

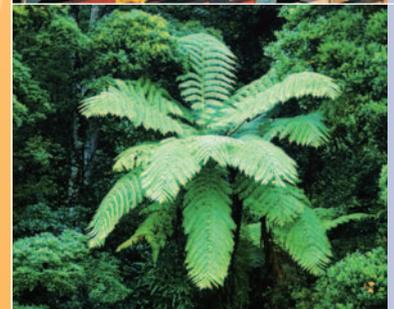
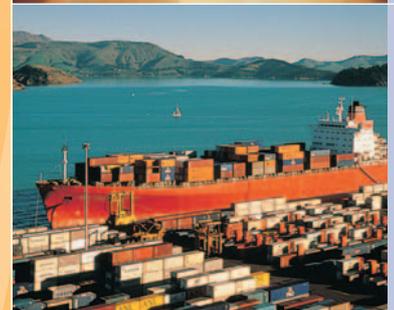


Cultural Models of GE Agriculture in the United States (Georgia) and New Zealand (Canterbury)



Tiffany Rinne

Research Report No. 304
July 2008



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Preface

The AERU has published a number of reports in recent years on public perceptions of new technologies and related social and economic issues. The research on which these reports have been based has focused mainly on the New Zealand public so the present report brings a welcome international comparative perspective to this area of research. The comparisons presented provide insight into how people in the United States and in New Zealand think about GE agriculture and related issues. This report will be of interest to many stakeholders in the GE debate, and to those interested in how New Zealanders think about health and the environment.

Professor Caroline Saunders
Director
AERU

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Summary

The goal of this research was to assess why genetic engineering (GE) agricultural technology was embraced in some industrialized nations (United States) while it evokes extreme concern and aversion in others (New Zealand).

GE technology is highly controversial—while proponents promote its potential to significantly increase global food production, improve food nutritional quality and decrease agrochemical use, opponents question its safety and morality. They object to its unnaturalness, using terms such as "Franken food", and warn of health and environmental dangers such as gene transfers to wild species, decreased genetic diversity, and pest resistance to agri-chemicals.

Both the United States (US) and New Zealand (NZ) are economically dependent on their large agricultural sectors, yet their respective governments and general publics have responded with opposing positions to GE food and crops.

Empirically grounded cognitive approaches were used to look directly at the cognitive cultural models afforded GE technology, and how these models relate to very different national responses. It was postulated that differences in reaction to GE food technology could be correlated to differences in the mental constructs surrounding health and the environment held by members of the two societies (given the technology's potential positive and negative consequences in these two areas).

The following two questions guided the research:

- 1. How do the cultural models invoked by GE technology vary among stakeholder groups (consumers, GE farmers, organic farmers), inter- and intra-culturally, in the United States and New Zealand?***
- 2. How do the cultural models invoked by GE technology vary with the cultural meanings given to health and the environment?***

Cultural modeling can play a pivotal role in understanding technological acceptance—an increasingly important endeavor, given the mass production and global distribution of new technologies. Previous research on GE technology has often taken respondents out of social context by not emphasizing the culturally mediated nature of GE acceptance. Cognitive cultural modeling is an effective means of integrating the role of social context and culture into our understanding of technological acceptance.

In this research data analyses suggest that there are marked differences intra-culturally in the US and NZ with respect to how stakeholder groups cognitively model health and the environment and in turn, how these groups cognitively model GE technology. Inter-culturally, respondent environment models varied widely and cognitive modeling suggests that stakeholder perceptions of the environment were an important component in determining their stance on GE food and agricultural technology. New Zealand's clean green national identity was often a key feature influencing respondent stances on GE technology.

Chapter 1

Introduction

1.1 Research objective

“The 21st century has been dubbed the biotechnology century” (Eichelbaum 2001). Despite this proclamation, biotechnological advances, like genetically engineering in agriculture (GE, GMOs, GM), have proven to be internationally contentious. The FAO has defined biotechnology as “the use of biological processes or organisms for the production of materials and services of benefit to humankind” (Zaid et al. 1999). With respect to genetic engineering in agriculture, recent biotechnology innovations allow scientists to select specific genes from one organism and introduce them into another to confer a desired trait. This technology is often touted as producing new varieties of plants or animals more quickly than conventional breeding methods and as having the capacity to introduce traits not possible through traditional techniques. Crop varieties developed through genetic engineering were first introduced for commercial production in 1996 and are now planted commercially in twenty-three countries (James 2008). GE crops, such as soybean, maize, cotton, and canola, are planted on more than 200 million acres worldwide (James 2004). The United States, Argentina, Canada, Brazil, China, Paraguay, India, and South Africa dominate the GE market and produce 99 percent of all GE crops (James 2004). US farmers are by far the largest producers of GE crops, producing 59 percent (by acreage) of all GE crops worldwide (James 2004).

Genetic engineering in agriculture, which can involve interspecies gene transfers, deletion of genes, or modification of genes, poses ethical quandaries for many as it calls into question where species boundaries lie and what it means to be human. Not all of the world’s cultures have been open to this form of technology as it often conflicts with cultural and societal values. Genetic engineering is decidedly Western in orientation, having been developed primarily in Europe and the USA. However, not even all Western developed countries have been amenable to the technology. It is naïve of the GE industry and pro-GE countries to assume that the values they have placed upon the technology are held by all cultures, even Western ones. Drawing from current approaches in cognitive anthropology, this research considers how lay understandings of genetic engineering agricultural technology underlie and shape its broader public acceptance or rejection. The research specifically addresses *why GE food and crop technology is accepted in some industrialized nations (United States) while it evokes extreme concern and aversion in others (New Zealand)*.

1.2 Benefits of genetic engineering

Genetically modified food and crop technology (GE technology) has novel characteristics not seen in other technological advances, meaning that lay people have little existing experience with the technology to draw on when assessing its value and risks. Proponents of the rapid implementation of GE technology point to its potentially beneficial effects on global health and the environment. To increase crop productivity, at least potentially, many current GE crops have genes for herbicide tolerance or pest and disease resistance. Additionally, many future crops are likely to have genes for improved texture, taste, appearance, and nutritional value (Altieri 1998, McHugen 2000, Uzogara 2001, van den Bergh, et al. 2002). By increasing agricultural productivity (i.e. limiting the amount of land under agricultural production) and lessening inputs from pesticides and herbicides, GE crop technologies could

significantly contribute to environmental conservation efforts. The National Center for Food and Agricultural Policy (NCFAP) found that the combined impact of genetically engineered crops led to a pesticide usage decrease of 69.7 million pounds in 2005 (Sankula 2006). Moreover, proponents claim GE crop production may be essential for addressing current famines and for guaranteeing sufficient food to feed future world populations (Conway & Serageldin 2000, Pretty 2001, van den Bergh et al. 2002). Without productivity gains in agriculture or a world-wide expansion of cropland, a global shortage of food in the future is forecast (Pimentel 2004).

1.3 Risks of genetic engineering

Despite the potential benefits of GE technology, many consumers and environmental advocacy groups question the moral, environmental, and health consequences of GE use. GE crops and food are the most rejected form of biotechnological application (Wagner et al. 2001). Opponents use terms such as “Frankenstein food”, “farmageddon” and “genetic manipulation” to point to its unnaturalness and associated health and environmental dangers. Environmental dangers include gene transfer to wild varieties of plants or to soil bacteria, as well as increased insect and weed resistance to the pesticides and herbicides produced by GE crops (Ginzburg 1991, Pretty 2001, Uzogara 2000, van den Bergh et al. 2002). Possible health dangers include allergic reactions (e.g. fish genes inserted into vegetables), introduction of toxins, and antibiotic resistance of human intestinal bacteria (Koch 1999, McHugen 2000, Pretty 2001, van den Bergh et al. 2002). Opponents of GE have stated its benefits to be primarily economic and restricted to large multinational corporations with genetic code and biotech procedure patents (Krimsky & Wrubel 1996).

1.4 Genetic engineering in the United States and New Zealand

Both the United States (US) and New Zealand (NZ) are economically dependent on their large agricultural sectors, yet their respective governments and general publics have responded with opposing positions to GE food and crops. Public opinion surveys in the US regularly indicate a high level of support for the technology and Americans have been willing to accept relatively high levels of risks to the environment in order to gain benefits from the technology such as lower prices and improved taste (US Congress-Office of Technology Assessment 1987). Since the first planting of GE commercial crops in 1996, the United States has led the world in the adoption of biotech derived crops and American farmers have steadily increased their acreage under biotech production from 5 million acres in 1996 to 123 million acres in 2005 (Sankula 2006).

Despite increasing prevalence of GE agriculture worldwide, not all countries have readily adopted the technology. New Zealand is a place where it remains particularly contentious. According to Hamilton (2001), New Zealand has some of the most stringent laws in the world regarding genetic engineering and went so far as to conduct a Royal Commission on Genetic Modification to assess its safety and value for the country. Currently, New Zealand has only very limited field trials of GE crops. “Clean green” New Zealand is part of NZ national identity (Coyle et al. 2003). It is embedded in the nation’s consciousness and is crucial for the country’s economic health. GE is viewed as a potential contamination of nature and threat to New Zealand national identity (Coyle et al. 2003).

Since 1987, a number of large-scale public opinion surveys have been conducted in the United States and New Zealand. The following is a brief review of several large-scale

opinion polls conducted in the US and New Zealand, which highlight general trends in public perceptions of GE technology over the last 20 years. A review of opinion poll data is given in order to establish that the populations of the US and New Zealand do indeed differ with respect to stances towards GE technology.

1.4.1 United States

A 1987 study conducted by the United States Office of Technology Assessment (OTA) indicated that two-thirds of the 1,273 Americans surveyed believed that genetic engineering would “make life better for all people”. Only one-fourth of respondents felt that “humans should not meddle with nature”. The OTA report also came to the conclusion that while the public expressed abstract concerns regarding genetic engineering, they approved of almost every aspect of its applications, both environmental and therapeutic and were willing to accept relatively high levels of risks to the environment in order to gain the benefits of the technology (OTA 1987).

Hoban and Kendall (1992) conducted a phone survey of 1,228 US respondents titled “Consumer Attitudes about the Use of Biotechnology in Agriculture and Food Production”. The survey was commissioned by the United States Department of Agriculture and found that “people were fairly positive about the general concept of biotechnology” in the production of food, particularly plant applications (Hoban and Kendall 1992). The primary reason for US consumer support of the technology was the prospect of a lower price for food. A 1998 paper by Hoban indicates that surveys he conducted in 1992, 1994, and 1998 all show just over 70 percent of Americans supporting the technology, with the highest level of support among highly educated men. Most Americans said they would buy new varieties of genetically engineered produce with better flavor or pest resistance properties. American respondents were primarily concerned with the taste of food and its price and not how the products were developed (Hoban 1998). By contrast, European consumers were more concerned about environmental, political and social impacts resulting from the technology (Hoban 1998). Hoban (1998) concluded that “American consumers are optimistic about biotechnology. They will accept the products if they see a benefit to themselves or society; and if the price is right!”

While Americans have by and large been more accepting than not of genetic engineering and biotechnology, surveys conducted by the International Food Information Council (IFIC), indicates that American support for biotechnology is undergoing steady erosion. Seventy-eight percent of Americans saw benefits of biotechnology in 1997, this fell to 75 percent in February 1999, then to 63 percent in October 1999, and finally to 59 percent in May 2000. Priest (2000) found similar results indicating an increased level of concern about biotechnology among Americans, although more than 50 percent of Americans were still positive about the technology. Despite this decline, Priest (2000) contends that “people in the US continue to have faith that science and industry involved with biotechnology are working for the good of society”. Genetically engineered foods, although a concern for Americans are less of a concern than other food related issues like antibiotic use in livestock, zoonotic diseases, bacterial contamination, pesticide contamination, and artificial preservatives (Priest 2000).

A 2006 study conducted by IFIC showed that a majority of Americans were still confident in the safety of the food supply in the United States and had little concern with respect to agricultural biotechnology. Only three percent of consumers expressed concerns about the safety of food biotechnology and only one percent said they would like to see information about genetically engineered products on food labels. The majority of consumers were either

neutral or unsure about their opinions regarding food biotechnology but of those who held an opinion, more than half were positively inclined towards the technology.

1.4.2 New Zealand

In 1990, a survey was conducted by the New Zealand Department of Scientific and Industrial Research (DSIR) to explore public attitudes towards biotechnology (Couchman and Fink-Jensen 1990). The DSIR surveyed 2000 members of the public and their findings suggested that New Zealanders were supportive of biotechnology, in general, although only nine percent of those surveyed could explain what was meant by the word “biotechnology”. While the survey indicated support for biotechnology in general, it also indicated that 50 percent of respondents were concerned about eating products with genetically modified ingredients.

In 1997, AGB McNair, working in conjunction with Greenpeace, Soil and Health, and Friends of the Earth, conducted a poll on perceptions of genetically engineered foods (ERMA 2002). One thousand New Zealanders were telephoned and the major findings indicated that 43 percent of respondents worry a lot about eating genetically engineered foods and only 12 percent of those polled did not worry about eating genetically engineered food.

A 1998-1999 HortResearch study used focus groups, conjoint analysis and a telephone survey (n=1000) to determine public awareness and understanding of biotechnology as it pertains to food. The study’s findings indicated that New Zealanders were still making up their mind with respect to the benefits and risks of the technology and were considerably nervous about the unknown aspects of the technology with respect to health and environmental factors (ERMA 2002). Like the DSIR study, 50 percent of those polled indicated negativity towards genetic engineering in food production. Similarly, the BRC Marketing and Social Research study for the Royal Commission on Genetic Modification (2001), based on telephone surveys of 1153 respondents, found that respondents saw more advantages in using genetic engineering in medicine, pest control and plant research and more disadvantages in using it for food production and in farm animals.

In 2001, the New Zealand Royal on Genetic Modification recommended proceeding with caution with respect to genetic engineering and the door seemed to be opening to the technology in New Zealand. However, public opinion surveys conducted after the Royal Commission still indicated a high level of concern with respect to genetic engineering technology in agriculture with about 50 percent of those surveyed being either concerned or very concerned about the technology (Cook et al. 2004, Cook & Fairweather 2005).

1.5 Research questions and corresponding hypotheses

The following questions and corresponding hypothesis guided the research:

Q1. How do the cultural meanings invoked by GE technology vary among stakeholder groups inter- and intra-culturally in the United States (US) and New Zealand (NZ)?

Hypothesis 1A: The cultural meanings given to GE technology will vary between stakeholders in the US and New Zealand with New Zealanders ascribing more negative attributes to the technology. As previously mentioned, surveys have shown a steady decline in acceptance of GE foods and agriculture among New Zealanders (Coyle 2003, Gamble et al. 2002, Hoban 1997) in contrast to what is described as general acceptance of GE technology within the US (Uzogara 2000).

Hypothesis 1B: The cultural meanings given to GE technology will vary between stakeholders (consumers, the organic farming community, the GE/GE amenable farming community) in the US and New Zealand intra-culturally.

Question 1 and the corresponding hypotheses were used to establish that the US and New Zealand do differ with regard to the cultural meanings applied to GE technology. Further, the US and New Zealand are not made up of homogenized populations, thus the research sought to highlight how three key stakeholder groups within the GE debate differ with regard to meanings afforded GE technology. Inter-cultural comparisons were made across stakeholder groups between the two countries (e.g. consumers to consumers, farming community to farming community), and intra-cultural comparisons were made across stakeholders in each region (e.g. GE farming community vs. organic farming community vs. consumers).

Q2. How do the cultural meanings invoked by GE technology vary with the cultural meanings given to health and the environment? Previous economic research suggested that consumers consider both environmental and health factors in assessing GE food attributes (Hu et al. 2004).

Hypothesis 2A: The cultural meanings given to human health will be related to the cultural meanings ascribed to GE technology. In other words, those respondents ascribing similar meanings to human health will afford GE technology similar meanings.

Hypothesis 2B: The cultural meanings given to the environment will be related to the cultural meanings ascribed to GE technology. As with H2a, it is hypothesized that those respondents ascribing similar meanings to the environment will afford GE technology similar meanings.

Question 2 and the corresponding hypotheses were used to understand how two important cultural factors, perceptions of health and perceptions of the environment, influence how people conceptualize GE technology.

Chapter 2

Cognitive Anthropology and Cognitive Cultural Modeling

2.1 Introduction

Application of cognitive anthropological approaches to the study of technology is relative new and provides a unique opportunity to empirically study differences in understandings of biotechnology across groups (such as diverse stakeholders) and to better understand how and why lay perspectives on new technologies develop, including the position of non-acceptance.

2.2 Cultural models

Theoretically and methodologically developed in the 1980s, cultural models are a means to systematically analyze personal discourse and behavior. Cultural modeling developed as a reaction to anthropology's crisis of representation, spurred by the Redfield-Lewis debate. Redfield and Lewis were two anthropological ethnographers that conducted research in the same place 20 years apart. Their findings disagreed significantly and more than could be explained by the passage of time. This caused anthropology to question current ethnographic methods as being biased. Cognitive anthropology developed, in part, to counter this bias in representation by focusing on the indigenous person's view of things.

Early work on cultural representations within cognitive anthropology focused on either lexical semantics or indexical reference. Researchers (see Berlin 1992, Berlin and Kay 1969) in lexical semantics searched for nomenclature and classification patterns in order to compare patterns across societies and potentially derive "transcultural universals" (Blount 2002). Lexical semantics researchers have successfully uncovered patterns in lexical structure across diverse societies for color terminology, ethnomedicine and ethnobotany, to name a few.

Much research on lexical semantics has revealed that words do not typically "reference their objects in a one-to-one isomorphic relationship, i.e., one word references one and only one object or even one kind of object" (Blount 2002). Instead, words are often labels for information clusters with the clusters being ordered in culturally complex and patterned ways (Blount 2002). Indexical reference researchers have looked at how words point to topics both as direct references and in a broader sense via meanings assigned to them as a result of discourse structure (Blount 2002). According to Blount (2002), "to understand the meaning of words, participants in discourse must share some expectations to what the word actually indexes, how it is used and what it means in that particular context". Thus, words have a cultural dimension and can be considered artifacts of culture.

Drawing on ideas from indexical reference research, cultural modeling is a means to move beyond lexical semantic representations. Cultural models systematically draw on personal discourse thereby allowing researchers to get the insider's perspective on respondent knowledge, thought, and word meanings. According to D'Andrade (1990) and as highlighted in Holland and Cole (1995):

Culture consists of learned and shared systems of meaning and understanding, communicated primarily by means of natural language. These meanings and understandings are not just representations about what is in the world; they are also directive, evocative, and reality constructing in character

Cultural models look at the meanings of semantic fields employed by people and take into account both internal mental constructs and external social constructs (Holland and Cole 1995). The meaning of cultural models is twofold. First, cultural models are presupposed, taken for granted models of knowledge and thought that are used in the course of everyday life to guide a person's understanding of the world and their behavior (D'Andrade 1984) and second, they are constructed representations made by researchers in order to describe shared knowledge and perceptions used by groups of people in their daily lives (Blount 2002, Cooley 2003).

An assumption of cultural modeling is that when individuals engage the world they do so in a simplified and focused mannered that does not include all the detail and complexity of a situation (Quinn and Holland 1987, Blount 2002). According to Blount (2002),

By focusing on a small set or subset of complexity, the world is reduced to perceptually and cognitively manageable portions, i.e., it is simplified. Cognitive engagement with the world could not possibly be otherwise, neither as a single snapshot that captures all of the reality of one instant nor as a series of rapid-fire snapshots. Engagement with the world in any specific instance is necessarily in simplified, scaled-down, modeled form. Individuals model their world as they encounter it, and since members of social groups need to model the world in similar, communicable ways, modeling tends to be along pathways that are mutually understood and shared, in other words, cultural.

2.3 Schemas

People engage with the world according to schema, which are experientially based mental structures that allow individuals to engage with the world in “relatively straightforward, predictable, and meaningful ways” (Blount 2002). Schemas are the constituent pieces that comprise meaning (Holland and Cole 1995). They are often comprised of pre-packaged default type information (ie. information based on idealizations, prototypes, and general resemblances) that helps to maximize cognitive efficiency by scaling down the complexity of the world. By serializing, embedding, and hierarchically organizing multiple schemata into a series of foundational thought components, cultural models of the world can be built (Strauss and Quinn 1997, Blount 2002).

Schemas are essentially selection mechanisms that specify how different elements relate to one another (Holland and Cole 1995). Cultural models can be used to illustrate how cultural groups reason about objects (thermostats, cars, remote controls), social institutions (marriage, funerals, birthday parties) and human properties (workings of the body and mind) (Holland and Cole 1995). For the purposes of this study, they will be used to illustrate how stakeholder groups reason about GE.

2.4 Early work in cultural modeling

Early cultural modeling work dealt mainly with social and psychological phenomena such as marriage, emotions, morality, and personal relationships. The application of cultural modeling to other topical areas was slower to develop and only started to take off in 1999 as cultural models began to be applied to ecological and environmental research in anthropology. Cultural modeling has since been used to look at environmental movements and the construction of personal identity (Kitchell, Kempton, Holland, and Tesch 2000), the

phenomena of “pfiisteria hysteria” (Paolisso and Maloney 1999), historical environment reconstruction (Dailey 1999), coastal zone management (Cooley 1999), and issues concerning public water supplies in coastal Georgia (Childer 2001).

2.5 What cultural modeling can offer the GE debate

Anthropology, via cultural modeling, can play a pivotal role in understanding technological acceptance, an increasingly important endeavor given the mass production and global distribution of new technologies. The research findings from this report will help to better understand cross-cultural conflicts over GE technology, and biotechnology in general, by looking at the potential impacts culture may have on meanings applied to GE. This research will use cultural modeling to describe and analyze how key stakeholder groups in the GE debate understand and perceive GE and whether these attitudes and patterns of thought are idiosyncratic or shared within the group. Cultural modeling can enhance communication across stakeholder groups by accurately documenting and evaluating the interrelated thoughts and feelings of affected constituent groups. By gaining a fuller understanding of the cultural elements influencing the GE debate, a greater understanding of international conflict over biotechnology will be garnered.

Chapter 3

Research Design and Methodology

3.1 Field sites

The US portion of the research was conducted in both Northeast Georgia, home to a mid-size organic farming community, and Southwest Georgia, home to a large GE farming community. The New Zealand portion was conducted in the South Island province of Canterbury. The research areas in Georgia and Canterbury were selected because they have several key features in common:

(1) Both areas contain active farming communities, including small and large scale producers, and are prime crop farming areas for local, national, and export production.

(2) These areas either contain or are located near a major metropolitan city where regional crops are sold and eaten (i.e. Atlanta and Christchurch).

(3) Historical features of colonial settlement and landscape transformation are shared, as similar populations of settlers/farmers emigrated from England and Scotland (albeit 100 years earlier in Northeast Georgia) (Crosby 1993).

(4) Significant academic/farming community outreach programs are present in both regions, in Canterbury through Lincoln University and in Georgia through the University of Georgia. Thus, in both contexts, there are mechanisms in place for two-way science-community flows of information about agricultural technology.

(5) There is an overlap in the predominant crops grown in both areas. Both areas produce onions, sweet corn, peas, potatoes, and squash. In NZ, the only GE crops that have been allowed, although in a very limited field test context, are onions and brassicas. In Northeast Georgia, GE versions of sweet corn, cotton, and soybean are widely grown.

3.2 Methods of data collection and analysis

The research goal was to devise cultural models of health, environment, and GE for each respondent stakeholder group using both qualitative and quantitative methodologies. Both qualitative and quantitative forms of analysis have their weaknesses. Qualitative research has been criticized for lacking scientific rigor and reproducibility while quantitative research has been criticized for missing nuances of understanding, which can only be achieved via in-depth interviews (Myers 2000). By combining both forms of analysis, these limitations can be minimized.

Cultural modeling is one area of research in which both forms of analysis can be readily combined. Within anthropology cultural models have previously been derived via schema analysis of respondent discourse. This research combines schema analysis, a qualitative form of analysis, with quantitative forms of analysis such as consensus analysis. The quantitative measures taken during the course of this research contribute to the production of cultural models by mathematically confirming and quantifying inter-group differences in model foundational components derived via schema analysis. Both schema analysis and the quantitative measures utilized in this research highlight patterns of agreement and disagreement among groups. Schema analysis then provides further depth of understanding

by uncovering how model foundational components interconnect and by providing a more nuanced understanding of what each foundational component truly means.

During the first portion of respondent interviews, free-listing exercises were conducted. Free-listing is a standard and objective way to gather a meaningful sample of the domains being investigated without investigator bias (Romney 1999). The goal of the free-listing exercises was to elicit relevant items specific to the domains: human health, the environment, and GE technology.

Respondents were asked to freely list items specific to the following categories: adjectives used to describe the United States/New Zealand, the most pressing problems facing the US/New Zealand, how to maintain health, characteristics of healthy food, human health threats, environmental threats, what you do to preserve/conservate the environment, adjectives used to describe GE; risks of GE, benefits of GE.

In conjunction with the free-listing exercises, rank-order exercises, knowledge testing, Likert scaling, and risk scenario exercises were also conducted. In the rank-order exercises respondents ordered sets of cards according to given criteria. Card sets to be ordered included: threats to health, threats to the environment, reasons why a healthy environment is important, benefits of genetic engineering in agriculture and risks of genetic engineering in agriculture (Appendix 1). With respect to knowledge testing, respondents were given a four-part test assessing general science knowledge, GE knowledge, environmental knowledge, and nutrition knowledge (Appendices 5 & 6). The knowledge tests given in each country were adapted, where appropriate, to take into account cultural differences. For the Likert scaling exercises, respondents were asked to rate their trust in the groups involved in determining GE policy (Appendix 7), the likelihood of GE risks happening within the next 20 years (Appendix 2), religiousness and political stance (Appendix 3) and their level of engagement with GE (Appendix 4). Risk scenario testing involved exercises, in which respondents had to indicate what level of risk they were willing to accept for a given level of return (Appendix 8).

