

Sustainable biotechnology and mothers of young children

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Report to Department of Management Communication,
University of Waikato

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1.0 EXECUTIVE SUMMARY

Sustainable biotechnology and mothers of young children

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As part of the broader programme, “Socially and culturally sustainable biotechnology” led by the Department of Management Communication at the University of Waikato, mothers of children aged 10 and under were interviewed to examine the social, cultural and spiritual dimensions of biotechnology. Ten focus groups were conducted and used ‘sustainable biotechnology’ as a centre-point for discussion, concentrating on four different biotechnology scenarios: non-transgenic genetically modified crops; fungus found on kauri trees to assist with bioremediation; pre-implantation genetic diagnosis (PGD); and pest-resistant genetically modified pine and fruit crops.

The findings from the current stage of the research were consistent on a number of points with those of the previous stage of the research and with findings on the general public throughout the world.

- The women expressed a range of descriptors associated with biotechnology (from ‘scary’ to ‘progress’).
- The media was the main source of images, and there was an awareness of the need to sensationalise.
- There was a fear of unknown long-term consequences on health and environment.
- Some women viewed the technology as ‘Playing God’, or interfering with nature.
- There was a desire for biotechnology to be highly controlled/contained.
- Thus there was a desire for an objective and transparent regulatory body to ensure regulation and control of the technology.
- Many women experienced some form of consumer alienation (Allison, 1978), including a resentment of financial motivations and considerations, and a lack of trust in big businesses and institutions involved in biotechnology.
- Women expressed concern about the ever-widening boundaries of acceptability (what is ethically acceptable) and potential for misuse of the technology e.g. human cloning.
- They expressed the need to protect the environment.
- They emphasised the value of ‘nature’, and the perception that ‘natural’ was better.
- Safety/health of children/future generations was of considerable importance.
- A number of women expressed a desire to return to traditional food production.
- Labelling was seen as a means of exercising choice over consumption.
- The women felt that those who were less well off financially had less choice/control, because they could not afford alternatives.
- The women felt there was a lack of unbiased information, but conversely expressed a feeling of information overload.
- Some women felt that scientists were out of touch with reality, although more women in the current study were optimistic and appreciative of the role that science played in their lives compared with the 2003 study.
- The feeling of powerlessness apparent in previous research was not so prevalent in this series of focus groups.

Additional insights included:

- Women felt that all life was valuable, regardless of ability or disability.
- They felt that perfection of society should never be a goal.
- Regardless of whether PGD was supported or not, the women felt the decision to receive the procedure should not be dictated by one's ability to pay for it – it should be publicly available.
- The women saw their and future generations' quality of life as intimately intertwined with the health of the environment, making the environment particularly important.

Because, to the women in our study, the health of the environment was so closely linked to health of society, anything that had potentially negative consequences on the ecosystem was perceived to pose a threat to the woman, her family and future generations. Economical considerations were frequently perceived as serving those outside the woman's valued entities and were therefore considered of lesser priority, or indeed strongly rejected (especially if those outside entities were perceived as threatening her valued entities). The strong fear of unknown long-term consequences on health and the environment was likely to reflect the desire for a mother to ensure she could protect her offspring from harm both now and in the future. The need for strict controls to be put in place by regulatory and research authorities was therefore seen as an important step in allaying her fears. However, true partnership and participation would be a critical aspect of this regulation, since it would only be by such means that mothers would feel they were in control the safety of their own children and future generations.

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2.0 INTRODUCTION

Over the last ten years, the issue of biotechnology has taken on varying degrees of importance globally. In an effort to track this, a considerable amount of research has been conducted in the area of public attitudes and perceptions of biotechnology. The bulk of the studies have used quantitative techniques that aim to assess the prevalence of opinion, (e.g. Cook *et al.*, 2004; Gamble and Gunson, 2002; Alexander and Toner, 2004; Gaskell *et al.*, 2003). Such methods are limited in terms of their explanatory capabilities, since they do not enable the researcher to explore the reasons for, and causes of the respondent's answers. However, in order for scientific development to truly be a partnership between the public, industry and government, the public must be given the opportunity to reveal more than just attitudes and expected behavioural response. The linking of attitudes to values is important because attitudes towards new objects must be built on something stable, and relatively enduring value orientations might provide this foundation (Stern *et al.*, 1995). Recent research has used qualitative techniques to explore the underlying values and beliefs of members of the community towards biotechnology (Hunt *et al.*, 2003; Coyle *et al.*, 2003; Gamble and Kassardjian, 2004).

So what is meant by the term 'values'? Hofstede (1980) defined values as 'a broad tendency to prefer certain states of affairs over others' while Smith and Bond (1988) defined values as 'universalistic statements about what we think is desirable or attractive'. Schwartz (1999) defined values as:

'conceptions of the desirable that guide the way social actors (e.g. organisational leaders, policy-makers, individual persons) select actions, evaluate people and events, and explain their actions and evaluations...In this view, values are trans-situational criteria or goals...ordered by importance as guiding principles in life.'

Feather (1994; as cited in Vaughan and Hogg, 1998) identified several features of values:

- They are general beliefs about desirable behaviours and goals.
- They involve judgements about 'goodness' and 'badness'.
- They transcend attitudes and influence the form of the attitudes.
- They provide standards for deciding between alternative behaviours, evaluating actions, planning behaviour, justifying opinions and conduct, and presenting the self to others.
- For any given person, they can be organised into hierarchies and the relative importance of the values may change over a lifetime.
- Value systems vary across individuals, groups and cultures.

