefit analysis that allows service providers to design their services/products to best match consumer preferences knowing that consumers are likely to be willing to pay for them. They can avoid the situation where a desirable product is created but its costs exceed the likely amounts consumers are willing to pay to receive them.

More details of how WTP studies are conducted are described in the companion report *Measuring Customer Preferences for Drinking Water Services: Methods for Water Utilities (D6.2.2)*. Two broad distinctions are worth describing here. One relates to WTP assessed on the basis of consumers' behaviour in existing markets versus WTP assessed on goods/services that have yet to appear on the market. The former are referred to as 'revealed preference' approaches of which there are relatively few studies specifically on drinking water other than those that look at bottled water use. For reasons discussed elsewhere in this document and in the companion document *Consumer Trust and Confidence: An Overview* bottled water use is a complex purchase behaviour. Bottled waters offer a number of attributes beyond satisfying a need for clean drinking water (e.g. portability and convenience) and thus WTP values placed on it cannot be used in a simple way to place a value on the water itself.

Studies that investigate likely WTP for products with attribute combinations that do not yet exist on the market are referred to as 'stated preference' studies. Within this type of study there are broadly two common approaches. The first is called the 'contingent valuation' (CV) approach where respondents are invited to value a product as a whole. This is to be contrasted with 'choice modelling' (CM) approaches where the value of individual attributes of a product are assessed (the latter are also referred to as 'choice experiments' and 'conjoint modelling'). The relative merits of each are fully discussed in Bateman, Day, Hanemann, Hett, Hanley, Jones-Lee, M., Loomes, G., Mourato, S. & Ozdemiroglu, E. (2002).

There are a multitude of factors affecting willingness to pay for water services. According to Ntengwe (2004) willingness to pay for water services is affected by existing water quality, affordability and ability to pay, together with consumers' level of awareness of water management issues. The status quo can also have a significant effect on willingness to pay amounts, with

consumers generally preferring the status quo over changes in service levels and costs structures (Hensher, 2005).

Raje *et al* (2002) argue that some consumers have a zero willingness to pay more because of a lack of faith in the management system of their water supplier, and only by increasing management transparency and the transparent use of funds are people willing to pay more for improved water services. This view is reflected in the findings of a study conducted by the UK Drinking Water Inspectorate (1998) which found that willingness to pay for improved water services was significantly influenced by consumers' attitudes towards the water companies. Amongst consumers from the lowest income groups, it was affordability which limited their willingness (or ability) to pay more for water services (Raje, 2002).

WTP studies while very useful are always context specific and so extracting generalisations from WTP studies can be problematic. Thus for any given context fresh WTP studies are called for especially as monetary values will change overtime as a function of factors such as inflation and the presence of new alternative options. The following sections give some examples of the kinds of outputs from WTP studies.

2.3.1 *Willingness to Pay for Improved Water Quality*

Kim and Cho (2002) used a contingent valuation method to determine consumer WTP for the removal of high copper concentrations in their water. The general finding was that in smaller communities (in Minnesota, USA) the amounts that people were willing to pay would not cover the costs of improved treatment processes and systems. Similarly Cho, Easter, McCann & Homans (2005) looked at concentrations of iron and sulphate in community water supplies in south-western Minnesota. Again using a CV approach, on average, individuals were willing to pay US\$5.25 per month (in 1995 U.S. dollars) to reduce the level of iron and US\$4.33 per month to reduce the level of sulphate in their water to bring levels down to the USEPA's standards. Respondents who already thought their water quality was poor were willing to pay more to improve its quality. Again the aggregate WTP of the population was insufficient to meet the costs of achieving these goals suggesting the necessary changes would not be economically viable.

A similar finding was found in a Latvian WTP study that investigated consumers' WTP for cleaning up pollution in surface water supplies. Here Ready, Malzubris & Senkane (2002) showed that while Latvian consumers were prepared to pay up to 0.7% of their household income for improvements in surface water quality this sum, once aggregated, was insufficient to implement the necessary changes.

WTP for securing safe drinking water can be related to factors such as age, location, socio-economic status (SES) and level of education. For example Nielsen, Gyrd-Hansen, Kristiansen, & Nexøe (2003) found that older

respondents were reluctant to pay any more to avoid future health threats from drinking water than younger ones. Al-Ghuraiz, & Enshassi (2005) found relationships between WTP and location among the population of the Gaza Strip. Here those living in poor villages without access to good quality supplies were prepared to pay substantial amounts to secure safe supplies. This presumably reflects the very poor nature of the supplies since most WTP studies tend to find that it is those with greater disposable income that are usually prepared to pay more.

In a study concerned with avoiding health risks due to contaminated drinking water Abou-Ali (2003) conducted both a CV and CM study of Cairo residents' WTP for improvements to secure safe tap water. Here WTP, as expected, is related to household income – the higher the income the greater the WTP. Better educated heads of households had higher WTPs too. Overall the study revealed a WTP around 1% of mean income for a decrease of 25% in the short run probability of health risks due to poor quality water and a reduction of 2% of the probability of contracting water born diseases in the longer term. These figures suggest a WTP below what would be economically viable for implementing the necessary improvements though the author notes that there may nonetheless be non-financial considerations for proceeding with the improvements that would increase the general social well-being of the population. This study is interesting in that it used both CV and CM approaches which produced broadly comparable WTP estimates unlike previous attempts to use both approaches which have produced figures where the CVM estimate was higher than the CE estimate by a factor of 20 (Boxall *et al*, 1996).

