Cultural sensitivity of the contingent valuation method

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September 1992

Information Paper No. 41

Centre for Resource Management
Lincoln University
The Centre for Resource Management is a research and teaching organisation based at Lincoln University in Canterbury. Research at the Centre is focused on the development of conceptually sound methods for resource use that may lead to a sustainable future. The Centre for Resource Management acknowledges the financial support received from the Foundation for Research, Science and Technology in the production of this publication.

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## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>2 Contingent valuation - an overview</strong></td>
<td>3</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>3</td>
</tr>
<tr>
<td>2.2 Willingness-to-pay versus willingness-to-accept</td>
<td>3</td>
</tr>
<tr>
<td>2.3 The choice of elicitation methods</td>
<td>4</td>
</tr>
<tr>
<td>2.4 Sources of bias in contingent valuation surveys</td>
<td>5</td>
</tr>
<tr>
<td>2.5 Conclusion</td>
<td>6</td>
</tr>
<tr>
<td><strong>3 Measuring attitudes</strong></td>
<td>7</td>
</tr>
<tr>
<td>3.1 Attitude as a determinant of behaviour</td>
<td>7</td>
</tr>
<tr>
<td>3.2 The relationship between attitude and willingness-to-pay</td>
<td>8</td>
</tr>
<tr>
<td><strong>4 Options for upgrading Dunedin city's sewage treatment and disposal system</strong></td>
<td>9</td>
</tr>
<tr>
<td>4.1 Rationale behind the choice of case study</td>
<td>9</td>
</tr>
<tr>
<td>4.2 Dunedin City Council's wastewater treatment and disposal options study</td>
<td>9</td>
</tr>
<tr>
<td><strong>5 Survey design</strong></td>
<td>13</td>
</tr>
<tr>
<td>5.1 Sample selection</td>
<td>13</td>
</tr>
<tr>
<td>5.2 Design of the attitudinal component in the survey</td>
<td>13</td>
</tr>
<tr>
<td>5.2.1 Stage One - identifying salient beliefs</td>
<td>13</td>
</tr>
<tr>
<td>5.2.2 Stage Two - evaluating salient beliefs</td>
<td>15</td>
</tr>
<tr>
<td>5.3 Designing the contingent valuation survey</td>
<td>16</td>
</tr>
<tr>
<td>5.4 Socio-economic/demographic questions</td>
<td>17</td>
</tr>
<tr>
<td><strong>6 Results</strong></td>
<td>19</td>
</tr>
<tr>
<td>6.1 Survey response rate</td>
<td>19</td>
</tr>
<tr>
<td>6.2 Attitude</td>
<td>20</td>
</tr>
<tr>
<td>6.3 Willingness-to-pay</td>
<td>22</td>
</tr>
<tr>
<td>6.4 The relationship between attitude and willingness-to-pay</td>
<td>26</td>
</tr>
<tr>
<td><strong>7 Conclusions</strong></td>
<td>27</td>
</tr>
<tr>
<td>7.1 Cultural sensitivity of contingent valuation</td>
<td>27</td>
</tr>
<tr>
<td>7.2 The influence of payment periodicity</td>
<td>28</td>
</tr>
<tr>
<td>7.3 Household versus individual willingness-to-pay</td>
<td>28</td>
</tr>
<tr>
<td>7.4 Obstacles in contingent valuation research</td>
<td>28</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>29</td>
</tr>
<tr>
<td><strong>Appendix 1</strong></td>
<td>31</td>
</tr>
</tbody>
</table>
CHAPTER 1

Introduction

Resource management decision making usually involves balancing the costs of a public policy with the benefits. In the last two decades there has been growing recognition that the public good nature of resource management issues has meant that the environmental costs and benefits associated with policy options have been difficult, if not impossible, to measure. This measurement difficulty has often resulted in environmental costs and benefits being excluded from resource management policy evaluations or inaccurately approximated.

In an attempt to overcome this difficulty several economic valuation techniques have been developed. These techniques have been used to measure benefits gained from the presence of national parks, improved water quality, improved flood protection, and numerous other natural resources. These benefits are not ordinarily priced in markets and are called non-market goods or services.

The main non-market valuation techniques that are used include: contingent valuation (CV), travel cost, and hedonic pricing. The most versatile of these methods is CV. Unlike the travel cost and hedonic pricing techniques, CV can be applied to a wide range of environmental goods. Further, it is not restricted to measuring the use values from natural resources and can be used to measure the benefits that people receive from knowing that a resource exists and that it will remain available for future generations.

With the passing of the Resource Management Act 1991 there is likely to be increased interest in CV. Section 32 of the Act requires resource management agencies to identify the most effective and efficient way of carrying out their functions to meet the purpose of the Act. Reasons for and against the various policy or management options facing resource management agencies, and their benefits and costs, must be considered before decisions are made.

It is unlikely that Section 32 is intended to force resource management agencies to carry out rigorous cost benefit analyses, including non-market valuations, for all of the resource decisions they make. There may, however, be situations where CV could prove to be an effective way of measuring the non-market costs and benefits of alternative policies, plans, or rules.

While CV provides a flexible tool for non-market valuation, a large number of questions remain unanswered about the validity and reliability of the results obtained from such studies. If the technique is to be used to fulfill Section 32 requirements of the Resource Management Act, further research is required to address these questions.

Probably the greatest priority in CV research is to determine whether its application is consistent with the overall framework set out in the Resource Management Act. The purpose and principles of the Resource Management Act place emphasis on the values held by Maori toward a resource. The objective of this research is therefore to address the extent to which CV can capture differences in value arising for cultural reasons.
This publication describes a methodology that was developed and tested for measuring the cultural specificity of CV. The methodology involved comparing attitudinal data with assigned non-market values. Attitudinal data were derived using Fishbein and Ajzen's Theory of Reasoned Behaviour model, while assigned non-market values were obtained using an open-ended CV format. The attitudinal and CV models were applied to both Maori and Pakeha respondents to test the strength of their attitude and willingness-to-pay for a natural resource.

A comparison of the two types of data determined whether there were any differences in attitudes held by Maori and Pakeha towards natural resource uses, and whether these differences were reflected in their willingness-to-pay for a natural resource use. The results of the study could therefore be used to assess the cultural sensitivity of the CV method.

In the first three chapters of this publication the theoretical basis of CV and Fishbein and Ajzen's model for measuring attitudes are discussed. In Chapter Four the case study used in this research - options for improved sewage disposal in Dunedin - is described. Methods used to compare attitudinal data with assigned non-market values are described in Chapter 5. Chapter 6 contains the results of the comparative analysis. The publication concludes with a general discussion of research findings from this project and areas for future CV research.
CHAPTER 2

Contingent valuation - an overview

2.1 Introduction

The CV method measures environmental costs and benefits where no market exists for the good in question. Essentially the CV method asks people to value particular increases or decreases in the quantity of some good, contingent upon the existence of a hypothetical market. Contingent valuation involves asking people what they would be willing to pay or willing to accept if a market for the good existed and its quantity/quality changed. While some CV studies use experimental techniques, in which subjects respond to stimuli in "laboratory" conditions, most CV studies use a survey format.

Respondents involved in a CV survey are presented with information in three parts (Mitchell and Carson, 1989):

1. A detailed description of the good(s) being valued and the hypothetical circumstance under which it is made available to the respondent
   The hypothetical market described in this part of the survey should be plausible and possible. The market describes the good to be valued, the current level of provision and the proposed increase/decrease in provision, the institutional structure under which the good is to be provided, and the method of payment.

2. Questions that elicit the respondent's willingness-to-pay for the good(s) being valued
   Elicitation methods can either obtain actual willingness-to-pay amounts, or discrete indicators of willingness-to-pay. Actual amounts are obtained by asking respondents how much they would be willing to pay/accept for a change in the level of provision of a good. Discrete indicators are obtained when respondents are asked if they would be willing to pay/accept a specified amount for a change in the level of provision of a good.

3. Questions about respondents' characteristics e.g. age, sex, income or use of the good(s)
   Characteristics are entered into regression equations to examine the influence they have on willingness-to-pay.