Values can be seen as distinct from attitudes or beliefs, since they function as an organised system and serve to determine attitudes and behaviours (Schultz and Zelezny, 1999). Stern *et al.* (1995) saw values as being shaped largely by preadult socialisation and, compared with attitudes, as resistant to being reshaped by information. *Attitudes* were defined by Vaughan and Hogg (1998) as "relatively enduring organisations of beliefs, feelings, and behavioural tendencies towards socially significant objects, groups, events or symbol a general feeling or evaluation - positive or negative - about some person, object or issue". They contrast to norms in that they are private, internalised cognitive constructs. In contrast, *norms* were defined as "attitudinal and behavioural uniformities that define group membership and differentiate between groups". They are public and represent the cumulative expectations of others.

As part of the broader programme, “Socially and culturally sustainable biotechnology” led by the Department of Management Communication at the University of Waikato, mothers of children aged 10 and under were interviewed to examine the social, cultural and spiritual dimensions of biotechnology in 2003 and 2004. This group was chosen because women have been found to be more concerned with food and health issues (Rozin *et al.*, 1999), including food safety (Gamble and Gunson, 2002), and are more likely to be attracted to “magical” food and health beliefs (Aarnio and Lindeman, 2004). Also, because women have traditionally been the main household shoppers, their influence on the food their family consumes is substantial, making an understanding of their perceptions crucial for anyone involved in the area of biotechnology. Additionally, the presence of children in the home may have an impact on food choice, because of its potential association with higher food risk aversion or quality consciousness. Parenting may also trigger a focus on nutrition, yielding a search for nurturing benefits through the provision of wholesome foods (Verbeke, 2005).

In 2003 mothers made up one of five selected community groups interviewed, the other four being scientists, Buddhists, business people, and the environmentally active (Gamble and Kassardjian, 2004). The groups were selected because they represented some of the value spheres that have been shown to have an impact on attitudes towards biotechnology (relationship to science, to religion, to business, to family and to the environment). A total of 69 people took part in ten focus groups (two sessions per community group). All the focus groups took place in Auckland, in October, just before the lifting of the moratorium on Genetic Modification. Topics included awareness and understanding of the term ‘biotechnology’, perceptions of the debate on biotechnology, responses to a range of biotechnology applications, and an exploration of the underlying values and their relative importance in attitude formation.

Mothers, Buddhists and environmentalists shared commonalities in their worldviews. They were the least optimistic of the benefits of biotechnology, and expressed concern with the unknown long-term consequences on health and the environment. In addition, they required strict regulations to control the technology. They were cynical and resentful of the physical and moral negative influences that business (financial) considerations had on quality of life, and on the preservation of nature. In addition, they all expressed feelings of powerlessness, either in terms of being able to accumulate information to educate themselves, or in terms of their impact on decision-making. Nevertheless, when an application could be deemed to fulfil a real need, could be contained, caused no loss of life or suffering and enabled choice on the part of the recipient, these participants could accept specific biotechnology applications. These participants could be distinguished from business people who adhered to the theory of productionism (which holds the belief that more is better, problems can be solved by the application of technology, and that progress is a good thing), and scientists who had a tendency to view science as more predictable and controllable than the public believed.

Their disparity in worldviews in the sphere of science meant scientists and laypeople (including mothers) did not communicate at the same level, despite having the same concerns for health and the environment. This has caused feelings of frustration and powerlessness on both sides, since each is essentially speaking a ‘different language’.

2.1 AIM OF THE RESEARCH

A subsequent study was conducted in 2004 focusing on mothers of young children using the concept of ‘sustainable’ biotechnology as a centre-point of discussion. Ten focus groups (n=74) discussed their perspectives on four selected biotechnology scenarios: non-transgenic GM crops, fungus for soil bioremediation; Pre-Implantation Genetic Diagnosis; and pest-resistant GM pine and fruit trees. The following report examines the results of these discussions.

3.0 METHOD

A recruitment agency was used to enlist a total of 74 women who had at least one child who was 10 years or younger. Ten focus groups were held at either 1:00 or 7:00pm over a period of two weeks in February 2005, each lasting around 90 minutes. The groups were conducted at the Mount Albert Research Centre consumer facilities and were led by the same experienced moderator throughout. Groups were videotaped and voice-recorded, and participants were paid for participating.

3.1 DISCUSSION TOPICS

Discussion topics included:

1. response to the term “Sustainable development”, and the sources of those perceptions;
2. response to the Government definition of “sustainable development”;
3. response to the term “biotechnology”, and the sources of those perceptions;
4. exploration of perceptions of biotechnology from a sustainable development perspective, using four scenarios as discussion points (what are the issues, what values are informing views, what are the likely impacts on particular groups, and under what circumstances would this application be “sustainable” according the government definition):
 - developing non-transgenic genetically modified plants,
 - bioremediation/bioprospecting,
 - Preimplantation Genetic Diagnosis (PGD),
 - developing genetically modified pest-resistant trees;
5. identification of which aspects of sustainable development should take precedence in deciding what is an acceptable, sustainable biotechnology (e.g. economic, social, environmental, cultural and ethical values);
6. identification of sustainable and unsustainable biotechnologies.

Appendix 1 provides the actual discussion guide used for the focus groups, including the wording of the four scenarios presented.

3.2 ANALYSIS

All tapes were transcribed. On completion, a researcher went through the transcripts to identify who the speaker of each comment was, and to check the accuracy of the transcript. The text of the transcripts was entered into Microsoft® Excel 2000 on a question-by-question basis, incorporating group membership and individual number. This allowed development of a coding schedule. This quantitative step ensured isolated comments or verbose respondents were not given undue emphasis. Coding schedules and themes were then developed and comments categorised according to these.