Dutch research on WTP for cleaner surface water ((Brouwer, 2004) indicated a statistically significant influence on the WTP of the following factors:

- the proposed amount of money attached to different scenarios
- the importance people ascribed to having cleaner water
- annual income
- attitude towards paying for the environment
- doing any recreation activities with boats
- difficulties with answering the WTP question

Factors that did not seem to have a significant influence on the WTP for cleaner surface water were:

- demographic and socio-economic factors like age, gender, size of the household, area
- detailed water use factors like frequency of swimming, sailing, surfing or fishing activities on Dutch surface water
- factors related to the perception of the water quality
- factors related to the knowledge- and information level of the respondents (familiarity with the water quality standards, whether they think they are properly informed about these, degree to which people are familiar with the content of the information magazine, whether or not they visited the website,

- and the extent to which they know they already are paying for cleaner water
- factors related to their attitude with regard to environmental problems in general and membership of environmental protection organization like Greenpeace or WWF.

It is noteworthy that knowledge and information level, the perception of water quality and attitude regarding environmental issues apparently did not have a significant influence on the WTP in this case.

Willingness to pay for improvements to the water supply is also contingent on issues of ownership, and this has implications for the trend towards greater private sector participation in the European water sector. Willingness to pay is lower when the supplier is in the private sector (e.g. WTP studies in UK, Argentina, and Sri Lanka) and willingness to pay anything more is close to zero if the private sector supplier is seen to be wasteful or profiteering (Raje et al, 2002; DWI, 1998). Where the state or regional government is responsible, WTP can be higher than the status quo. For example, in Greece, residents were willing to pay up to €45 extra per year via their water rates in order to ensure the full operation of an existing but only partially operational wastewater treatment plant. Reasons for the willingness to pay for a cleaner water environment included peoples' pride in their city, as well as moral and ethical concerns (Kontogianni et al, 2003).

2.3.2 *Willingness to Pay for Stability of Supply*

Burn, Tucker, Rahilly *et al* (2003) used contingent valuation methods in order to examine the values people placed on current and possible future water restrictions in terms of their strength and duration. Out of 2032 Australian respondents, 21 % were willing to pay a one-off fee to avoid the current interruptions. Respondents who had experienced water interruptions in the past 5 years were on average willing to pay less for increased reliability than those who had not experienced a restriction.

CSIRO (Hatton MacDonald *et al*, 2005) research showed that Australian customers are willing to pay positive amounts to reduce the frequency with which interruptions occur. Unimportant aspects to customers are the provision of alternative water supplies during an interruption and notification of the interruption. Many of the main effects such as communication and the provision of an alternative water supply were not found to be statistically significant predictors of WTP. Variables such as age, perceptions of inconvenience, and income were significant predictors, however experience of an interruption did not have a significant influence on WTP.

To some extent these findings contradicted the pre-survey group work that suggested communication was very important. The findings about notification were also inconsistent with the CSIRO (2002) findings, where notification was named as being one of the most important aspects of

interruptions. These differences may reflect differences in data collection method and thus should give rise to some caution.

Henscher, Shore and Train (2006) investigated Canberra households' and businesses' WTP to avoid drought water restrictions, using CM approaches. In this case participants appeared unwilling to pay to avoid low-level restrictions at all or to avoid higher levels of restrictions that are not in place every day. Participants seemed more willing to change their behaviours (e.g. watering their gardens on alternative days) rather than pay more on their bills.

In a US CV study Griffin and Mjelde (2000) assessed Texan customers' WTP to avoid water restrictions. Respondents were found to be willing to pay, on average, between \$25.34 and \$34.39 (in 1997 US Dollars) to avoid such restrictions. They also found that respondents were willing to pay, on average, \$9.76/month (or 25.6 per cent of their bill) to improve future supply security levels. However, these authors question their own findings suggesting that the WTP figures are unrealistically high given the relatively low frequency of supply disruptions. A similar Californian CV study (Koss and Khawaja, 2001) suggested WTP figures of between \$11.67 and \$16.92 per month to avoid restrictions (in 1993 US dollars) though in this case WTP figures were dependent on the frequency and severity of previously experienced restrictions.

2.3.3 *Willingness to Pay for Bottled Water*

Bottled water purchasing can provide information about consumers' WTP for water services as the purchase of bottled water may indirectly reveal a WTP for higher quality drinking water (a 'revealed preference' in economic terms). Adote Abrahams *et al* (2000) argue that bottled water and filtered water are perfect substitutes for tap water since they fulfil the need for drinking water, with bottled water being purchased either as a risk averting behaviour by consumers to avoid a perceived (or 'real') risk, or for reasons of improved taste and odour, or appearance and/or convenience. It is assumed that bottled water prices are high because consumers are willing to pay these prices (Gleick, 2004) though Adote Abrahams *et al* (2000) note that drinking water from municipal supplies is essentially free given the price charged for municipal supplies and the relatively tiny quantities each individual can consume.

According to the bottled water industry, between 1999 and 2004 growth in global sales leapt from 98.4 to 151.4 billion litres (26 to 40 billion gallons) per year (IBWA, 2005). Market analysis has revealed that in 2005 alone, the global bottled water market advanced by 8.3%, with bottled water volumes reaching 173 billion litres, and is believed that it is likely to continue to increase in the future (Zenith International, 2006).

Since the 1970's, Europeans have been considered to be at the forefront of bottled water consumption (Kane 2000). Recent reports however have

suggested that sales may be reaching a plateau in Western Europe, with rapid growth expected in Eastern Europe, whilst sales in the UK, US and most other places are increasing. There has been some evidence that in France and Italy consumers are moving away from premium brands and opting for lower cost alternatives (The Times, June 2006). This would suggest that the maximum WTP for bottled water has, or is just about to be, reached in these countries.

2.3.4 *Limitations of Willingness-to-Pay Studies*

The WTP literature in general is a sophisticated one with a lot of activity being devoted to evolving the most efficient and valid procedures to elicit economic values (cf. Bateman *et al*, 2002). Despite this effort and sophistication the techniques still rely on study participants being motivated to provide honest answers and, even if motivated to be honest, be capable of producing valid answers.