2.2 Willingness-to-pay versus willingness-to-accept

When setting up a CV study respondents can either be asked how much they would be willing to pay to fund an improvement in environmental quality or they can be asked how much they are willing to accept in compensation for no improvement in environmental quality. Contingent valuation studies that have used both willingness-to-pay (WTP) and willingness-to-accept (WTA) formats have consistently found that respondents provide a higher value when asked how much they would be willing to accept. These findings raise the important question of which value (WTP or WTA) is the theoretically correct one to use. While various theories have been developed to explain this discrepancy (Kahneman and Tavresky, 1979; Randall, 1980; and Hanemann 1986, cited in Mitchell and Carson, 1986) the issue is largely unresolved.
Mitchell and Carson have, however, developed a partial solution to this problem. They argue that for public goods that require annual payments to maintain a given level of the good, WTP is the theoretically correct format.

A large number of decisions taken under the Resource Management Act will deal with public goods for which an annual payment is required. Based on Mitchell and Carson’s partial solution, WTP is likely to be the appropriate format to use in most cases.

2.3 The choice of elicitation methods

A variety of techniques has been used to elicit WTP amounts from people. The simplest method involves using an open-ended format in which respondents are asked for the maximum amount they are willing to pay. The disadvantage of this technique is that respondents find it difficult to pick a value out of the air without some form of assistance. As a consequence, the open-ended format causes a large number of non-responses and protest zeros. To overcome this problem CV researchers have developed several other methods to measure a respondent’s maximum WTP for a good.

The oldest of these methods is the bidding game in which respondents are asked if they are willing to pay a particular price for the good - yes or no. Depending on the respondent’s answer, the bid is either raised or lowered and the process repeated until the respondent’s maximum WTP is obtained. The difficulty with this technique is that the starting bid tends to imply a value for the good. Studies have shown that the value of the starting bid significantly influences the respondent’s maximum WTP (Mitchell and Carson, 1989, p.100). A further difficulty with the bidding game is that it cannot be used in postal surveys.

As an alternative to the bidding game the payment card was developed. The payment card was designed to maintain the properties of the open-ended approach whilst providing respondents with a visual aid that contains a large array of potential WTP amounts. The major difficulty with payment cards is deciding what the upper limit should be and what increments to use. Kahneman (cited in Cummings et al., 1986, p.207) argues that payment cards do not eliminate bias because they provide the respondent with a “reasonable range” from which to select values and thus cause “entering bias”.

A further refinement of payment cards is the inclusion of benchmarks. Benchmarks provide information about the cost associated with providing other public goods. The use of benchmarks is intended to remind respondents that they are already paying for many goods through taxes. Unfortunately there is a danger that respondents may base their valuations entirely on the costs included in the benchmarks.

To overcome the problem associated with the open-ended approach a dichotomous choice (also referred to as “take it or leave it”) has been developed. This elicitation method uses a large number of prices that encompass the expected maximum WTP of most respondents. These prices are then randomly assigned to individuals involved in the survey. Survey respondents are required to indicate whether or not they are willing to pay the specified amount for the good being valued. Logistic or probit regression curves can then be fitted to predict the percentage of respondents willing to pay each of the randomly assigned prices. The median WTP can be readily identified using this procedure, while the mean WTP has to be calculated from the area under the probability curve.
The dichotomous choice approach has several advantages. As Carson and Mitchell point out:

"It simplifies the respondent's task in a fashion similar to the bidding game, without having the iterative properties of that method. The respondent only has to make a judgement about a given price, a type of judgement performed frequently by consumers and those who vote in a referendum. In this respect, the take-it-or-leave-it method may be especially suitable for mail interviews or, presuming the scenario does not require the use of visual aids, telephone interviews. This approach is also incentive-compatible in that it is in the respondent's strategic interest to say yes if her WTP is greater than or equal to the price asked, and to say no otherwise" (p.101).

Despite the obvious benefits from using the dichotomous choice approach the method has several drawbacks. Firstly, because the technique only provides a discrete indicator of maximum WTP it requires a large sample size to obtain statistical precision. Secondly, the use of logit and probit regression procedures to specify valuation functions and calculate mean WTP requires a number of mathematical assumptions to be made.

Despite these drawbacks the dichotomous choice method is gaining widespread acceptance by CV researchers as the preferred technique for estimating WTP.

2.4 Sources of bias in contingent valuation surveys

Three key sources of potential systematic error have been identified in contingent valuation WTP estimates.

1. Incentives to misrepresent responses
Scenarios described in hypothetical markets can contain incentives for respondents to misrepresent their true WTP. These incentives can lead to two types of behaviour. Strategic behaviour occurs when respondents try to influence the payment for or future outcome of policies. Compliance behaviour occurs when respondents attempt to comply with presumed expectations of the survey sponsor or make an attempt to gain status in the eyes of a particular interviewer. Both types of behaviour result in differences between respondents true WTP and the amount they specify.

2. Implied value cues
This type of bias occurs when respondents think that elements of the contingent scenario provide information about the "correct" value for the good. As discussed in Section 2.3 the use of bidding games and payment cards to elicit WTP can result in this type of bias. The order in which valuation questions for different levels of a good (or different goods) are presented can also be seen by respondents as a cue to the true value of goods. The fact that the CV survey was commissioned in the first place may also make respondents feel that the amenity must have value.

3. Scenario mis-specification
Scenario mis-specification occurs when respondents do not respond to the correct contingent scenario. Three types of scenario mis-specification can occur. Theoretical mis-specification occurs when the economic theory or the major policy elements of the scenario described in the CV survey are incorrect. Amenity mis-specification occurs when the respondent does not understand the scenario as the researcher intends it to be understood. This occurs when respondents perceive a broader or narrower policy package than the one described or where a respondent values the probability of a good being delivered differently to that intended by the researcher. Context mis-specification occurs where the perceived context of a market differs from
the intended context. Examples of context mis-specification bias include situations where the payment vehicle used in the survey has a strong influence on the respondent's valuation (i.e. the payment vehicle holds value in itself), or where there is ambiguity in the property rights described in the scenario. Confusion over the method of provision of the good can also result in this type of bias.

2.5 Conclusion

Despite a large number of potential biases in CV, Mitchell and Carson argue that a carefully constructed questionnaire can help to eliminate many of them. The question that still remains is whether CV is capable of measuring the full range of costs and benefits associated with a public good. In the next chapter the relationship between measures of value obtained from CV and measures of value obtained from attitudinal surveying is discussed.
CHAPTER 3

Measuring attitudes

While economists measure the value of an object in monetary terms, the concept used by social psychologists to refer to the value of any object is attitude. An attitude is "a disposition to respond favourably or unfavourably to a commodity, person, institution, or event" (Ajzen and Peterson, 1988). This chapter provides a brief overview of attitude theory and a discussion of the relationship between attitude and WTP.

3.1 Attitude as a determinant of behaviour

A central question in the development of attitude theory has been whether attitudes can be used to predict behaviour. In an attempt to resolve this issue Fishbein and Ajzen (1988) developed the "theory of reasoned action" in which they specify a relationship between behavioural and attitudinal components. This model has gained widespread acceptance and has been applied in areas such as consumer behaviour, political science, communications, and recreation.

Fishbein and Ajzen's model suggests that behaviour is dependent on a person's inclination to perform a given behaviour i.e. their behavioural intentions. Behavioural intentions are, in turn, determined by a person's attitude and his/her subjective norm.

The model allows attitudes towards an act to be evaluated from a set of salient beliefs that a person holds towards an act. Specifically:

$$\text{Attitude} = \sum_{i=1}^{n} b_i e_i$$

where $e_i$ is the strength of the belief (subjective probability) that a certain outcome will result from an act, $b_i$ is an evaluation of the belief (favourable or unfavourable), and $n$ is the number of salient beliefs held by an individual.