To provide a quantitative base for the cognitive cultural modeling, cultural consensus analysis of free-list data using ANTHROPAC statistical software was carried out (Romney et al. 1986). Further, using SPSS statistical software, Mann-Whitney U tests of the rank-order, Likert scale, knowledge test, and economic scenario data were conducted. Consensus analysis can contribute to cultural modeling by emphasizing the importance of sharing as a defining feature of cultural knowledge (Dressler & Bindon 2000). It uses patterns of agreement, or consensus, among informants to generate a composite picture of all the informant's knowledge and perceptions about a specific domain (group of related items). It enables a researcher to determine if there is sufficient sharing in responses to structured questions within and among groups to make it reasonable to infer that respondents are drawing on a single cultural model (Romney et al. 1986). In other words, consensus analysis helps determine if, at high levels of generality, attitudes and knowledge are shared within a group. Mann Whitney U tests are a means of determining whether a set of scores is from the same population.

Embedded amongst the more quantitatively based portions of the interview were semi-structured interview questions (Appendix 9) to be utilized for schema analysis. Additionally, the free-listing and rank-order exercises often sparked additional comments and discussion beyond what was called for in the exercises. These side bar discussions were invaluable in uncovering small nuances of thought associated with health, environment and genetic engineering. In order to analyze the discourse obtained during the semi-structured interviews,

each interview text was imported into NVivo 7 and coded according to key words and phrases. It was then inductively analyzed for patterns, structure, and linkages of schemas.

By combining the results from the quantitative data discussed earlier with the data obtained during the semi-structured interviews, cultural models with linked and embedded upper and lower level schema were inductively formed. The cultural models demonstrate how each stakeholder group assigns meaning to GE technology, human health, and the environment.

3.3 Informants

Consumers, the organic farming community and the GE farming community were selected for analysis because each group has the potential to be significantly impacted by both the benefits and risks of GE technology. Details of the samples are shown in Table 3.1. The main criteria for selecting informants varied by stakeholder group. Informants for the organic farming community were either currently engaged in organic farming (ie. following organic farming protocols equal to or better than those established by an accredited organic certification agency) or an active member of the organic food movement as indicated by employment at organic food stores or locally grown cooperatives. Informants for the GE farming group were either currently engaged in GE crop cultivation or amenable to the planting of GE seeds, in the case of NZ farmers. Informants within the consumer stakeholder group were the household member who did the majority of the household food shopping.

Table 3.1: Description of samples

	Number of Respondents	Sex	Age Range	Average Age
US consumers	36	female	18-64	34
NZ consumers	32	female	18-78	36
US Organic	15	male and female	24-57	37
NZ Organic	16	male and female	21-64	44
US GE	18	male	26-65	45
NZ GE	6	male	35-63	51

Within the consumer group, only females were interviewed as women are, in general, more responsible for food shopping and preparation (Charles and Kerr 1988, Worsley et al. 2000). Within the GE farming group only men were interviewed due to an insufficient number of females to draw from who farm conventionally. Within the organic farming/food community, both men and woman were interviewed as both sexes were prevalent in sufficient numbers within the farming community. While sampling was conducted opportunistically within each stakeholder group due to the difficulty of obtaining respondents willing to participate in a one and a half hour interview, effort was made to obtain respondents across the spectrum of age.

As the research design involves the methodological merger of both qualitative and quantitative data, particular care was taking in choosing an appropriate sample size. The sample size of each stakeholder group was kept relatively small. The study’s small sample sizes allowed for an in depth inquiry into perceptions of GE, the environment and health. According to Myers (2000), “a small sample size may be more useful in examining a situation in depth from various perspectives, whereas a large sample would be inconsequential...small qualitative studies can gain a more personal understanding of [a] phenomenon.”

The initial research goal was to obtain at least 15 respondents from each of the farming stakeholder groups and at least 30 respondents from the consumer respondent groups. Regarding the greater sample sizes for the consumer groups, it was felt that consumer groups would exhibit a greater diversity of thought regarding GE, health and the environment compared to farmer research participants, thus, a greater sample size was felt warranted. These initial sample size goals were tentative estimations of sample sizes thought necessary to achieve informational redundancy. Had informational redundancy not been achieved with the initial sample size estimations, further sampling would have been carried out until informational redundancy had been achieved. The sample size goals were met for all stakeholder groups except for the NZ GE-amenable group in which only six respondents were obtained due to a relative scarcity of farming individuals meeting the aforementioned selection criteria. It should be noted that the additional number of respondents interviewed above the sample size goals (15 farmer and 30 consumer respondents) are not indicative of informational redundancy not being achieved once the sample size goal was met. Instead, the additional number of respondents merely reflects additional interviews being scheduled in case of participant cancellation.

Consensus analysis was an important quantitative-based methodological tool used in this research and was used in conjunction with additional quantitative measurements such as rank ordering, knowledge testing and Likert scaling. According to Weller and Romney (1988), using consensus analysis and assuming an average cultural competence level among informants of 0.5 or higher, a confidence level of 0.95 can be achieved using nine respondents per sampling frame. Cultural competence refers to “how much of a given domain of culture each individual informant ‘knows’” (Romney et al. 1986). Each frame used in the course of this research had more than nine respondents except for the NZ GE-amenable farming group, which only had six respondents due to sampling constraints. Thus the sample sizes chosen for this study were more than adequate for consensus analysis to be conducted in all cases but one. For the NZ GE group with only six respondents, consensus analysis could still be used assuming respondents exhibited a cultural competence level higher than 0.5. This assumption was not unwarranted given that members of this stakeholder group exhibited strong cohesion of thought regarding notions of health, environment and GE. The other forms of quantitative analysis were statistically analyzed using Mann Whitney U-tests, a statistical test designed for use with data from small samples.

The sample sizes chosen for this study, in addition to fulfilling the sample size needs for the qualitative portion of the research, also met the needs of the quantitative portion.

Chapter 4

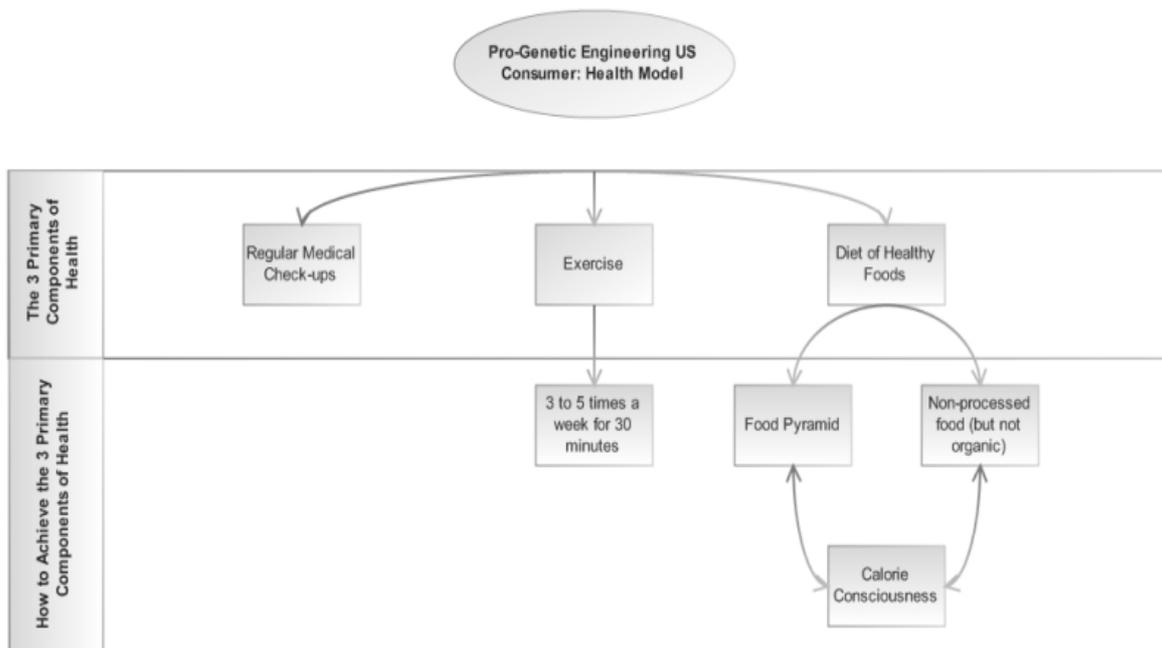
Cultural Models of US Stakeholders

4.1 Introduction

In this chapter cultural models of health, environment, and GE for US stakeholders will be presented pictorially and discussed. As previously mentioned, these models were derived from both quantitative data (cultural consensus analysis, rank-ordering, knowledge testing, Likert scale data, risk scenario data) and from qualitative data from semi-structured interview questions. Consumer respondents were divided into groups based on each respondent's self-classification as Pro-GE, Anti-GE, or neutral. Only Pro-GE and Anti-GE respondent data was modeled as an insufficient number of respondents (three respondents) classified themselves as neutral towards the technology. Consumer respondents were divided into groups in order to evaluate the significance of environmental and health perceptions in influencing a person's stance on GE and to highlight the different ways in which each group views GE.

4.2 US Stakeholder health models

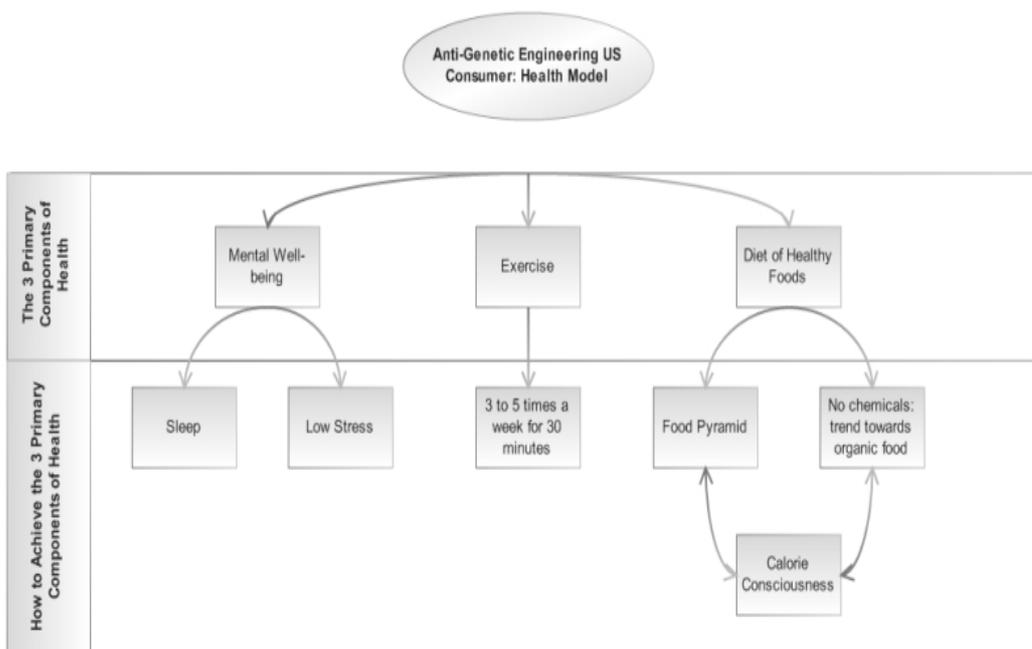
Figure 4.1: Pro-GE US consumer health model



Cultural consensus analysis of Pro-GE US consumer free-list data revealed that for this consumer group personal health was comprised of three primary schematic components; regular medical check-ups, exercise and a diet of healthy foods. Further questioning based on participant free-list responses revealed that respondents believed a person should exercise three to five times a week for 30 minutes to reach optimal health. The form of exercise did not matter as long as it elevated the heart rate and made you sweat. A healthy diet was comprised of non-processed food based on the food pyramid while also being calorie conscious. The fruits and vegetables component of the food pyramid was heavily emphasized

as being particularly important for health. With respect to calorie consciousness, respondents often stated that healthy food was low in fat and sugar and was consumed in moderation. It should be noted, that while there was consensus within this group that diet, exercise, and regular medical check-ups were needed for health, this does not mean that people were putting their health model into practice. When respondents were asked what they did to maintain their health, many stated that they did not regularly follow their model for health and were unhealthy as a result.

Figure 4.2: Anti-GE US consumer health model



Cultural consensus analysis of Anti-GE US consumer free-list data reveals similar schematic components to Pro-GE US consumer respondents with a few key differences. As was the case with Pro-GE US consumer respondents, Anti-GE US respondents believed health to be based on exercise and a diet of healthy foods. However, the models differ in the third component, with Anti-GE US consumer respondents believing mental well-being was needed for health. Mental well-being could be achieved by having a low stress lifestyle and by getting an adequate amount of sleep.

Semi-structured interview questions coupled with findings from the rank-order exercises revealed that Pro and Anti-GE respondents shared similar views on diet and exercise with one key difference. The Anti-GE respondents were more concerned with food not containing synthetic chemicals rather than it being non-processed. The “Threats to Health” rank order exercise (Appendix 10) revealed that Anti-GE US consumers considered chemicals in food to be significantly more threatening to health than their Pro-GE counterparts. Furthermore, there was a strong trend within this group towards wanting organic food. The following are a few representative comments regarding chemicals on food and organics:

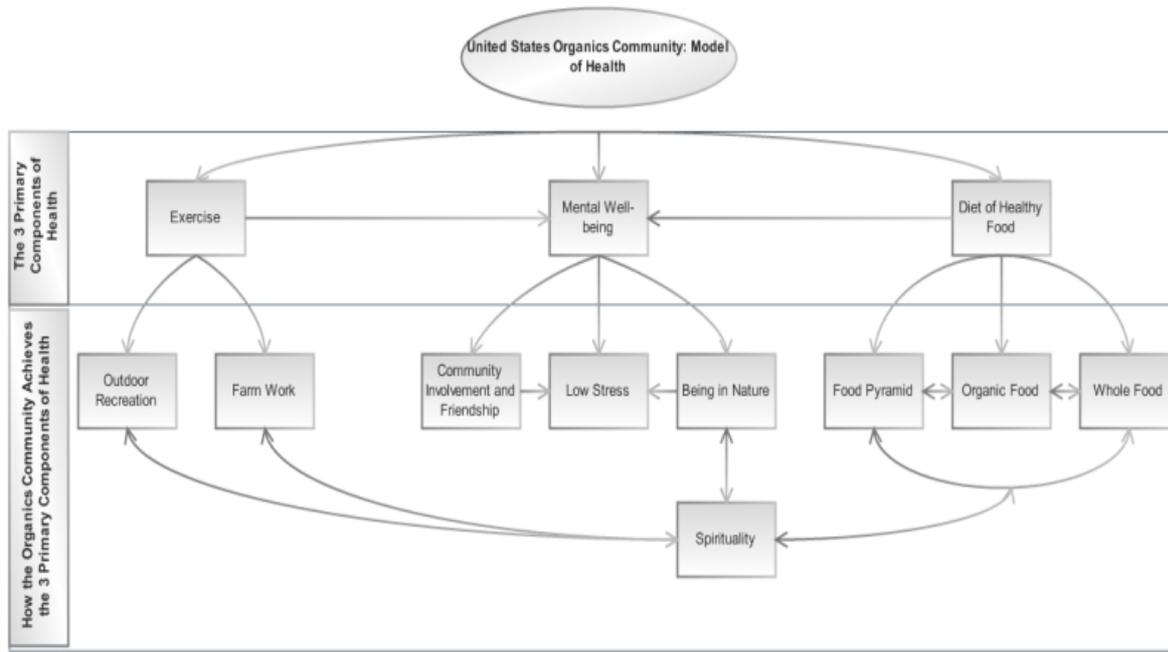
“The chemicals on food cause cancer, if I could I’d like to only purchase organics but it’s the expense” *Anti-GE US Consumer 1, Age 45.*

“Organics just taste better, organics taste real” *Anti-GE US Consumer 29, Age 20.*

“My dad has cancer and my mom has done a lot of research that organics are better. He was a farm boy and probably exposed to pesticides” *Anti-GE US Consumer 31, Age 22.*

As was the case with Pro-GE US consumers, respondents in this group did not necessarily follow their own health model and many considered themselves to be unhealthy.

Figure 4.3: US organics community health model



Compared to US consumers, the US organic farming community had a much more detailed model of what was needed to achieve health. As was the case with Anti-GE US consumers, consensus analysis (Appendix 21) suggests that the US organic community believed health to be derived from three schematic components: mental well-being, exercise, and a diet of healthy food. However, semi-structured interview data revealed what was considered to be necessary to achieve these three primary elements differed significantly.

Mental well-being was believed to be intimately associated with exercise and a healthy diet and resulted from a low stress lifestyle that included community involvement/friendships and being in nature. For the US organics group, exercise was less structured as far as time and frequency compared to US consumers and included participating in outdoor activities (hiking, biking, running) and doing farm work.

As was the case with both US consumer groups, a healthy diet was based on the food pyramid. Unlike US consumers, however, it was also believed that for food to be healthy it also had to be both organically grown and whole food. Organic food is free of chemicals like pesticides, which are a major concern for the US organics community as indicated by the “Threats to Health” rank order. The results show the organics community to be significantly more concerned about chemicals in food threatening health than both US consumers ($p=0.001$) and US GE farmers ($p=0.008$) (Appendix 10). Members of this group emphasize that:

“Food should not be poisoned with chemicals or fortified with things it doesn’t need, it should be unrefined and closer to basic food properties.” *US Organic 5, age 30.*

“The chemical foods we eat are the problem. If you feed an engine nasty gas it won’t run well.” *US Organic 9, age 57.*

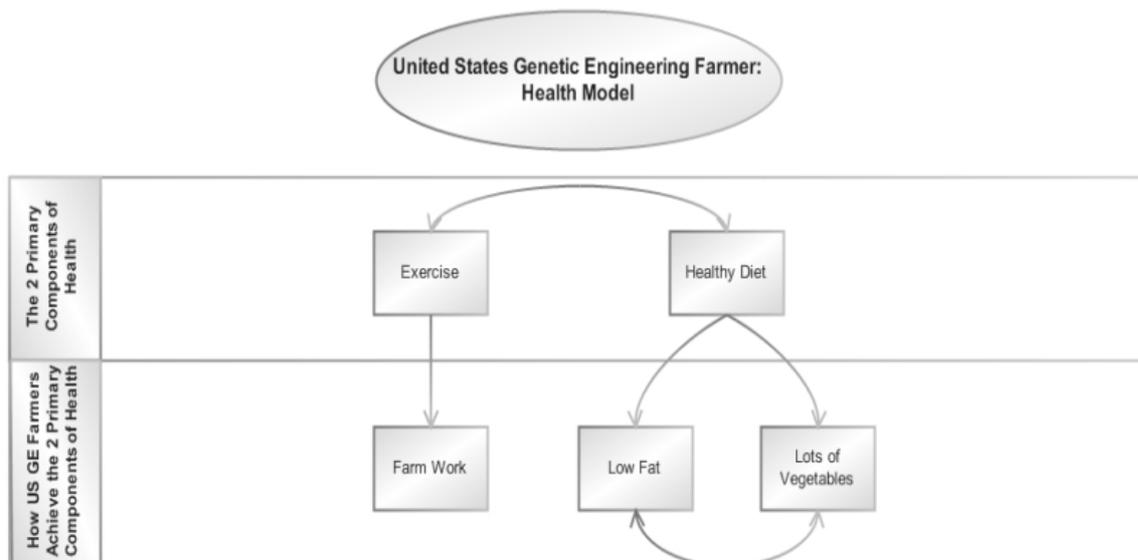
An interesting differential between the organic model and the consumer models is the addition of a spirituality component. Each of the three schematic components of health for the organics group is tied to their spirituality, which is based on a symbiotic-type relationship with nature. Interestingly, spirituality was both a means to achieve health and a result of its achievement. The following are a few comments highlighting this group’s thoughts on health, the environment and spirituality:

“Nature fuels me, invigorates, keeps me grounded. It’s my connection to the rest of the world, to other people in other countries who are connected to it. It makes me feel small and insignificant in a health way” *US organic 15, age 30.*

“It’s all ecological even if people don’t recognize it, it is all interconnected. The main threat to health is being apart from nature” *US organic 5, age 30.*

Given the organic community’s view of how nature, health and spirituality are interconnected, it is not surprising that their views on health are closely tied to their perceptions of environmental health. For this group, threats to the environment were deemed to be threats to health. The “Threats to Health” rank order exercise coupled with additional questioning indicated that pollution (Consumers vs. Organic $p=0.007$, GE farmers vs. Organic $p=0.005$), overpopulation (Consumers vs. Organic $p=0.031$), and genetically engineered food and crops (Consumers vs. Organic $p=0.005$, GE farmers vs. Organic $p=0.005$), were considered to be greater threats to health, in part, because they were believed to be dangerous for the environment.

Figure 4.4: US GE community health model



Compared to both US consumer and organic respondents, GE farmer respondents had a much simpler model of health. Consensus analysis (Appendix 21) indicated that as a group, GE farmers believe health to result from two schema, exercise and a healthy diet. A healthy diet had lots of vegetables and was low in fat. Sufficient exercise was believed to come from doing farm work. Many GE farmer respondents were moderately perplexed by questions

regarding health maintenance and characteristics of healthy food. The topics of health in general and their own personal health, in particular, are not often thought or talked about within this stakeholder group. Thus, the simplicity of their health model is not surprising.

4.3 US stakeholder environment models

Figure 4.5: Pro and anti-GE US consumer environment model



The environment models for Pro and Anti-GE US consumers was very simplified as the environment proved to be something which American consumers rarely think about. There was no over-arching schematic foundation, as will be seen in the organic and GE environment models, by which US consumers viewed the environment. Semi-structured interview data indicates that US consumer perceptions of the environment do not extend much beyond that of their personal environmental space (ie. their home, neighborhood, community area).

Although their primary view of the environment was heavily focused on their own personal environment, they also saw the wider environment as an “amorphous other”. Pro and Anti-GE US consumers differed in the degree in which they saw the wider environment as important, with Anti-GE US consumers being more environmentally concerned.

Most respondents seemed puzzled by questions regarding their interactions with and perceptions of the environment. When respondents were asked directly about their “relationship” with nature, many stated that they had “no relationship”. One respondent said,

“I don’t notice the environment in the day to day, I don’t see or feel it. I don’t have a relationship with the environment except maybe animals like deer near the house” *US Consumer 33, age 53.*

Due to the very limited nature of the relationship US consumers have with the environment, it is not surprising that the group as a whole does very little in the way of actively trying to preserve/conservate the environment. As consensus analysis (Appendix 21) indicates, the only

“environmental” activity commonly undertaken by this group is recycling, a practice which is standard in most Georgia counties.

For US consumers, a healthy environment was recognized as necessary for personal health but it was not an idea at the forefront of their thinking. The connection made between human health and environmental health was not as strong as the same connection made by members of the organics community, the difference being that this group was not actively seeking to have a connection with nature and was not actively seeking, in day to day living, to maintain a healthy environment for health purposes.

As depicted by the absence of arrows interconnecting the model’s schematic components, US consumers lack a cohesive model of the environment. For them, the environment is their own personal environment; this view is neither connected to the activity of recycling - an activity done more out of habit than any real desire to actively participate in environmental protection - nor is it strongly connected to the recognition that environmental health and human health are related.

Figure 4.6: US organics community environment model



Compared to US consumers, US organic farming community respondents had a much more detailed model of the environment. Their conception of the environment extended well beyond their own personal environment to an idealized conception of the natural world. The schematic base of the model was a view of the environment as nature and nature was seen as a form of spirituality. In many cases, “nature” was the respondent’s religion. Through the intertwining of nature and spirituality, respondents viewed the environment as one in which man was an integral part of nature.

Because these respondents feel a deep connection with the environment, part of their perceptions of the environment include their interactions with it, as indicated by the third tier of the model. Stewardship, both at the domestic household level and at the agricultural farm level, was a key idea for these respondents. Consensus analysis (Appendix 21) shows this stakeholder group to be more involved in environmental preservation/conservation efforts on

a day-to-day basis than US consumers or GE farmers. With regards to domestic stewardship activities, group members recycled, reused items and in general consumed responsibly (reduced their energy, water, and fuel usage; purchased items with limited packaging, limited consumerism behaviors). The “Threats to the Environment” rank order indicates that compared to US consumers, respondents from the organics community saw consumerism as significantly more threatening for the environment ($p=0.009$) (Appendix 11). Thus it is not surprising the group sought to limit their own levels of consumerism. The following are a few comments made by members of the organics community, which highlight their positions regarding consumerism:

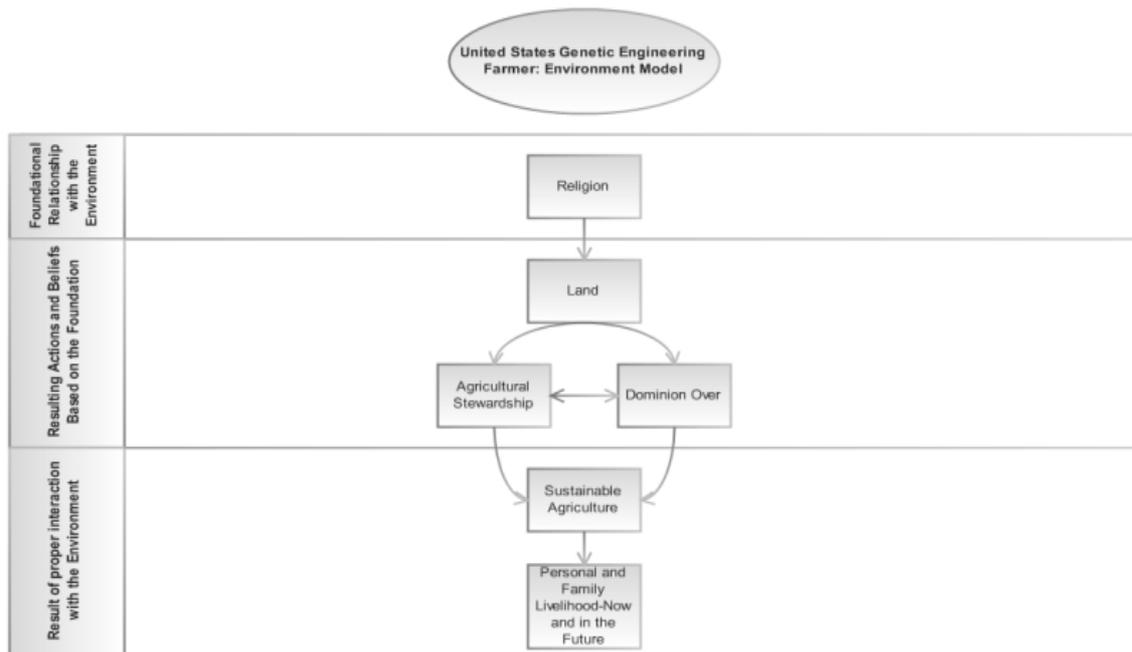
“To help the environment I limit my fossil fuel usage, I take my own bags to the grocery. I try to be responsible with what I buy. I try to vote with my pocketbook” *US Organic Respondent 15, age 30.*

“I don’t buy unnecessary things, people buy too much that is unnecessary, it’s a waste” *US Organic Respondent 7, age 31.*

In addition to domestic stewardship activities, consensus analysis shows that farming organically was another means by which this group sought to work towards environmental health. For these respondents, agricultural stewardship was synonymous with organic agriculture in which no pesticides were used on the land. The goal of the organic farming enterprise was to create a sustainable ecosystem.