WTP studies make a number of assumptions which may not hold true. For example, it is assumed that people have real, fixed values for products/services that can be accessed and that these are sufficiently stable to permit policy planning to be based on them. Valuing a single product is a complex task requiring the respondent to consider the value they place on the product in monetary terms (they may never have done this in the past in the case of water for instance) and to compare this to other things that they value and want to purchase whilst simultaneously considering their total available financial resources. It is assumed that the consumer will act rationally to maximise the value that could be obtained from their resources. It is unclear though, how, and indeed whether, people weigh competing demands on their resources and thus construct values in the ways implied by economic welfare theory which underpins WTP and WTA studies.

When considering valuation in the context of policy options the assumption that option values can be expressed in monetary terms and can be compared and traded off against one another is often challenged (Stagl, 2007). Moral choices can conflict with and often override economic choices. For instance, trading children, drugs and weapons are considered by many to be fundamentally inappropriate options, not merely ones with a low monetary value. Similarly some 'goods' have values that are very difficult, if not impossible to assess monetarily (e.g. environmental assets) since so many parameters are necessary for a realistic valuation to be reached. For example, putting a value on a lake is contingent on what the lake is to be used for by whom and over what period of time. It will also be contingent on the availability of other options to achieve the same policy goal as yet unconsidered. It may not be possible to value the option on one value dimension (i.e. money) alone.

Even if stable WTPs exist stated preference studies assume that people will freely provide them. Much of the literature critical of WTP studies questions this latter assumption (e.g. Merrett, 2002) and many studies show evidence of

participants engaging in strategic responding and misrepresenting their WTP values in the hope of lowering the eventual price of a good. WTP studies also raise ethical questions (e.g. Whittington, 2003). Particularly in the developing world where participants are not used to social research participants may feel under pressure to respond in certain ways believing, for example, that their responses will be made known to the authorities.

In order to establish WTP studies as a useful and legitimate tool in this area much more research is required that shows that WTP values assessed through SP techniques actually accord with reality when the relevant product/service becomes available on the market. In the case of water services, do consumers actually pay the extra amounts they said they would when a new service level is supplied? Do these meet with political objections or increased levels of non-payment? If not, were the assessed WTP values underestimates of true WTP? Unfortunately many WTP studies exist only as unpublished reports for water companies and it is not known whether any data that would shed light on this exist.

Given this level of uncertainty around the predictive value of WTP studies and the possible methodological and conceptual problems associated with them it would be unwise to rely entirely on WTP approaches to assess consumer preferences. See Bateman *et al* (2002) for a comprehensive review of good WTP study practices. See also Abley (2000) for a critical review of the assumptions underlying SP techniques.

2.4 External Influences on Consumer Preferences

Turgeon *et al* (2004) argue that drinking water quality satisfaction and risk perception are closely related. Their study, carried out in Quebec, demonstrated that consumers are able to perceive known variations in water quality, and that variations in water quality and geographical location have a strong impact on consumer perceptions and satisfaction. Consumers' perceptions of drinking water risk result from a combination of objective information together with a combination of social, cultural and psychological factors. Other factors, such as an aging population also may influence risk tolerance in a society since perceptions of risk are known to vary with age (Means, 2002). Risk perception amongst consumers who live nearer a water treatment plant tends to be high, whilst satisfaction levels are lower than people living further away from the plant (Turgeon, *et al* 2004).

Dissatisfaction may emanate from of lack of communication. Fessenden-Raden *et al* (1987) suggested that customer dissatisfaction with drinking water may be due in part to the lack of effective communication by water company experts during water pollution incidents, such as chemical contamination of groundwater.

2.5 Other Indicators of Consumer Preferences - Complaints

Dissatisfaction as a manifestation of failure to satisfy consumer expectations may be difficult to detect. One obvious method of monitoring public dissatisfaction is to examine levels of customer complaints. Most water companies recognise that customer complaints are an important indicator of customer dissatisfaction and duly monitor them closely. Owen (2000) in her study reported complaints about a variety of issues from quality of water to sources of water, water treatment processes, water distribution networks, domestic plumbing systems and billing. Most consumer complaints are received and handled by their respective water companies in the first instance.

Across the original 15 EU countries 72% of residents report that information given by water suppliers is clear (e.g. billing, contracts, leaflets) the other 28% reported that the information was unclear (18%) or they did not know whether it was clear (10%). Just over 20% of consumers thought their contract with the company was 'unfair' and 2% had lodged a complaint in connection with their water supplier in the previous 12 months. Of those who had complained in the EU15 a full 41% thought that their complaint had been dealt with 'fairly badly' or 'very badly' with the biggest group of these complaints being about billing. The numbers are small here so some caution is required (Candidate Countries Eurobarometer, 2003).

While the rate of complaints to water companies was low at 4% in a study of German consumers (ATT *et al*, 2005) almost 40% of consumers who made a complaint were dissatisfied with the response of the water company. The study found that although German consumers overall had a positive image of their water companies, consumers were less positive when asked whether their water company was too bureaucratic or about the fairness of water prices. In part this may have been due to consumers being ill-informed about water prices as the average price estimated by consumers in the study of approximately €5 per cubic metre was considerably higher than the actual average price of water charged at €1.81.

In the UK, should dissatisfaction still remain after making a complaint - presumably due to an ineffective response by the water company at handling the initial complaint - one avenue for customers to pursue their complaint with the Drinking Water Inspectorate (DWI), the key body for monitoring water quality. In 2001 the DWI received 346 complaints in relation to drinking water quality. In rank order of most complaints, these complaints were related to discolouration, taste and odour of chlorine, other taste and odour issues, particulates, illness, hardness and lead. The inspectorate reported that most of these complaints were handled by asking the relevant water company to look into the matter and take remedial action where necessary (DWI, 2001).