The subjective norm is the normative component of behaviour and deals with the influence of the social environment on behaviour. People's subjective norms are their perceptions that most people who are important to them think they should or should not perform the act in question. While the subjective norm can be evaluated in a similar way to attitudes (Ajzen and Fishbein, 1980), doubt has been expressed about whether it adds any predictive power over and above the attitudinal component. Warshaw (1980) argues that the separating of the normative component probably resulted in measuring overlapping rather than independent dimensions of behavioural intent, as the normative component is highly intercorrelated with the attitudinal component. For this reason, attitudinal surveys often exclude the normative component, or merge subjective norm evaluations with attitudinal evaluations. No attempt has been made to isolate the normative component of behaviour in this research project.
Fishbein and Ajzen emphasise that in order for attitudes to accurately predict behaviours the two must correspond with respect to target, action, context, and time. For example the topic “paying extra for sewage disposal in the next rate bill” may evoke a different set of beliefs to that generated by the general topic of “paying for improved sewage disposal”.

3.2 The relationship between attitude and willingness-to-pay

A large number of studies has been undertaken to test the validity of CV techniques, yet few of these have involved the use of attitudinal data. Most studies compare non-market values obtained from CV with values obtained from other non-market valuation techniques.

One of the few attempts to compare non-market values with attitudinal data was a study carried out by Kerr and Manfredo (1991). This study tested a model that used both WTP and attitude scores to predict people’s acceptance of user fees for recreational services. The study showed that people’s attitudes towards paying were correlated with the amount they specified they were willing to pay.

The research described in this publication is significantly different from Kerr and Manfredo’s study in that this research attempts to measure people’s attitude towards the good as opposed to their attitude toward paying for the good.

Although some CV researchers have called for greater use of attitudinal surveying methods for understanding and improving CV surveys, (Harris et al., 1989; Fishbein and Peterson 1988), as yet no studies have been carried out to compare people’s attitude towards a resource with their WTP.

Fishbein and Peterson make the following comment on the relationship between CV and attitudinal surveying methods:

“In sum, attitudinal estimates of a public good’s value are relatively general in nature, capturing the rich variety of costs and benefits associated with the good. They are useless, however, when monetary estimates of costs and benefits are essential. On the other hand, the Contingent Valuation method, or any other method designed to estimate a public good’s monetary value, tends to yield a rather narrow measure of value that fails to reflect many important psychological costs and benefits” (pp.75).

It is the potential failure of CV to consider some psychological costs and benefits that is the focus of this research. It is proposed to test whether distinctive attitudes of different cultural groups are reflected in the WTP amounts specified by each group. Any failure of CV to detect differences in attitude will suggest that the method does have the limitations described by Fishbein and Peterson.

If CV is found to provide a very narrow range of costs and benefits it may be necessary to incorporate some measures of attitude into CV studies.

Fishbein and Peterson suggest that when properly applied “… the Contingent Valuation method and attitudinal assessments of value complement each other by examining different aspects of a public good’s costs and benefits” (p.75).
CHAPTER 4

Options for upgrading Dunedin city's sewage treatment and disposal system

4.1 Rationale behind the choice of case study

In choosing a case study for this research, four criteria had to be met. Firstly, the study had to focus on a resource that Maori and Pakeha might be expected to hold different values towards. Secondly, the scenario described in the survey had to be believable and the method of payment seen as realistic. Thirdly, the issue described in the survey had to be topical to capture the interest of the public and to stimulate a high response rate. Fourthly, the results of the study were likely to be of most value if the resource being considered was a major resource management issue under the Resource Management Act 1991.

Options for upgrading Dunedin City's sewage treatment and disposal system met all of these requirements in the following ways:

- sewage treatment and disposal has been the subject of a large number of claims made by Maori to the Waitangi Tribunal. Maori hold strong views towards the mixing of waste water with natural bodies of water and consistently call for involvement in any decisions by local government relating to sewage disposal. Maori have shown a preference towards land-based disposal in a number of claims to the Waitangi Tribunal,
- Dunedin City Council was concurrently undertaking a major study into how the city would upgrade its existing sewage system whilst this research was underway. The issue was therefore topical and it was felt that there would be strong public interest in any survey that was sent out,
- because people already pay for sewage disposal in their rates, the use of rates as a payment vehicle in the CV survey was realistic, and
- deciding on the best long-term strategy for sewage treatment and disposal is a difficult process for local government in New Zealand. Assessing various options under Section 32 of the Resource Management Act 1991 is likely to lengthen this process. Mechanisms for quantifying the non-market benefits associated with alternative options would prove useful for decision makers.

4.2 Dunedin City Council's wastewater treatment and disposal options study

In 1991 the Dunedin City Council initiated a study into options for upgrading the existing treatment and disposal facilities. The objective of the study was to identify a range of technically feasible options, evaluate the most feasible options and develop an integrated plan for upgrading the city's wastewater treatment and disposal facilities in a way that was environmentally acceptable and affordable. The Council emphasised the importance of public participation in this process.
In August 1991 the first stage of this study was completed and the Council released a summary report (Royds Garden and Becca Steven Environmental Engineering Consultants, 1992) describing the existing system and a wide range of upgrading options.

The report described the current methods of sewage disposal in Dunedin:

1. four Harbour Outfall Pipes,
2. two main coastal outfall pipes at Lawyers Head and at Green Island, and
3. a sewage outfall pipe into the Taieri River.

Disposal sites are shown in Figure 4.1

![Figure 4.1. Existing sewage treatment and disposal in Dunedin.](image)

Alternatives for upgrading the existing system discussed in the report included increasing the treatment standard at some outfalls, redirecting sewage from the Harbour and Taieri River outfalls, increasing the length of the ocean outfalls and disposing of sewage onto land. These alternatives were considered in combination with each other to generate a large number of options for improved sewage treatment and disposal.
The options identified in the report were then evaluated by the Council and those to be carried forward for more detailed, Stage Two, investigation were identified. Among the options to be carried forward was a land disposal option. Other options were based on continued water-based disposal with a range of treatment standards and outfall sites. It was emphasised in the Stage One report that upgrades of the sewage scheme could be completed in stages over several years.

For the purposes of this research it was decided to measure people's WTP for, and attitude towards, land disposal of sewage versus water disposal. It was hypothesised that Maori were likely to have a preference for land disposal, which would be reflected in measures of attitude obtained from the Fishbein and Ajzen model. A test could then be carried out to determine whether any significant differences between Maori and Pakeha attitudes towards the two options were reflected in the WTP amounts specified by the two groups.

In designing a questionnaire that described two options (land and water disposal) to respondents it was necessary to select only one of the possible water disposal options being considered by the council in Stage Two. It was decided to describe the outcome that would result if the Council chose the most environmentally acceptable system for water disposal of sewage.

The two options that were chosen for the case study are shown in Figure 4.2.

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1. Options to be carried forward for Stage Two investigation were outlined in a report prepared by management consultants Octa Associates Limited, (1991).

2. It should be noted that in the report prepared by Octa Associates Limited it was recommended "that the land disposal scheme be a subject of a desk study to confirm the stage one study findings that it is not a suitable option at this stage." This recommendation was amended at a Council Meeting held in November 1991 when a Councillor expressed concern that the investigations appeared to favour an ocean outfall and that the land disposal needed further serious consideration. It was then agreed "that the land disposal scheme be the subject of a further study to confirm whether it is a suitable option at this stage."
Water Disposal (Option A)
Under Option A all of Dunedin's sewage would be piped to expanded treatment plants at Green Island and Tahuna. These treatment plants would provide a high level of secondary treatment and disinfection with all solids, organic material and micro-organisms being removed. All treated sewage would then be discharged into the sea through outfall pipes at least 1 km in length. This would require an extension of the existing Green Island and Lawyers Head outfalls.

Land Disposal (Option B)
The land disposal option would involve stopping all discharges into the Harbour, Taieri River, Lawyers Head and Green Island outfalls, treating all sewage to the same level described in Option A and then spraying the sewage onto land. An area of land south of Brighton has been identified as suitable for land disposal of sewage.

During the preparation of the survey, the results from Stage Two of the Council's study were not available. The options described above are therefore based on information provided in the Stage One report.
CHAPTER 5

Survey design

Central to this research was the survey used to measure people's attitudes and WTP for improved sewage disposal (Appendix 1). The design of the survey was complicated by the need to have a split Maori/Pakeha sample and the inclusion of both WTP and attitude questions. Outlined below is a summary of the methods adopted in the design of the survey.