Both domestic and agricultural stewardship were viewed as leading to a high quality of life (see US organic health model). Quality of life was seen as interconnected to a holistic lifestyle, which could be achieved through harmony with nature and a rejection of mainstream consumption patterns. A holistic lifestyle was then seen as connected to preservation of the future for all living kind. In the “Reasons for a healthy environment” rank order, members of the US organics community ranked “moral obligation to future generations” significantly higher than US consumers ($p=0.043$) and the group as a whole was very future oriented.

Figure 4.7: US GE community environment model



The US GE farmer model of the environment was rooted in their Christian religious values. On the religiosity Likert scale, US GE farmers were found to be significantly more religious than both US consumer respondents ($p=0.001$) and US organics respondents ($p=0.025$) (Appendix 16). As opposed to the organics community, who viewed the environment as nature, semi-structured interview data revealed that US GE farmers viewed the environment as land; land over which they had dominion. The idea of dominion over the land is tied to the group’s Christian religious values. Genesis 1:28 states, “Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth”. The idea of having dominion over the land is very different from the organic community’s notion of man as a part of nature and led to very different farming goals for each group. While members of the organics community sought to integrate themselves into their local ecosystem and “be one with nature”, GE farmers saw themselves more as tamers and shapers of the land. It was thought that humankind could best serve God by increasing land productivity via increased crop yields.

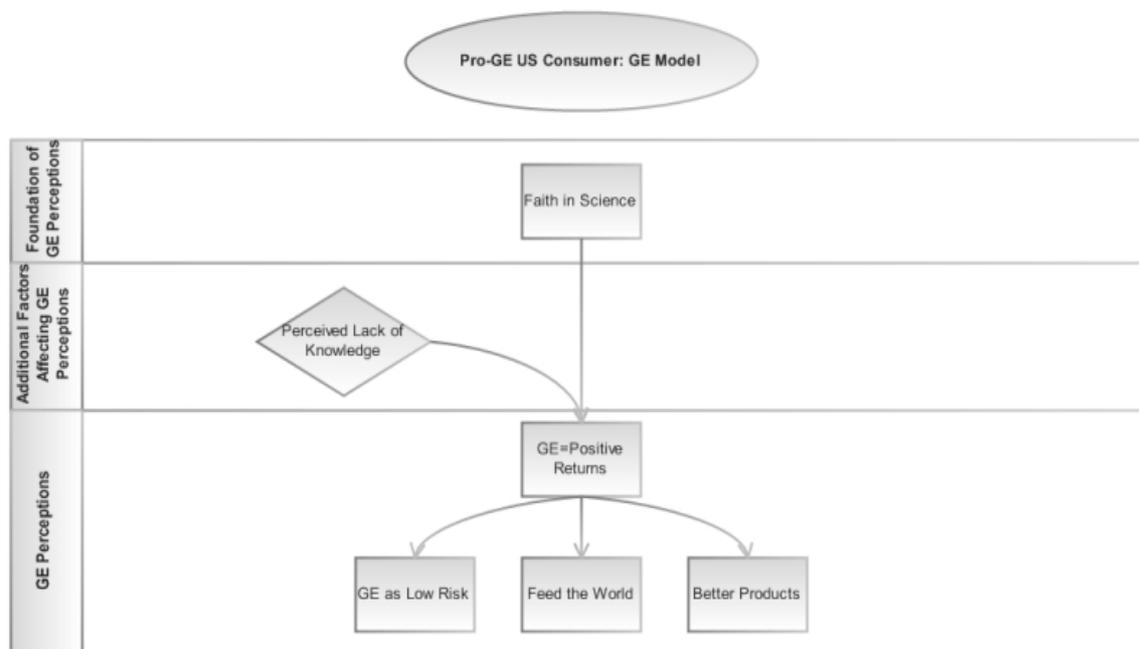
Although US GE farmers felt that they held dominion over the land, they also possessed a strong land stewardship ethic. US GE farmer respondents often stated that they had been unfairly characterized by environmentalists as rapists of the land. According to one farmer:

“No one is a bigger environmentalist than a farmer, without the land we can’t make a living.” *US GE farmer 16, age 45.*

Unlike organic farmers who viewed stewardship as land management that would lead to sustainable ecosystems, US GE farmers viewed stewardship as management leading to the ability to farm in perpetuity. Consensus analysis (Appendix 21) shows that, for US GE farmers, preserving/conserving the environment (for this group synonymous with the term “land”) means preventing erosion and applying chemicals correctly. Farmers felt that these two actions helped secure land fertility and the future of the farm.

4.4 US stakeholder GE models

Figure 4.8: Pro-GE US consumer GE Model



Pro-GE US consumer’s perceptions of genetic engineering in agriculture were rooted in a strong faith in science. Compared to anti-GE US consumers, pro-GE US consumers were significantly more likely to trust scientists ($p=0.023$) as indicated on the Likert Trust Scale (Appendix 20). Furthermore, both pro and anti-GE US consumers felt that they lacked knowledge about GE. The pro-GE group’s strong faith in science coupled with their perceived lack of knowledge regarding the technology resulted in the respondents deferring judgment on the safety and benefits of GE to scientists. A few indicative comments include:

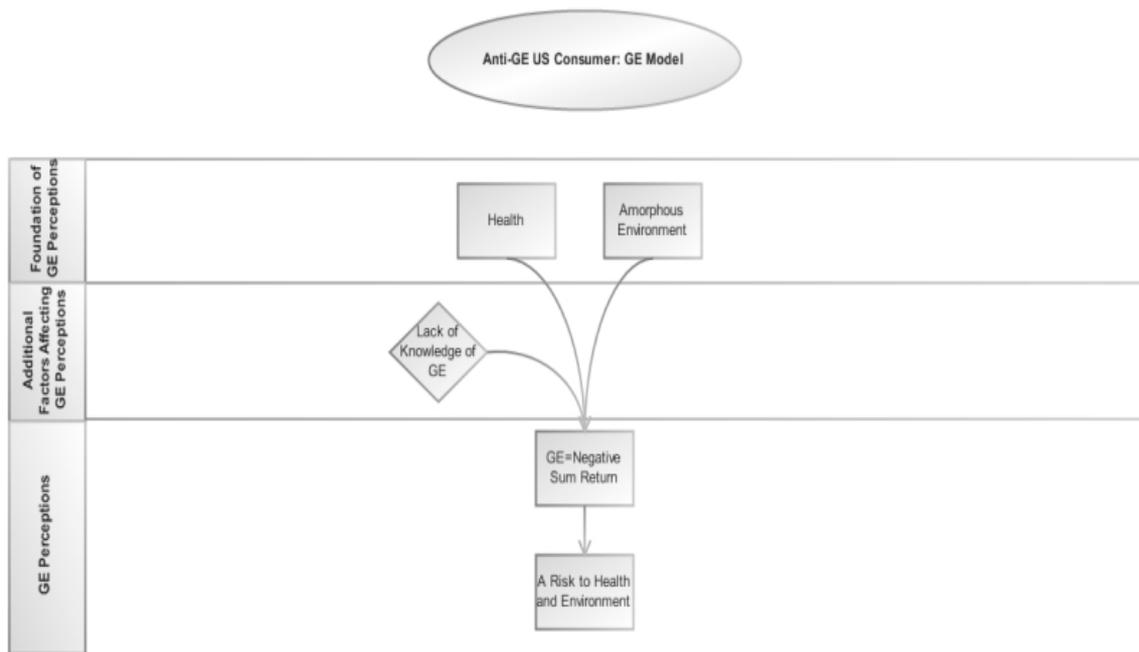
“I trust scientists the most because when dealing with something so new and untried, the professionals would be the most able to predict possible outcomes.” (*Pro-GE US Consumer 8, age 26*).

“I trust scientists, they have fewer opportunities and desires for personal gain. I think they’re in it for the passion.” (*Pro-GE US Consumer 7, age 22*).

It should be noted that although Pro-GE US consumers felt they lacked knowledge about GE, they did score significantly higher than Anti-GE US consumers on the GE knowledge assessment ($p=0.002$) (Appendix 18).

Respondents believed GE was a relatively low risk to society as indicated by the health and environmental threat rank-order exercises. Compared to anti-GE consumer respondents, Pro-GE respondents saw GE as being significantly less threatening to both health and the environment ($p=0.000$ and $p=0.000$ respectively) (Appendices 10&11). Furthermore, when Pro-GE respondents did think a certain GE risk was likely to happen, they felt the risk would be contained in a laboratory or scientists would find a swift solution and minimal harm would result. Pro-GE US consumer respondents felt the technology was worth the minimal risks it posed as it could offer consumers better products in the form of food that was more nutritive, better looking, and more tasteful and it could help feed the world.

Figure 4.9: Anti-GE US consumer GE model

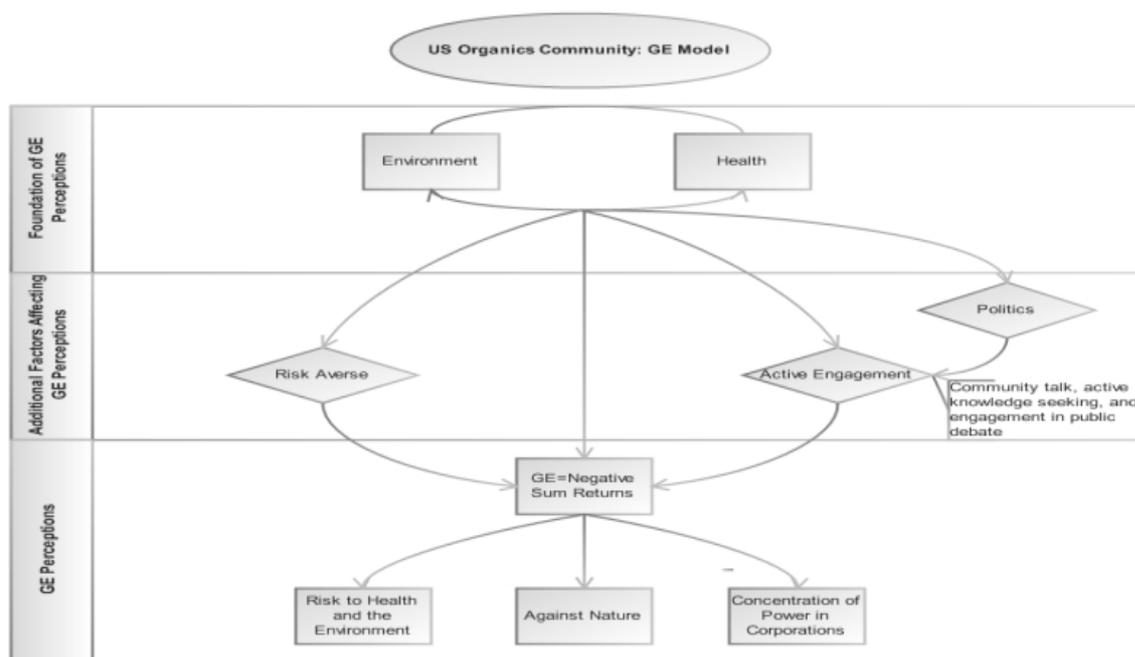


Anti-GE US consumer respondent’s perceptions of GE were rooted in their models of health and the environment. Rank order results suggest that anti-GE US consumers viewed GE as being a greater threat to health ($p=0.000$) and the environment ($p=0.000$) than did Pro-GE US respondents (Appendices 10&11). For respondents within this group, GE was strongly associated with chemicals like pesticides and herbicides, which were deemed to be unhealthy and something the group as a whole sought to avoid.

As discussed previously, US consumer’s environment model does not extend much beyond their personal environment on a daily basis. However, when asked to think about threats to the wider environment, they are able to do so and Anti-GE US consumer respondents saw GE as a greater threat to the environment than Pro-GE consumers. Although this group does not have a highly specified model of the environment, they do have a generalized concern for it and are in favor of activities done for its benefit. For example, Anti-GE US respondents ranked “protection of the environment” as a more significant potential benefit (if all benefits were true benefits) of GE than did Pro-GE US consumers ($p=0.032$) (Appendix 13).

As was the case with the pro-GE respondents, this group also felt unknowledgeable about GE technology. However, for this respondent group, potential fears resulting from a lack of knowledge about this novel technology were not assuaged by a faith in science. The result was a general distrust of the technology and greater perceived risk. While respondents in this group felt GE was a risk to both health and the environment, only a few of those interviewed could name specific risks; the main risk was considered to be unforeseen consequences. There was also no significant difference between Pro and Anti GE respondents with respect to how likely they thought GE risks were to come to pass (Appendix 15). However, unlike Pro-GE respondents, members of this group felt that scientists would not be able to sufficiently fix any negative GE repercussions.

Figure 4.10: US organics community GE model



US organic farming community perceptions of GE are rooted in the circular interconnection of their models of environment and health. As indicated by the health and environment models in sections 4.1 and 4.2, organic community respondents have a very strong relationship with nature that extends into the spiritual realm. Environmental health and personal health are believed to be strongly interlinked. Respondent models of health and the environment fed into their political views. Members of this group were often quite active politically and often said that they vote with their consumer dollar and actively advocate on behalf of the environment. The Likert politics scale indicates that members of the organic farming community are significantly more liberal than both US consumers and GE farmers ($p=0.012$ and $p=0.000$ respectively) as they considered the US democratic party to be more socially responsible and environmentally friendly (Appendix 16).

This group’s environment and health models, combined with their political activism, led them to be actively engaged in the GE debate. Their engagement took the form of actively talking about GE within the community, seeking out knowledge regarding GE through television and print media sources and being willing to engage in public meetings concerning GE. The engagement Likert scale (Appendix 4) indicates that organic farming community respondents are significantly more likely to seek knowledge of GE via the media than US GE farmers ($p=0.002$) and are more likely to engage in public debates than both US GE farmers ($p=0.014$) and consumer respondents ($p=0.006$) (Appendix 17). They are also more likely to have talked about GE than consumer respondents ($p=0.000$) (Appendix 17).

The organic community’s stance on what constitutes human health behavior and a healthy environment shapes their risk behavior. The community has a high level of risk aversion with respect to the environment and health. The economic risk scenario tests (Appendix 8) indicate that members of the organic farming community are significantly less willing to risk either health or the environment in return for increased crop yields compared to members of the GE farming community ($p=0.000$ and $p=0.000$ respectively) (Appendix 19). Furthermore, US organics respondents ranked GE as significantly more threatening to health ($p=0.005$ and $p=0.005$) than both US consumers and GE farmers, respectively (Appendix 10) and

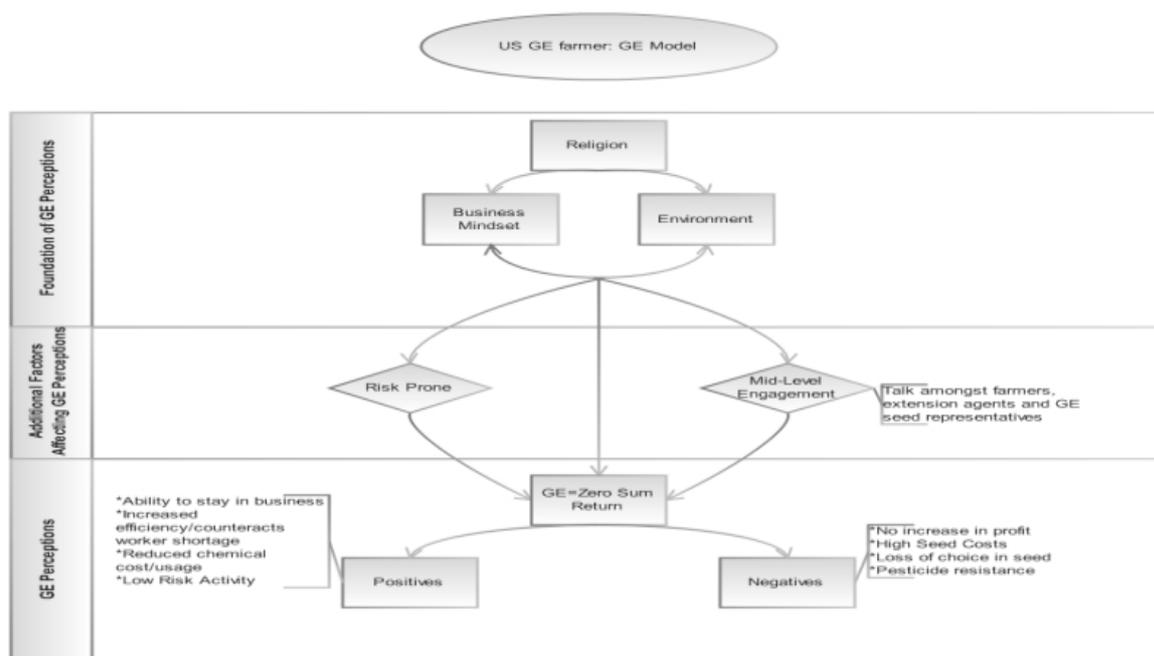
significantly more threatening to the environment ($p=0.001$) than US consumers (Appendix 11). Given the groups risk aversion and perception of GE as a significant environment and health threat - environment and human health being two key elements of organic farming philosophy – it is not surprising that respondents were GE opposed.

Coupled with the group’s risk aversion, the organics community believed GE risks were more likely to come to fruition than did US consumers and GE farmers. Compared to US consumers, members of the US organic farming community saw the following risks of GE as being significantly more likely to happen: loss of crop diversity ($p=0.011$), gene transfer to wild varieties of plants ($p=0.020$), toxicity from GE foods ($p=0.017$), negative alterations in nutritional quality ($p=0.034$), limited access to GE crop varieties ($p=0.002$), a lack of labeling of GE ingredients in food ($p=0.004$), and increased risk of food allergens ($p=0.007$) (Appendix 15). Similarly, compared to the US GE farming community, respondents saw the following risks as being significantly more likely to happen: human antibiotic resistance ($p=0.004$), creation of new viruses ($p=0.002$), loss of crop diversity ($p=0.005$), gene transfer to wild varieties of plants ($p=0.001$), toxicity from GE foods ($p=0.001$), negative alterations in nutritional quality ($p=0.000$), a lack of labeling of GE ingredients in food ($p=0.000$), and increased risk of food allergens ($p=0.000$) (Appendix 15).

The US organic farming community’s root models of health and the environment, coupled with their political activism, general risk aversion and active engagement in the GE debate leads to a view of GE as being a negative sum return. Consensus analysis indicates that this group saw GE as a technology with no true benefits. It is against the group’s conception of nature and concentrates power in the hands of a few large corporations while risking health and the environment. According to one respondent:

“GE is trying to make nature out of equations, it’s a tool of control, we are sucking at the nipple of a technological cow and it is a false idol” (*US Organic 5, age 30*).

Figure 4.11: US GE farming community GE model



The GE farming community perceptions of GE are rooted in their schemas of religion, business, and the environment. As stated in section 4.2 on environment models, GE farmers tend to have strong religious values with an accompanying notion of dominion over the land. The idea of dominion ties in nicely with the group's business mindset as improving upon land productivity, while fulfilling a religious doctrine to make the land productive, also is profitable from a business perspective.

Unlike members of the organic farming community, who participate in farming to fulfill a spiritual desire to work with the land, to be a part of nature and to make a living, GE farmers approach farming with a business mind-set. They enjoy their work but they do not have a spiritual connection to the land. Their farm is a business to them and they farm to make a living. For them, farming is about the economic bottom line.

The use of GE products as part of their business, leads GE farmers to have a mid-level of engagement in the GE debate. The engagement Likert scales indicate that GE farmers were significantly more likely than US consumers to have talked about GE ($p=0.001$) (Appendix 17) with the main focus being how to achieve higher crop yields. Despite a high level of GE talk within the community, GE farmers were less likely than consumers or those in the organics community to seek out and read an article or watch a show on GE ($p=0.016$ and $p=0.002$ respectively) (Appendix 17). For GE farmers, GE seed company representative were the primary sources of knowledge concerning GE. It is important to note that the information they receive regarding GE is likely to be biased towards being pro-GE as it, in many instances, comes directly from the GE seed companies. As stated previously, compared to organic farmers, GE farmers were also less likely to attend a public meeting about GE ($p=0.014$)(Appendix 17).

GE farmer's strong orientation towards being business-minded also influenced their willingness to take risks with both health and the environment. The risk scenario exercises, indicate that GE farmers were significantly more willing to risk human health and the environment for a benefit of improved crop yields ($p=0.000$ and $p=0.000$ respectively) (Appendix 19) than were organic farmers.

Overall, GE farmers perceived genetic engineering technology as a zero sum return. Consensus analysis indicated that as a group, GE farmers saw the chief negative of GE as being high seed costs (Appendix 21). Additional negatives included loss of choice in seed and pesticide resistance. Companies such as Monsanto have a virtual monopoly over seeds in general and GE seeds in particular. Farmers have little to no choice in what seed varieties they can choose for farming. In many cases, conventional, non-GE varieties of seeds are no longer sold in sufficient quantities for them to be used on a large-scale US farm. Furthermore, GE crops were not improving farmer profit margins. The money farmers save on agricultural chemicals is negated by the high cost of GE seeds.

Consensus was also reached with respect to the positives of GE technology (Appendix 21). GE allowed increased farming efficiency (via reduced chemical spraying), which helps to counteract a worker shortage. American farmers have, in recent years, been faced with worker shortages coupled with the need to increase the amount of land under cultivation in order to stay in business. GE has allowed farmers to farm more land with fewer people.

Another positive was that the technology was viewed as being a low-risk technology. As indicated during the discussion of the organic farming community GE model, GE farmers, compared to the organic community, viewed GE crops and food as being significantly less risky with respect to: human antibiotic resistance ($p=0.004$), creation of new viruses

($p=0.002$), loss of crop diversity ($p=0.005$), gene transfer to wild varieties of plants ($p=0.001$), toxicity from GE foods ($p=0.001$), negative alterations in nutritional quality ($p=0.000$), a lack of labeling of GE ingredients in food ($p=0.000$), and increased risk of food allergens ($p=0.000$) (Appendix 15). Similarly, GE farmers, compared to US consumers, found GE to be less risky with respect to: human antibiotic resistance ($p=0.000$), creation of new viruses ($p=0.000$), gene transfer to wild varieties of plants ($p=0.015$), negative alterations in the nutritional quality of food ($p=0.001$), a lack of labeling of GE ingredients in food ($p=0.001$), and increased risk of food allergens ($p=0.000$) (Appendix 15).

Chapter 5

Cultural Models of NZ Stakeholders

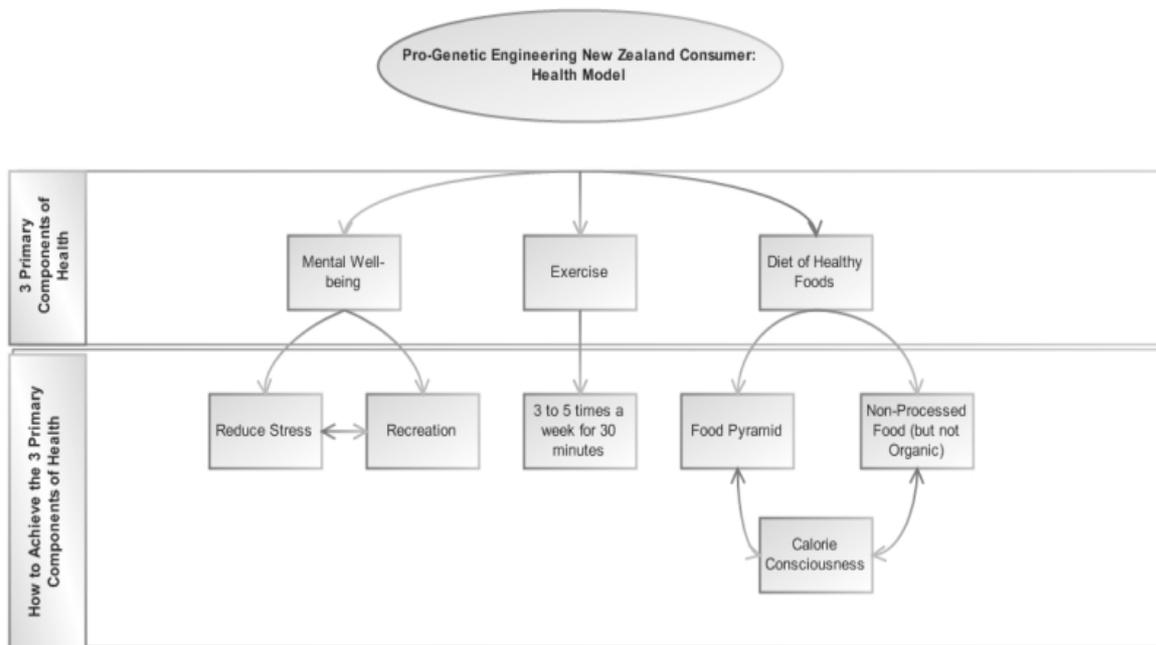
5.1 Introduction

In this chapter, cultural models of health, environment, and GE for NZ stakeholders will be presented pictorially and discussed. As previously mentioned, these models were derived from both quantitative data (cultural consensus analysis, rank-ordering, knowledge testing, Likert scale data, economic scenario data) and qualitative data from semi-structured interview questions. Consumer respondents were divided into groups based on each respondent’s self-classification as Pro-GE, Anti-GE, or neutral. Only Pro-GE and Anti-GE respondent data was modeled as an insufficient number of respondents (three respondents) classified themselves as neutral towards the technology. Consumer respondents were divided into groups in order to evaluate the significance of environmental and health perceptions in influencing a person’s stance on GE and to highlight the different ways in which each group views GE.