It is important to note that customer complaints may demonstrate concern about drinking water as well as dissatisfaction with water companies themselves. In their 2001 report the DWI reported that, while most consumers who contacted the inspectorate had a concern about a water quality issue, a

growing number involved consumers who were dissatisfied with the way their initial complaints were being handled by some water companies.

It should be noted that complaining rates are an imprecise indicator of the level of consumer dissatisfaction. Some dissatisfied consumers will complain but others will not for various reasons including cynicism about the likelihood of their complaint being dealt with satisfactorily or a personal dislike of complaining in general. Some people are habitual complainers who will complain about any service irrespective of its quality.

3 Explaining Consumer Preferences - Models of Preference and Risk Perception

We have already discussed some of the concepts underlying WTP studies and these are discussed further in the companion TECHNEAU document *Customer Preferences For Drinking Water Services: Methods For Water Utilities (D6.2.2)*. Here we discuss a number of concepts that regularly appear in research on consumer behaviours and we focus this on service provision rather than models of consumer choice in 'true' markets (i.e. where consumers are presented with a number of competing products from which to choose).

3.1 Models of Service Quality

Research on satisfaction with service quality and service providers has a long history but it is probably fair to conclude that this research has largely been of an *ad hoc* nature with numerous theoretically unconnected surveys and polls. The same applies to studies of attitudes towards governments and regulatory bodies. Most major companies commission poll research to gauge client satisfaction and approval ratings but the measures used are usually industry-specific questions often limited in number and sophistication. Typically, a number of service-specific attributes are rated on 5 or 7 point scales much as described in the previous section which are analysed primarily descriptively.

The area is not totally devoid of conceptual traditions however. One common approach is known as GAP analysis. According to Kotler (1994) there are five potential gaps in the delivery of services:

- consumer expectation and management perception - the management may not perceive the customers' needs
- management perception and service-quality specification - the management may assess the customer requirements but may not define this with sufficient clarity for their staff
- service-quality specification and service delivery - the staff may have conflicting demands and may not meet the standard of service required
- service delivery and external communication - the customers may not get the service which they have been led to expect from external communications
- perceived service and expected service - fast food staff may clean tables frequently but this may be perceived by the customers as an indication that staff are rushing them through the meals

The literature has been concerned with identifying which dimensions of service quality are the key ones on which to focus GAP analyses. The theories

of service quality are dominated by multidimensional structural frameworks and there are broadly two schools of thought about the number of key dimensions of quality that consumers look for: these are the Nordic European and the North American schools. Early service quality researchers established the Nordic European School which suggested that service quality was assessed on two, or at most, three dimensions. The suggestion was that measurement of service quality is based on a kind of “disconfirmation theory” where quality is assessed on whether a service was better than expected or worse than expected (Grönroos, 1984; Lehtinen and Lehtinen, 1991). Evidence that people did indeed assess quality on two or three basic dimensions was not clear and so debates have ensued about how many key dimensions there were.

The North American School made a significant contribution to the measurement of service quality with a well known model called SERVQUAL (Parasuraman *et al*, 1985). The model was developed as a result of research across a range of service industries including retail banking, credit card provision, security brokerage and, product repair and maintenance. The SERVQUAL model suggests that quality is assessed on five abstract dimensions of quality; assurance, responsiveness, reliability, tangibles (physical facilities) and empathy. According to the model, service quality is a “gap” between the customer’s expectations and perception and therefore, it should be measured by subtracting customer’s ratings of the performance (P) on the quality dimensions from customer expectation (E) on each dimension. The greater the positive gap ($P > E$) the better service quality and vice versa.

The picture is complicated by the fact that other researchers have reported differentially interpretable service quality factor structures varying from one to sixteen service quality factors which appear to differ from the SERVQUAL model in different service sectors (Carmen, 1990; Lewis, 1984). However, Teas (1994) has proposed what he regarded as a more relevant model. His Normed Quality model (NQ) was based on the effect of such factors as the number of attributes a service has, the importance of each attribute, the individual’s perception of the amount of the attribute that has been provided and the individual’s perceived amount of attribute possessed by the norm (a norm-referenced expectation). Furthermore, the Nordic European School suggest that a two factor model may be sufficient formed of the SERVQUAL “tangibles” dimension and an amalgamation of the remaining four dimensions.

The debate about how many dimensions of service quality there are continues and it is most probably the case that the number is dependent on the service sector concerned. Some sectors offering complex services may be evaluated on more dimensions compared with those that offer comparatively simple services. Recent methods for assessing customer satisfaction such as the Subjective Social Indicator method (see *Customer Preferences For Drinking Water Services: Methods For Water Utilities*) allow participants to define the relevant attributes and qualities of a service and go some way to allowing researchers to identify the key dimensions relevant for any given service.

3.2 Risk and Hazard Perception

Objections to new developments and complaints about a service or product are often linked to perceived risks associated with it. Such perceived risks can lead to financial loss, physical harm, or be psychological in nature. For formal risk assessors the amount of risk associated with a hazard is assessed by a measure of the degree of harm or damage that might follow from exposure to the hazard multiplied by the likelihood that this exposure will occur. However, for many decades there has been a debate about why such 'expert' risk assessments do not seem to correspond with 'lay' assessments of risk. For example, most studies show that people perceive far more risk and threat from living near a nuclear power station than they do from driving a car. Formal risk assessments would place driving a car as the more risky behaviour and the question has been why is it that people will campaign against power stations yet happily continue to drive.

The 'Psychometric Paradigm', developed by Slovic, Fischhoff, and Lichtenstein (1980) was particularly influential in the field of risk research during the 1980's. The psychometric approach suggests that for those who are not risk assessors hazards are perceived according to the qualitative characteristics of hazards, known as 'risk attributes' and that many more of these attributes are considered than are considered by risk assessors who concern themselves only with extent of harm and likelihood of harm. The additional attributes considered include the perceived voluntariness of exposure to the hazard, fairness of exposure (e.g. culpability of any causalities), levels of containment, levels knowledge and awareness of exposure, lack of trust in those responsible for monitoring or regulating the hazard, familiarity of the hazard, the unknown nature of long-term effects, unclear social advantages or benefits and extent to which a person can identify with the casualties.