5.1 Sample selection

To detect any cultural differences in attitude and WTP for the two sewage disposal options, a sample consisting of both Maori and Pakeha respondents was required. The sample was obtained by selecting 680 Dunedin addresses from the Southern Maori Electoral Roll and a further 1000 addresses were randomly selected from the three general electoral districts (333 from Dunedin West and St Kilda, and 334 from Dunedin North).

Survey forms were sent to "the resident" at the selected addresses. The advantage with this approach was that survey forms, sent to addresses where previous occupants had recently moved, could be completed by the current occupants. The main disadvantage, however, was that there could be no guarantee that survey forms sent to addresses of those on the Maori Electoral Roll would actually be completed by Maori respondents. To overcome this problem it was necessary to include a question on ethnic origin in the survey. Only those respondents who indicated that they were Maori in the ethnic origin question were treated as Maori.

5.2 Design of the attitudinal component in the survey

Applying Fishbein and Ajzen's model to measure attitudes required a two-stage survey programme. The first stage involved identifying a set of salient beliefs towards land and water disposal of sewage. During the second stage, survey respondents were asked to evaluate these beliefs.

5.2.1 Stage One - identifying salient beliefs

As prescribed by Fishbein and Ajzen, salient beliefs were identified through a series of interviews. Interviewees were asked several open-ended questions in an attempt to elicit their main beliefs towards the land and water disposal options. The intention was to record the interviewees' beliefs in their own words. Interviews were arranged by phone one week in advance and then carried out in the interviewees' own home or their workplace. Each interview was recorded on tape.

A total of 15 people were interviewed for their salient beliefs. A deliberate attempt was made to ensure that approximately half of those interviewed were Maori. A further effort was made to interview men and women from a wide range of ages and occupations. These efforts were taken to ensure that the full spectrum of beliefs was elicited during interviews.
As a lead into the interview, interviewees were told that the City Council was investigating options for improving the City's existing sewage system. They were then asked what they thought of the existing system. The upgraded water disposal option (Option A) was then described by the interviewer and respondents were asked for their views on this option. This process was completed for the land disposal option (Option B). Finally, respondents were asked to compare the two options and to make any other further comments.

Throughout the interviews, the interviewers attempted to elicit the interviewees' underlying beliefs. In some cases this involved asking respondents why they held a certain opinion in order to elicit the underlying belief.

On completion of the interviews, the entire list of beliefs elicited during the taped interviews was assembled. In many cases the beliefs elicited by some interviewees were sub-beliefs of more general beliefs. Where this occurred an attempt was made to collapse sub-beliefs under general beliefs. As a result the following salient belief sets emerged for each option.

**Disposing of sewage using wastewater disposal, Option A would:**

1. ensure that treated sewage was not washed back onto shore,
2. ensure that treated sewage did not contaminate seafood,
3. prevent sewage from harming animals and plants along the coastline,
4. prevent sewage from harming animals and plants in the sea,
5. ensure that sewage does not spoil recreational activities along the coastline,
6. protect human health from any pollution caused by the disposal of treated sewage,
7. keep the effects of sewage disposal well away from the attention of people,
8. protect the spiritual values held by Maori towards the sea, and
9. not be an expensive option.

**Disposing of sewage using land disposal, Option B would:**

10. allow treated sewage to be reused or recycled as a fertiliser,
11. not be offensive to the public,
12. enable the environmental impacts of sewage to be monitored,
13. not contaminate underground water,
14. require a large expanse of land,
15. possibly cause land to become unstable,
16. possibly be expensive, and
17. require an acceptable site to be found.

During the interviews, the beliefs were expressed in both a positive and negative way. For example whilst some interviewees thought that the water disposal option would not contaminate seafood, others believed that seafood would be contaminated.
5.2.2 Stage Two - evaluating salient beliefs

As outlined in Chapter 3 the Fishbein and Ajzen model defines attitude as follows:

\[ \text{Attitude} = \sum_{i=1}^{n} b_i e_i \]

Stage Two of the attitudinal component of this research was designed to measure the parameters \( b_i \) and \( e_i \) in the model and thus derive an overall measure of attitude toward each sewage disposal option.

In this case study the parameter \( b_i \) is the respondent's evaluation of the outcome described in each belief statement and \( e_i \) is the respondents subjective probability that a specified sewage disposal option will lead to this outcome.

Respondents were first asked to evaluate the belief statement on a scale of importance as follows:

- extremely important (4),
- very important (3),
- quite important (2),
- slightly important (1), and
- not important (0).

The values given in brackets were not provided to respondents but were used as \( b_i \) values in the analysis of survey results.

Respondents were then asked whether they thought that the sewage disposal option would result in the outcome described in the belief statement. The following agreement scale was provided:

- agree strongly (2),
- agree (1),
- neither agree nor disagree (0),
- disagree (-1), and
- disagree strongly (-2).

Again the values in brackets were not provided to respondents but were used as \( e_i \) values in the analysis of survey results.

By multiplying the \( b_i \) value by the \( e_i \) value, a belief score was obtained for each belief statement. For example, if a respondent believed that it was very important to ensure that sewage is not washed onto the shore but disagreed that the water disposal option would remove sewage from the coastline, his/her score for this belief statement would be -3 i.e. \((b_i(3) \times e_i(-1))\).  

In the design of the survey it became difficult to structure all belief statements in a way that produced positive \( e_i \) values when respondents were in favour of a sewage disposal option. As a result it was necessary to reverse the polarity of the agree/disagree scale for Questions 13 and 16 of the land disposal option. In these two questions respondents who agreed with the statement were given negative \( e_i \) values of -2 and -1 and respondents who disagreed were given positive values.
Overall attitudes towards each sewage disposal option could then be derived by adding together the scores obtained for each belief statement.

5.3 Designing the contingent valuation survey.

In addition to the attitudinal component described above, the survey included questions designed to measure a respondent's WTP for each sewage disposal option. In formulating these questions every attempt was made to develop the most suitable scenario and eliminate potential sources of bias.

The overall design of this research project limited the type of elicitation methods that could be used in the CV part of the survey. The need to compare each individual's WTP with his/her attitude score ruled out the use of the dichotomous choice (take it or leave it) approach. This restricted the choice of elicitation methods to an open-ended, bidding game, or payment card method. Due to biases associated with the use of payment cards and bidding games in CV studies, it was decided to use the open-ended approach in the WTP questions.

A well-designed CV survey should measure the WTP of all socioeconomic groups. While rates have proved to be a convenient payment vehicle in some CV studies, there is a danger that lower socioeconomic groups living in rented accommodation may be excluded if only residents that pay rates are selected to give their WTP. By selecting a sample from the electoral roll rather than the Council's list of ratepayers, this problem was avoided. The inclusion of ratepayers and those paying rent does, however, mean that CV questions have to be suitable to both groups. To overcome this difficulty, the scenario used involved asked rentpayers how much extra rent they would be willing to pay for each sewage disposal option assuming that their landlord/landlady would pass on any increase in rates. Those paying rates were asked how much extra rates they would be willing to pay.

The inclusion of rentpayers in the sample meant that several difficulties had to be overcome. Firstly, the problem of whether respondents were basing their WTP amounts on a household or individual basis had to be addressed. Those paying rates could be expected to answer the WTP question in terms of how much their household would be willing to pay. Similarly, those paying rent on behalf of their families would be expected to respond on a household basis. However, respondents who contribute to a share in the total rent may well base their WTP on an individual basis i.e. the extra amount they would be willing to pay in their share of the rent. To overcome this potential problem respondents were asked whether they were responding on behalf of their household or as an individual. Those responding on an individual basis were then asked how many occupants contributed to the rent. By multiplying the individual WTP amount by the number of occupants in the house it was intended to convert individual WTP to household WTP.