Only limited comparisons will be made between US and NZ models in this section as model comparisons will be the focus of Chapter 6.

5.2 NZ stakeholder health models

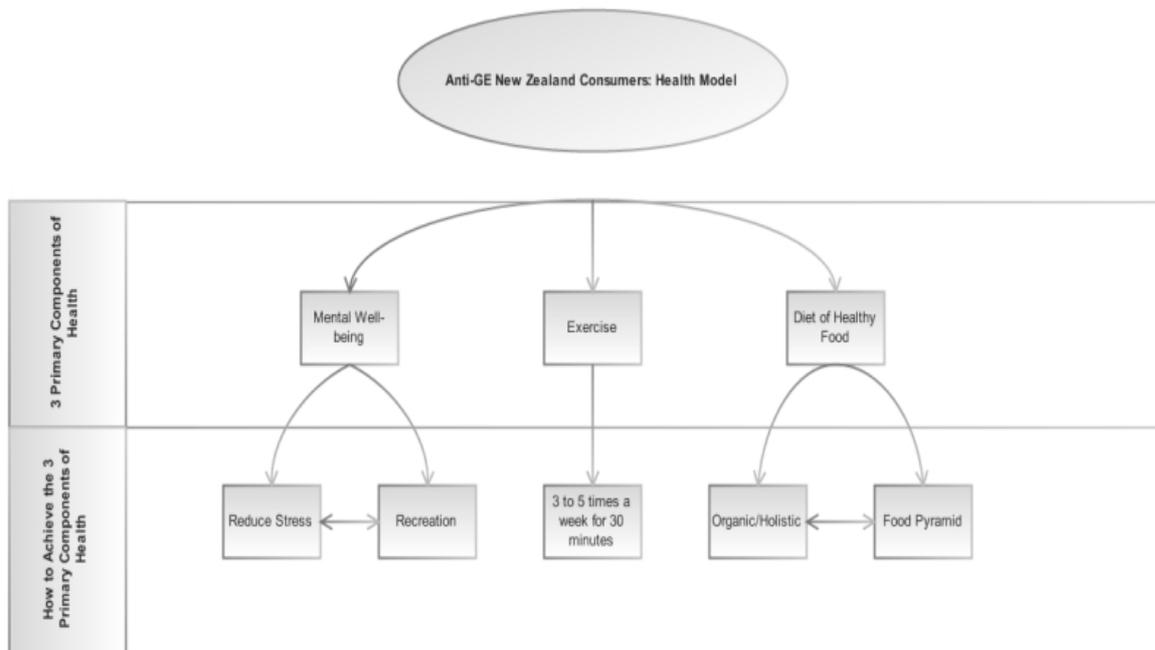
Figure 5.1: Pro-GE NZ consumer health model



Cultural consensus analysis of Pro-GE NZ consumers revealed that personal health was thought to be based on three schematic components: mental well-being, exercise, and a diet of healthy foods (Appendix 21). Semi-structured interview data uncovered further details of what each of these three primary components should entail. Mental well-being could be achieved through a low stress lifestyle with plenty of recreation. Exercise should consist of

workouts three to five times a week, which increased your heart rate. A diet of healthy food was based on the food pyramid and had a variety of foods in it, particularly fruits and vegetables. To be healthy, the foods should be non-processed and preferably low in fat and sugar. It should be noted that respondents did not necessarily follow their own health model and many felt they did not live a healthy lifestyle.

Figure 5.2: Anti-GE NZ consumer health model



Similar to Pro-GE NZ consumer respondents, Anti-GE NZ consumer respondents were in consensus that mental well-being, exercise, and a diet of healthy food were needed for health (Appendix 21). There was also agreement among the two groups with regard to what mental well-being and exercise entailed. The main difference between the Pro and Anti-GE models is with respect to what is meant by a diet of healthy foods. For Anti-GE respondents, a healthy diet was comprised of a variety of foods based on the requirements set out by the food pyramid and it was thought that food should be organic. Organic food was considered to be more healthy because it lacked chemicals like pesticides and was closer to what was natural. Comments include:

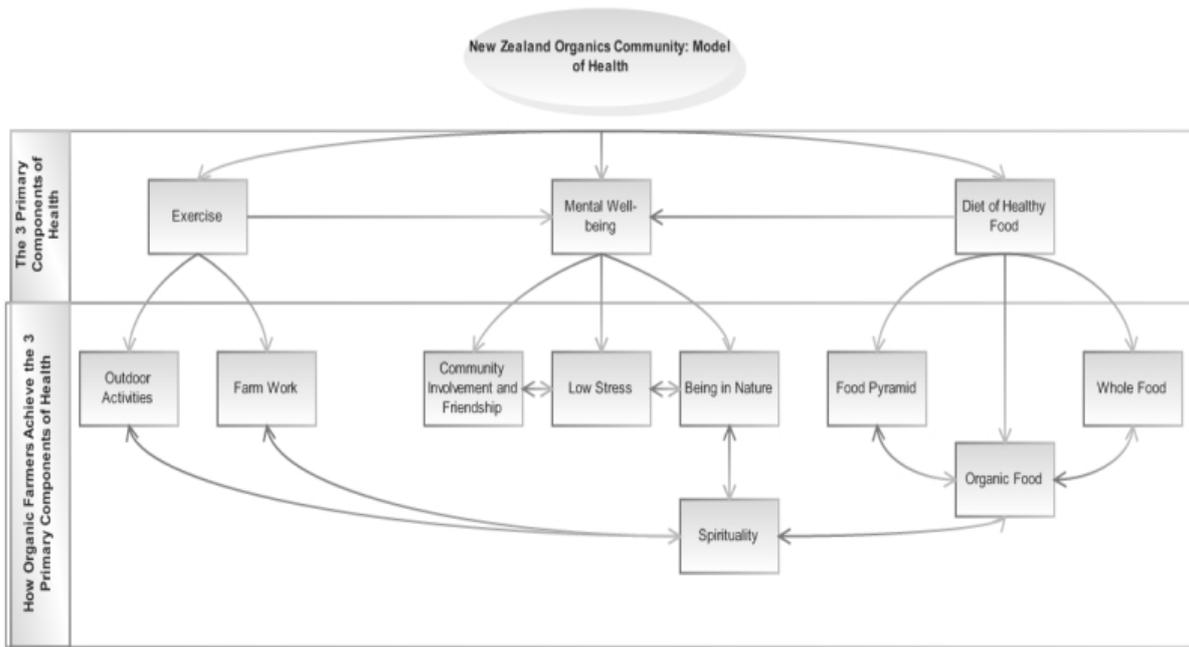
“Organic food is better than normal food about causing cancer” *NZ consumer 1, age 18.*

“Organic food could help for optimal health because it’s missing preservatives” *NZ consumer 2, age 21.*

“I like organic food, it’s the healthiest type of food, there is no poisons in the food” *NZ consumer 19, age 69.*

This group was also not calorie conscious, unlike respondents in the Pro-GE group. It was thought that by eating healthy organic foods, one could maintain a proper weight without being particularly calorie conscious. It should be noted that while respondents in this group thought food should be organic to be healthy, they did not always buy organic food due to its high cost.

Figure 5.3: NZ organics community health model



The NZ organic farming community had an identical health model to the US organic farming community. This is not surprising given that the underlying philosophy of the organic farming movement crosses international borders.

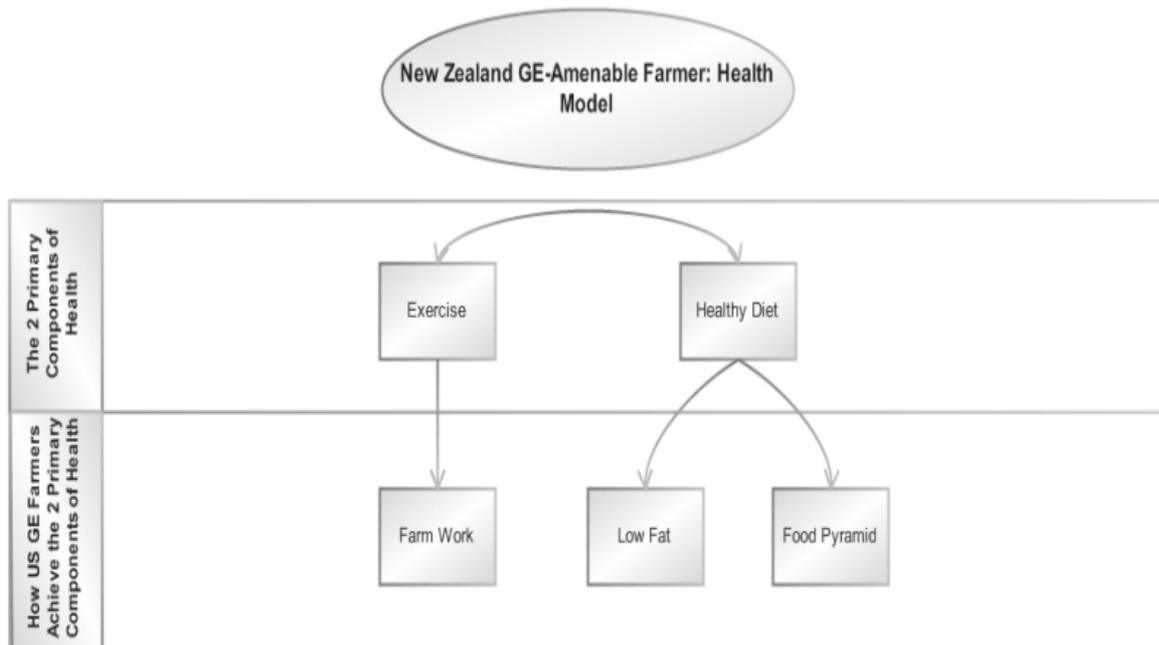
Compared to NZ consumers, the NZ organic farming community had a much more detailed model of what was needed to achieve health. Similar to NZ consumers, consensus analysis (Appendix 21) suggests that the NZ organic community believed health to be derived from three schematic components: mental well-being, exercise, and a diet of healthy food, however, what was needed to achieve these three primary elements differed significantly.

Mental well-being was believed to be closely associated with exercise as well as a healthy diet and resulted from a low stress lifestyle comprised of community involvement/friendships and being in nature. For the NZ organics group, exercise was less structured as far as time and frequency compared to NZ consumers and included participating in outdoor recreational activities in addition to physical labor on the farm.

Like NZ Anti-GE respondents, respondents from the NZ organics community believed a healthy diet was based on the food pyramid and was organically grown. However, unlike Anti-GE NZ consumers, this group actively ate organic food on a daily basis. Organic food is pesticide free, and pesticides are a major concern for the NZ organics community as indicated by the “Threats to Health” rank order. The results show the organics community to be significantly more concerned about chemicals in/on food threatening health than NZ GE farmers (0.007) (Appendix 10).

The NZ organics community had similar feelings about nature and spirituality and their connection to health as were highlighted during the discussion of the US organic community’s health model.

Figure 5.4: NZ GE-amenable farming community health model



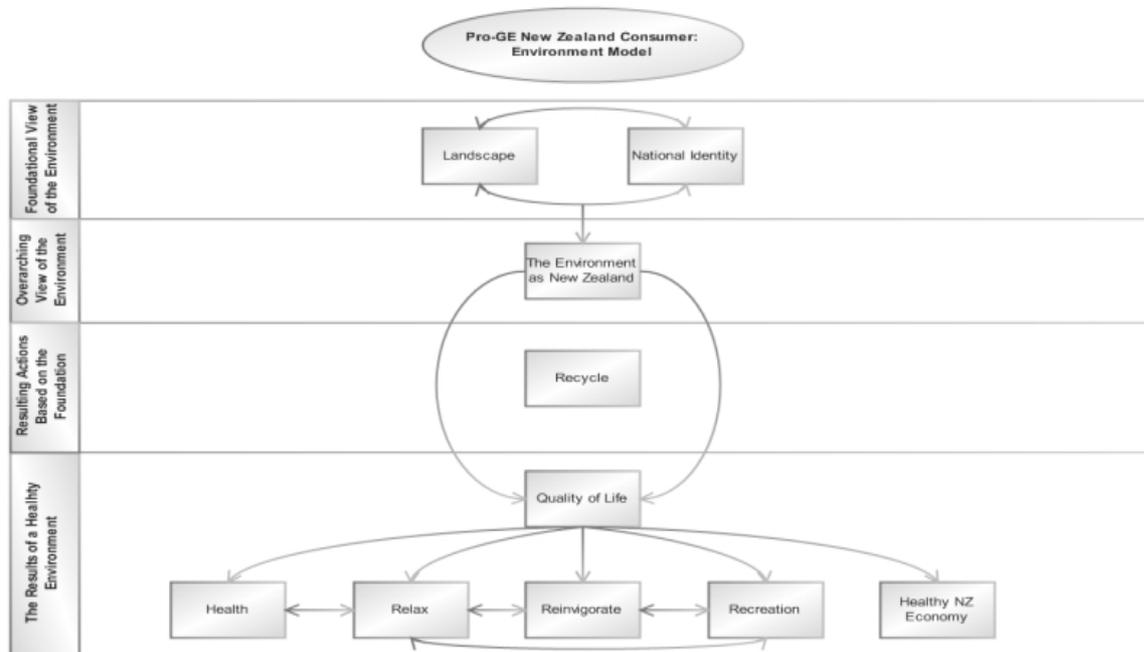
NZ GE amenable farmers had only two schema at the base of their health model as opposed to three for NZ consumers and organic respondents. Similar to US GE farmers, consensus analysis (Appendix 21) indicated that exercise and a healthy diet were the two primary schematic components for the health model. A healthy diet was based on food pyramid recommendations and was low in fat. Sufficient exercise was believed to come from doing farm work. One farmer commented:

“If I want to get more exercise I’ll buy a bigger tractor with another step on it” (NZ GE-Amenable 1, age 54).

Similar to US GE farmers, many NZ GE-Amenable farmer respondents were moderately perplexed by questions about what should be done to maintain health and what are characteristics of healthy food. Health is not a topic discussed frequently within that community, thus, it is not surprising that their health model was relatively simplified.

5.3 New Zealand stakeholder environment models

Figure 5.5: Pro-GE NZ consumer environment model



Compared to US consumer environment models, the environment model for pro-GE NZ consumers was considerably more integrated and developed. As previously discussed, New Zealand has an international reputation for being clean and green and part of the nation’s economy is based on tourists coming to New Zealand to see its majestic surroundings. This clean green image has shaped the country’s national identity with national identity, in turn, shaping conceptions of the environment. Semi-structured interview data reveals that New Zealanders are very proud of their nation’s scenic landscapes and consensus analysis indicates that NZ consumers were in agreement that the nation is “green” (Appendix 21). The term green was used to refer to the nation’s physically green and environmentally healthy landscape. For Pro-GE NZ consumers, the overarching view people had with respect to the environment was to see the environment as New Zealand. With a national identity based on the environment, it is not surprising that the term “environment” and the associations that follow from it are linked to conceptions of nationhood.

While this group felt a strong affinity for the environment as part of their national identity, they were not active participants in environmental conservation efforts and were involved in only one environmental conservation activity, recycling (Appendix 21).

For NZ Pro-GE consumers, a healthy environment was recognized as necessary for quality of life. It helped maintain quality of life by giving New Zealanders a place for recreation, which in turn provided them with reinvigoration and relaxation. It was also seen as directly tied to good human health by providing a source of relaxation as well as a healthy, non-toxic environment in which to live. Finally, a healthy environment meant a healthy New Zealand economy, another facet of quality of life.

Figure 5.6: Anti-GE NZ consumer environment model

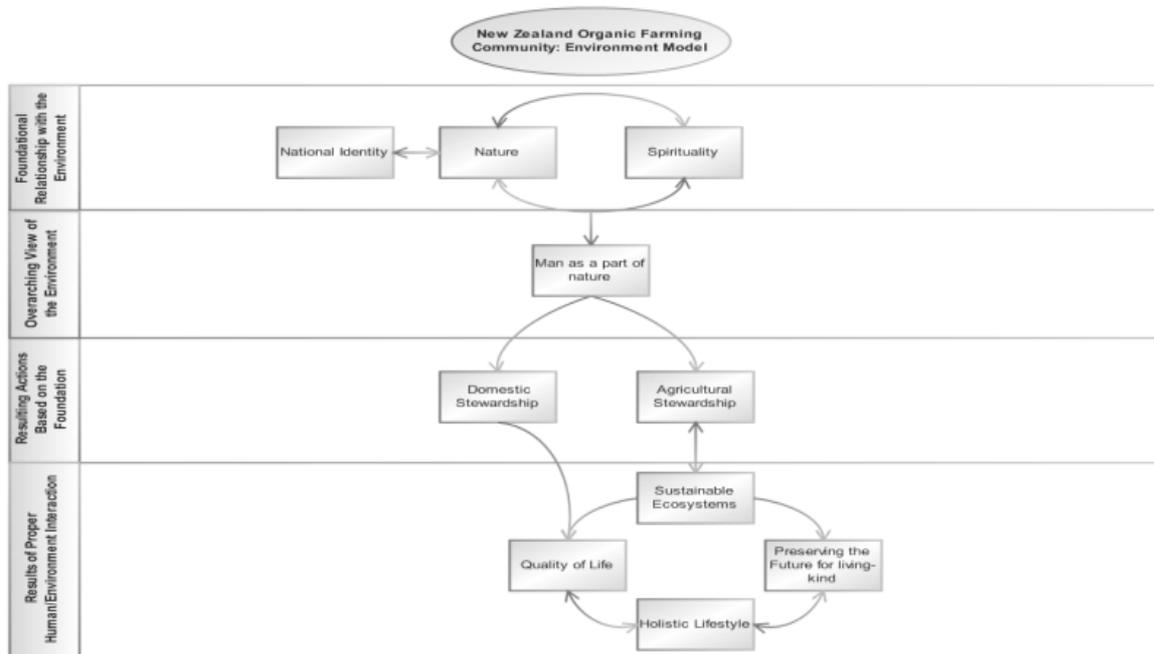


For Anti-GE NZ respondents, New Zealand national identity and notions of the environment were integrally related, with each shaping the other. Consensus analysis indicates that this group was in agreement that clean and green were appropriate adjectives to describe New Zealand (Appendix 21). As was the case for Pro-GE respondents, the overarching view of the environment was to view the environment as New Zealand.

While Anti-GE respondents felt that the nation’s environment was healthy compared to other countries, they felt New Zealand’s cleanness and greenness were functions of its low population, isolation and limited industry and not the result of New Zealanders being particularly environmental in their actions. Compared to Pro-GE consumer respondents this group was more involved in domestic stewardship activities and scored higher on the environmental knowledge assessment ($p=0.010$) (Appendix 18). Consensus analysis shows that this group recycled and composted to protect the environment and tried to consume responsibly by limiting energy and fossil fuel consumption (Appendix 21). Moreover, as was mentioned in the health model for this group, respondents preferred organic food. Their primary reason for preferring organics was due to perceived health benefits but a secondary reason was its positive benefits for the environment.

Similar to Pro-GE respondents, this group believed a healthy environment provided New Zealanders with a high quality of life. More environmentally minded, the Anti-GE respondents were also concerned with New Zealand achieving a landscape of sustainable ecosystems, as this was needed for a stable quality of life. Respondents in this group mentioned biodiversity, self-regeneration, and balance as key features of sustainable ecosystems.

Figure 5.7: NZ organic farming community environment model



The NZ organic community environment model is identical to that of the US organic community except for the addition of the national identity factor as a foundational component in the model.

As was previously discussed, the philosophy of the organics community transcends international borders, thus, it is not surprising that the organics communities in the both US and New Zealand share almost identical models of the environment.

Compared to NZ consumers, NZ organic farming community respondents had what might be characterized as a deeper relationship with the environment and thus had a much more detailed model of the environment. The environment was seen as nature and nature was a form of spirituality. Through the intertwining of nature and spirituality, respondents viewed the environment as one in which man was an integral part of nature.

As was the case with the US organics community, part of this groups perceptions of the environment include their interactions with it, as indicated by the third tier of the model. Stewardship, both at the domestic household level and at the agricultural farm level, was a key idea for these respondents. Consensus analysis (Appendix 21) shows this stakeholder group to be more involved in environmental preservation/conservation efforts on a daily basis than NZ consumers or GE-amenable farmers. With regards to domestic stewardship activities, group members recycled, composted and actively tried to consume responsibly (reduced their energy, water, and fuel usage; purchased items with limited packaging, limited consumerism behaviors).

Consensus analysis shows that farming organically was another means by which this group sought to work towards environmental health (Appendix 21). For these respondents, agricultural stewardship was synonymous with organic agriculture in which no pesticides were used on the land. The goal of the organic farming enterprise was to create a sustainable ecosystem.

Both domestic and agricultural stewardship were viewed as leading to a high quality of life, a holistic lifestyle and the preservation of the future for living-kind. A holistic lifestyle was conceived of being one in which balance is achieved in life through harmony with nature and the rejection of mainstream consumption patterns. Like the US organics community, members of the NZ organics community ranked “moral obligation to future generations” significantly higher than NZ consumers ($p=0.001$) in the “Reasons for healthy environment” rank order (Appendix 12). The group as a whole was very future oriented.

Figure 5.8: NZ GE-amenable farming community environment model



Unlike US GE farmers, Christian religious values did not play a role in how NZ GE-amenable farmers viewed the environment and there was not the same conception of dominion over the land. The religion Likert scale (Appendix 16) indicates that US GE farmers were significantly more religious than NZ GE-amenable farmers ($p=0.002$).

Instead of an environmental model based on religion, this group, like New Zealand consumers, had national identity and the idea of landscape as foundational schematic components of their model. For this group, however, national identity was not synonymous with clean and green New Zealand but rather with agricultural New Zealand. New Zealand has a long agricultural history and those interviewed felt farming was a more appropriate representational identity for the nation than clean and green.

Respondents saw the environment as both landscape and land. The terms land and landscape have different connotations for GE-amenable farmers as landscape brings to mind picturesque vistas and aesthetic qualities, all part of the New Zealand tourist package, while land brings to mind cultivation, productivity, and personal livelihood.

Similar to NZ consumers, this group viewed the environment as New Zealand and as such, they saw themselves as stewards of the land. They believed that agriculture was still the backbone of the nation and farming was a fulfillment of national ideology. By farming responsibly, they helped to keep the nation beautiful, increase New Zealand’s economic

success and ensure a future in agriculture (sustainable agriculture) both for New Zealand and themselves. With respect to agricultural sustainability, the following are representative comments:

“If you’ve got the resources and its sustainable and you’re not going to damage it you can manipulate it. To grow things you only need soil to stand a plant up in and then add fertilizer but that isn’t very sustainable. If its not sustainable it will affect you and it will crash down overnight.” *NZ GE-Amenable Farmer 1, age 54.*

“Farmers are the biggest environmentalists because if we get it wrong it affects us directly in our back pocket. I’m fully aware of what I’m dealing with. I live and work with the land and make decisions about what it is doing at a given time. I change my way of farming to suit what the environment needs” *NZ GE-Amenable Farmer 1, age 54.*

“A healthy environment is sustainable. It’s not deteriorating. Some of them are highly modified but still healthy. I want to hand over my farm in better condition than I took it over in - this needs to be done for the whole of the environment.” *NZ GE-Amenable Farmer 2, age 61.*

5.4 New Zealand stakeholder GE models

Figure 5.9: Pro-GE NZ consumer GE model



Similar to Pro-GE US consumers, Pro-GE NZ consumer perceptions of genetic engineering in agriculture were rooted in a strong faith in science. Compared to GE opposed NZ consumers, pro-GE NZ consumers were significantly more likely to trust scientists ($p=0.001$) as indicated on the Likert Trust Scale (Appendix 21). The following are a few respondent comments regarding trust and GE technology:

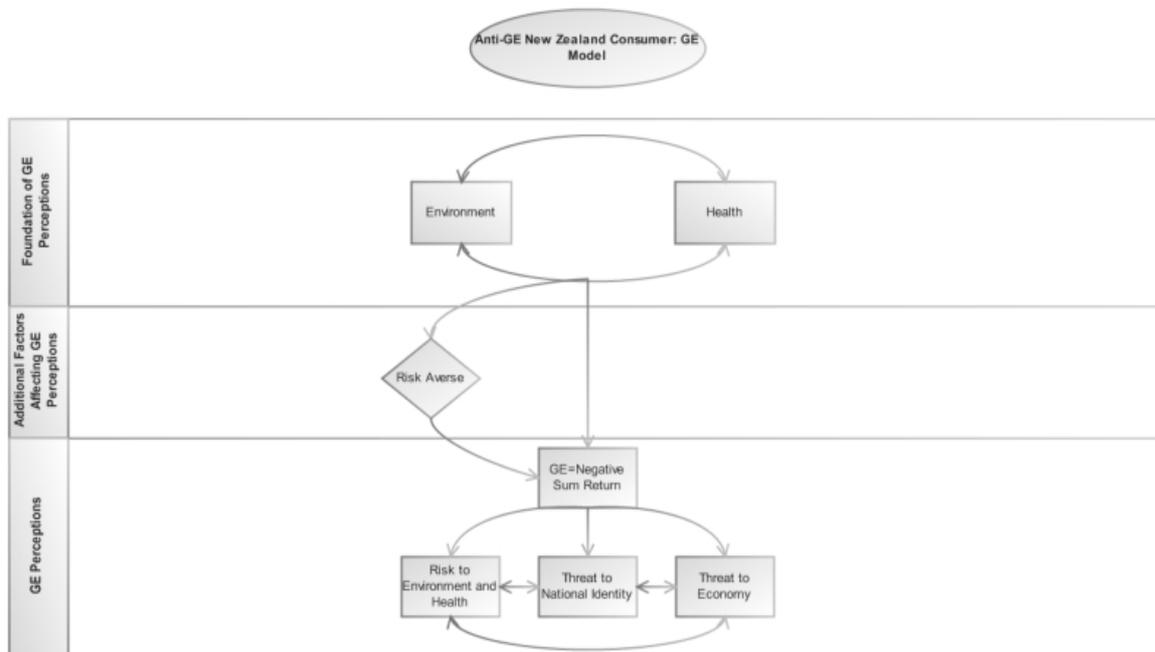
“I’m concerned enough about the technology to look into it, to investigate its dangers but I assume the people behind it, the scientists, can be trusted” *NZ Consumer 6, age 27.*

“I love science, its how the world works...GE isn't unnatural, we've been doing it for years in the form of grafting and cross-breeding. *NZ Consumer 3, age 24.*

In addition to this group's faith in science, respondents tended to be both more accepting of risk and less likely to see GE as a significant risk. Pro-GE respondents were prone to take risks as indicated by the risk scenario exercises (Appendix 8). The exercises suggest that Pro-GE consumers are more willing to risk the environment (p=0.043), native species (p=0.034), and food allergenicity (p=0.009) in order to receive discount food prices than are Anti-GE respondents (Appendix 21). Moreover, according to the Health Threats rank order exercise, Pro-GE respondents saw GE as being significantly less threatening to health than did consumer respondents opposed to GE (p=0.025) (Appendix 10). Compared to Anti-GE respondents, this group also felt GE risks such as creation of viruses (p=0.041), food toxicity (p=0.031), decreased crop genetic diversity (p=0.002), gene transfer (p=0.004), negative alterations in nutritional quality (p=0.006), lack of food labeling (p=0.031) and the introduction of allergens into food (p=0.001) were less likely to occur (Appendix 15).