Hazards in different domains have different degrees of the aforementioned attributes. In a classic study Slovic (1987) asked participants to rate 81 hazards on a number of dimensions, such as controllable vs. uncontrollable; voluntary vs. involuntary; consequences fatal vs. consequences not fatal etc. Using factor analytic techniques he found that two main factors explained the ways in which members of the public categorised the hazards - seriousness of consequences (perceived dread) and degree of familiarity (unknown risk). As seen in figure 3.1, a dreaded hazard (Factor 1) is characterised as being uncontrollable, exposure to it is involuntary, with potentially globally catastrophic consequences and high risks to future generations. Incidents related to nuclear power were most prominent on this dimension. Unknown hazards (Factor 2) were characterised as unobservable, new hazards that were unknown to science. Chemical technologies scored highest for this factor. Put crudely the key here is that expert assessors are effectively only rating hazards on dimensions strongly related to Factor 1 here yet the lay public are introducing additional (Factor 2) considerations into their assessments.

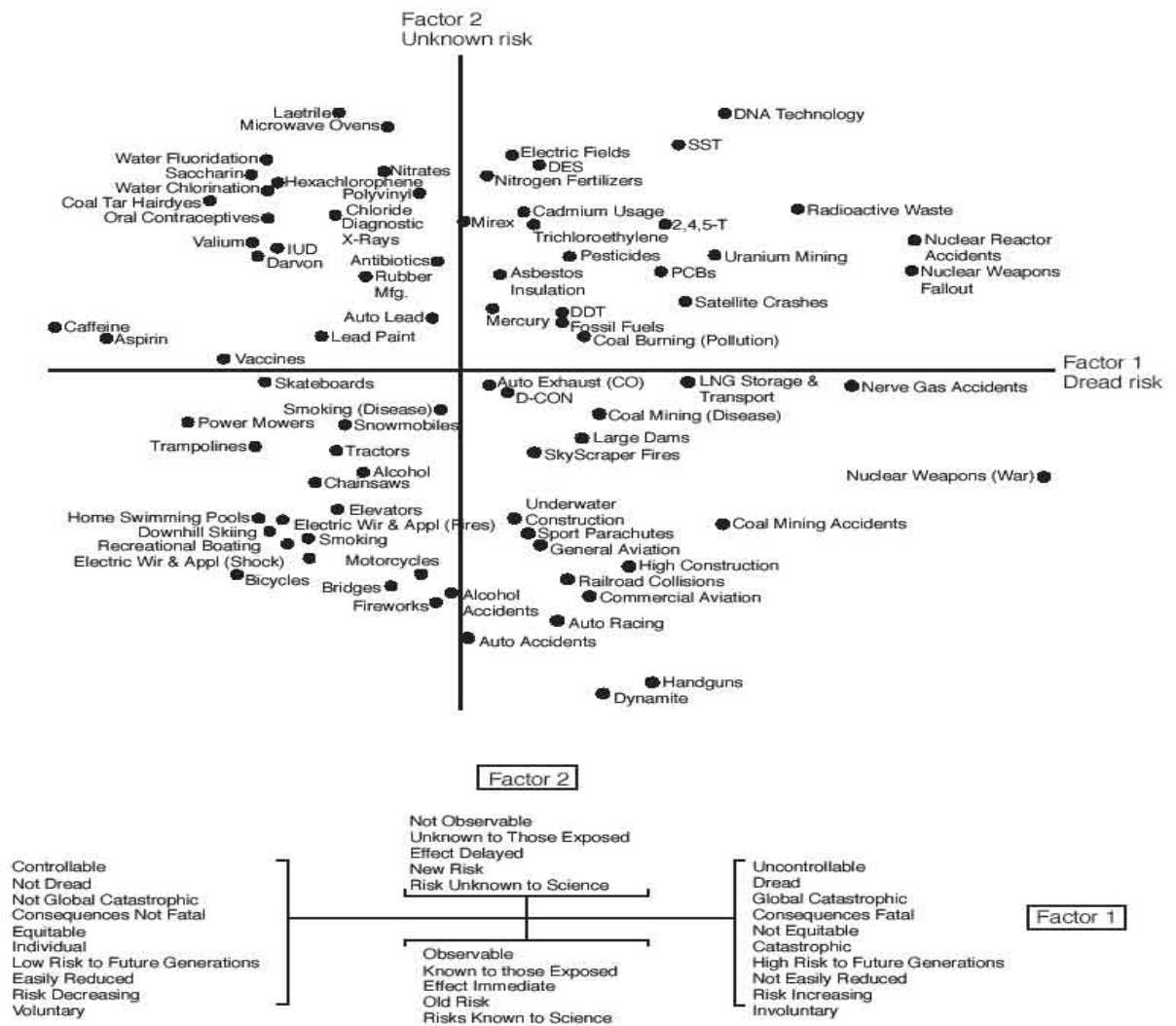


Figure 3.1 Location of 81 hazards on Factors 1 and 2 derived from the interrelationships among 15 risk characteristics. Each factor is made up of a combination of characteristics, as indicated by the lower diagram.

Source: Slovic (1987).

Hazard perceptions are also influenced by socio-demographic background factors. Flynn *et al* (1994) conducted a survey in which perceptions of environmental health risks were measured for 1275 white and 214 non-white people. White males tended to differ from the other members of the sample in terms of their attitudes and perceptions (see figure 3.2). They perceived risks to be much smaller and much more acceptable than others. Drawing on these data, the authors suggest that socio-political factors such as power, status, alienation, and trust are strong determinants of people's perception and acceptance of risk.