A second issue that emerged was the time period used in the payment vehicle. As rates are charged on an annual basis it seemed realistic to ask ratepayers how much they would be willing to pay per year. Those paying rent, however, are more familiar with weekly payments. It may therefore be that when rent is used as a payment vehicle, rentpayers may specify a more realistic WTP amount if asked how much they would be willing to pay each week. While this proposition was accepted in this study the area has not been well researched and it may be open to challenge. Using different time periods in the payment vehicles for rates and rent does, however, provide an opportunity in this research to study the effect of time period on WTP.
The CV scenario required respondents to value both the land and water disposal options. This requirement created a potential source of bias in the way respondents might make their valuations because some respondents may have formulated their WTP after comparing the two proposed options, while the WTP specified by other respondents may have been based on a comparison of each proposed option with the existing situation. To ensure that all respondents made their valuations in the same way the survey asked respondents to formulate their WTP by comparing each proposed option with the existing situation. For example, respondents were asked how much they would be willing to pay for water disposal assuming that the land disposal option was not possible.

One of the most difficult problems to overcome in the design of the survey was the need to make the scenario as realistic as possible without providing respondents with too much complex information. This trade-off is neatly summarised by Mitchell and Carson:

"The researcher who wishes to make a scenario more realistic faces a tricky problem: on the one hand, an insufficiently realistic scenario will be vulnerable to bias; on the other, the elements which add realism to a scenario may themselves cause bias. Adding realism to a scenario may cause bias through an 'information overload' effect whereby respondents ignore important information and focus on, and possibly misinterpret, unimportant information in determining their willingness-to-pay for the good in question" (p.217).

In an attempt to provide sufficient information without causing "information overload" a deliberate attempt was made to present two options being considered by the Dunedin City Council in a generalised way. It was decided that presenting the options in the exact format used in the Council's scoping report would cause "information overload". In addition, the primary purpose of the research was not to measure the economic value of any particular option being investigated by the Council. The research was designed to explore potential differences in value held by different cultural groups. This objective was best achieved by keeping the CV scenario relatively simple.

5.4 Socio-economic/demographic questions

A third component of the survey was four general questions in which respondents were asked to specify their ethnic origin, sex, age and income group. As outlined above, the ethnic origin question was used to separate responses from different cultural groups and was central to analysing the results. Questions relating to sex, age and income were required because of the potential influence of these variables on respondents' attitude or their WTP.
CHAPTER 6

Results

After being pre-tested, the survey form included in Appendix 1 was sent to selected Dunedin residents. Measurements obtained for attitude and WTP are discussed separately first and are then compared.

6.1 Survey response rate

A total of 1,680 survey forms were mailed. Thirty of these were returned undelivered. In total, 470 responses were received. The total response rate was therefore 28%. A breakdown of response rates from each electoral district is given in Table 6.1.

<table>
<thead>
<tr>
<th>Electoral ward</th>
<th>Number sent out</th>
<th>Number received</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Maori</td>
<td>682</td>
<td>167</td>
<td>24%</td>
</tr>
<tr>
<td>(Dunedin Residents)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dunedin North</td>
<td>334</td>
<td>99</td>
<td>30%</td>
</tr>
<tr>
<td>Dunedin West</td>
<td>333</td>
<td>111</td>
<td>33%</td>
</tr>
<tr>
<td>St Kilda</td>
<td>331</td>
<td>93</td>
<td>28%</td>
</tr>
</tbody>
</table>

Overall the response rate was low compared with response rates in similar CV surveys. A number of factors may be responsible for the low return rate. Firstly, the inclusion of attitudinal questions in the CV survey may have resulted in a questionnaire that was perceived to be too long by some respondents. Secondly, some concern was expressed by the Dunedin City Council that the survey endorsed the land disposal option. Publicity surrounding the survey may have drawn respondents' attention to the fact that the survey was essentially hypothetical. This may have resulted in respondents not returning their forms, in the belief that their opinion would not influence the final outcome. Thirdly, the issue of sewage disposal has been widely debated in Dunedin during the past few years and respondents may have felt apathetic towards further discussion of the topic.

Of those responses obtained from addresses selected from the Southern Maori Electoral Roll only 69 (41%) of the 167 respondents indicated that they were Maori.
Table 6.2  Percentage of respondents by cultural origin.

<table>
<thead>
<tr>
<th>Culture</th>
<th>Number received</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>364</td>
<td>77</td>
</tr>
<tr>
<td>Māori</td>
<td>74</td>
<td>16</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Unspecified</td>
<td>19</td>
<td>4</td>
</tr>
</tbody>
</table>

While the number of Māori responses was proportionally higher than would have been obtained from a simple random sample of all Dunedin residents, it was anticipated that using the Southern Māori Electoral Roll would have resulted in a far higher proportion of Māori responses than 16%.

6.2 Attitude

Using the procedure described in Chapter 5 attitude scores were calculated for both the land and water disposal options.

Occasionally respondents omitted some of the belief statement questions. Where more than two belief statement questions were omitted for each option, no attitude score was calculated. When respondents had omitted less than two belief statement questions for each option, the missing statements were given a neutral value of zero and attitude scores were calculated accordingly. Adopting this approach meant that missing values were being treated as "neither agree nor disagree" responses. While it would have been desirable to exclude responses that had any missing values this would have severely reduced the dataset. Adopting this approach meant that of the 470 responses received, 70 responses could not be used in the measurement of attitudes towards water disposal and 57 responses could not be used in the measurement of attitudes towards land disposal.

The nine statements listed under the water disposal option meant that attitude toward water disposal had a theoretical range of -72 to +72. Similarly, the eight statements for land disposal resulted in a theoretical range of -64 to +64.

An analysis of attitude scores toward each option is provided in Table 6.3.
Table 6.3  An analysis of attitude scores for each option.

<table>
<thead>
<tr>
<th></th>
<th>Water disposal</th>
<th>Land disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.1</td>
<td>15.2</td>
</tr>
<tr>
<td>Median</td>
<td>2.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>32.5</td>
<td>15.6</td>
</tr>
<tr>
<td>Actual Range</td>
<td>min(-72), max(+72)</td>
<td>min(-37), max(+56)</td>
</tr>
<tr>
<td>Adjusted mean</td>
<td>*9.9</td>
<td>*23.8</td>
</tr>
</tbody>
</table>

* The adjusted mean has been calculated by expressing the real mean as a percentage of the theoretical positive range. The adjusted mean for water disposal is therefore the true mean (7.1) expressed as a percentage of 72, while the adjusted mean for land disposal is the true mean (15.6) expressed as a percentage of 64. Although no statistical tests can be applied to the adjusted means, they enable a comparison to be made between relative attitudes towards the two options.

For both sewage options the attitude score was positive indicating that attitudes towards each option are generally favourable. Overall, however, respondents showed a more favourable attitude towards the land disposal option. The higher standard deviation and overall range for the water disposal option indicates that there was a far wider range of attitudes held for water disposal than land disposal option.

Analysis of attitude scores according to culture is provided in Table 6.4.

Table 6.4  Attitude scores for each option according to culture.

<table>
<thead>
<tr>
<th></th>
<th>Water disposal option</th>
<th>Land disposal option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>European</td>
<td>Maori</td>
</tr>
<tr>
<td>Mean</td>
<td>6.7</td>
<td>10.1</td>
</tr>
<tr>
<td>Median</td>
<td>0</td>
<td>12.0</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>31.8</td>
<td>36.3</td>
</tr>
<tr>
<td>Range</td>
<td>Min(-72)</td>
<td>Min(-64)</td>
</tr>
<tr>
<td></td>
<td>Max(+72)</td>
<td>Max(+72)</td>
</tr>
<tr>
<td>Adjusted mean</td>
<td>9.3</td>
<td>14.0</td>
</tr>
</tbody>
</table>

NB. Responses from ethnic origins other than Maori or European are not included in Table 6.4.

A comparison of adjusted means shows that Maori respondents had a slightly stronger attitude towards both options than European respondents. To test whether this observed difference in attitude between the two cultures is significant a regression model was set up with attitude score as
the dependent variable and culture as the explanatory variable. For both sewage options, culture was found to have no significant influence on attitude at the 90% level. The regression equations are provided below with t scores in parentheses.