Overall, Pro-GE NZ consumer respondents felt the technology was worth the minimal risks it posed as it could offer consumers better products in the form of food that was more nutritive, better looking, and more tasteful and it could help feed the world by increasing shelf life and expanding production. It should be noted that while supportive of GE technology, in general, a number of respondents within this group were not supportive of its use in New Zealand. Even though they believed the technology was safe and worth the risk in world agriculture, they felt the current negative climate towards GE in parts of the world made GE to big of a risk for New Zealand to become irrevocably involved with the technology.

Figure 5.10: Anti-GE NZ consumers GE model



Anti-GE NZ consumer respondent's perceptions of GE were rooted in their models of health and the environment. Rank order results suggest that anti-GE NZ consumers viewed GE technology as being a greater threat to health than did Pro-GE NZ consumers, as mentioned previously (p=0.025)(Appendix 10). Respondents in this group preferred organic foods as they were considered more natural and as a result of being natural, more healthy. GE was

seen as unnatural. The following are a few representative comments made by members in this stakeholder group regarding naturalness and GE:

“GE would affect my life because I wouldn’t feel natural or healthy, it would stress me out” *NZ consumer 2, age 21.*

“I don’t want GE to happen it’s like fundamentally wrong, unnatural. If it happens I want to know about it for sure” *NZ consumer 5, age 27.*

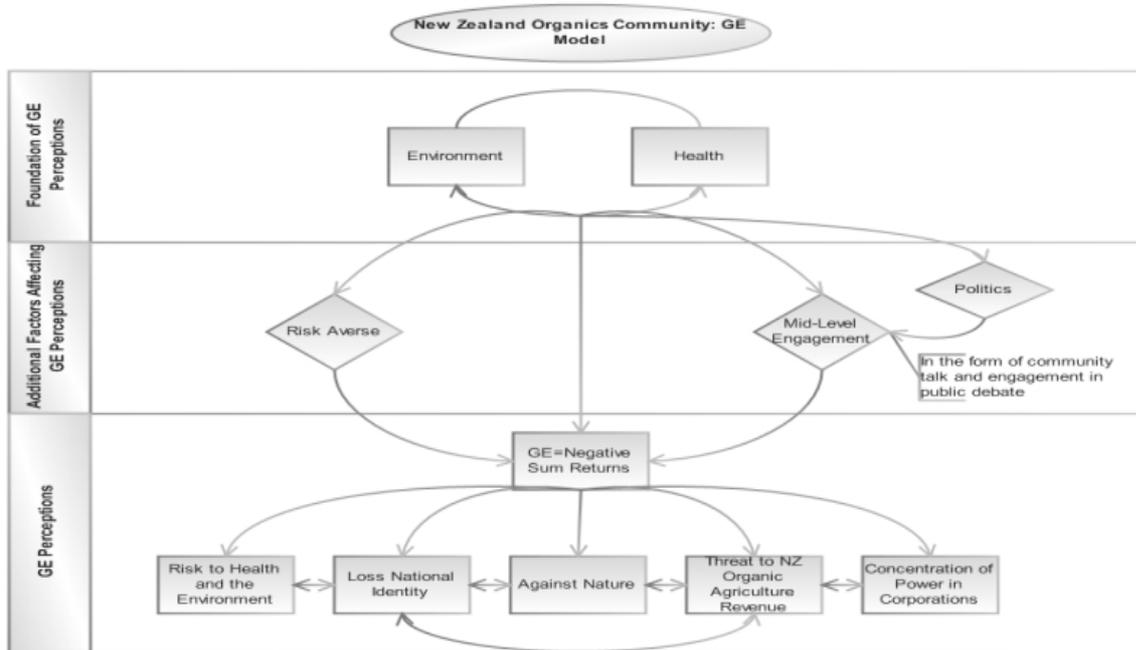
“GE is just messing with the natural” *NZ consumer 8, age 34.*

“GE is unnatural because it’s not a process that would happen without human interference, it being unnatural is one of the fundamental issues I have with it” *NZ consumer 10, age 40.*

There was not a statistically significant difference between Pro and Anti-GE NZ consumers with respect to how they ranked GE as an environmental threat in the “Threats to Environment” rank order. Both groups saw GE as a potentially serious threat to the environment and to New Zealand’s clean and green image. By threatening environmental health, GE was seen as a threat to both national identity and the economy. The “Threats to Environment” rank order indicates that, compared to US consumer respondents, NZ consumers saw GE as significantly more threatening to the environment ($p=0.011$)(Appendix 11).

Although both consumer groups saw GE as a potential environmental threat, Anti-GE consumers were averse to taking risks while Pro-GE consumers were more risk prone. As previously discussed, the risk scenario exercises suggest that anti-GE consumers are less willing to risk the environment ($p=0.043$), native species ($p=0.034$), and food allergenicity ($p=0.009$) in order to receive discount food prices than are Pro-GE respondents (Appendix 19). Furthermore, this respondent group felt that a number of GE health and environment risks were more likely to occur than their Pro-GE counterparts. Those risks included creation of viruses ($p=0.041$), food toxicity ($p=0.031$), decreased crop genetic diversity ($p=0.002$), gene transfer ($p=0.004$), negative alterations in nutritional quality ($p=0.006$), lack of food labeling ($p=0.031$) and the introduction of allergens into food ($p=0.001$) were less likely to occur (Appendix 15).

Figure 5.11: NZ organics community GE model



As was the case for US organic respondents, NZ organic respondent's perceptions of GE are rooted in the circular interconnection of their models of environment and health. As indicated by the models in sections 5.1 and 5.2, respondents have a spiritual relationship with nature and hold the view that environmental health and personal health are strongly interlinked. This group's perceptions of GE as a threat to both the environment and health led them to be quite active politically. All the respondents from the NZ organics community were members of the NZ Green Party, a party known for its activism on behalf of the environment.

This group was not as actively engaged in the GE debate as their US counterparts with what could be characterized as a mid-level of engagement. The group was more likely to talk about GE than NZ consumers but less likely to talk about it than GE amenable farmers ($p=0.001$ and $p=0.010$ respectively) (Appendix 17). Compared to US organic respondents, they were less likely to seek out knowledge regarding GE via the media ($p=0.024$).

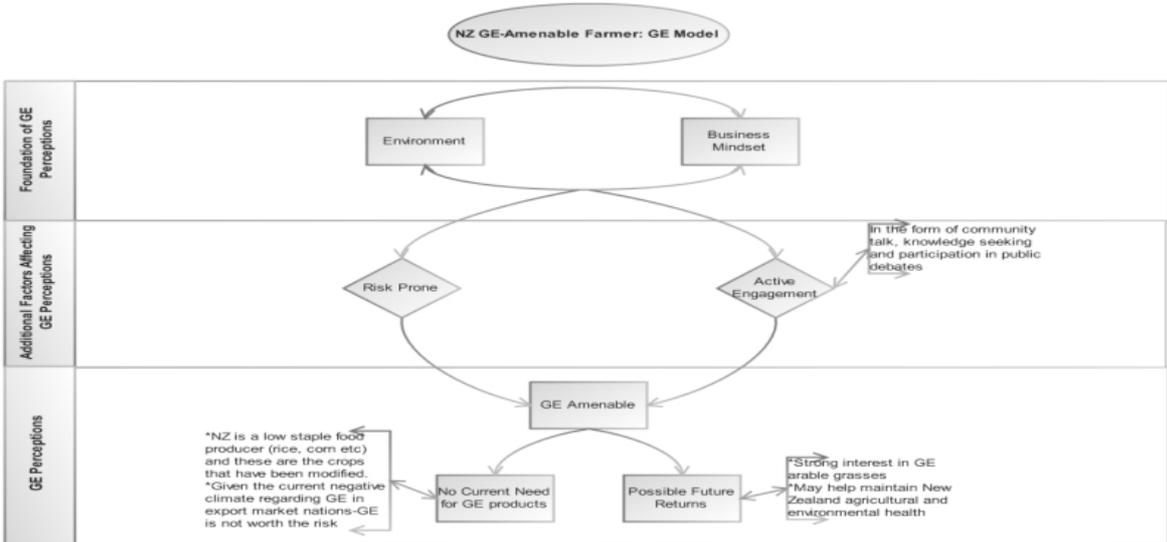
The NZ organics community has a high level of risk aversion with respect to the environment and health. The economic risk scenario tests suggest that the community is significantly less willing to risk either health or the environment in return for increased crop yields compared to members of the GE amenable community ($p=0.009$ and $p=0.000$ respectively) (Appendix 19). GE is potentially risky for both health and the environment, thus, it is not surprising that the organics community is averse to its application in farming. NZ organics respondents ranked GE as significantly more threatening to health ($p=0.018$ and $p=0.001$) (Appendix 10) and the environment ($p=0.001$ and $p=0.017$) than both NZ consumers and GE amenable farmers, respectively (Appendix 11).

In addition to the community's risk aversion with respect to health and the environment, respondents viewed many of the risks posed by GE as being more likely to come to fruition than did NZ consumers or GE amenable farmers. Compared to NZ consumers, members of the NZ organics community saw the following risks of GE as being significantly more likely to happen: human antibiotic resistance ($p=0.018$), loss of crop diversity ($p=0.039$), limited access to GE crop varieties ($p=0.021$) (Appendix 15). Similarly, compared to NZ GE

amenable farmers, members of the NZ organic farming community saw the following risks as being significantly more likely to happen: human antibiotic resistance (p=0.004), creation of new viruses (p=0.007), loss of crop diversity (p=0.002), gene transfer to wild varieties of plants (p=0.002), toxicity from GE foods (p=0.003), negative alterations in nutritional quality (p=0.004), a lack of labeling of GE ingredients in food (p=0.004), and increased risk of food allergens (p=0.002) (Appendix 15).

The NZ organics community’s foundational models of health and the environment, coupled with their general risk aversion leads to a view of GE as being a negative sum return for New Zealand. The technology is against the group’s conception of nature, concentrates power in the hands of mega-corporations, risks health and the environment, risks the economic enterprise of organic farming in New Zealand and endangers the nation’s national identity. With respect to endangering the nation’s organic farming industry, respondents were concerned that crops would become contaminated by GE pollen. Contamination would result in lost revenue as farmers could no longer demand organic price premiums for their products.

Figure 5.12: NZ GE-amenable farming community GE model



Research indicates that respondent views on the environment, coupled with a business mindset, lay the foundation for how NZ GE amenable farmers view GE technology.

GE amenable farmers approach farming with a business mind-set as opposed to the spiritual mindset pervasive among the organic farming community. For them, the environment is not nature, as it is for organically minded individuals, it is land and landscape. They enjoy being outdoors but they do not have a spiritual connection to the land. Their farm is a business and an economic bottom line. By being successful farmers, they feel that they are helping to maintain New Zealand national ideology. They considered that ideology to be, not clean green New Zealand, but agricultural New Zealand - a landscape dotted with rolling agricultural fields. The following are a few representative comments:

“We are an agricultural nation and depend on agricultural products but urban people can’t get their heads around it. New Zealand’s agricultural base brings consumer goods into the country but the urban people think New Zealand would be better without farmers, they see farmers as polluters not producers.” *NZ GE-Amenable Farmer 1, age 54.*

“New Zealand is a food basket, it’s what we do. We export food to the world. 12 percent of New Zealand’s workforce is involved in just dairy farming. We help feed the world. Agriculture has made New Zealand green and scenic, all the rolling green farm fields” *NZ GE-Amenable Farmer 3, age 58.*

The business orientation of GE amenable farmers influenced their willingness to take risks with both health and the environment. The risk scenario exercises, indicate that GE amenable farmers were significantly more willing to risk human health and the environment for a benefit of improved crop yields ($p=0.009$ and $p=0.000$ respectively) (Appendix 19) than were organic farmers. Comments include:

“Man will always have an influence on the environment. If we need to knock over bush to grow more food, we’ll do it. It’s what we do...we have to recognize the constraints to staying alive...the environment may become degraded to do this” *NZ GE-Amenable 3, age 58.*

“The environment should be below economic and social viability in importance. Environmental regulations and the RMA are too restrictive” *NZ GE-Amenable 4, age 41.*

In addition to being risk prone, GE amenable farmers were also less likely to see GE as risky. As indicated during the discussion of the organic community GE model, GE amenable farmers, compared to the organic community, viewed GE crops and food as being significantly less risky with respect to: human antibiotic resistance ($p=0.004$), creation of new viruses ($p=0.007$), loss of crop diversity ($p=0.002$), gene transfer to wild varieties of plants ($p=0.002$), toxicity from GE foods ($p=0.003$), negative alterations in nutritional quality ($p=0.004$), a lack of labeling of GE ingredients in food ($p=0.004$), and increased risk of food allergens ($p=0.002$). Similarly, GE amenable farmers, compared to NZ consumers, found GE to be less risky with respect to: human antibiotic resistance ($p=0.043$), creation of new viruses ($p=0.026$), gene transfer to wild varieties of plants ($p=0.007$), negative alterations in the nutritional quality of food ($p=0.021$), a lack of labeling of GE ingredients in food ($p=0.012$), and increased risk of food allergens ($p=0.003$).

The desire to have the opportunity to use GE products as part of their business, leads GE amenable farmers to be actively engaged in the GE debate. The engagement Likert scales indicate that they were significantly more likely than NZ consumers and the NZ organics community to have talked about GE ($p=0.001$ and $p=0.035$ respectively) (Appendix 17) with the main focus being potential benefits GE might have for agriculture in New Zealand.

Overall, GE amenable farmers perceived genetic engineering technology as a technology that has future potential but also one that is not needed currently. Respondents felt there was little current need for the technology as it is presently most common in staple food crops like corn, soy and rice; crops New Zealand does not produce in large quantities. Moreover, the technology is not widely accepted throughout the world and many key New Zealand export markets do not want GE food at this time. Respondents do want the ability to use GE technology in the future should agricultural seed varieties be developed that suit New Zealand agriculture and should key export markets become more amenable to the technology.

They are proud of the nation’s reputation as an early adopter of technology and do not want to be left behind. A few representative comments follow:

“New Zealand agriculture has been so competitive because we pick up new science technology so fast and understand how it works and we adapt the technology to us” *NZ GE Amenable Farmer 1, age 54.*

“Technology, it’s what farmers do. Farmers in New Zealand have a quick uptake of new farming ideas and systems” *NZ GE-Amenable 3, age 58.*

“I can’t see the benefit of releasing it into New Zealand now. It would jeopardize our image for not much return. When the technology has moved to the next stage, when its widely accepted round the world, New Zealand will follow suit and may lead in the technology” *NZ GE-Amenable 4, age 41.*

“I want GE to be a future option so we can stay sustainable” *NZ GE-Amenable 6, age 31.*

Chapter 6

Discussion and Conclusion

6.1 Introduction

The primary purpose of this chapter is to discuss key stakeholder differences intra- and inter-culturally, with respect to perceptions of health, environment, and GE technology.

6.2 Discussion of health models

Comparatively, members of the organics communities in the US and NZ had by far the most comprehensive model of health. Notions of health are important components of organic farming philosophy and are strongly tied to notions of environmental health and spirituality. For members of the organic farming community, health was synonymous with being out in nature and eating food that was grown in harmony with nature i.e., organic and whole foods. In other words, nature fed the mind, body and soul. Topics regarding personal and environmental health were talked about frequently within the community and were at the forefront of people's minds on a daily basis.

By contrast, members of the GE farming and GE amenable farming communities had a much more truncated model of health as personal health was not something members of this community often thought about. Their models of health were based on only two schema components (exercise and a healthy diet) while other stakeholder groups had models based on three components (exercise, healthy diet, mental well-being/regular medical check-ups). In addition to their health models having only two schema components as opposed to three, the contents of the schemas were more simplified. For example, the healthy diet schema employed by US GE farmers consisted of only two components: low fat food and lots of vegetables. By contrast, the healthy diet schema used by members of the US organics community included three components, with each of those components comprised of comparatively deeper sub-components. For example, the "organic food" component in their model stands for food that was grown in a sustainable fashion without pesticides and damage to nature whereas the "vegetable and low fat" components of the GE farmer schema lack further subcomponents.

With respect to complexity, US and NZ consumer health models fell in between those of the organics and GE farming communities. Respondents had health models based on three components like that of the organics community but their models of health lack a spiritual tie to nature. Consumer models of health very much mirror what is touted by medical health practitioners as necessary for health (i.e., a low stress lifestyle with exercise three to five times a week for 30 minutes and a healthy diet). Comparing Pro and Anti-GE consumers, the main difference in the health models was with respect to the "healthy diet" schema. Anti-GE consumers had a strong concern about chemicals like pesticides in and on food. Due to their concern about chemical contamination, respondents often mentioned organic food as something they occasionally purchased. Anti-GE NZ consumers had a strong interest in organic food as a healthy alternative to conventionally farmed foods. US Anti-GE consumers were more undecided with respect to their feelings towards organic food but were open to learning more about its health benefits. Neither group was prepared to routinely pay high prices to eat organic on a daily basis.

Overall, the main variability in stakeholder health models occurred intra-culturally with only minor variations occurring between US and NZ stakeholders.

6.3 Discussion of environment models

The US and NZ organics communities had a more comprehensive and intricate environment model than did consumers and members of the GE community in each country. The two environment models were identical except for the addition of a national identity component in the NZ model. National identity played a key role in how all NZ stakeholders viewed the environment as NZ has historically had a national identity based on the beauty of its landscapes. As previously discussed, notions of nature were intimately tied to spirituality for those within the organics community and man was seen as an integral component of nature – humankind did not stand above nature but was instead seen as a component of it. Due to this view, community members were active stewards of the environment as they sought to achieve sustainable ecosystems. Working to achieve sustainable ecosystems was seen as a spiritual duty. Secondly, sustainable ecosystems were seen as a means of protecting New Zealand national identity.

GE and GE amenable farming communities in the US and NZ had very different environment models. There are several key differences between the two models. The main foundational elements members of each group drew upon in their environment models were quite different. Christianity played a significant role in the US model with the notion of dominion over the land being pervasive. By contrast, the NZ model had national identity as a significant shaper of how community members viewed the environment. While NZ consumers saw the nation's national identity as "clean green New Zealand", GE amenable farmers saw the national identity as being "agricultural New Zealand".

Although having different foundations, the environment model for both groups conceptualized the environment as "land", land to be tended and cultivated. This is in contrast to how members of the organics communities viewed the environment, as they conceptualized the environment as "nature". US respondents, with their conception of land dominion, felt very separate from the environment. It was seen as something one uses and manipulates to make a living. They approached farming from a very utilitarian perspective as opposed to the spiritual perspective prevalent among organic farmers. New Zealand respondents had a relationship with the environment that was less than spiritual but more than simply utilitarian. For members of this community, the land was a utilitarian means to make a living but it was also a symbol of national identity.

Both GE community groups touted agricultural stewardship as a tenet by which they live as it was believed to lead to sustainable agriculture and personal livelihood. Additionally, for the NZ community it was thought to lead to a fulfillment of national ideology and economic success.

The end goal of agricultural stewardship is very different for members of the GE and organic farming communities. The goal of agricultural stewardship for the GE communities is sustainable agriculture. The primary goal of sustainable agriculture is to ensure the farm's ability to produce economic returns into the future. By contrast, the goal for the organics communities is sustainable ecosystems and the preservation of a healthy planet into the future. Thus, the organics communities have a much more expansive goal driving their actions on behalf of the environment.

US and NZ consumer environment models differed significantly from each other and from the models employed by members of the organics and GE farming communities. US consumers had a non-integrated environment model. There were no overarching foundational views driving their perceptions of the environment with most respondents admitting that they did not often think of the environment as an entity onto itself. When respondents did think of the environment the focus tended to be on their own personal environment. Respondents abstractly recognized that environmental health was tied to personal health but respondents still remained disengaged from thinking about larger environmental issues. The larger environment was seen as an amorphous entity that was removed from their day-to-day life. In contrast, the environment was very much an integral part of daily life for both the organics and GE farming communities, spiritually for those in the organics community and economically for those in the GE community.

In contrast to the non-integrated environment model of US consumers, NZ consumer models showed more detail and interconnection. Similar to the NZ organics community, national identity was a foundational component for how members of this group thought about the environment. Clean green New Zealand was the national identity with which most respondents identified and that identity was tied into notions of the environment as a landscape. New Zealand is known internationally for its scenic landscapes so it is unsurprising that the average New Zealander associates the environment with notions of landscape. Similar to the NZ GE farming community, members of this group viewed the environment as New Zealand. The environment and its landscapes were seen as integral to New Zealand quality of life as it provided health, a place for recreation, and economic viability. Although both the consumer and GE groups saw the environment as New Zealand, their perceptions of New Zealand national identity were very different – agricultural New Zealand versus clean green New Zealand.

Overall, the environment models exhibited a lot of variability both inter and intra-culturally especially with respect to each group's conceptions of the environment – the organics communities saw the environment as nature, the US GE community saw it as land, the NZ GE amenable community saw it as land and landscape, US consumers viewed it as both an amorphous other and as their own personal environment, and NZ consumers viewed it as a landscape.

6.4 Discussion of stakeholder GE models

For many stakeholder groups, their views on the environment and health proved to be important determinants of their stance on GE technology.

For members of the organic farming communities in the US and New Zealand, GE is not congruent with their schemas of health and the environment. GE is viewed as an unholy and dangerous modification of nature, the very nature that is revered by members of this community. To modify nature in such a way is a direct affront to their spiritual ideals of living in harmony with the natural world. Furthermore, by threatening nature, GE is seen as a serious threat to human health, as environmental and human health are believed to be intimately related. Due to the high values placed upon the environment and health by members of the US and NZ organics communities, members are unwilling to accept even low levels of risk to either factor. Thus, GE technology is seen as a technology with negative returns.

GE easily fits in with the health and environment models espoused by members of the GE farming communities. Without a spiritual tie to the environment, community members can approach the environment in a more utilitarian business-oriented fashion and view it as land to be cultivated. For the US GE community, with its ties to Christian tenets of land dominion and improvement, GE is viewed as yet another technology enhancing man's control over nature and furthering land production efforts. It is seen as a technology improving upon weaknesses in the environment for the benefit of mankind. For the NZ GE amenable farming community, the technology is seen as one that could enhance New Zealand agriculture and ensure its competitiveness in world markets. By staying abreast of the latest agricultural technologies, members of this community feel that they are reaffirming agriculture as the backbone of New Zealand. Both groups are more accepting of the risks associated with GE, compared to members of the organics community, as they believe risks to be a standard part of farming and business. It should be noted that while both groups are accepting of GE technology, it is not an unequivocal acceptance for either group. The US farming community accepts the technology as it is believed to be necessary to stay in business but they have not found that the technology increases their profit margins. The NZ farming community is accepting of the technology in theory but only if the technology is applied towards crops important for NZ agriculture and if worldwide opinion of the technology changes such that the export market for GE crops is assured.

Compared to members of the organic and GE farming communities in the US and NZ, consumers had more simplified models of GE technology. The health and environment models of Pro-GE US and NZ consumers lacked any factors that would preclude acceptance of the technology. Faith in science was the primary reason for the acceptance of GE technology by Pro-GE consumers. Both groups felt that scientists were relatively unbiased regarding the safety of GE technology, and should the risks of GE come to fruition, respondents felt that scientists could adeptly handle and correct any problems that might arise. Overall, Pro-GE consumers felt the benefits of the technology outweighed the minimal risks it posed.

By contrast, the health and environment models of Anti-GE US and New Zealand respondents possessed factors that precluded acceptance of GE technology. Anti-GE consumers were very concerned with the health repercussions of chemical contaminations (pesticides, herbicides). While not the same as chemical contamination, GE technology was often associated as being similar by Anti-GE respondents. Chemicals were seen as artificial manipulators of nature as was GE technology. Thus, both groups felt the technology posed a risk to health. With respect to environment models, NZ consumers had an environment model based in notions of clean green New Zealand. By associating GE with chemical contaminations, a form of pollution, GE is seen as a direct threat to national identity and thus to the group's model of the environment. The environment model of Anti-GE US consumers was less developed than that of NZ consumers but respondents did consider GE to be more harmful to the environment than did Pro-GE US consumers. This group felt they lacked sufficient knowledge about GE. However, unlike Pro-GE US consumers whose lack of knowledge was mediated by a strong faith in science, this group's lack of knowledge caused members to want to proceed with caution with respect to GE. They did not feel that science could handle all of the risks of GE that might come to pass.