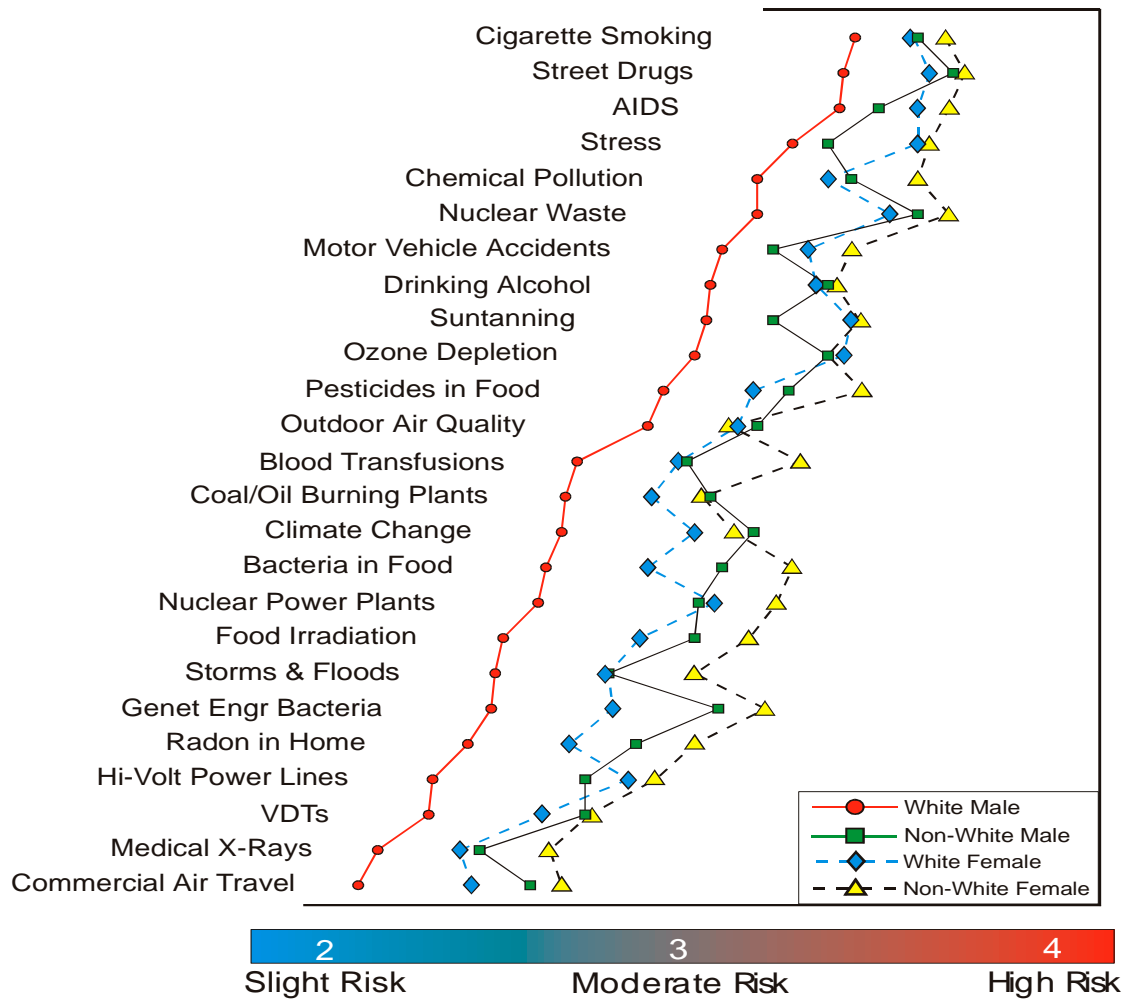


Figure 3.2. Gender and race differences in ratings of environmental hazards.
 Source: Flynn, Slovic and MacGregor (2000).

Risk/Hazard Perception as a Driver of Concern

Elements of the psychometric paradigm are still regarded as highly influential and have recently been integrated within the UK's HM Treasury Report on managing risks. Here six indicators are regarded as key to understanding the nature, and drivers of, public concern (nb. the report uses 'risk' to mean 'hazard' here).

1) Familiarity and experience of the risk

In general, people are more concerned about risks which are new to them and about which they have only a little knowledge or experience

2) Understanding of the cause-effect mechanism

People may be more concerned if the cause-effect mechanism is unknown or uncertain (e.g. if experts disagree) or if they themselves find it difficult to understand from the available information what effects hazards may have and how likely it is that they may be harmed

3) Equity of the consequences of the risk and the associated benefits

People tend to be more concerned if they perceive that the effects fall unfairly on a specific group in society, particularly if they themselves are part of that group

4) Fear of the risk consequences

People are naturally more concerned if the form of harm is particularly horrific, such as if it involves long term extreme pain, impacts on future generations, widespread impact, or because the harm (or degree of harm) is unknown or uncertain and could be very severe and irreversible. There may well be other reasons why fear is particularly high which might depend on individuals' perceptions and the context

5) Control of the risk

People tend to be more concerned if they feel they have no control over the risks involved

6) Trust in risk management

People tend to be more concerned if, not having personal control over the risks involved, they also do not trust those responsible for managing the risk on their behalf.

Source: HM Treasury, 2005, pp. 11

Other lines of research have focused on how perceptions of hazards are influenced by social settings and social, cultural and organisational factors, as opposed to the more individual level described above and implicit in the psychometric paradigm. These approaches assume that wider contextual issues, such as social relations, trust in government, industry and risk management, also influence public perceptions of risks.