Culture has a value of one for European respondents and zero for Maori respondents.

\[
\text{Attitude toward water disposal} = 6.87 + 3.38 \text{ culture} \\
p \text{value} = 0.4602
\]

\[
\text{Attitude toward land disposal} = 14.83 + 1.71 \text{ culture} \\
p \text{value} = 0.4250
\]

These findings were supported by the Mann-Whitney non parametric test used to examine whether attitude scores from each cultural groups had the same distribution. The Mann Whitney test found no significant difference between the distribution of attitudes in the two cultural groups.

Independent variables including age, sex and income were also tested for their influence on attitude. Regression models were created using dummy variables for each age group, income bracket, and sex of respondent. These regression models showed that the age group and income bracket of respondents had a statistically significant influence on attitudes. Where age or income was found to influence attitudes, culture was re-entered into age and income models in an attempt to discover any cultural influence that was masked by the effects of age or income. Again culture was found to have no significant influence on attitudes towards either of the two options.

6.3 Willingness-to-pay

As noted in the previous chapter, respondents were asked to specify whether they owned their own house or paid rent. Ratepayers were then asked how much extra they would be willing to pay in rates per year, while those paying rent were asked how much extra they would pay per week.

Table 6.5 provides summary statistics for WTP when ratepayers and rentpayers from both cultures are considered together.

A problem encountered during the analysis of results was the conversion of individual WTP amounts into household amounts. The design of the survey allowed for individual WTP amounts to be multiplied by the number of occupants living in a house to provide a household WTP amount. Unfortunately this proved unworkable because multiplying individual WTP amounts by the number of occupants resulted in mean household WTP amounts of $13.80 per week for water disposal and $20.75 per week for land disposal. These values were approximately three times larger than the mean WTP amounts specified on a household basis. To verify whether this conversion was realistic, a t-test was carried out to identify differences in individual WTP and household WTP for each option. For both options no significant difference was found in WTP extra rent between individuals and households. Based on this finding it was decided not to convert individual WTP to household WTP in an attempt to avoid any bias that may have resulted from over-inflated WTP amounts.
Table 6.5 Willingness-to-pay for each sewage option.

<table>
<thead>
<tr>
<th></th>
<th>WTP extra rates per year</th>
<th>WTP extra rent per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water disposal</td>
<td>Land disposal</td>
</tr>
<tr>
<td>Mean</td>
<td>51.0</td>
<td>72.5</td>
</tr>
<tr>
<td>5% trimmed mean</td>
<td>41.3</td>
<td>58.1</td>
</tr>
<tr>
<td>Median</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>66.79</td>
<td>101.1</td>
</tr>
<tr>
<td>No. of valid Responses</td>
<td>285</td>
<td>280</td>
</tr>
<tr>
<td>Range (min-max)</td>
<td>(0-500)</td>
<td>(0-1000)</td>
</tr>
</tbody>
</table>

* These values represent weekly WTP amounts that have been multiplied by 52 to convert them into annual payments.

Table 6.6 provides a breakdown of WTP amounts for both ratepayers and rentpayers according to culture.

Table 6.6 Willingness-to-pay for each option according to culture.

<table>
<thead>
<tr>
<th></th>
<th>WTP extra rates per year</th>
<th>WTP extra rent per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water disposal option</td>
<td>Land disposal option</td>
</tr>
<tr>
<td></td>
<td>Pakeha Maori</td>
<td>Pakeha Maori</td>
</tr>
<tr>
<td>Mean WTP</td>
<td>51.3</td>
<td>37.0</td>
</tr>
<tr>
<td>5% trimmed mean</td>
<td>42.4</td>
<td>28.4</td>
</tr>
<tr>
<td>Median WTP</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>67.4</td>
<td>60.3</td>
</tr>
<tr>
<td>Number of valid responses (n)</td>
<td>236</td>
<td>39</td>
</tr>
<tr>
<td>range (min-max)</td>
<td>(0-500)</td>
<td>(0-350)</td>
</tr>
</tbody>
</table>

|                        | Water disposal option    | Land disposal option    | Water disposal option | Land disposal option |
|                        | Pakeha Maori             | Pakeha Maori            | Pakeha Maori          | Pakeha Maori          |
| Mean WTP               | 4.3                      | 2.6                     | 5.8                    | 6.3                    |
| 5% trimmed mean        | 3.8                      | 2.3                     | 5.1                    | 5.9                    |
| Median WTP             | 2.5                      | 2                       | 5                      | 5                      |
| Standard deviation     | 4.7                      | 2.9                     | 5.9                    | 5.7                    |
| Number of valid responses (n) | 77                      | 15                      | 77                     | 15                     |
| range (min-max)        | (0-20)                   | (0-10)                  | (0-30)                 | (0-20)                 |
A further difficulty emerged when comparing WTP rates with WTP rent. It had originally been intended to convert weekly WTP rent responses into annual payments and to consider the WTP responses from ratepayers and rentpayers together. However, there was a significant difference between WTP amounts specified on a weekly basis and amounts specified on an annual basis. When weekly WTP amounts were converted to annual payments, rentpayers were prepared to pay, on average, four times as much as ratepayers (Table 6.5). Due to this divergence in values, WTP extra rent and extra rates had to be considered separately resulting in four datasets for subsequent analysis:

1. WTP extra rates for water disposal,
2. WTP extra rates for land disposal,
3. WTP extra rent for water disposal, and
4. WTP extra rent for land disposal.

Statistical analysis of the four datasets revealed that while both cultures were prepared to pay a significantly higher amount for the land disposal option, the question of real interest to this research was whether there were significant differences in the WTP amounts between Maori and Pakeha for each option. On average, Maori respondents were prepared to pay slightly less for water disposal than Pakeha respondents (Table 6.5). Maori were, however, prepared to pay more for land disposal than Pakeha respondents. To test whether these observed differences were significant, regression models were set up with WTP as the dependent variable and culture as the explanatory variable. The four regression equations are provided below with t scores in parentheses.

Culture has a value of one for Maori respondents and zero for European respondents.

\[
(\log) \ WTP \text{ extra rates for water disposal} = 1.6278 - 0.1346 \text{culture} \\
p \text{value} = 0.1672
\]

\[
(\log) \ WTP \text{ extra rates for land disposal} = 1.6911 + 0.0155 \text{culture} \\
p \text{value} = 0.8749
\]

\[
(\log) \ WTP \text{ extra rent for water disposal} = 0.5913 - 0.2550 \text{culture} \\
p \text{value} = 0.0710^* \\
\]

\[
(\log) \ WTP \text{ extra rent for land disposal} = 0.6519 - 0.0642 \text{culture} \\
p \text{value} = 0.6214
\]

* significant at the 90% level.

NB. To meet the normality and equal variance assumptions of regression modelling WTP values were transformed into log values. The equations therefore provide estimates of log WTP.

\[4 \] Paired t-tests were used to test whether respondents from both cultures were prepared to pay more for the land disposal option. When tested at the five percent level both ratepayers and rentpayers were prepared to pay significantly more for the land disposal option. Similar findings emerged when the non-parametric Wilcoxon matched-pairs signed-rank test was used.
The only dataset in which culture was found to have a significant influence was WTP extra rent for water disposal. Due to the small sample size of Maori respondents in the WTP rent datasets, the results from the two rent datasets must be treated with caution.

Independent variables, including income, age and sex, were then tested for their influence on WTP. Dummy variables for each age group, income bracket, and sex of respondent were used in the regression models. The only variable found to have a significant influence on WTP was income. Generally respondents who were in higher income brackets were willing to pay higher amounts for each option. Culture was then re-entered into the income models in an attempt to discover any cultural influence that had been masked by the effects of income. When included with income as an explanatory variable, culture was still found to have no significant influence on WTP.

Although the assumptions, such as equality of variance and normality, appeared to be met in the regression models, a further non parametric test was carried out to test the conclusion reached in the regression models. The Man Whitney U test was used to test the hypothesis that WTP has the same distribution in the two cultural groups. When tested at the 90% level, no significant difference in WTP distributions were found. This supports the conclusions generated by the regression models.