4.0 RESULTS

4.1 PARTICIPANTS

Table 1 provides the detail of the demographic make-up of the ten focus groups. The participants were aged 20-51 with a mean age of 36.3 (std dev. 5.8). Seventy percent indicated their ethnicity as European, while 15% identified themselves as Maori or Maori/European, and 14% indicated some affiliation with the Pacific Islands. Over half (55%) stated they did not belong to any religious affiliation, while nearly a quarter (42%) said they were 'Christian' and nine percent specified they were Catholic. Forty-nine percent of the women were in some paid employment, and 40% had post-secondary school training.

Involvement with the biotechnology debate was low, with nearly three quarters of the women following the biotechnology debate only occasionally or not at all, and 88% said they had not participated in any biotechnology events.

Table 1. The demographic information for these focus groups.

	Total N=	FG1 8	FG2 7	FG3 6	FG4 7	FG5 7	FG6 8	FG7 8	FG8 10	FG9 7	FG10 6
Age:											
20-30	12	1	2	0	0	2	0	3	1	2	1
31-40	43	3	5	3	5	4	5	3	7	3	5
41-50	18	3	0	3	2	1	3	2	2	2	0
N/A	1	1	0	0	0	0	0	0	0	0	0
Number of children:											
1	15	1	1	1	1	0	2	0	5	3	1
2	30	3	4	4	5	4	2	6	3	2	1
3	20	4	2	1	1	3	4	1	2	0	2
4 or more	5	0	0	0	0	0	0	1	0	2	2
Ethnicity:											
European	52	6	6	3	7	5	7	4	6	4	4
European/Maori	5	1	0	0	0	2	1	1	0	0	0
European/Cook Is	1	0	1	0	0	0	0	0	0	0	0
Maori	6	0	0	2	0	0	0	0	2	1	1
Indian	1	1	0	0	0	0	0	0	0	0	0
Niuean	3	0	0	0	0	0	0	0	2	0	1
Samoan	4	0	0	1	0	0	0	1	0	2	0
Pacific Island/Maori	2	0	0	0	0	0	0	2	0	0	0
Religion											
Non-religious	41	5	2	5	4	2	4	5	7	3	4
Anglican	2	0	0	0	1	0	0	1	0	0	0
Baptist	1	0	0	0	0	0	0	1	0	0	0
Catholic	7	0	2	1	0	0	2	1	0	0	1
Christian	17	1	2	0	1	4	2	0	2	4	1
Jehovah's Witness	1	1	0	0	0	0	0	0	0	0	0
Mormon	1	0	0	0	0	1	0	0	0	0	0
Presbyterian	1	0	0	0	1	0	0	0	0	0	0
Sikh	1	1	0	0	0	0	0	0	0	0	0
Spiritual	2	0	1	0	0	0	0	0	1	0	0
Occupation:											
Full-time homemaker	38	5	3	3	3	3	2	3	8	6	2
Work part- time/full-time	36	3	4	3	4	4	6	5	2	1	4
Highest educational qualification											
Secondary	41	5	3	4	5	3	4	4	6	4	3
Dip/Cert	12	1	1	1	0	3	2	2	1	1	0
Tertiary	18	1	3	0	2	1	2	2	3	2	2
N/A	3	1	0	1	0	0	0	0	0	0	1
Followed debate											
A lot	8	1	1	0	1	2	1	0	1	0	1
Occasionally	54	3	6	5	5	5	6	7	8	5	4
Not at all	12	4	0	1	1	0	1	1	1	2	1
Participation in biotechnology events											
Yes	9	0	2	1	0	4	0	0	2	0	0
No	65	8	5	5	7	3	8	8	8	7	6

4.2 SUSTAINABLE DEVELOPMENT

4.2.1 Images or associations

When asked to reveal the images and associations that the term ‘sustainable development’ incited, the main associations included ‘development’, and the notion of reusability or recycle-ability, environmental friendliness, and progress. Few participants viewed the term in a negative light.

I6, G6: “I guess some sort of development that has minimal impact on the surrounding environment.”¹

I3, G7: “ something that is renewable”

I8, G7: “ not wearing out the earth”.

4.2.2 Image sources

The media, and specifically newspapers, magazines, TV, and radio were the main sources of information regarding ‘sustainable biotechnology’. Some respondents indicated an awareness that the media tended to polarise debate because of the greater interest in conflict or because it was more ‘sensational’.

I5, G4: “The media seems to be quite polarised and presents the extremes. Either you love it or you hate it and it has to be one of those...”

Others felt the word was not particularly meaningful to them and simply created a definition by breaking the word down, or they called it a ‘jargon’ word.

4.2.3 Response to Government definition of ‘sustainable development in New Zealand’

The Government definition of ‘sustainable development in New Zealand’ (see Appendix 1) was seen to fit well with the participants’ own definitions, noting similarities such as ‘taking important things into account’, or ‘taking a long-term view’. However, several women felt that taking a long-term view was idealistic, in that they felt we could only ever make decisions based on our current level of knowledge, without actually being able to predict the future. A willingness to learn from mistakes was therefore important.

I6, G6: “...you have no idea what future generations will need. It’s that assumption that future generations will require or want the same things that we want in our society. But we don’t know, so it’s almost a bit wishy-washy, cause we have assumptions as to what the ideal is. It’s very idealistic.”

4.3 BIOTECHNOLOGY

4.3.1 Images or associations

Associations with the term ‘biotechnology’ were neutral-negative, and were typically involved very general concepts, rather than any technical knowledge of the procedure itself. Most frequently the term elicited scientific associations such as ‘research’, ‘experimenting’, ‘inventing’, ‘testing’, ‘science’, ‘labs’ and ‘sterile’, although other women commented it was ‘mucking around with nature’, or made them ‘anxious/scary’. Nevertheless a number of women associated the term with progress or improvement.