In a series of in-depth focus groups, Petts *et al* (2003) found that when discussing day-to-day concerns, most revolved around health and health care, followed by crime, law and order. Other concerns, such as food (e.g. genetically modified products), new technologies (e.g. mobile phones) and the environment (e.g. climate change) featured to a lesser extent. Within the

focus groups, individuals tended to relate these issues to personal or local experiences – concerns were embedded in socio-cultural factors. This was found to be particularly the case for health and health care issues, where people voiced concerns about issues as they directly affected their own day-to-day lives.

3.3 The Social Amplification of Risk

The process of *social amplification* refers to the social dynamics that influence how risk events are represented and communicated. The Social Amplification of Risk Framework (SARF) was developed in order to understand the social processes that mediate the relationship between a hazardous event and its consequences. SARF emphasises the social contexts in which risks occur, and assumes that risk events have a *signal value* that is propagated through a social network. In Stage I the focus is upon the hazard event and the relationship between the various stations of amplification and their relationships with public perceptions and initial behavioural responses. Stage II of the framework is concerned with secondary impact, where there is a hypothesised link between the amplification of risk perceptions and behaviours and secondary consequences, which consist of socio-economic and political impacts (Breakwell and Barnett, 2001).

Flynn *et al* (2000) state that risk is amplified when:

- A new and possibly catastrophic risk has emerged;
- The risk managers try to conceal the risks: so when found out the public think they cannot be trusted;
- The risk managers are not in control of the hazard;
- The experts do not understand the risks or do not understand the long-term cumulative effects of chemicals or contaminants.

They go on to state that risk is attenuated when:

- Risks do not resonate with public concerns and fears/dreads;
- Media reporting on the hazard is limited and not sustained;
- Benefits of the hazard are necessary;
- Hazards are well understood and controlled;
- Managers are trusted and display control and expertise.

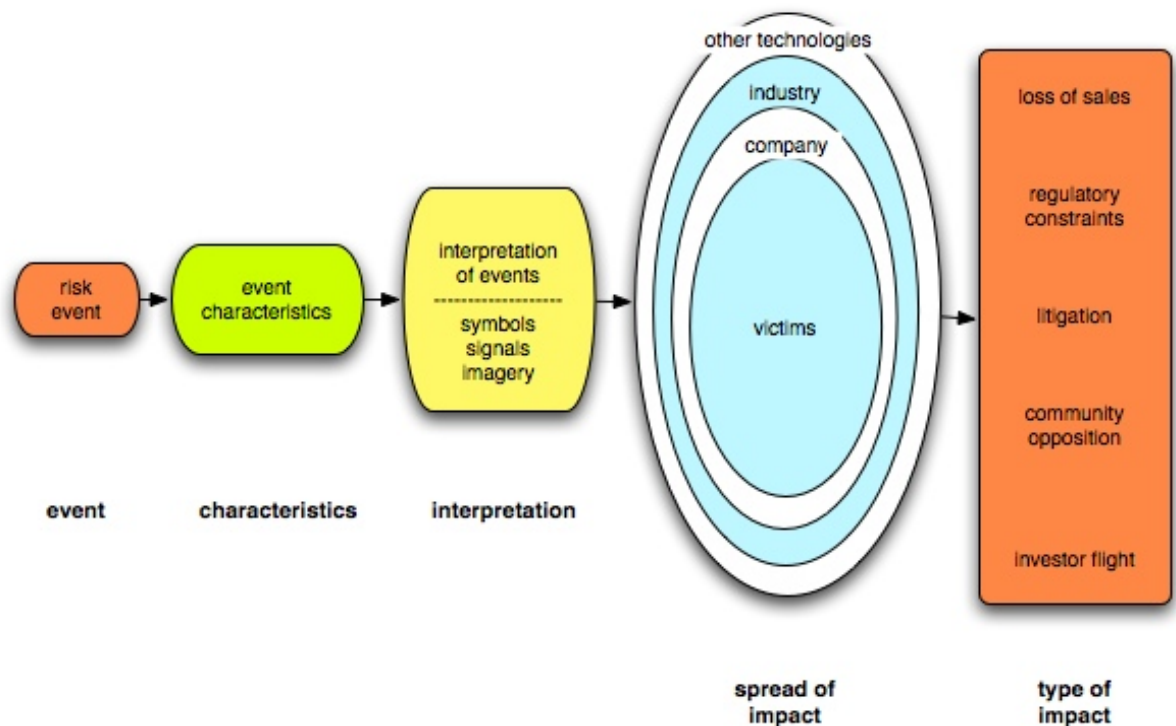


Figure 3.3: The Social Amplification of Risk Framework
Adapted from: Kasperson, *et al*, (1988).

Examples of recent cases in which social amplification effects have occurred include the threat Severe Acute Respiratory Syndrome (SARS), anthrax contamination of mail, bovine spongiform encephalopathy (BSE), H5N1/bird flu and *Legionella pneumophila* outbreaks. Relatively small incidents involving new, unfamiliar technologies can cause greater unrest than a train incident with many casualties. The role of the media is important in this. An explanation for this can be found in the effect that the media have on involvement. *Involvement* is the consumer's perception of the importance or personal relevance of a product or service. Despite the fact that involvement is usually low for everyday products (water, bread, socks), the situational sources (including the media) are likely to influence the level of involvement consumers feel. The media and other sources of information can also have an influence on confidence. By informing consumers, both confidence and awareness can be raised. This in turn may influence the trust people have in the responsible institutions and the government (Petts, Horlick-Jones, Murdoch, 2001). However, research in some technological domains has suggested that merely communicating about a potential hazard or even suggesting that something might be a hazard can itself raise concerns that were not present previously (cf. McGregor, Slovic & Morgan, 1994). Such hazards, by definition will not be ones that the public are familiar with and this will be perceived as high on psychometric model's Unknown Risks Factor 2 discussed above.