6.5 In conclusion

The perceptions and meanings of GE technology uncovered during the course of this research clearly support Hypotheses 1a and 1b, regarding inter- and intra-cultural variation in cultural

meanings invoked by GE technology. With respect to Hypothesis 1a, the research shows that New Zealanders do, by and large, ascribe more negative attributes to GE technology than do US consumers. Out of 32 NZ consumers interviewed, only 11 were in favor of the technology. Furthermore, those stakeholders open to GE technology (pro-GE consumers and GE amenable farmers) felt that either the technology was not currently needed in New Zealand (GE amenable farmers), it was currently a potential danger for New Zealand from an economic standpoint (Pro-GE NZ consumers, NZ GE amenable farmers), or that it could tarnish the nation's image (Pro-GE NZ consumers).

Intra-culturally, the meanings ascribed to GE varied widely, thus, supporting Hypothesis 1b. Members of the organics communities in each nation saw the technology as inherently risky and an affront to nature and their life philosophy of living in balance with nature. By contrast, members of the GE farming communities saw the technology as innovative and as necessary from a business perspective. US GE farmers need the technology to stay in business due to labor shortages and NZ GE amenable farmers hope to gain a competitive advantage in international markets should the technology gain increased acceptance worldwide and be applied to crops relevant to NZ agriculture. Consumers in both nations were less engaged with the GE debate compared to those in the organics and GE communities and were divided with respect to their stances on GE technology. Those consumers with a strong faith in science were more accepting of the technology while consumers highly concerned with chemicals in and on food often felt very negatively towards GE. They associated GE technology with agrichemicals, like pesticides and herbicides, and thus viewed it as a potential food pollutant.

With respect to stakeholder GE models, differences in stakeholder perceptions of health and the environment often played a significant role in determining respondent stances on GE. As predicted by Hypothesis 2a, health proved to be a key component in explaining intra-cultural variation in stances on GE. Anti-GE consumers associated the technology with chemical contamination of food, which they considered a health risk and members of the organics community associated the technology with unnaturalness and saw it as an affront to their spiritual connection with nature. By contrast, Pro-GE consumers and members of the GE farming community, while not necessarily seeing the technology as better for health, also did not see it as a threat to health.

Analysis showed respondent environment models to be an important determinant of GE stances both inter and intra-culturally as predicted by Hypothesis 2b. From an intra-cultural perspective, each group had a unique conception of the environment. For example, members of the organics community viewed the environment as nature and GE, with its manipulation of genes, was seen as unnatural. By contrast, members of the GE community viewed the environment as land used to make a living and the technology was seen as one offering improvements to the land and securing agricultural sustainability.

From an inter-cultural perspective, New Zealand's clean green national identity was often a key feature influencing respondent stances on GE technology. For example, Anti-GE NZ consumers were opposed to the technology partially because they felt GE was a direct threat to national identity. By contrast, Anti-GE US consumers do not have a national identity associated with the environment or a comprehensively conceived environment model and opposed the technology primarily because they lack knowledge about the technology and want to proceed with caution.

Overall, cognitive cultural modeling proved an effective means of representing stakeholder perceptions of GE technology. Furthermore, by modeling factors associated with the risks

and benefits of GE technology (ie. health and environment), one can gain a clearer picture of why groups both support and oppose the technology.

6.6 Application of research to public debates

Cultural modeling revealed multiple points of potential miscommunication and ideological discontinuity both inter- and intra-culturally that may impede effective communication between stakeholders regarding GE technology. Cultural modeling also revealed potential points of continuity that may serve as starting points for effective communication.

6.6.1 Intra-cultural discontinuities

From an intra-cultural perspective, the cultural models revealed six primary points of potential semantic miscommunication and ideological discontinuity.

In both the US and New Zealand, the three stakeholder groups under investigation (consumers, members of the organic farming community, members of the GE/GE amenable farming community) had very different conceptualizations of the environment. For members of the organics community in the US and NZ, the environment was viewed as nature, a spiritual entity from which they gleaned peace and strength. For GE and GE-amenable farmers, the environment was land, an economic commodity. US consumers saw the environment as either an amorphous entity outside their general experience or thought of it as their personal day-to-day environment of home, neighborhood, workplace etc. NZ consumers, on the other hand, saw the environment as part of their nation's unique national identity. The term environment means very different things to each of these stakeholder groups but is a very commonly used term bandied around when discussing the pro's and con's of GE technology. Use of the term environment could prove to be a major point of miscommunication during public debate of GE technology if the stakeholder groups involved in the process remain unaware of what that term means to others involved in the debate.

Notions of health are likely to cause miscommunication between members of the organics communities in each nation and the other two stakeholder groups. For the organics community, health is a very integrated idea which goes well beyond federal guidelines for a healthy diet and common recommendations issued by the local physician to exercise and reduce stress. For members of the organics communities, health has mental, spiritual and physical components, which are all intimately tied to their conceptions of being in nature. GE is viewed by the organics community as a direct affront to the mental, spiritual and physical components of health. It threatens environmental health, a source of spiritual and mental well-being as well as physical recreation, and it threatens the integrity of food, a source of physical well-being. GE and GE-amenable farmers and Pro-GE consumers have a narrower view of health by comparison and are unlikely to understand this group's vehement opposition to GE on the grounds of health. For GE and GE-amenable farmers and Pro-GE consumers, GE would only be a threat to health if the foods produced via GE methods were unsafe. These groups do not recognize how GE could be seen as a health threat on a multitude of fronts—spiritual, mental and physical. They instead believe that if scientists and government agencies have confirmed GE food to be safe then it is safe.

A potential point of miscommunication between US GE farmers and the US organics community has to do with religion and notions of spirituality. Religion and spirituality are central ideas utilized by each stakeholder group to affirm their stance regarding genetic engineering. For GE farmers, the Christian notion of improving upon the land gives them license to adopt GE, the ultimate form of improving upon nature's weaknesses.

Contrastingly, notions of religious spirituality held by the organics community form a central reason for GE opposition as GE is seen as playing with nature. As previously discussed nature serves a spiritual purpose for this community. Thus, both stakeholder groups approach GE from entirely different religious perspectives with each group's religious perspective serving to support their stance towards GE.

Finally, a point of potential miscommunication between members of the GE and organics communities in each country arises from the idea of agricultural stewardship. Both groups used the term agricultural stewardship to describe their motto on proper farming practices. However, that term meant very different things to each stakeholder group. For members of the organics community, agricultural stewardship is synonymous with achieving sustainable ecosystems. By contrast, for members of the GE farming community, agricultural stewardship is commensurate with sustainable agriculture. Members of the organics community have a much more expansive view of what sustainable agriculture entails. For them, it is a means to preserve an ecosystem in perpetuity as opposed to the preservation of only agricultural farmland. The difference in scale of sustainability denoted by the term agricultural stewardship for these two stakeholder groups would likely cause miscommunication during public debate should the term be utilized by participants.

6.6.2 Intra-cultural continuities

In order for public debate to be fruitful, identification of points of common ground between stakeholder groups can be particularly helpful. Points of common ground allow stakeholder groups to identify with each other and can create a sense of a larger community among groups with disparate values and ideas. As identified above, the GE and organics communities in the US and NZ approach ideas of health, environment and GE from very different perspectives. However, there are points of common ground between the two groups that could serve as launching points for communication during public debate regarding GE.

The cognitive cultural models reveal two points of common ground between members of the organics and GE communities. The first point of common ground shared by both communities is an orientation towards looking to the future. Both communities are concerned about being able to continue their chosen lifestyle into the future. This future orientation leads community members to want to practice agricultural stewardship. As discussed previously, agricultural stewardship means something different to each community (ie. sustainable ecosystems vs. sustainable agriculture) but the ultimate goal of agriculture stewardship is the same, community members want to preserve their lifestyle and livelihood in perpetuity. Recognition of this shared goal could prove to be a good starting point for negotiations about GE agriculture.

The second point of common ground is that both the organics and GE communities in the US and New Zealand include in their cognitive models of the environment the idea of the environment as a livelihood. The type of livelihood is very different for each group but both groups recognize that their lifestyle and livelihood is very much tied to the environment, whether the environment be conceptualized as nature or as land. Recognition of shared dependence on the environment for one's livelihood is another good starting point from which to begin public debate regarding GE agriculture.

6.6.3 An inter-cultural discontinuity

The cultural models reveal national identity to be an important point of contention between the US and New Zealand regarding GE technology. The US is one of the original innovators of GE technology and has swiftly adopted the technology into mainstream agriculture. GE fits in well with the US's long history of being a technocracy, in which technology was seen as a source of human well-being and economic prosperity (Hennen 1999). The US has a national identity based partially on technological innovation (Jasanoff 2005). New Zealand, on the other hand, lacks a technocratic history. While New Zealanders have been ready adopters of technology should a given technology suit their needs, they lack a strong history of technological innovation and have imported most of their technology from overseas (Smith 2001). Instead of a national identity based on technological innovation, New Zealand's national identity is based on being "clean green", "100% Pure" New Zealand (Coyle et al. 2003). A healthy, majestic environment is one of New Zealand's number one commodities. As depicted in the cognitive cultural models for New Zealand stakeholders, NZ national identity is strongly linked to how NZ consumers and the organics community conceptualize the environment, which is in turn linked to how they conceptualize GE.

Each nation is likely to approach a public debate on GE from the standpoint of how GE fits in with their national identity. In order for effective communication to occur between the two nations each nation must recognize and understand what GE means to the other nation's identity. What is seen as threatening to the environment and the economy in New Zealand is seen as an acceptable environmental risk and valuable for the economy in the US. As long as GE is seen as a potential threat to the environment, New Zealand is unlikely to adopt the technology as it goes against the fabric of their society.

The New Zealand government is currently pushing to add another dimension to New Zealand national identity, that of New Zealand as innovator (Coyle and Fairweather 2005, Oram 2001). If this new initiative is successful and the idea of New Zealand as innovator becomes entrenched in New Zealand culture, the people of New Zealand may become more open to GE technology. If this were to occur, participants in a public debate between the US and NZ regarding GE technology would have a common point of interest—innovation—to begin the deliberative process.

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Appendix 1

Rank Order Card Sets

1. **Threats to Health**-Respondents were asked to order cards from most serious threat to human health to least serious threat to human health.
 - a. Recreational Drug Use
 - b. Lack of Exercise
 - c. Obesity
 - d. Lack of Health Insurance
 - e. Stress
 - f. Inadequate Sleep
 - g. Environmental Pollution
 - h. Smoking
 - i. Chemicals in Food
 - j. Overpopulation
 - k. Genetically Engineered Foods
2. **Threats to the Environment**-Respondents were asked to order cards from most serious threat to the environment to least serious threat to the environment.
 - a. Global Warming
 - b. Air Pollution
 - c. Oil Drilling
 - d. Deforestation
 - e. Ozone Depletion
 - f. Development (housing and commercial)
 - g. Pesticides and Herbicides
 - h. Water Pollution
 - i. Consumerism
 - j. Over-harvesting of Animals and Fish
 - k. Overpopulation
 - l. Genetic Engineering in Agriculture
 - m. Land Pollution
3. **Reasons to Maintain a Healthy Environment**-Respondents were asked to order cards from most important reason to maintain a healthy environment to least important reason to maintain a healthy environment.
 - a. Maintenance of Food Chains
 - b. Aesthetics
 - c. Moral Obligation to Future Generations
 - d. Provides Economic Resources to Society (ex. water, timber)
 - e. Human Health
 - f. Moral Obligation to the Other Living Inhabitants of the Earth (animals, insects, plants)
4. **Benefits of Genetic Engineering in Agriculture and Food Production**-Respondents were asked to order cards from most important benefit of GE to society to least important benefit of GE to society if all the cards represented true potential benefits.
 - a. Reduced Chemical Use
 - b. Increased Crop Yield

- c. Improved Taste
 - d. Improved Nutritional Quality
 - e. Crop Defense Against Diseases and Pests
 - f. Protection of the Environment
 - g. Improved Food Shelf-Life
 - h. Production of Edible Vaccines and Drugs
 - i. Increase in Food Availability
 - j. Wealth and Job Creation
5. **Risks of Genetic Engineering in Agriculture and Food Production**-Respondents were asked to order cards from most risky for society to least risky for society if all the risks were equally likely to happen.
- a. Creation of New Viruses
 - b. Threats to Crop Genetic Diversity
 - c. Negative Alteration in the Nutritional Quality of Food
 - d. Introduced Food Toxicity
 - e. Introduction of Allergens into Food
 - f. Limited Access to Seeds through the Patenting of GE Seeds
 - g. Human Antibiotic Resistance
 - h. Lack of Labeling of GE Ingredients in Food
 - i. Unintentional Gene Transfer to Wild Plants

Appendix 2

Perceived Likelihood of GE Risks

Opponents of genetic engineering often cite the following as potential negative consequences. On a scale from 1 to 5 (1 being not at all likely to happen and 5 being very likely to happen), what do you think is the likelihood of the following consequences being caused by genetic engineering in agriculture within the next 20 years:

Human Antibiotic Resistance	1	2	3	4	5
Creation of New Viruses	1	2	3	4	5
Decrease in Crop Genetic Diversity	1	2	3	4	5
Unintentional Gene Transfer to Wild Plants	1	2	3	4	5
Toxicity in Genetically Engineered Foods	1	2	3	4	5
A negative alteration in the nutritional quality of food	1	2	3	4	5
Limited access to seeds through patenting of GM crop varieties	1	2	3	4	5
A lack of labeling of genetically engineered ingredients in food	1	2	3	4	5
Introduction of food allergens	1	2	3	4	5

Appendix 3

Ranking of Religiosity and Political Stance

On a scale of 1 to 10 (with 1 being not at all religious and 10 being very religious), how religious are you?

1 2 3 4 5 6 7 8 9 10

In political matters people talk of “the left” (liberal) and “the right” (conservative). How would you place your views on this scale? (1=extreme left, 10=extreme right).

1 2 3 4 5 6 7 8 9 10

Appendix 4

Engagement in the GE Debate

(Derived from Eurobarometer 58.0 2002)

1. Before today had you ever talked about modern genetic engineering with anyone?
Frequently Occasionally Once or twice Never

2. If you have talked with someone before about genetic engineering, can you please tell me their relationship to you (family member, friend, co-worker, stranger).

3. I would take the time to read articles or watch TV programmes on the advantages and disadvantages of development of biotechnology.
Strongly disagree Disagree Neutral/Agree Strongly agree

4. I would be prepared to take part in public discussions or hearings about genetic engineering.
Strongly disagree Disagree Neutral/Agree Strongly agree

Appendix 5

US Knowledge Test

General Science Knowledge Assessment (Taken from NSF Survey of Public Attitudes Towards and Understanding of Science and Technology, 2001)

The correct answers are in bold.

1. The center of the Earth is very hot.
A. **True**
B. False
2. Cigarette smoking is linked to lung cancer.
A. **True**
B. False
3. The earliest humans lived at the same time as the dinosaurs.
A. True
B. **False**
4. Radioactive milk can be made safe by boiling it.
A. True
B. **False**
5. Which travels faster: light or sound?
A. **Light**
B. Sound
6. Does the Earth go around the Sun, or does the Sun go around the Earth?
A. **Earth around Sun**
B. Sun around Earth
7. How long does it take for the Earth to go around the Sun or the Sun to go around the Earth?
A. one day
B. one month
C. **one year**
8. The universe began with a huge explosion.
A. **True**
B. False
9. The continents on which we live have been moving their location for millions of years and will continue to move in the future.
A. **True**
B. False
10. Antibiotics kill viruses as well as bacteria.
A. True
B. **False**
11. Human beings, as we know them today, developed from earlier species of animals.
A. **True**
B. False
12. All radioactivity is man-made.
A. True
B. **False**

13. The oxygen we breathe comes from plants.
A. True
B. False
14. Lasers work by focusing sound waves.
A. True
B. False
15. Electrons are smaller than atoms.
A. True
B. False

Genetics Knowledge Assessment (Taken from Eurobarometer 58.0, 2002)

16. There are bacteria, which survive on waste water.
A. True
B. False
17. Ordinary tomatoes do not contain genes, while genetically modified tomatoes do.
A. True
B. False
18. The cloning of living things produces genetically identical offspring.
A. True
B. False
19. By eating a genetically modified fruit, a person's genes could also become modified.
A. True
B. False
20. It is the father's genes that determine whether a child is a girl.
A. True
B. False
21. Yeast for brewing beer consists of living organisms
A. True
B. False
22. It is possible to find out in the first few months of pregnancy whether a child will have Down's Syndrome.
A. True
B. False
23. Genetically modified animals are always bigger than ordinary ones.
A. True
B. False
24. More than half of human genes are identical to those of chimpanzees.
A. True
B. False
25. It is impossible to transfer animal genes into plants
A. True
B. False

Environmental Knowledge Assessment (Taken from National Environmental Education and Training Foundation website-www.neetf.org/roper/roper2001-b.htm (date accessed September 2006))

26. There are many different kinds of animals and plants, and they live in many different types of environments. What is the word used to describe this idea? Is it...

- A. multiplicity
- B. biodiversity**
- C. socio-economics
- D. evolution
- E. don't know

27. Carbon monoxide is a major contributor to air pollution in the U.S. Which of the following is the biggest source of carbon monoxide? Is it...

- A. factories and businesses
- B. people breathing
- C. motor vehicles**
- D. trees
- E. don't know

28. How is most of the electricity in the U.S. generated? It is...

- A. by burning oil, coal, and wood**
- B. with nuclear power
- C. through solar energy
- D. at hydroelectric power plants
- E. don't know

29. What is the most common cause of pollution of streams, rivers, and oceans? Is it...

- A. dumping of garbage by cities
- B. surface water running off yards, city streets, paved lots, and farm fields**
- C. trash washed into the ocean from beaches
- D. waste dumped by factories
- E. don't know

30. Which of the following is a renewable resource? Is it...

- A. oil
- B. iron ore
- C. trees**
- D. coal
- E. don't know

31. Ozone forms a protective layer in the earth's upper atmosphere. What does ozone protect us from? Is it...
- A. acid rain
 - B. global warming
 - C. sudden changes in temperature
 - D. harmful, cancer causing sunlight**
 - E. don't know
32. Where does most of the garbage in the U.S. end up? Is it in...
- A. oceans
 - B. incinerators
 - C. recycling centers
 - D. landfills**
 - E. don't know
33. What is the name of the primary federal agency that works to protect the environment? Is it the...
- A. Environmental protection agency (EPA)**
 - B. Department of Health, Environment and Safety (the DHES)
 - C. National Environmental Agency (the NEA)
 - D. Federal Pollution Control Agency (the FPCA)
 - E. Don't know
34. Which of the following household wastes is considered hazardous waste? Is it...
- A. plastic packaging
 - B. glass
 - C. batteries**
 - D. spoiled food
 - E. don't know
35. What is the most common reason that an animal species becomes extinct? Is it because...
- A. pesticides are killing them
 - B. their habitats are being destroyed by humans**
 - C. there is too much hunting
 - D. there are climate changes that affect them
 - E. don't know
36. Scientists have not determined the best solution for disposing of nuclear waste. In the U.S., what do we do with it? Do we...
- A. use it as nuclear fuel
 - B. sell it to other countries
 - C. dump it in landfills
 - D. store and monitor the waste**
 - E. don't know

37. What is the primary benefit of wetlands? Do they...
- A. promote flooding
 - B. help clean the water before it enters lakes, streams, rivers, or oceans**
 - C. help keep the number of undesirable plants and animals low
 - D. provide good sites for landfills
 - E. don't know

Nutrition and Health Knowledge (Questions 38-40 taken from Anderson (2001), Questions 41-49 taken from Papakonstantinow et al. (2002)).

38. In which of the groups below are **ALL** the foods a rich source of carbohydrates?

- A. bread, orange juice, soft drink, spaghetti**
- B. avocado, beer, eggs, banana
- C. cheese, potato, rice, pineapple
- D. fish, dried apricots, fruit juice, peanuts

39. In which of the groups below are **ALL** the food high in fat?

- A. peanut butter, corn chips, banana, chocolate
- B. apple pie, cream, cheese, lollipops, eggs
- C. boiled potato, avocado, bacon, peanuts
- D. butter, margarine, sour cream, oil**

40. In which of the groups below are **ALL** the foods high in protein?

- A. cheese, potato, spinach, egg
- B. avocado, beef steak, skim milk, chocolate
- C. fish, shrimp, lamb, tofu**
- D. baked beans, egg whites, peas, orange juice

41. A calorie measures energy released from the body in the form of heat.

- A. True**
- B. False

42. Fats yield more energy per gram than either carbohydrates or proteins

- A. True**
- B. False

43. A product contains 15 percent saturated fat. Is this product a low, medium or high source of saturated fat?

- A. low
- B. medium**
- C. high

44. A product contains 49 percent sodium. Is this product a low, medium, or high source of sodium?
- A. low
 - B. medium
 - C. **high**
45. Which of the following nutrients poses the greatest risk for heart disease?
- A. **saturated fat**
 - B. cholesterol
 - C. total sugar
 - D. fiber
46. The nutrient that increases the risk for hypertension when consumed in excess is?
- A. vitamin A
 - B. vitamin E
 - C. **sodium**
 - D. iron
47. Which nutrient deficiency is related to osteoporosis?
- A. iron
 - B. **calcium**
 - C. vitamin C
 - D. zinc
48. Which of the following groups has the highest need for iron?
- A. elderly
 - B. men
 - C. **women**
 - D. children
49. Which nutrient described on food labels decreases constipation?
- A. fat
 - B. protein
 - C. **fiber**
 - D. vitamin C

Appendix 6

NZ Knowledge Test

General Science Knowledge (Taken from National Science Foundation Survey of Public Attitudes Towards and Understanding of Science and Technology, 2001)

The correct answers are in bold.

1. The center of the Earth is very hot.
A. **True**
B. False
2. Cigarette smoking is linked to lung cancer.
A. **True**
B. False
3. The earliest humans lived at the same time as the dinosaurs.
A. True
B. **False**
4. Radioactive milk can be made safe by boiling it.
A. True
B. **False**
5. Which travels faster: light or sound?
A. **Light**
B. Sound
6. Does the Earth go around the Sun, or does the Sun go around the Earth?
A. **Earth around Sun**
B. Sun around Earth
7. How long does it take for the Earth to go around the Sun or the Sun to go around the Earth?
A. one day
B. one month
C. **one year**
8. The universe began with a huge explosion.
A. **True**
B. False
9. The continents on which we live have been moving their location for millions of years and will continue to move in the future.
A. **True**
B. False
10. Antibiotics kill viruses as well as bacteria.
A. True
B. **False**
11. Human beings, as we know them today, developed from earlier species of animals.
A. **True**
B. False
12. All radioactivity is man-made.
A. True
B. **False**

13. The oxygen we breathe comes from plants.

A. True

B. False

14. Lasers work by focusing sound waves.

A. True

B. False

15. Electrons are smaller than atoms.

A. True

B. False

Genetics Knowledge Assessment (Taken from Eurobarometer 58.0, 2002)

16. There are bacteria which survive on waste water.

A. True

B. False

17. Ordinary tomatoes do not contain genes, while genetically modified tomatoes do.

A. True

B. False

18. The cloning of living things produces genetically identical offspring.

A. True

B. False

19. By eating a genetically modified fruit, a person's genes could also become modified.

A. True

B. False

20. It is the father's genes that determine whether a child is a girl.

A. True

B. False

21. Yeast for brewing beer consists of living organisms

A. True

B. False

22. It is possible to find out in the first few months of pregnancy whether a child will have Down's Syndrome.

A. True

B. False

23. Genetically modified animals are always bigger than ordinary ones.

A. True

B. False

24. More than half of human genes are identical to those of chimpanzees.

A. True

B. False

25. It is impossible to transfer animal genes into plants

A. True

B. False

Environmental Knowledge Assessment (Derived from National Environmental Education and Training Foundation website (modified to fit New Zealand)-www.neetf.org/roper/roper2001-b.htm (date accessed - September 2006))

26. There are many different kinds of animals and plants, and they live in many different types of environments. What is the word used to describe this idea? Is it...

- A. multiplicity
- B. biodiversity**
- C. socio-economics
- D. evolution
- E. don't know

27. Carbon monoxide is a major contributor to air pollution in New Zealand. Which of the following is the biggest source of carbon monoxide? Is it...

- A. factories and businesses
- B. people breathing
- C. motor vehicles**
- D. trees
- E. don't know

28. How is most of the electricity in New Zealand generated? It is...

- A. by burning oil, coal, and wood
- B. with nuclear power
- C. through solar energy
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29. What is the most common cause of pollution of streams, rivers, and oceans? Is it...

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31. Ozone forms a protective layer in the earth's upper atmosphere. What does ozone protect us from? Is it...
- A. acid rain
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 - C. sudden changes in temperature
 - D. harmful, cancer causing sunlight**
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- A. oceans
 - B. incinerators
 - C. recycling centers
 - D. landfills**
 - E. don't know
33. What is the name of the primary government agency that works to protect the environment? Is it the...
- A. Ministry for the Environment New Zealand**
 - B. Department of Health, Environment and Safety (the DHES)
 - C. National Environmental Agency (the NEA)
 - D. Federal Pollution Control Agency (the FPCA)
 - E. Don't know
34. Which of the following household wastes is considered hazardous waste? Is it...
- A. plastic packaging
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35. What is the most common reason that an animal species becomes extinct? Is it because...
- A. pesticides are killing them
 - B. their habitats are being destroyed by humans**
 - C. there is too much hunting
 - D. there are climate changes that affect them
 - E. don't know
36. Scientists have not determined the best solution for disposing of non-medical nuclear waste generated from nuclear power plants. In New Zealand, what do we do with it? Do we...
- A. nothing, NZ has no non-medical nuclear waste**
 - B. sell it to other countries
 - C. dump it in landfills
 - D. store and monitor the waste
 - E. don't know

37. What is the primary benefit of wetlands? Do they...
- A. promote flooding
 - B. help clean the water before it enters lakes, streams, rivers, or oceans**
 - C. help keep the number of undesirable plants and animals low
 - D. provide good sites for landfills
 - E. don't know

Nutrition and Health Knowledge Assessment (Questions 38-40 taken from Anderson (2001), Questions 41-49 taken from Papakonstinow et al. (2002)).