4.3.2 Image sources

As with the term ‘Sustainable development’, participants’ main source of information regarding their perceptions of ‘biotechnology’ came from the media, specifically television, newspapers and magazines such as *New Scientist*. A few women gained their information

¹ “I” indicates which individual in each group “G” made the comment. Appendix 4 details the coding schedule used for classification.

from school or tertiary studies, or had been involved in discussions with interest groups, or friends/family.

A number of women indicated that their feelings towards biotechnology would vary depending on the application. Thus, in order to stimulate an exploration of our participants' values regarding biotechnology, we provided them with four different scenarios around which to base their discussion (as detailed in Appendix 1):

- developing non-transgenic genetically modified plants;
- bioremediation/bio-prospecting;
- Pre-implantation Genetic Diagnosis (PGD);
- developing genetically modified pest-resistant trees.

4.4 DEVELOPING NON-TRANSGENIC GENETICALLY MODIFIED PLANTS

The first scenario described to the women involved the development of non-transgenic genetically modified plants. The scenario read:

Controversy has surrounded the development of genetically modified or GM crops, particularly where this is perceived to involve the transfer of genes between different species. Even transferring genes between plants of the same species has required the use of DNA sequences from bacteria to transfer the genes. However, scientists are now developing a technique that allows genes to be transferred between plants of the same species using DNA sequences from the target plant species. Although the resulting plants are genetically modified, no foreign genetic material is involved or transferred. Scientists hope that this will allow the use of GM for highly targeted and precise breeding in a way that is socially acceptable and responsible.

4.4.1 Initial response

Many comments provided by the women indicated a need for more information, or clarification regarding the procedure. In addition, a number wanted to know the reason for genetically modifying the plants, since this would have an impact on the acceptability of the product. For example, medical applications would be more acceptable than food applications.

I1, G10: "So I guess if I am able to understand how it works I would be more comfortable about accepting it..."

I7, G1: "Why are they doing it? Do they need to, or are they just having fun with the way they're doing it? Just to prove they can do it or something."

Some women were dubious of the real need for some of the potential developments (such as improved flavour, or better storage characteristics) and saw them as a marketing ploy by big companies to get the consumer to buy more of their products. The need for growers to buy new seeds from companies like Monsanto was also seen in a negative light.

I4, G5: "You've got these crops that they should reproduce, but they make a special GM crop and...you have to keep buying the seeds".

I2, G8: "We don't have to always think that we need technology to improve our lives. I think we get caught up in this consumer thing, where you have to have an apple that hasn't got a black mark on it".

Participants were concerned about unknown long-term consequences and antibiotic resistance, and indicated a need for the crops to be contained as a means of limiting potential negative impacts. However, not all participants saw the scenario in a negative way, with

some indicating they felt fine about such products since it was within the same species. A need for honesty and transparency, and the use of labelling to enable choice, were seen as important by some mothers.

I1, G8: “The knowledge thing. Even if it’s from the same plant, I think you still have a right to know, if that is what you’re consuming...”

4.4.2 Values

The participants revealed that their role as mothers was important in this scenario since they expressed a concern about the health of their children and future generations, and desired an ability to control what their children ate. Unfortunately, some found that ‘healthy’ food was expensive, and their food choices were dictated by cost.

I6, G4: “I think as a mother, if it’s relating to food, I care about what my children have. I don’t want to give them something that’s not going to be good for them. It sort of stirs up all those feelings on what we like, because we can deal with the consequences, but we’re making the choice for them. We don’t want to give them anything that will effect their long-term health or anything.”

I2, G1: “I mean if you are starving and you’re on the bones of you bum you’re not going to say no are you?...I guess it comes to the point where I just get the best you can. I can’t do anything about price.”

From here a dichotomy emerged. On the one hand, some mothers expressed a desire to return to nature, indicating that ‘natural’ was best. Two groups suggested growing their own food as a way of exerting control and taking responsibility for health, but few women actually did this to any extent. A number of mothers raised the belief that food could have a negative impact on behaviour and health (such as allergies) and that GM food would increase this problem.

I3, G2: “I just don’t think you can improve on nature. I think there’s a reason the way things are.”

I5, G5: “How many other people out there with organic food and non-GM anything and fewer chemicals and less preservatives in food, we wouldn’t have as much sickness, we wouldn’t have so many of the problems we are experiencing these days.”

On the other hand, some mothers expressed optimism that science could lead to improved qualities in food and hence improved health, and challenged the notion that we should or could control everything in our environment.

I2, G1: “I don’t know what was in my lawn, so why would I want to plant? That’s the thing. You can get really anal about it and go okay, well if we dig 10 foot under and plant.... I mean it’s much of a muchness at the end of the day”.

I6, G6: “...over time science has improved, and our length of life is longer. We’re living longer, we’re taller, and we’re fatter than what they used to be. With the improvement of science, we live longer.”

I2, G3: “I don’t think it’s just the taste that they are enhancing, I think it’s the quality or nutrition value of the product. If it really is what they are saying, then the kids will benefit.”

4.4.3 Affected groups

When asked who would be affected by non-transgenic GM crops, the women were divided as to whether the public would benefit or lose out. Some recognised that food might be cheaper or better quality, and there might be less wastage of food. Other women were concerned about the unknown consequences, lack of choice and potentially higher prices.

Growers, farmers and sellers, and the Government were the groups most frequently identified as benefiting from non-transgenic GM crops. In comparison, a range of groups were selected as potentially missing out, including farmers who did not want GM crops, producers, growers, environmental people, those on a low income, third world countries, children, and chemical companies who would sell fewer chemicals.

4.4.4 Sustainable GM crops

The main requirements the mothers in these focus groups had for non-transgenic GM crops to be sustainable were that there was open, honest discussion and partnership during the development of the product, and that the crops were contained in a controlled environment or laboratory. Other issues raised included a need to be proven as safe, a good reason or need for the development, an assurance that the environment would be protected, and having people's best interests at heart, rather than being financially motivated.