Despite the marginally significant cultural influence on WTP rent, the results from the other three datasets and the non parametric tests support the conclusion that culture had no significant influence on WTP.

Due to the small sample size used in this study only large differences between Pakeha and Maori WTP would be significant. Consideration should be given to the size of sample needed to detect significant differences.

Using the equation below it is possible to calculate the sample size required to determine whether the observed difference in Pakeha and Maori WTP for water disposal is significant at the 95% level.

\[ n = \frac{Z_{1-\alpha/2}^2 \sigma^2}{e^2} \]

- \(n\) = required sample size
- \(e\) = absolute difference between the two means
- \(\sigma\) = standard deviation

Based on an approximated standard deviation of 70, and an absolute difference of $14.30 ($51.30 - $37) between Pakeha and Maori mean WTP for water disposal, the sample size required to test whether this observed difference is significant at the 95% level is 368 (184 Pakeha respondents and 184 Maori respondents). Alternatively, in a split sample where only 20% of the sample is Maori the sample would have to be 575 (460 Pakeha and 115 Maori). 

---

Sample size for the split sample has been calculated by substituting five in place of two in the equation, calculating the required Pakeha sampling size and then multiplying this by 0.25 to obtain the required Maori sample size. See Lyman and Ott (1988, p.206).
6.4 The relationship between attitude and willingness-to-pay

As noted in Chapter 4 some social psychologists have suggested that CV provides a very narrow measure of value. To test this proposition, regression models were set up with WTP as the dependent variable and attitude as the explanatory variable. Attitudes towards the water and land disposal options were tested for both WTP rent and WTP rates. The four regression equations are provided below with t scores in parentheses.

NB. To meet the assumption required in linear regression, WTP values were again transformed into log values.

\[
\begin{align*}
\text{(log) WTP extra rates for water disposal} & = 1.633 - 0.001 \text{ attitude toward water disposal} \\
\text{p value} & = 0.3118
\end{align*}
\]

\[
\begin{align*}
\text{(log) WTP extra rates for land disposal} & = 1.630 + 0.005 \text{ attitude toward land disposal} \\
\text{p value} & = 0.0224^{**}
\end{align*}
\]

\[
\begin{align*}
\text{(log) WTP extra rent for water disposal} & = 0.600 - 0.005 \text{ attitude toward water disposal} \\
\text{p value} & = 0.0149^{**}
\end{align*}
\]

\[
\begin{align*}
\text{(log) WTP extra rent for land disposal} & = 0.622 + 0.003 \text{ attitude toward land disposal} \\
\text{p value} & = 0.3744
\end{align*}
\]

\(^{**}\) Significant at the 95% level

Results to emerge from this analysis provide no clear indication of the relationship between attitude and WTP. While a significant relationship was found between attitude and WTP in two of the datasets, the results are confusing. It was hypothesised in the design of this research that respondents with a positive attitude towards an option would be willing to pay more than someone with a negative attitude. This hypothesis was supported for the water disposal option. However, attitude was negatively correlated with WTP for the land disposal option. There is no clear explanation for this discrepancy.

To control the effects of income on WTP, and age on attitude, dummy variables for each income bracket and age group were added to the regression models. In all four models the inclusion of age and income variables provided no further insights into the relationship between WTP and attitude.

Although a significant relationship was found between attitude and WTP in two of the datasets, no firm conclusions can be drawn. The results suggest that the relationship between attitude and WTP is weak and that the two measures of value are quite distinct. Further research is required before this finding can be confirmed.
CHAPTER SEVEN

Conclusions

The passing of the Resource Management Act 1991 has created considerable interest in the use of CV to estimate costs and benefits from non-market environmental goods. Given the importance placed on Maori values in environmental legislation it is critical that CV studies are capable of measuring the values held by both Maori and Pakeha towards a resource. The objective of this research was to measure the cultural specificity of the CV technique by comparing people's attitudes towards environmental issues with their WTP for a particular aspect of the environment or its management.

7.1 Cultural sensitivity of contingent valuation

Using Dunedin City's sewage disposal options as a case study, three questions had to be answered before the cultural sensitivity of CV was to be assessed.

1. Are measures of attitude toward the two options related to the amount respondents are willing to pay for each option?

2. Do Maori and Pakeha hold different attitudes towards the two sewage disposal options?

3. Is there a significant difference in the amounts that the two cultural groups are willing to pay for each option?

In the design of the study it was hypothesised that WTP reflects an individual's attitude. The relationship between attitude and WTP to emerge from the survey results was, however, very weak and provided very little support for the hypothesis. This finding supports the view held by some social psychologists that CV is too narrow and specific to serve as a measure of psychological value. It was also hypothesised that Maori attitudes towards the two sewage disposal options may be significantly different to those of Pakeha. However, no significant differences between Maori and Pakeha attitudes towards the two sewage disposal options were found. In response to the third question, no statistically significant relationship was found between culture and WTP.

While the research provided no direct evidence that CV was unable to capture different cultural values, the findings raise two important questions. Firstly, the most serious issue is the potentially narrow measure of value that WTP may provide. The research findings suggest that further effort should be made to capture a wider range of psychological values in CV studies. Secondly, although no statistically significant relationship was found between culture and WTP, the results did provide some indication of a divergence in WTP between cultures. It may well be that by using a larger sample size, and thus generating a statistical test with more power, culture may be found to influence WTP. Further research in this area is warranted.
7.2 The influence of payment periodicity

The use of rates as a payment vehicle has proved popular in CV studies. In the design of this research it was decided that including only ratepayers in the sample might result in certain socioeconomic groups, who were more likely to live in rented accommodation, being under-represented. To avoid this potential bias both ratepayers and rentpayers were included in the sample. An interesting finding to emerge from the study was that ratepayers who were asked how much they were willing to pay per week specified equivalent annual amounts significantly higher than ratepayers who were asked how much they would pay annually. Rentpayers volunteering weekly payments were prepared to pay, on average, four times as much as those who were asked how much they would pay annually. This raises the important question of the influence that payment periodicity, used in a CV survey, can have on the value derived for an environmental good. The effect of payment periodicity on WTP requires further research.

7.3 Household versus individual willingness-to-pay

The inclusion of rentpayers in the sample created a difficulty in identifying whether rent-paying respondents were basing their WTP amounts on a household or individual basis. To overcome this confusion respondents were asked to indicate whether they paid rent on behalf of their family or whether they contributed to a share of the total rent. Respondents who contributed to a share of the rent were asked to base their WTP on the extra amounts they would be willing to pay in their share of the rent. While it was expected that household WTP amounts would be significantly higher than individual WTP amounts, no statistically significant differences were found. If rent is used as a payment vehicle in future CV studies it is recommended that the distinction between household and individual WTP be the subject of further research.

7.4 Obstacles in contingent valuation research

Throughout this study several obstacles were overcome in the design and implementation of the CV study. Those involved in CV research need to be aware of two major difficulties that can occur.

Firstly, to obtain useful results from CV studies researchers need to present a scenario that is realistic. Where respondents can detect a hypothetical nature to CV scenarios the results obtained can often be strongly biased. At the same time scenarios must be easily understood and not overload respondents with information. The required balance between realism and simplicity is difficult to obtain. Where information is represented in a simplified way to respondents, there is a danger that those involved in the management of the resource featuring in the scenario may feel that important information is excluded from the survey and that not including this information may consequently influence people's attitude toward certain policies.

Secondly, the use of rates as a payment vehicle has proved to be an effective way of eliciting people's WTP in CV studies. Respondents are usually asked how much they would be WTP in rates to fund an improvement in environmental quality. Rates increases, however, are a politically sensitive issue and any suggestion of an increase can cause an unfavourable response from both local government politicians and residents.
References


Lyman and Ott. 1988. An introduction to statistical methods and data analysis. PWS - KENT, Boston USA.


16 April, 1992

Dear Resident

The Centre for Resource Management at Lincoln University is carrying out some research into options that are available for upgrading Dunedin's existing sewage treatment and disposal scheme.

Options for improving the existing system are being considered by the Dunedin City Council. Two options are summarised in the information sheet which is included with this questionnaire. Please read this carefully before answering the questionnaire.