38. In which of the groups below are **ALL** the foods a rich source of carbohydrates?

- A. bread, orange juice, soft drink, spaghetti**
- B. avocado, beer, eggs, banana
- C. cheese, potato, rice, pineapple
- D. fish, dried apricots, fruit juice, peanuts

39. In which of the groups below are **ALL** the food high in fat?

- A. peanut butter, corn chips, banana, chocolate
- B. apple pie, cream, cheese, lollipops, eggs
- C. boiled potato, avocado, bacon, peanuts
- D. butter, margarine, sour cream, oil**

40. In which of the groups below are **ALL** the foods high in protein?

- A. cheese, potato, spinach, egg
- B. avocado, beef steak, skim milk, chocolate
- C. fish, prawns, lamb, tofu**
- D. baked beans, egg whites, peas, orange juice

41. A calorie measures energy released from the body in the form of heat.

- A. True**
- B. False

42. Fats yield more energy per gram than either carbohydrates or proteins

- A. True**
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43. A product contains 15 percent saturated fat. Is this product a low, medium or high source of saturated fat?

- A. low
- B. medium**
- C. high

44. A product contains 49 percent sodium. Is this product a low, medium, or high source of sodium?
- A. low
 - B. medium
 - C. **high**
45. Which of the following nutrients poses the greatest risk for heart disease?
- A. **saturated fat**
 - B. cholesterol
 - C. total sugar
 - D. fiber
46. The nutrient that increases the risk for hypertension when consumed in excess is?
- A. vitamin A
 - B. vitamin E
 - C. **sodium**
 - D. iron
47. Which nutrient deficiency is related to osteoporosis?
- A. iron
 - B. **calcium**
 - C. vitamin C
 - D. zinc
48. Which of the following groups has the highest need for iron?
- A. elderly
 - B. men
 - C. **women**
 - D. children
49. Which nutrient described on food labels decreases constipation?
- A. fat
 - B. protein
 - C. **fiber**
 - D. vitamin C

Appendix 7

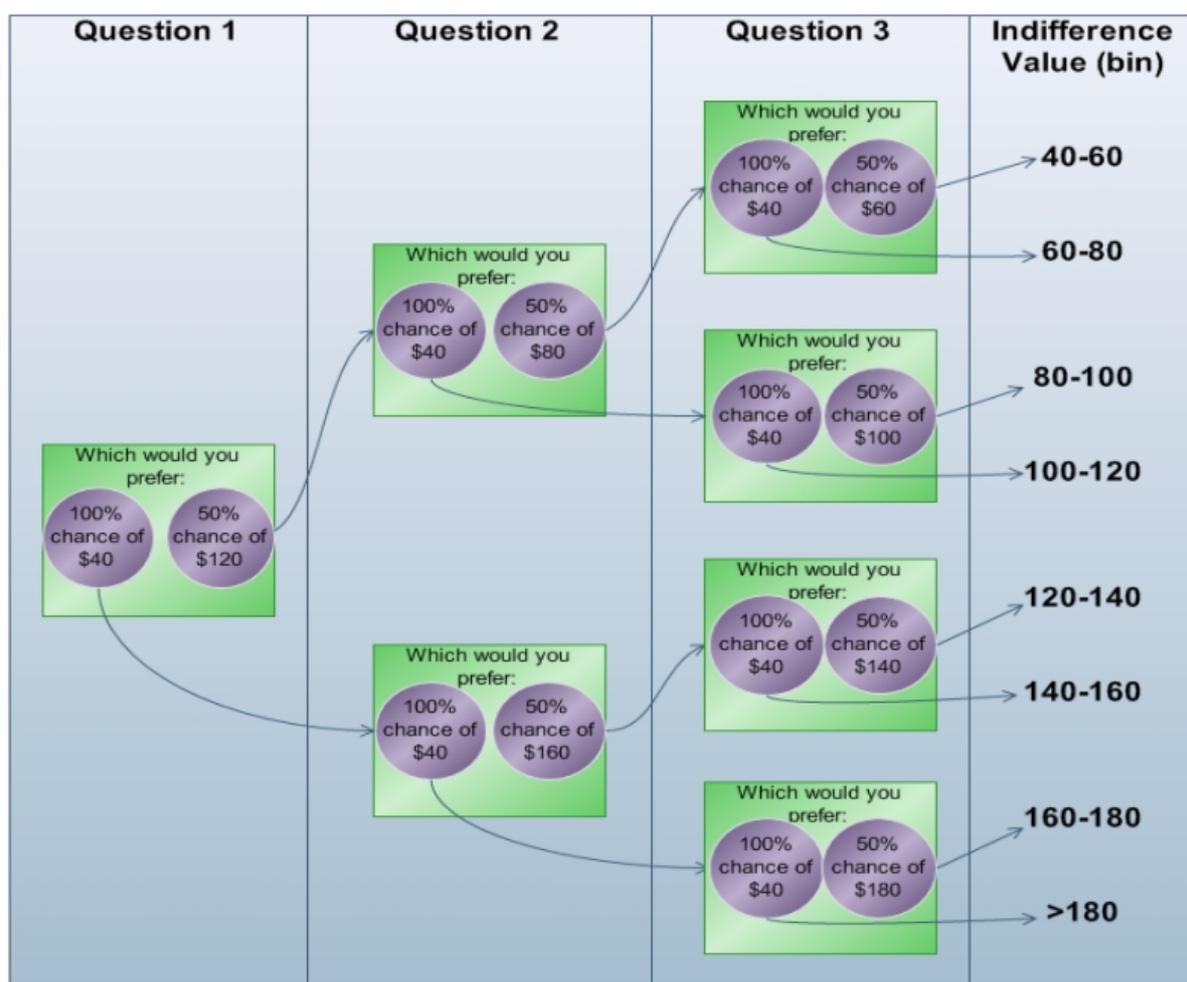
Level of Trust in Groups Involved in GE Policy Formation

Trust-Listed below are interest groups involved in the debate surrounding genetically engineered food and crop technology. For each group please indicate the degree to which you trust each group involved in the debate to act in your best interests regarding genetic engineering policy.

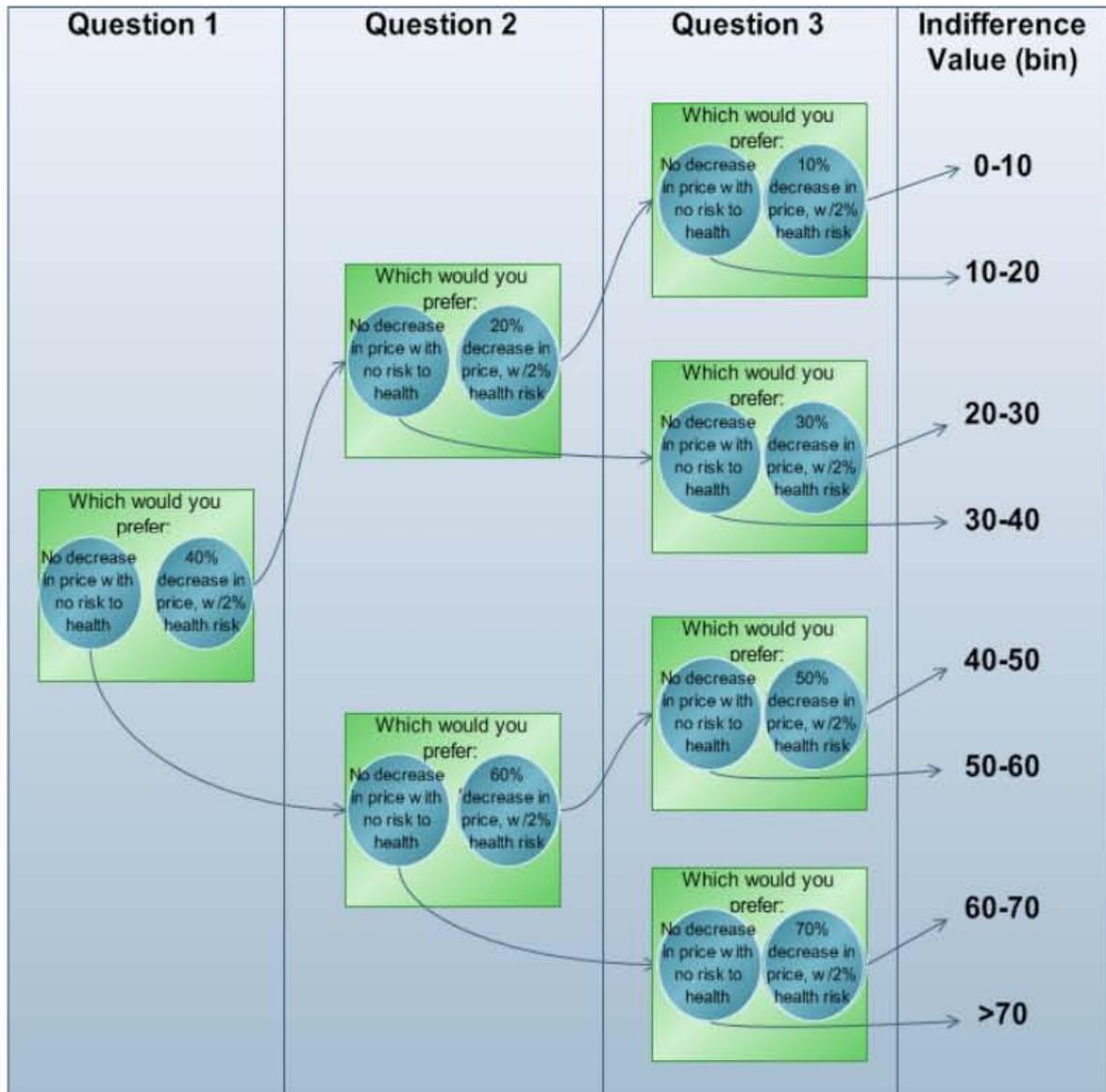
1. Industry	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
2. Medical Doctors	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
3. Ethics Committees	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
4. Consumer Organizations	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
5. The Church	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
6. Newspapers and Magazines	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
7. Farmers	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
8. Government	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
9. Environmental Groups	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
10. Grocery Stores	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
11. Scientists	Strongly distrust	Distrust	Neutral	Trust	Strongly trust
12. Individual Citizens	Strongly distrust	Distrust	Neutral	Trust	Strongly trust

Appendix 8 Risk Scenarios

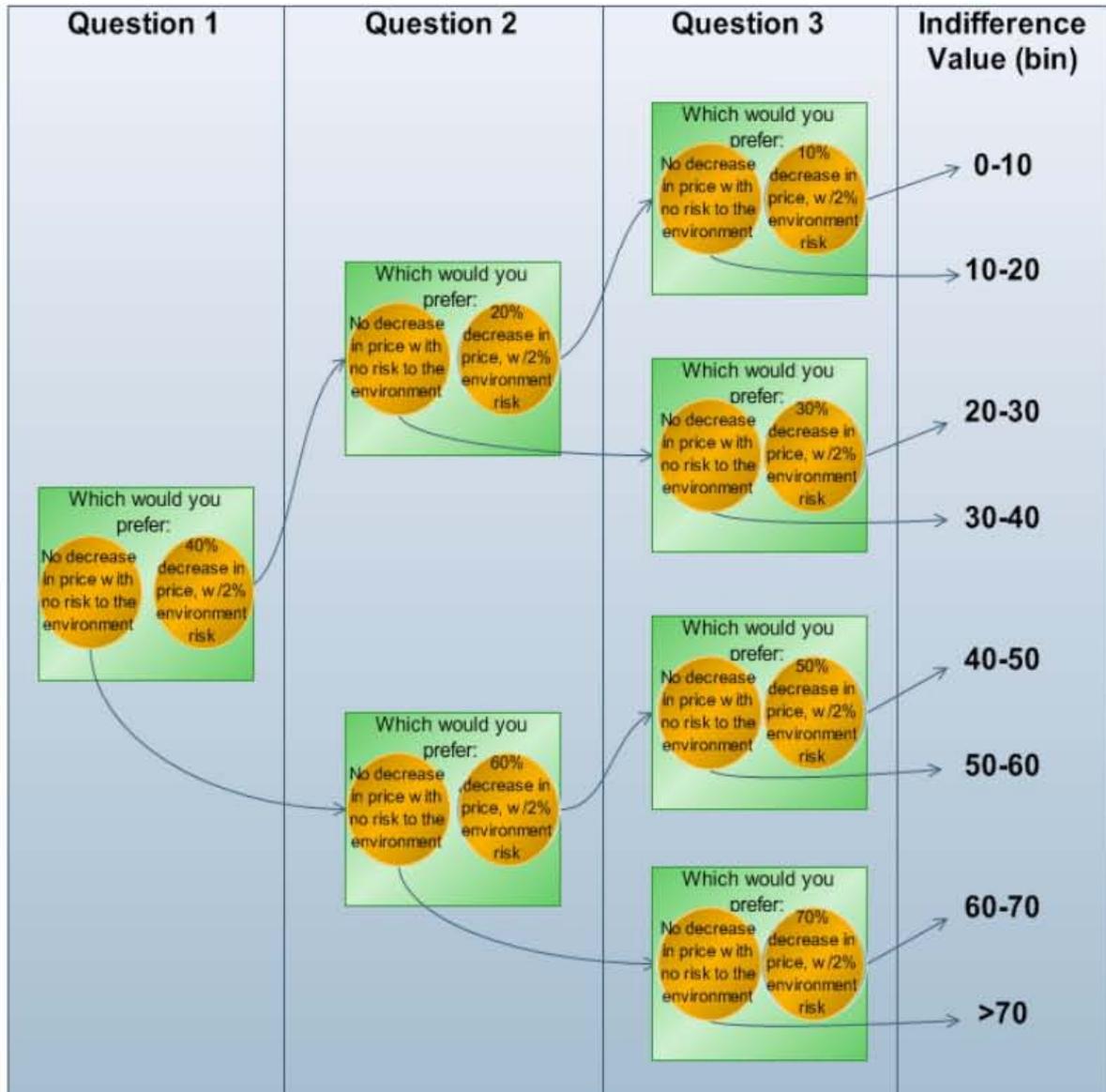
General Risk Scenario-Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of monetary values for which respondents would be indifferent choosing between an assured monetary return of \$40 or a 50 percent chance of increasing their monetary return by at least one half - or losing it all.



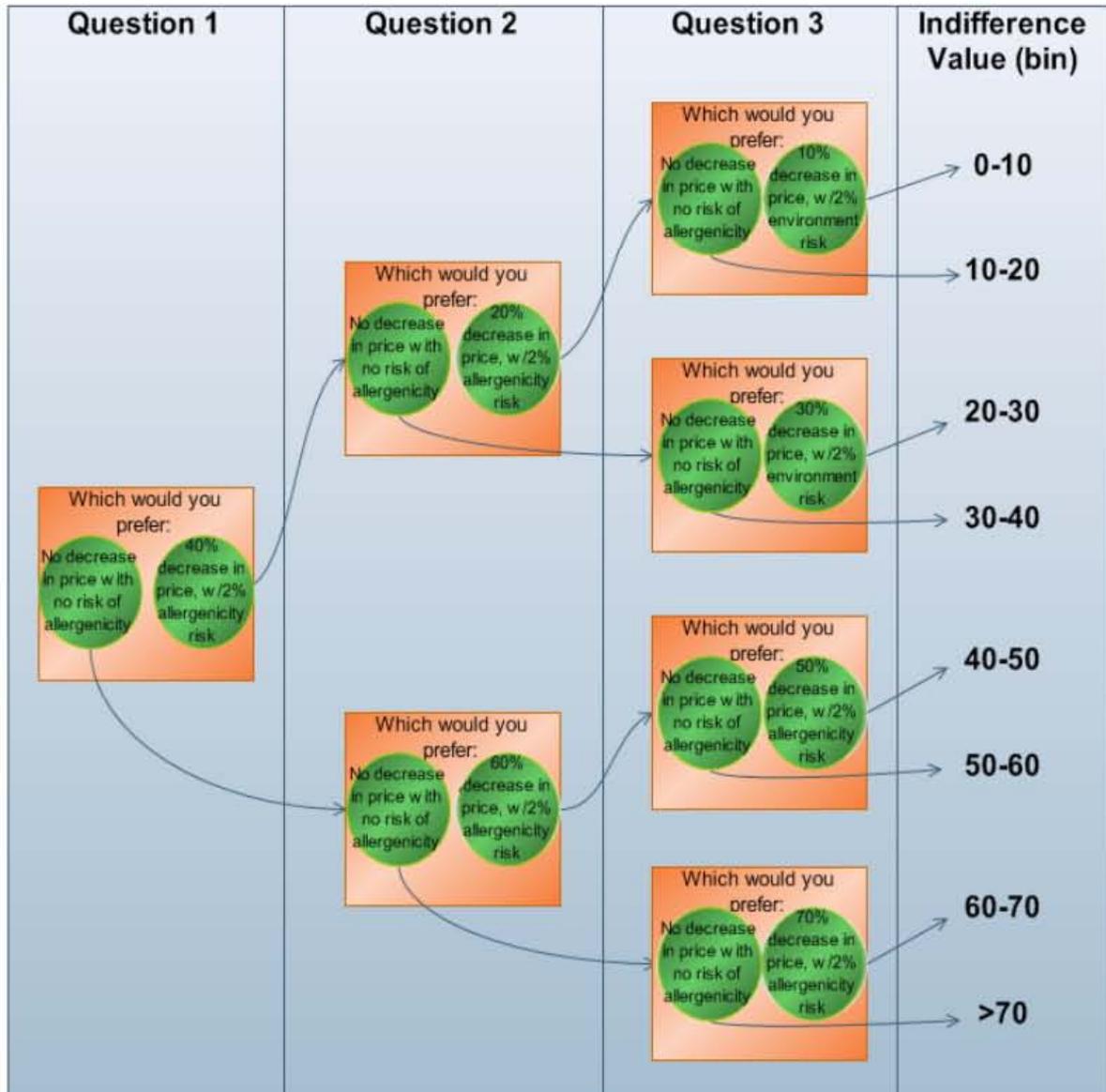
Benefits Willing to Forego for No Risk to Health- Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of price discounts for which respondents would be indifferent choosing between no price discount and no risk to health and discounted food that poses a two percent risk to health.



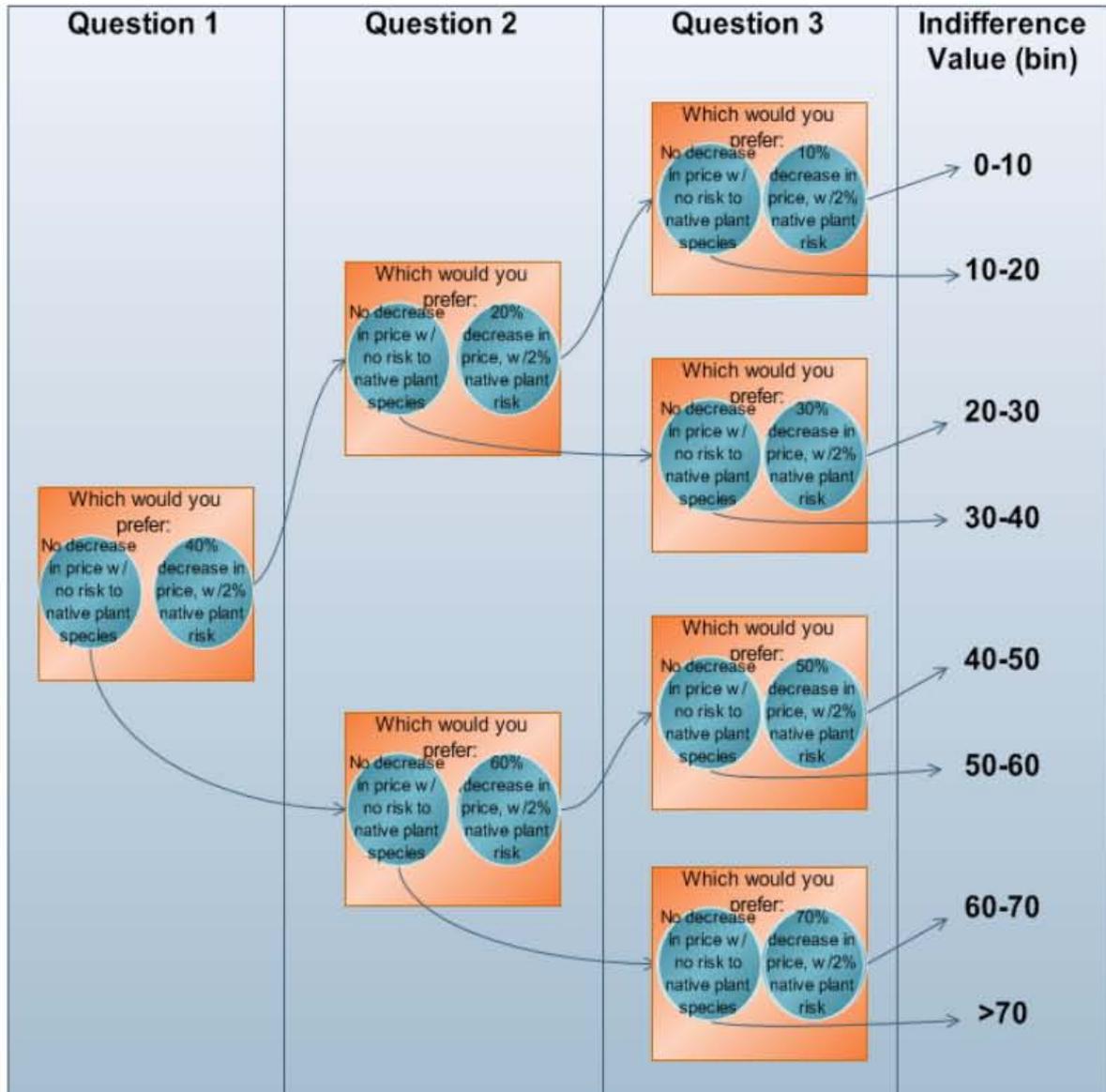
Benefits Willing to Forego for No Risk to the Environment-Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of price discounts for which respondents would be indifferent choosing between no price discount and no risk or discounted prices with a two percent risk to the environment.



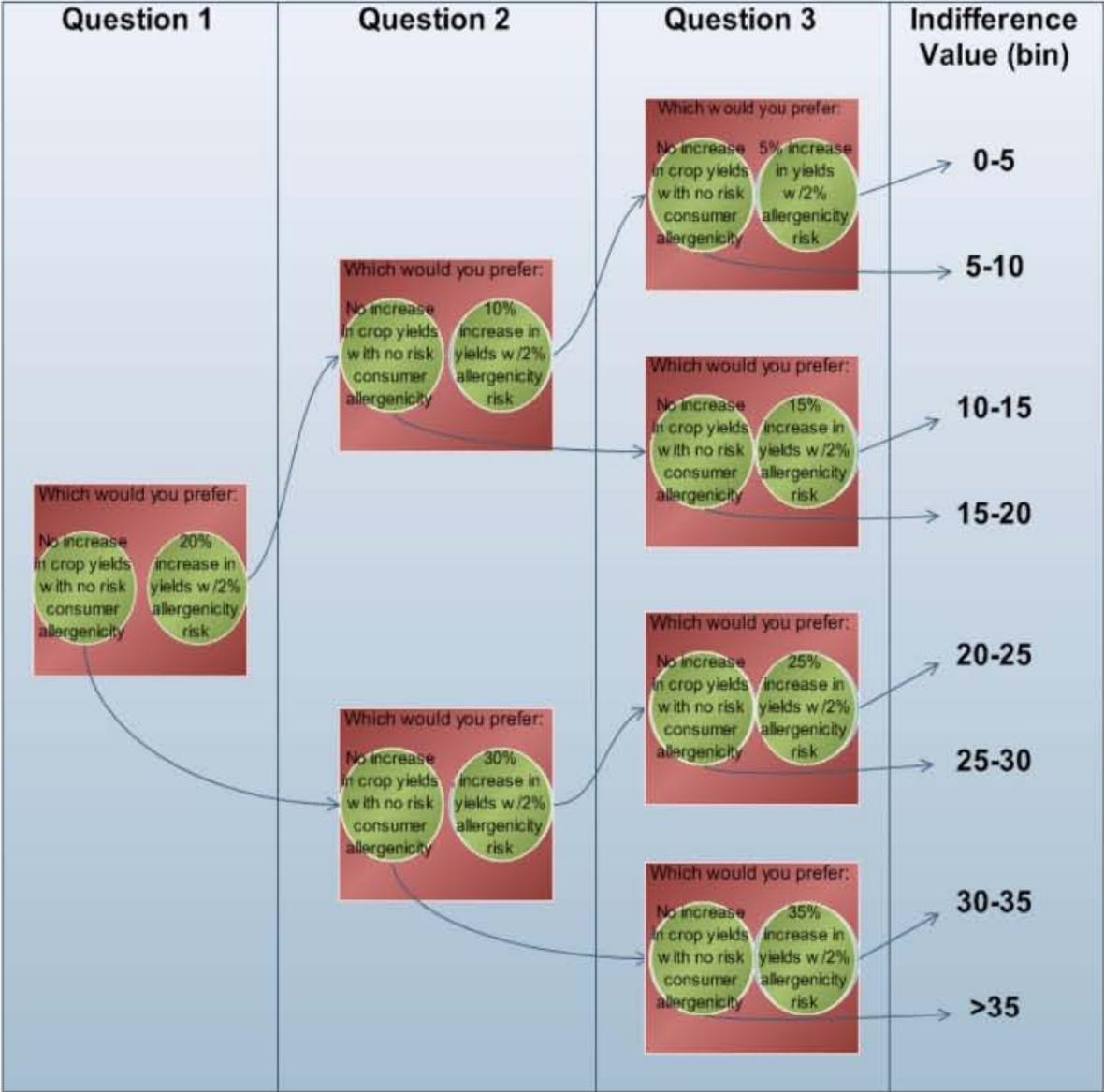
Benefits Willing to Forego for No Allergenicity Risk-Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of price discounts for which respondents would be indifferent choosing between no price discount and no risk of allergenicity or a price discount with a two percent risk of food allergenicity.