I1, G2: "That's where the participation of partnership has to come into play. They all need to put their pennies' worth in, and not just a chosen group of people – everybody."

I1, G7: "If it was proven to be safe I guess".

I6, G3: "Maybe looking after people. I don't see it working for any of the points. It's more about feeding our need for our greed, like, let's just get more of it, let's make it last longer, then we can sell heaps more."

4.5 BIOREMEDIATION/BIOPROSPECTING

The second scenario presented to the women involved a fungus used for bioremediation. The description of the scenario is as follows:

A New Zealand university research team working in a national park has identified a native fungus growing on New Zealand kauri trees that has the ability to break down and remove dangerous poisons from soil. The fungus offers a way to improve the safety of work conditions at existing industrial production sites or decontaminate former sites, which may have been subsequently built upon. The researchers have formed a joint venture with an overseas biotechnology company to develop and commercially exploit the new fungus technology. The joint venture has filed patent applications in New Zealand and overseas for the use of the native fungus.

4.5.1 Initial response

Of the four scenarios, this was the most acceptable, with a large number of women indicating they thought this development would be a good idea, and a natural way to protect the environment. However, the mothers also asked many questions indicating a need for more information regarding how the fungus was grown and collected, the likely impact on the kauri trees and the environment, and the potential impact on the environment and food chain. Thus in terms of an immediate response, the environment was of the greatest concern to the mothers.

I4, G4: "Initially it sounds like a really good idea"

I6, G6: "I think it's great!"

I6, G3: "I like the idea of that because that's improving through nature what we have been destroying".

I5, G1: "What happens to the fungus once it's broken down and they've removed the dangerous poison from the soil?"

I4, G1: "you wonder whether it will destroy our trees here. Do the trees need to have that fungus on them to keep their growth going?"

I5, G5: “How would they do it? Would they grow the fungus so it’s completely a natural thing or would they get a synthetic mixture that emulates the natural fungus itself and use that?”

4.5.2 Values

Upon consideration, five value areas appeared. The environment continued to be of great importance, but concerns for children’s health or that of future generations was also revealed to be important. In one respect, the women felt that the bioremediation scenario could help improve the quality of soil that their children played in, but in another respect there was concern about unknown health effects related to the fungus.

I6, G3: “If they can’t duplicate it, and they find out that it can do all that, we don’t want them going in and destroying all the kauri trees to get this fungus”.

I8, G7: “These contaminated sites, that is actually an issue for us. More and more sites get found that are not safe. Kids might be playing in it. That definitely could be a way forward. It would be good if they could find something to clean up the soil.”

I4, G6: “20-30 years down the track, people that are affected by it then, that don’t know anything about it. What’s going to happen?”

Some women appeared to be optimistic and trusting about science, stating they felt a bioremediation fungus would help to clean up the land for future generations, and believed that the development would have been well researched before being released into the environment. However, feelings of consumer alienation were also apparent (Allison, 1978), reflected by comments of feeling distrustful of overseas companies’ motivations and irresponsibility toward the natural environment.

I2, G1: “It would be nice, just like if you could give a hand me down pair of pants to a child, if you can give that piece of land to somebody else to utilise.”

I3, G1: “The accent is on exploit. It’s like oh! Does that mean it will be like the rain forests? When I read that, it sounds good at the beginning and then when you get down to the ‘exploit’ I think ‘hmmm’. It feels like you’re going to be used for what little money you can get now, as opposed to really thinking it’s sustainable development.”

Finally, in a related way, one group of women indicated they felt vulnerable and disempowered by their lack of understanding of the process, and their dependence on authorities that they did not know whether to trust.

I4, G10: “For me personally, I feel a bit of a fool and I don’t fully understand what I’m even talking about. I sit here now and wing it.”

I2, G10: “People are saying things for their own ends aren’t they, especially this topic. I think people tend to put their trust in people, or believe in what people are saying because there is a huge level of understanding”.

4.5.3 Affected groups

When asked who they thought would be affected by a fungus with bioremediation properties, the main people seen to benefit were either ‘them’ which included big-businesses/overseas companies, government, and researchers, or the people working/living on the contaminated sites, and ‘everyone’ (because of improvements in health and environment).

I3 G1: “Industry, giants, you know. The government and other industry giants, they would be the only people with money enough to do this.”

I7, G8: “It’s targeting a specific occupation, or group of people that are working in a position, that they benefit from it. It might not affect anybody in this room, but it might affect someone that you know.”

In terms of who might lose out by the development, few mentioned specific groups. The main potential loser was the environment (specifically the kauri trees), while several women mentioned the New Zealand economy if the technology went overseas.

I2, G1: “if the trees get destroyed, in New Zealand we’re known for having these beautiful places to go, like the Waitakeres and Tane Mahuta and all that, places where we can go to have a nice time playing in the reserves and that. Potentially that could disappear and that sucks for everybody.”

I5, G3: “...it seems as if it would be something that a private company would buy. That means a private company or private investor from overseas is benefiting from our natural products. I don’t think it will be something that our county will benefit from at all. I think it will be something that will be exported, like everything else.”

4.5.4 Sustainable bioremediation

The women were asked what they required for this development to be sustainable in New Zealand. The first criterion was that it minimised impacts on the environment, which involved not harming the kauri tree, controlling removal of fungus, and ensuring the fungus was contained. The second criterion was that the technology was proven to be safe and effective. The third criterion involved the issue of ownership. New Zealand should ensure it retained the majority of control, perhaps with the involvement of the government, while the role of overseas companies should be limited.