By completing this questionnaire you will be able to give us your views on options for upgrading Dunedin's existing sewage scheme.

I would be grateful if you could take the short amount of time required to complete this questionnaire and return it in the postage paid envelope before Friday 15 May 1992. Your response will be treated with the utmost confidence and your name will not be associated with the answers you provide.

Yours sincerely

Ray Lambert
RESEARCH OFFICER
Existing sewage treatment and disposal in Dunedin

Disposal

Dunedin currently disposes of its sewage in three main ways.

(1) Four harbour outfall pipes (seven percent of sewage from the Dunedin area is discharged through these outfalls),

(2) Two main coastal outfall pipes at Lawyers Head and out from Green Island (75% of sewage from the Dunedin area is discharged through these outfalls),

(3) A sewage outfall pipe into the Taieri River (18% of sewage from the Dunedin area is discharged into this river).

- Each of these disposal sites are shown in Figure 1.

Treatment

There is some variation on the level of treatment at each of these sites. Some sewage is treated to a primary level with only the large solids being removed (e.g. Green Island outfall) while others use secondary treatment processes that remove all solids and organic matter (e.g. Taieri River and harbour outfalls). Overall the level of treatment is quite basic and there are no guarantees that the water around the outfalls is safe to take shellfish from or swim in.
Options for Improving the existing system

Two options that are being considered by the Dunedin City Council to improve the existing system are shown in Figure 2. Under either option sewage will no longer be discharged into the harbour or the Taieri River.

Option A
Under Option A all Dunedin's sewage would be piped to expanded treatment plants at Green Island and Tahuna. These treatment plants would provide a high level of secondary treatment and disinfection with all solids, organic material and micro-organisms being removed. All treated sewage would then be discharged into the sea through long outfall pipes at least 1 km in length. This would require an extension of the existing Green Island and Lawyers Head outfalls. This treatment and disposal system would make it safer to take shellfish from the sea and to swim along the coastline.

Option B
Another option being considered by the Council is to stop all discharges into the Harbour, Taieri River, Lawyers Head and Green Island outfalls, treat all sewage to the same level described in Option A and then spray the sewage on to land. An area of land south of Brighton has been identified as being suitable for land disposal of sewage.
Part one of this questionnaire asks you for some general views on each of the sewage disposal options. Please respond by placing a tick in the box which most closely represents the way you feel.

For example, suppose we asked you the questions below. If you think that reducing air pollution is quite important and you are certain that using unleaded petrol reduces air pollution you would answer in the following way:

Reducing air pollution is:

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<tr>
<td>✓</td>
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Using unleaded petrol helps reduce air pollution:

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<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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<tr>
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Option one Disposing of treated sewage into the open sea using long outfall pipes

It is my opinion that:

1. Ensuring treated sewage is not washed up onto the shore is:

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<tr>
<td>✓</td>
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2. Ensuring sewage does not contaminate kaimoana (seafood) is:

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<th>extremely important</th>
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<tr>
<td>✓</td>
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3. Preventing sewage from harming animals and plants along the coastline is:

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<tr>
<td>✓</td>
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4. Preventing sewage from harming animals and plants in the sea is:

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Disposing of sewage by treating it and then piping it into the sea through long outfall pipes at least 1 km long would:

10. Remove sewage from along the coastline:

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<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
<th>disagree strongly</th>
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<tr>
<td></td>
<td>agree</td>
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11. Ensure that Kaimoana (seafood) were not contaminated:

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<tr>
<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
<th>disagree strongly</th>
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<td>agree</td>
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12. Not harm animals and plants along the coastline:

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<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
<th>disagree strongly</th>
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<td></td>
<td>agree</td>
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13. Not harm animals and plants in the sea:

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<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
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14. Not spoil recreational activities (e.g. swimming, walking, fishing, boating, surfing):

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<th>agree</th>
<th>neither agree</th>
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15. Not endanger human health:

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<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
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16. Keep the effects of treated sewage disposal well away from the attention of people:

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<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
<th>disagree strongly</th>
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<td>agree</td>
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17. Protect Maori spiritual values towards the sea:

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<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
<th>disagree strongly</th>
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<td></td>
<td>agree</td>
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18. Not be very expensive:

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<tr>
<th>agree</th>
<th>neither agree</th>
<th>disagree</th>
<th>disagree strongly</th>
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<td>agree</td>
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Option two  Land disposal of sewage

1. Reusing or recycling treated sewage as a fertiliser is:

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2. Ensuring that sewage disposal methods do not offend the public is:

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3. The opportunity to observe the environmental impacts of sewage disposal is:

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4. Protecting groundwater from sewage contamination is:

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5. Finding a large enough land area for sewage disposal is:

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6. The stability of land used for a sewage scheme involving disposal of treated sewage onto land is:

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7. The cost of building and running a land-based disposal system for treated sewage is:

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8. Finding an acceptable site for land disposal of sewage is:

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</table>
9. Allow treated sewage to be reused or recycled as a fertiliser:

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<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
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</table>

10. Not be offensive to the public:

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<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
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</table>

11. Enable the environmental impacts of sewage disposal to be monitored:

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<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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12. Not contaminate underground water supplies:

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<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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</table>

13. Not be possible because of the difficulty in finding enough land:

<table>
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<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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14. Not cause land to become unstable after sewage was sprayed on it:

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<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>disagree strongly</th>
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</table>

15. Not be expensive:

<table>
<thead>
<tr>
<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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</table>

16. Not be possible because of the difficulty in finding an acceptable site:

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<th>agree strongly</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
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Question One

Is this house: (please ✓)

[ ] Owner occupied

[ ] Rented

If this house is owner-occupied please answer Question Two of this section only. If this house is rented please answer Question Three of this section.

Question Two (answer only if you own your own home)

One way of funding improvement in Dunedin's sewage treatment system would be to increase rates.

Long sea outfall option

- Assuming that land disposal is not possible, what is the maximum amount you would be willing to pay in extra rates per year to improve Dunedin's existing sewage scheme by treating sewage to a secondary level and then discharging it into the sea through pipes that extend at least 1 km out from the coastline (Option A in Figure 2)

Extra rates per year $ __________

Land-based option

- Assuming that ocean disposal is not possible, what is the maximum amount you would be willing to pay in extra rates per year to improve Dunedin's existing sewage scheme by treating sewage to a secondary level and then spraying it on to a large area of land south of Brighton (Option B in Figure 2).

Extra rates per year $ __________
Question Three (answer only if you are renting this house)

- How many occupants live in this house? 
- Do you pay the rent on behalf of your family, or do all occupants of this house contribute to the rent?
  - Pay rent on behalf of family (please ✓)
  - All occupants contribute to the rent (please ✓)

If all occupants of this house contribute to the rent please base your answer to the following question on your share of the rent i.e. how much extra in your share of the rent would you be willing to pay?

One way of funding improvements in Dunedin's sewage treatment system would be to increase rates. Assuming that your landlord/landlady would pass on any increase in rates by increasing your rent could you please answer the following questions.

Long sea outfall option

- Assuming that land disposal of sewage is not possible, what is the maximum amount you would be willing to pay in extra rent per week to improve Dunedin's existing sewage scheme by treating sewage to a secondary level and then discharging it into the sea through pipes that extend at least 1 km out from the coastline (Option A in Figure 2):

  Extra rent per week $_________

Land-based option

- Assuming that sea disposal of sewage is not possible, what is the maximum amount you would be willing to pay in extra rent per week to improve Dunedin's existing sewage scheme by treating sewage to a secondary level and then spreading it on to a large area of land south

General questions

1. What is your ethnic origin (please ✓ appropriate box)
   - European
   - Maori
   - Pacific Islander
   - Asian
   - Other (please specify)

2. What is your sex?
   - Male
   - Female

3. What age group are you in?
   - 18-25 years
   - 26-35 years
   - 36-50 years
   - 51-65 years
   - Over 65

4. What is your annual income?
   - $20,000 - $24,999
   - $25,000 - $29,999
   - $30,000 - $34,999
   - $35,000 - $39,999
   - $40,000 - $49,999
   - Over $50,000