3.4 Acceptance

The relationship between acceptance, trust and risk perception is discussed in the companion TECHNEAU report *Consumer Trust: An Overview* but some general points are made here. Using the psychometric approach discussed in section 3.2, risk perception studies have been used to forecast acceptance and opposition to specific technologies. Slovic (2000) notes that nuclear power has been a frequently researched topic due to the substantial public opposition it has provoked despite experts' assurances of its relative safety compared to other hazards and behaviours. Here the research has demonstrated that people judge the benefits of nuclear power to be small, whereas the risks are regarded to be unacceptably great. Fischhoff *et al* (1981) proposed that levels of acceptance will be governed by various factors, resulting in the typology below:

Risks perceived to...	are more accepted than	...risks perceived to...
be voluntary		be imposed
be under an individual's control		be controlled by others
Have clear benefits		have little or no benefit
be fairly distributed		be unfairly distributed
be natural		be manmade
be statistical		be catastrophic
be generated by a trusted source		be generated by an untrusted source
be familiar		be exotic
affect adults		affect children

From Fischhoff et al, 1981

In line with examining risks in context, Pidgeon *et al* (2003) conducted a major quantitative survey that aimed to investigate the relationships between public attitudes to science and risk, trust in risk regulation and risk governance. The study also explored levels of acceptance. Pidgeon *et al* researched perceptions of five key hazards; genetically modified food, climate change, mobile telecommunications, human genetics, and radioactive waste. They found radioactive waste was viewed most negatively of the five hazards. It was regarded as having the lowest benefits and the highest costs. Evidently, concern about radioactive waste was high, and it was seen as the least acceptable hazard. Conversely, genetic testing was regarded as being a good thing. It was deemed most acceptable with relatively low perceived risks and higher perceived benefits, and thus generated lower levels of concern.

Forty-one percent of respondents felt that the benefits of the *use* of mobile phones outweighed any potential risks. Risks were therefore perceived to be low, whilst perceived benefits were high. Climate change was regarded as a bad thing, associated with low benefits and high risks (perceived risks were found to be closer to those of radioactive waste than any of the other risk issues). Concern about climate change was high, and it was regarded as largely unacceptable. Responses to genetically modified food were mixed. Although compared with the other four hazards it was evaluated more

positively 44% of respondents felt it was a bad thing, whilst 35% were neutral about the issue. Furthermore, people appeared to be less concerned about GM food than about the other potential hazards. However, more people thought the risks outweigh the benefits. The acceptability of GM Food was moderately low.

Attempts have also been made to identify factors that influence levels of acceptance. Much attention has been paid to the nature of public knowledge, values, attitudes and concerns, and where these fit in with decision-making processes. In the light of previous instances of public resistance to technical change, institutions are increasingly consulting and sponsoring public understanding of science research (Irwin & Michael, 2003). See the companion TECHNEAU report *Consumer Trust: An Overview* for more discussion of the relationship between knowledge and acceptance.

In studies such as the above there are always a number of methodological issues that should encourage caution in seeking generalisations. Taking the radioactive waste hazard as an example, respondents' ratings of the benefits of such waste are likely to be influenced by the framing of the survey questions. If asked whether such waste has any benefits in a way that is context-free most people would initially assume not. If, however, the question is set in the context of radioactive waste generated as by-product of a medical intervention that you or one of you family had just benefited from, the ratings are likely to be different. Given this kind of contextual effect any study of the acceptance of specific technology/service/product needs to involve some qualitative investigation of the contexts in which the acceptance (or not) has to take place.

4 Conclusions

1. Water has a unique position as a consumer product and thus care is needed in extrapolating findings and theories from other consumer related areas. Theories of consumer behaviour in markets are unlikely to be of use in understanding consumers' relationship with water suppliers. Even among utility suppliers it has a particular and unique position.
2. As a result of the special nature of water and the relatively recent nature of research into consumers' preferences in this domain there is no single, dominant theory in the field although Willingness-to-Pay (WTP) studies based on economic welfare theory are the most numerous.
3. Consumers *prefer* water supplies that are 100% safe but what remains unclear is what proportion of the population *expect* less than 100% safety and what levels of risk are *acceptable* to which sets of consumers. This is a topic which is as yet under-researched.
4. We need to identify the key service quality dimensions that are specific to the water sector. Some of these are evident from the literature (aesthetic qualities, customer relations responsiveness etc.) but there will be others and these need to be identified.
5. WTP is greater for more immediate aspects of the supply (e.g. safe drinking water, better taste and odour) than for more long term or distal supply issues (e.g. infrastructure improvements, decreased river pollution).
6. Many water-related WTP studies produce WTP values that are below the cost of implementing the relevant changes.
7. WTP is lower when the supplier is in the private sector and WTP anything more is close to zero if private sector supplier is seen to be wasteful or profiteering. Where the state/regional government is responsible WTP can be higher than the status quo. Trust in the supplier and their motives probably moderate WTP but this needs to be tested
8. There are a number of conceptual and methodological problems associated with WTP approached that make it unwise to rely on WTP alone when assessing likely consumer responses to future changes. Given contextual effects in survey research any study of the acceptance of a specific technology/service/product needs to involve some qualitative investigation of the contexts in which consumers will make their judgments. It is likely that socio-cultural factors will

influence consumers' value judgements and preference and these need to be taken seriously and researched further.

9. A number of high quality WTP studies have been conducted in the water domain but as yet there is no clear evidence that WTP values achieved in these studies are matched by actual payment of them when preferred options are turned into real policies or services.
10. In the context of risk perceptions and citizens' concerns, alerting the public to either new water-borne hazards or new treatment processes intended to safeguard against such hazards is likely to cause anxiety. This should be regarded as a natural feature of human hazard perception. People are influenced by the degree to which they know and are aware of their exposure to hazards and raising awareness of something not previously considered naturally places it in the new and unknown half of the Psychometric 'Risk space'.

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