I2, G3: “just taking that long view of researching it in the lab, and not being in a hurry to exploit it”.

I4, G4: “You might have to put a protective thing on the kauris which there is anyway”.

I8, G1: “I’m thinking too, even if we had the backing of a major company who is backing the money for it, to have something like New Zealand control, that other investors didn’t have any say whatsoever.”

4.6 PREIMPLANTATION GENETIC DIAGNOSIS (PGD)

Pre-implantation Genetic Diagnosis (PGD) was the third scenario presented to the women, and read as follows:

PGD is a procedure for testing early human embryos for serious inherited genetic conditions causing disease or disability. PGD involves the creation of embryos via *in vitro* fertilisation (IVF), the genetic testing of one or two cells from these embryos for specific genetic conditions, and the subsequent transfer of unaffected embryos to a woman’s uterus. Affected embryos are discarded. This allows prospective parents at risk of transmitting a serious genetic condition to their children an alternative to attempted natural conception. Natural conception would involve a risk to the health of the future child or the possibility of pregnancy termination if the foetus is found to be affected by the condition following prenatal diagnosis.

4.6.1 Initial response

Not surprisingly, the scenario regarding Preimplantation Genetic Diagnosis (PGD) was the development that elicited the greatest amount of comment, and it was on this issue that the greatest degree of polarity was revealed. A commonly agreed opinion was that it should be the personal choice of the parents to have, or not have the procedure.

I4, G1: “I think everyone has their own opinion on it. It would be depending on whether you could have a child or not anyway...It’s a personal thing. We all thank God that we’ve got 2

lucky children now who are healthy and well. I don't know what I would feel like if one of them had a disorder, or something like that. I think that's a very personal thing that everyone has their own opinion on."

I5, G6: "I think this is a sticky question actually because of personal morals, religion, beliefs, what you want. I think you can get yourself into trouble by voicing your opinions on something like this. Unless you're actually in that position I don't think you can really grasp what it's like."

Another issue of concern to a large number of women was who decided which conditions were 'serious', and where the line should be drawn (referred to as the 'slippery slope').

I6, G3: "It says 'serious inherited genetic conditions'. Like you were just saying, what is classed as serious? How are the guidelines going to be broadened over the years to say your family had a cancer gene? You're not worthy of living because you're going to end up with cancer. You're not going to get a choice."

It was at this point that opinions began to diverge. While it was agreed that attempts to create 'super-babies' or 'designer-babies' were obviously unacceptable, many women felt the procedure was a valuable tool to prevent unnecessary suffering and ensure the wellbeing of children.

I7, G2: "If you're a woman and you've got serious genetic conditions in your family, and there is a risk, say you've had two children with some kind of disease, and you might have already had one and had a miscarriage or whatever, I think that for someone that wants a child, and wants a healthy child, I'd say that would be great. I think there's enough trouble in the world without having... I think there should be an age limit on it. It should be for genetic conditions. I don't believe in the whole area of picking the sex of your child."

Many women felt that all life was valuable regardless of the disabilities possessed by the child, and that parents should count themselves lucky to have any child. In addition, some women had cultural, ethical or religious issues with the procedure, with the belief that nature (or God) would ensure the survival of those who were 'meant' to survive. However, this was complicated by the fact that some women had an issue with in vitro fertilisation to begin with. Two women felt that those at risk of producing children with severe inheritable diseases or disabilities should adopt children rather than having their own.

I1, G3: "Some people just can't have children, as much as they want them, it's not meant to be, you know what I mean? If they have to go through all this palaver, surely they're mucking around with what's meant to happen. Some people, it's really bad they can't have children, but it's not meant to be. They're kind of mucking around with it. Playing God really."

I4, G4: "I mean part of me thinks it's a very individual thing, but also I suppose the wrong side of it, the other side of it is, are we then saying that anybody with a disability, some sort of genetic condition is less worthy to be given the chance? I know many, many people with handicaps, disabilities, whatever you want to call it, who are contributing, who are functioning, worthwhile human beings. It's kind of that playing God thing that still bothers me a bit."

4.6.2 Values

The values revealed in response to this scenario are consistent with the initial comments elicited and discussed above. Across women there was an agreement that a woman was entitled to have her own opinion. The women were also in agreement regarding the value of all life and that perfection should not be the goal of this procedure. However, while some

women felt the procedure would be a valuable tool for improving the wellbeing of children as long as the benefits outweighed moral considerations, others felt strongly that the procedure was morally wrong, unnatural or playing God. Personal revelations were occasionally used to reinforce a position.

I5, G1: "I'd like to know that if I did have something that was hereditary...that you have the option of you know, deciding, knowing that a healthy child is being produced. Your child could have anything else, you know it's just taking away one less risk."

I3, G2: "I don't know that I want to see the end of people with Down's Syndrome in this world. I think there's – a special reason? Yeah, sometimes that happens to us for whatever reason."

I2, G5: "Friends of mine had twin boys and they've had masses of operations...They said it was like the two genes from the husband and wife just clashed and resulted in what happened. They said 'look if you went on and had any more children, it would be a 99% chance that this would happen again'. Little did they know that they had already had another little girl and she's absolutely just perfect and normal."

I6, G6: "...I'm pregnant and I've lost children for different reasons. God is there for me to help as to whether those children are born or not born, with whatever problems they might have. God's grace is there. Because we are mothers, that's our role, to deal with the children that we have..."

The potential for mistakes and the ever-loosening boundaries of what PGD should be used for were of concern to many women who requested strict guidelines and controls.

I3, G7: "The other thing is, we look at this from our social set of rules. Whereas from another country, like Romania, where you can be 66 and have a child. They might have a whole different set of rules with which they looked at that issue."