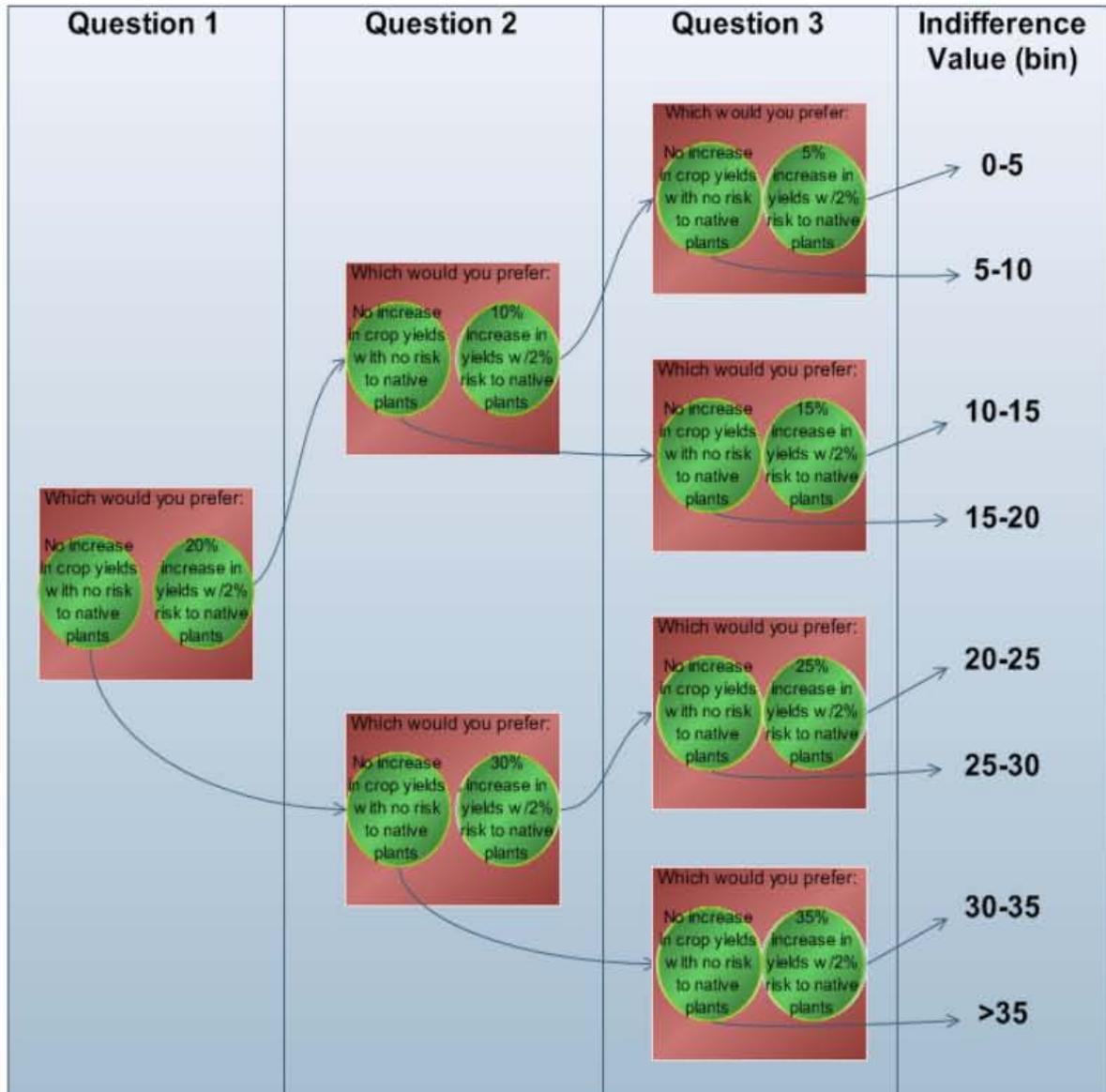
Benefits Willing to Forego for No Risk to Native Plants-Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of price discounts for which respondents would be indifferent choosing between no price discount and no risk to native plants or a price discount with a two percent risk to native plants.



Farmers-Benefits Willing to Forego for No Risk of Consumer Allergenicity-Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of percentage crop yield increases for which respondents would be indifferent choosing between no increase in crop yields and no risk of consumer allergenicity or increased crop yields with a two percent risk of consumer allergenicity.



Farmers-Benefits Willing to Forego for No Risk to Native Plant Species-Respondents were asked risk preference questions from Question Sets 1 through 3. The risk scenario presented to respondents was determined by answers given in prior question sets. The arrows in the figure below indicate the flow of questions posed to respondents. The resulting indifference value represents the range of percentage crop yield increases for which respondents would be indifferent choosing between no increase in crop yields with no risk to native plants or increased crop yields with a two percent risk to native plants.



Appendix 9

Examples of Common Semi-Structured Interview Questions

Examples of potential interview questions are:

1. What are the characteristics of a healthy human?
2. How can human health be maintained?
3. Can you describe for me what components a healthy diet should have or not have?
4. How would you characterize your own health?
5. What are the biggest threats to human health?
6. How would you describe the current state of people's health in your country?
7. What are your opinions about technology? Benefits? Risks?
8. What are the characteristics of a healthy environment?
9. How can a healthy environment be maintained?
10. What are the biggest threats to environmental health?
11. How healthy is the current state of the environment in your country?
12. Should the environment be a top, mid, or lower level concern for the nation? Why?
13. How important is environmental health for human well-being?
14. How important is the environment to you?
15. How would you characterize your relationship with nature?
16. Can you give me your definition of genetic engineering in agriculture?
17. How knowledgeable do you feel about GE technology?
18. What opinions do you have about genetic engineering agricultural technology?
19. How do you feel about eating GE food?
20. What factors do you consider when evaluating the risks and benefits of GM technology [examples might include *type of genetic modification* (microbial, plant or animal), *rationale for modification* (nutritional, sensory, or economic), *associated health and environmental benefits and risks*, and *ethical concerns* (playing god, tampering with nature)]?
21. What influences will GE agricultural technology have on your life?
22. How prevalent do you think the technology is in the US/NZ?

Based on participant answers, further questions were asked to discern deeper meanings and to get a clear picture of how participants thought about health, the environment and GE technology.

Appendix 10

Statistically Significant Mann Whitney U Results for the Threats to Health Rank Order

Rank Order Item	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Ant-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Illicit Drug Use	U=86.5 p=0.045 G [^]	----	U=21.5 p=0.004 G [^]	----	----	----	----	----	----	----	----
Lack of Exercise	----	----	----	----	U=41 p=0.027 G [^]	----	U=11 p=0.013 G [^]	----	----	----	----
Obesity	----	----	----	----	----	----	----	----	----	----	----
Lack of Health Insurance	U=71 p=0.013 C [^]	U=132 p=0.047 C [^]	----	----	----	----	----	U=43 p=0.002 Pro [^]	U=149 p=0.000 US [^]	----	----
Stress	----	----	----	----	----	----	----	----	----	----	----
Inadequate Sleep	----	----	----	----	U=46 p=0.041 G [^]	----	----	U=53.5 p=0.036 Pro [^]	----	----	----
Environmental Pollution	----	U=104 p=0.007 O [^]	U=22.5 p=0.005 O [^]	----	----	----	----	----	----	U=46 p=0.025 US [^]	----
Smoking	----	----	----	----	----	----	----	----	----	----	----
Chemicals in food	----	U=76 p=0.001 O [^]	U=25 p=0.008 O [^]	U=45.5 p=0.033 Anti [^]	U=38.5 p=0.020 C [^]	----	U=8.5 p=0.007 O [^]	----	U=329.5 p=0.032 NZ [^]	----	----
Overpopulation	----	U=125.5 p=0.031 O [^]	----	----	----	----	----	----	----	----	----
Genetically Engineered Foods	----	U=100 p=0.005 O [^]	U=23 p=0.005 O [^]	U=20 p=0.000 Anti [^]	U=19.5 p=0.002 C [^]	U=114.5 p=0.018 O [^]	U=2 p=0.001 O [^]	U=50 p=0.025 Anti [^]	U=242 p=0.001 NZ [^]	----	----

Note: This table presents Mann Whitney U results for the “Threats to Health Rank order” exercise given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group ranked the item as being more threatening to health (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

Note: (----) denotes table cells for which no statistically significant results were obtained.

See Appendix 1 for the “Threats to Health” Rank Order Items

Appendix 11

Statistically Significant Mann Whitney U Results for Threats to the Environment Rank Order

Rank Order Item	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Global Warming	----	----	----	----	----	----	U=13.5 p=0.022 O [^]	----	----	----	----
Air Pollution	----	----	----	----	----	----	----	U=34.5 p=.003 Pro [^]	----	----	----
Oil Drilling	----	----	----	U=49.5 p=0.05 Pro [^]	U=43.5 p=0.033 G [^]	----	----	----	U=298.5 p=0.009 US [^]	----	----
Deforestation	----	----	----	----	----	----	----	----	----	----	----
Ozone Depletion	----	----	----	----	----	----	----	----	----	----	----
Development (housing and commercial)	----	----	----	----	U=22 p=0.003 G [^]	----	U=4 p=0.001 G [^]	----	U=303.5 p=0.013 US [^]	U=26.5 p=0.002 US [^]	----
Pesticides and Herbicides	----	U=83.5 p=0.001 O [^]	U=25 p=0.015 O [^]	----	U=31.5 p=0.009 C [^]	----	U=2.5 p=0.000 O [^]	----	----	----	----
Water Pollution	----	----	----	----	----	U=16.5 p=0.021 C [^]	----	U=32 p=.002 Pro [^]	----	U=45.5 p=0.026 US [^]	U=10.5 p=0.05 US [^]
Consumerism	U=74 p=0.041 G [^]	U=106.5 p=0.009 O [^]	----	U=46 p=0.037 Pro [^]	----	----	----	----	----	U=46 p=0.028 US [^]	----
Over-harvesting of animals and fish	----	----	----	----	----	----	----	----	----	----	----
Overpopulation	----	----	----	----	----	----	----	----	----	----	----
Genetic Engineering in Agriculture	----	U=81 p=0.001 O [^]	----	U=22 p=0.000 Anti [^]	----	U=73.5 p=0.001 O [^]	U=12 p=0.017 O [^]	----	U=304 p=0.011 NZ [^]	----	----
Land Pollution	----	----	----	----	----	U=23 p=0.032 C [^]	----	----	----	U=45 p=0.024 US [^]	----

Note: This table presents Mann Whitney U results for the “Threats to environment Rank order” exercise given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group ranked the item as being more threatening to the environment (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 12

Statistically Significant Mann Whitney U Results for the Reasons for a Healthy Environment Rank Order

Rank Order Item	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Maintenance of Food Chains	----	----	----	----	----	----	----	----	----	----	----
Aesthetics	----	----	----	----	----	----	----	----	----	----	----
Moral Obligation to Future Generations	----	U=120 p=0.043 O [^]	----	----	----	U=70.5 p=0.001 O [^]	----	----	----	----	----
Provides Economic Resources (water, timber)	----	U=118.5 p=0.038 C [^]	----	----	----	----	----	U=51 p=0.026 Pro [^]	----	----	----
Human Health	----	----	----	----	----	----	----	U=47 p=0.014 Pro [^]	----	----	----
Moral Obligation to other living inhabitants of the earth (animals, insects, plants)	----	----	----	----	----	----	----	----	----	----	----

Note: This table presents Mann Whitney U results for the “Reasons to Maintain a Healthy Environment Rank order” exercise given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group ranked the item as being more important (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

Note: (----) denotes table cells for which no statistically significant results were obtained.

See Appendix 1 for the “Reasons for a Healthy Environment” Rank Order Items

Appendix 13

Statistically Significant Mann Whitney U Results for the Benefits of GE Rank Order

Rank Order Item	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Reduced Chemical Use	U=122.5 p=0.006 G [^]	----	----	----	----	U=133.5 p=0.017 O [^]	----	----	----	----	----
Increased Crop Yields	----	----	----	----	----	----	----	----	----	----	----
Improved Taste	----	----	----	----	----	----	----	----	----	----	----
Improved Nutritional Quality	U=144 p=0.05 C [^]	----	----	----	----	----	----	----	----	----	----
Crop Defense Against Diseases and Pests	----	----	----	----	----	----	----	U=49.5 p=0.036 Pro [^]	----	----	----
Protection of the Environment	----	----	----	U=70.5 p=0.032 Anti [^]	----	----	----	U=28.5 p=0.001 Anti [^]	----	----	----
Improved Food Shelf-life	U=142.5 p=0.044 G [^]	----	----	----	----	----	----	U=14.5 p=0.000 Pro [^]	----	----	----
Production of Edible Vaccines and Drugs	----	----	----	----	----	----	----	----	----	----	U=14.5 p=0.029 NZ [^]
Increase in Food Availability	U=142 p=0.044 C [^]	----	----	----	----	----	----	----	----	----	----
Wealth and Job Creation	----	----	----	----	----	----	----	----	----	----	----

Note: This table presents Mann Whitney U results for the “Benefits of GE rank order” exercise given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group ranked the item as being more beneficial (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

Note: (----) denotes table cells for which no statistically significant results were obtained.
See Appendix 1 for the “The Benefits of GE” Rank Order Items

Appendix 14

Statistically Significant Mann Whitney U Results for the Risks of GE Rank Order

Rank Order Item	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Human Antibiotic Resistance	----	----	----	----	----	----	----	----	----	----	----
Creation of New Viruses	----	U=109.5 p=0.041 C [^]	----	----	U=31.5 p=0.027 C [^]	----	----	----	U=407 p=0.03 US [^]	----	U=11.5 p=0.044 US [^]
Decrease in Crop Genetic Diversity	----	U=73.5 p=0.002 O [^]	U=34.5 p=.015 O [^]	----	----	----	----	U=52.5 p=0.034 Anti [^]	----	----	----
Unintentional Gene Transfer to Wild Plants	----	U=75 p=0.002 O [^]	----	----	----	----	----	U=53 p=0.037 Anti [^]	----	----	----
Toxicity in GE Foods	----	U=113.5 p=0.05 C [^]	----	----	----	----	----	----	----	----	----
A Negative Alteration in the Nutritional Quality of Food	----	----	----	----	----	----	----	----	----	----	----
Limited Access to seeds through Patenting of GE Crop Varieties	----	U=108 p=0.038 O [^]	----	U=78.5 p=0.044 Pro [^]	----	U=161 p=.036 O [^]	----	----	----	----	----
Lack of Labeling of GE Ingredients in Food	----	----	----	----	----	----	----	U=45 p=0.012 Pro [^]	----	----	----
Introduction of Food Allergens	----	----	----	----	U=30.5 p=0.026 GE [^]	----	U=16 p=0.05 GE [^]	----	----	----	----

Note: This table presents Mann Whitney U results for the “Risks of GE rank order” exercise given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance (p< or =0.05) and a designation of which stakeholder group ranked the item as being more risky (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

Note: (----) denotes table cells for which no statistically significant results were obtained.

See Appendix 1 for the “Risks of GE” Rank Order Items

Appendix 15

Statistically Significant Mann Whitney U Results for Likelihood of GE Risk Likert Scale Items

Likert Scale Item	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti -GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Human Antibiotic Resistance	U=154 p=0.000 C^	----	U=74.5 p=0.004 O^	----	U=47 p=0.043 C^	U=151.5 p=0.018 O^	U=10 p=0.004 O^	----	----	----	----
Creation of New Viruses	U=136.5 p=0.000 C^	----	U=68.5 p=0.002 O^	----	U=42 p=0.026 C^	----	U=12.5 p=0.007 O^	U=55.5 p=0.041 Anti^	----	----	----
Decrease in Crop Genetic Diversity	----	U=121.5 p=0.011 O^	U=81 p=0.005 O^	----	U=32 p=0.008 C^	U=166.5 p=0.039 O^	U=8.5 p=0.002 O^	U=34.5 p=0.002 Anti^	----	----	----
Unintentional Gene Transfer to Wild Plants	U=242.5 p=0.015 C^	U=130.5 p=0.020 O^	U=62 p=0.001 O^	----	U=32 p=0.007 C^	----	U=9.5 p=0.002 O^	U=40 p=0.004 Anti^	----	----	----
Toxicity in GE Foods	----	U=127.5 p=0.017 O^	U=63.5 p=0.001 O^	----	U=40 p=0.022 C^	----	U=9 p=0.003 O^	U=52.5 p=0.031 Anti^	----	----	----
A Negative Alteration in the Nutritional Quality of Food	U=188.5 p=0.001 C^	U=138 p=0.034 O^	U=40.5 p=0.000 O^	----	U=40 p=0.021 C^	----	U=10 p=0.004 O^	U=39 p=0.006 Anti^	----	----	----
Limited Access to seeds through Patenting of GE Crop Varieties	----	U=101.5 p=0.002 O^	----	----	----	U=159.5 p=0.021 O^	----	----	----	----	----
Lack of Labeling of GE Ingredients in Food	U=192.5 p=0.001 C^	U=116 p=0.004 O^	U=33.5 p=0.000 O^	----	U=36 p=0.012 C^	----	U=11 p=0.004 O^	U=54 p=0.031 Anti^	----	----	----
Introduction of Food Allergens	U=140 p=0.000C^	U=116 p=0.007 O^	U=22.5 p=0.000 O^	----	U=23.5 p=0.003 C^	----	U=6.5 p=0.002 O^	U=26 p=0.001 Anti^	----	----	----

Note: This table presents Mann Whitney U results for the “Likelihood of GE risks” exercise given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those Likert scale items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group saw the item as being more likely to happen within the next 20 years (C^=consumers, O^=organic farming community, G^=GE farming community, Pro^=Pro-GE consumers, Anti^=Anti-GE consumers, US^=US stakeholders, NZ^=NZ stakeholders).

See Appendix 2 for the “Likelihood of GE Risks” Likert scale

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 16

Statistically Significant Mann Whitney U Results for Religion and Politics Likert Scales

Likert Scale	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Religion	U=82 p=0.001 G [^]	----	U=45 p=0.025 G [^]	----	----	----	----	----	U=310 p=0.001 US [^]	U=56.5 p=0.030 US [^]	U=4 p=0.002 US [^]
Politics	U=56.5 p=0.000 G [^]	U=157.5 p=0.012 C [^]	U=5 p=0.000 G [^]	----	U=16 p=0.001 G [^]	----	U=2 p=0.001 G [^]	----	----	----	----

Note: This table presents Mann Whitney U results for the “Religion and Politics” Likert scale exercises given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group was either more religious or more conservative politically (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 17

Statistically Significant Mann Whitney U Results for the Engagement in the GE Debate Likert Scales

Likert Scale	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Engagement 1*	U=98 p=0.001 G^	U=64 p=0.000 O^	----	----	U=15 p=0.001 G^	U=133.5 p=0.010 O^	U=20 p=0.035 G^	----	----	----	----
Engagement 3*	U=137 p=0.016 C^	----	U=31.5 p=0.002 O^	----	----	----	----	----	----	U=58 p=0.024 US^	----
Engagement 4*	----	U=129 p=0.006 O^	U=41 p=0.014 O^	----	----	----	----	----	----	----	----

Note: This table presents Mann Whitney U results for the “Engagement in the GE Debate” Likert scale exercises given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group was more engaged (C^=consumers, O^=organic farming community, G^=GE farming community, Pro^=Pro-GE consumers, Anti^=Anti-GE consumers, US^=US stakeholders, NZ^=NZ stakeholders).

*The designation “Engagement 1” refers to the frequency with which participants spoke about issues related to GE with other people, “Engagement 3” refers to how likely participants were to read newspaper articles or watch TV program about GE and “Engagement 4” refers to how likely participants were to attend public meetings about GE. See Appendix 4 for the “Engagement in the GE debate” Likert Scales

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 18

Statistically Significant Mann Whitney U Results for Knowledge Tests

Knowledge Test	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
Test 1-General Science Knowledge	----	U=157 p=0.017 O [^]	U=47 p=0.010 O [^]	----	----	----	----	----	----	----	----
Test 2-GE Knowledge	----	----	----	U=63.5 p=0.002 Pro [^]	----	----	----	----	----	----	----
Test 3-Environment Knowledge	----	U=136.5 p=0.005 O [^]	U=54.5 p=0.023 O [^]	----	U=15.5 p=0.003 G [^]	U=88 p=0.000 O [^]	----	U=43 p=0.010 Anti [^]	----	----	----
Test 4-Health and Nutrition Knowledge	----	----	----	----	----	----	----	----	----	----	----

Note: This table presents Mann Whitney U results for the Knowledge Test exercises given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group scored higher on the knowledge test (C[^]=consumers, O[^]=organic farming community, G[^]=GE farming community, Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers, US[^]=US stakeholders, NZ[^]=NZ stakeholders).

See Appendix 5 & 6 for the US and NZ knowledge tests

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 19

Statistically Significant Mann Whitney U Results for Risk Scenario Exercises

Risk Scenario	United States				New Zealand				United States vs. New Zealand		
	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. GE	Consumer vs. Organic	Organic vs. GE	Pro vs. Anti-GE Consumers	Consumer vs. Consumer	Organic vs. Organic	GE vs. GE
General Risk Scenario	----	----	----	----	U=11 p=0.001 C^	----	U=1.5 p=0.001 O^	----	----	----	U=17 p=0.036 US^
Benefits willing to forego for no risk to health	N/A	N/A	N/A	----	N/A	N/A	N/A	----	----	N/A	N/A
Benefits willing to forego for no risk to the environment	N/A	N/A	N/A	----	N/A	N/A	N/A	U=51.5 p=0.043 Anti^	----	N/A	N/A
Benefits willing to forego for no allergenicity risk	N/A	N/A	N/A	----	N/A	N/A	N/A	U=42 p=0.009 Anti^	----	N/A	N/A
Benefits willing to forego for no risk to native plants	N/A	N/A	N/A	----	N/A	N/A	N/A	U=49 p=0.034 Anti^	----	N/A	N/A
Benefits willing to forego for no risk of consumer allergenicity	N/A	N/A	U=35 p=0.000 O^	N/A	N/A	N/A	U=18 p=0.009 O^	N/A	N/A	----	----
Benefits willing to forego for no risk to native plant species	N/A	N/A	U=15 p=0.000 O^	N/A	N/A	N/A	U=0 p=0.000 O^	N/A	N/A	----	----

Note: This table presents Mann Whitney U results for the Risk scenario exercises given to study participants. The table is divided into three sections: United States stakeholder comparisons, New Zealand stakeholder comparisons, and United States vs. New Zealand stakeholder comparisons. Only those rank-order items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance ($p < \text{or} = 0.05$) and a designation of which stakeholder group was more risk averse (C^=consumers, O^=organic farming community, G^=GE farming community, Pro^=Pro-GE consumers, Anti^=Anti-GE consumers, US^=US stakeholders, NZ^=NZ stakeholders). See Appendix 8 for examples of the risk scenario exercises

Note: N/A denotes table cells for which the risk scenario exercise was not administered to both sets of participants

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 20

Statistically Significant Mann Whitney U Results for the Trust Assessment Exercise

Group involved in GE Policy Formation	US Pro vs. Anti-GE Consumers	NZ Pro vs. Ant-GE Consumers
Industry	----	U=56, p=0.042 Pro [^]
Medical Doctors	----	----
Ethics Committees	----	----
Consumer Organizations	----	----
The Church	----	----
Newspapers and Magazines	----	----
Farmers	----	U=52, p=0.022 Pro [^]
Government	----	----
Environmental Groups	----	----
Grocery Stores	----	----
Scientists	U=70, p=0.023 Pro [^]	U=29.5 p=0.001 Pro [^]
Individual Citizens	----	----

Note: This table presents Mann Whitney U results for the “Level of Trust in Groups Involved in GE Policy Formation” exercise given to consumer research participants. Only those Likert scale items with statistically significant differences between stakeholder pairs are presented. The Mann Whitney U value is reported as is the level of significance (p< or =0.05) and a designation of which stakeholder group was more trusting (Pro[^]=Pro-GE consumers, Anti[^]=Anti-GE consumers).

See Appendix 7 for examples of the trust exercise

Note: (----) denotes table cells for which no statistically significant results were obtained.

Appendix 21

Results of Consensus Analysis of Free List Data

What adjectives would you use to describe the United States/New Zealand?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
----		<i>Pro-GE</i>	<i>Anti-GE</i>	----	----	----	----
		Green	Clean, Green				
What are the most pressing problems faced in the US/New Zealand today?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
War		----		Environment	----	Farming regulations	Farming regulations, Race relations
What things must a person do to maintain/achieve health?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
<i>Pro-GE</i>	<i>Anti-GE</i>	Exercise, Good nutrition, Mental well-being		Exercise, Good nutrition, Mental well-being	Exercise, Good nutrition, Mental well-being	Exercise, Good nutrition	Exercise, Good nutrition
Exercise, Good nutrition, Regular Check-ups	Exercise, Good nutrition, Mental well-being						
What do you consider to be the main threats to human health that are occurring today?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
Food, Pollution		Food		Food, Pollution	Food	Pollution	Malnutrition, Obesity
What do you consider to be the main threats to the environment that are occurring today?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
Pollution		Pollution, Humans		Pollution, Humans, Agriculture	Pollution, Deforestation, Agriculture, Humans	Pollution, Development	----
What things do you do to preserve/conservate the environment?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
Recycle		<i>Pro-GE</i>	<i>Anti-GE</i>	Recycle, Farm organically, Reuse, Consume responsibly	Recycle, Compost, Farm organically, Consume responsibly	Prevent Erosion, Correct Use of Chemicals	----
		Recycle	Recycle, compost, consume responsibly				
What adjectives would you use to describe genetic engineering in agriculture?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
----		----		Risky	Dangerous	Helpful	Innovative
What do you think are the benefits of GE?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
Increased yields		----		No true benefits	No true benefits	Increased yields Less chemicals, Less work	Increased yields, Less chemicals
What do you think are the risks of GE?							
US Consumers		NZ Consumers		US Organic	NZ Organic	US GE	NZ GE Amenable
Unforeseen consequences		Unforeseen consequences		Unforeseen consequences, Gene transfer, Loss of crop genetic diversity, Pest resistance	Unforeseen consequences, Gene transfer	Cost	----

Note: This table presents results of consensus analysis conducted on respondent free list data. The free list prompt is given and any items achieving consensus are listed below their respective stakeholder group heading.

Note: (----) denotes table cells in which no consensus was found

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