4.6.3 Affected groups

The main people who were seen to benefit from PGD were couples who had a high risk of passing on a serious inheritable disease to their offspring. Cultures with a high mortality rate because of some disease might also benefit, as would society in general by eliminating some inheritable diseases.

I3, G1: "I think, yeah that would be, I would agree with that, if it was for people who would naturally decide no we can't do it, we can't pass on whatever it is, I really can't see it hurting unless they then decide to do something untoward with it, you know."

I2, G7: "I guess one of the benefits is, eventually you're going to breed the genetic disorder out aren't you? Because if people don't go on replicating the damaged genetic material, then eventually it's going to be gone."

Interestingly, given the comments regarding the value of all life, only three comments were made regarding the notion that an embryo with the disease would not have a chance to live out its natural life.

At a general level, questions were raised as to who would be able to receive this procedure, since it would probably be very expensive.

I2, G6: "Well it's with the money thing too. The people who will benefit are the people who can, afford to perhaps, remove that illness."

4.6.4 Sustainable PGD

While some people believed that the procedure of PGD was ethically or morally wrong, and would therefore never be sustainable, the main criterion for those who were more accepting of it was that there was a trustworthy ethics committee, and strict international guidelines. In addition, they required that the procedure only be available to those who had a high risk of passing on a serious inheritable disease rather than to make ‘designer babies’. A number of comments suggested that assessment needed to be on a case-by-case basis.

I4, G6: “Yeah, it’s almost like there has to be some guidelines. It’s almost like there is that whole group of people who create the decision in what they feel, society, the couple, etc., etc.”

I3, G1: “I suppose if you can prove that you’re, I don’t know, I suppose that you fit this criterion. If you fit this criterion, legitimately fit this criterion, then I think it should be offered to you. I think the criteria should be someone who has the inherent history and that they will pass it on, if they’re carriers.”

4.7 DEVELOPING GENETICALLY MODIFIED PEST-RESISTANT TREES

The final scenario presented to the women concerned the development of genetically modified pest-resistant trees. Its description read as follows:

Recently, areas of Auckland and Hamilton have been aerially sprayed with insecticides in an attempt to destroy introduced pests such as the painted apple moth that threaten our horticultural industry. These spraying campaigns have caused considerable disruption and alleged health effects for many residents of these sprayed areas. In the future, it might be possible to genetically modify lines of commercial fruit trees and pine trees that would be resistant to such pests. This would protect our horticultural and forestry industries without the need for future aerial spraying campaigns.

4.7.1 Initial response

Initial discussion about GM pest-resistance trees typically focused on spraying and its negative impacts. When asked to indicate their preference of spraying or GM trees, a number of women commented that prevention was the answer and they would rather have better border control. Alternatively, several women felt sure there must be more natural alternatives to either spraying or GM crops.

I5, G5: “Yes I think start at the beginning. Don’t use a band-aid. Get to the source and resolve the issue. That’s my personal opinion on it. Protect the borders. Close up the borders. That’s better.”

I1, G2: “Some of the gardening clubs I belong to, they talk about natural ways of planting like chives around your rose bushes, and that’s supposed to get rid of aphids.”

A need for more information regarding the development was also apparent, including questions like ‘how would it work’, ‘where will they be grown’, ‘what’s in the GM trees, would they be harmful or taste bad’? Some women initially felt the development was a good idea, or at least preferable to the spraying, particularly in the pine trees, although many had reservations about actually eating GM fruit.

I5, G3: “Sounds good, but how would they do that? What would they have to add to the trees to make it pest resistant?”

I3, G9: “It sounds good doesn’t it? Having had those planes go over, it was awful.”

I4, G6: "...If they're going to GM fruit trees, how is that going to affect the fruit in the long run as well? Our children are going to be in the next generation and they will be eating the fruit."

However, there were many women who had questions regarding the unknown impacts on the environment, such as an impact on native species, or on the food chain in general. In addition, some participants were concerned about the possibility of insects developing resistance, and several women commented that there would always be a new species of pest to worry about, thus requiring many types of GM plants.

I3, G10: "I guess too, I mean what effect would it have on the native flora? A lot of the reason for the spraying is that the bugs, or whatever, that have come into New Zealand, are particularly damaging to our native plants and trees. You know, what effect on these trees does this genetic modification have?"

I1, G6: "Another super bug might come along. Can you actually, you know, we think again that the human race can just eradicate this, do away with that, but can we actually do that? That's the big thing. Okay we get rid of this, but there will be the next thing lining up probably."

4.7.2 Values

The majority of comments by the women focused on the environment and health. Nature was valued as was the preservation and future of the earth. Pest-resistant GM crops might have negative impacts on non-target species, birds or other links in the food chain, and there was concern that pests would develop resistance to the GM crops thus becoming an even bigger problem. In addition, the women felt there would always be another pest for which the genetic modification did not control, thus requiring continued manipulation of crops. In terms of health, the participants indicated they would not want to eat food that had been genetically modified to be resistant to pests, and would certainly not let their children eat it.

I1, G2: "My mum is a green girl. She says if you've got a headache, go hug a tree, get back down to nature, and go and work in the garden."

I3, G3: "We're never going to stop it are we? Our generation now is probably going to find that they're going to have a very different species to deal with in their time."

I2, G6: "...When it comes to the fruit that the kids are eating, has it got other genetic makeup of some other plant that they could be allergic to..."

4.7.3 Affected groups

Industry such as horticulture, forestry and exporters were seen to be the main beneficiaries of pest-resistant GM crops, although it was also recognised that the general public would benefit (because of better quality produce, and fewer pesticides). In addition, the New Zealand economy could potentially benefit for the same reasons. Fewer women felt that the general public or the New Zealand economy would lose out if the technology went ahead.

I3, G4: "I suppose what they're saying is that they can do it on the pine forests and that's the thing they were most concerned about. There is a lot of money in forestry and things like that for our economy."

I2, G7: "We'd all benefit because we weren't going to be sprayed on."

4.7.4 Sustainable pest-resistant GM crops

A number of women indicated that they felt the scenario was not acceptable or sustainable. However, for most women two main requirements were raised in order for the scenario to be sustainable: that it looked after people (i.e., was proven safe and was done for good reasons);

and that it did not adversely effect the environment (specifically the soil, water and food chain).

I1, G1: "I want to know that it's fine for my grandchildren."

I2, G3: "It's really looking after people. This is an alternative to aerial spraying because with aerial spraying there were a lot of issues on that. Some people were asthmatic, people who had allergies, it had been triggered because of the aerial spraying. I think the end result of it is really looking after people, to get rid of the pests."

I3, G4: "...if they only did the crops and that and they left all the other things in other areas, then the moth is okay. The moth is still going to be there and it's still not affecting the food chain. It's not taking the moth out completely if they did it that way. It may be a good thing, I don't know!"

In addition, several women required long-term monitoring, with the results made available to everyone.

4.8 WHICH ASPECTS OF SUSTAINABLE DEVELOPMENT SHOULD TAKE PRECEDENCE?

The majority of comments focused on the importance of considering people, whether from an ethical standpoint, or a cultural one, or whether it was simply looking after people (including health and safety).

I1, G2: "I think we're part in parcel to environmental and cultural. Your beliefs and values are what you've been brought up with: like going fishing with Granddad and picking apples on Auntie's farm."

I1, G3: "I think ethics. Especially with number 3 [PGD], I think that is very ethical."

I1, G6: "And respect really, I guess. No matter what, if you go back to look after people again, no matter what their social, or economic culture beliefs are, again if you've listened to what those are too, you are taking care of hopefully everybody's needs too and respecting..."

I6, G2: "Also, culturally though, I think it's everyone's culture within New Zealand, not just one group, like we must liaise with this group, or deal with this group. There are so many groups in New Zealand now. We're very universal. I think you have to go across New Zealand. We're one land. We shouldn't just look at one, which often occurs."

However, there was the recognition that although it was important to take everyone's beliefs and values into consideration, it was a difficult task to decide whose values should take precedence.

A number of comments indicated that the environment was also extremely important, with some women noting that a healthy environment was necessary for our own health.

I6, G2: "Environmental would be way up there as one of the most important."

I6, G3: "I think environmentally. If your land is crap and you can't live on it anymore. If you're poisoning yourself and your future generations, what good is money going to do for you? We'll end up like those people over in starving countries, with no land to grow crop on."

In contrast, women were resentful of what they saw as the overemphasis on economic considerations.

I4, G3: "I think morally, but I think economic probably rules everything doesn't it? At the end of the day?"

I7, G8: “The underlying thing is the money behind all things like this, that I find quite disturbing. The money issue, and how it’s a controlled thing. Unfortunately things are done without thinking. I go to teachers’ training college, and our technology teacher gave us this thing. They made these ovens for all these people in Africa, and they spent thousands and thousands of dollars designing them, they were gas-fuelled ovens. They gave them to all the families and no one could use the bloody things because they wanted to cook on an open fire. They didn’t even consider the individuals’ cultural beliefs in that round. What a waste of money. It was money driven. It was like, solve the problem, chuck the money, chuck them the ovens, they’ll be great. People didn’t want to use them. I find the money economic side of things is quite disturbing.”

While looking after people or the environment was particularly important for many women, a number felt that cultural, environmental, economic and social aspects were all interrelated, and that a balance across these was necessary and desirable. Alternatively, a few women felt that the situation being considered would influence which aspect should take precedence.

I2, G8: “I think it needs to be balanced. I think that to be able for everybody to live a full life and be valued, all those things have to be taken into account.”

I3, G1: “It’s just so case by case isn’t it? Economic, of course the big wigs, or whoever does that, it’s so important to them, environmental, to each individual group, or to each individual group, or family, or whatever, it’s just going to change all the time.”

4.9 WHICH APPLICATIONS OF BIOTECHNOLOGY ARE SUSTAINABLE?

Because of the low level of awareness and understanding about biotechnology, few women were able to come up with examples of biotechnology that they perceived as particularly sustainable. Focusing on the scenarios used in the discussion, bioremediation was perceived as sustainable by a couple of women, while PGD was seen as sustainable by three women. In contrast, two women felt that PGD was unsustainable, because it did not look after future generations, and three women felt that none of the scenarios was sustainable for one reason or another.

I4, G5: “I don’t think they’re [any of the applications] sustainable.”

I8, G6: “I think what you said, [bioremediation] is the most positive scientific research that is going out. The whole definition of sustainable development is so that it doesn’t compromise the ability of future generations to meet their own needs. It’s not supposed to do that. Then making babies, [PGD], is basically doing it for their own needs isn’t it? It kind of doesn’t make sense. I think those 2 kind of contradict each other. [PGD] I don’t think is sustainable development going by the definition.”

I7, G8: “In one way or another, most of them aren’t looking at the long-term view, or they haven’t proven something enough to make us happy that they have. Some of them don’t take into account social, economic or environmental. There are some that aren’t really up to scratch with any of them. Encouraging participation, partnerships. Far out, half the time we don’t know what’s going on.”

I4, G10: “PGD is sustainable.”

5.0 SUMMARY AND DISCUSSION

Ten focus groups were conducted with mothers of children aged ten years of age or younger. The focus groups used ‘sustainable biotechnology’ as a centre-point for discussion, concentrating on four different biotechnology scenarios: non-transgenic GM crops; fungus found on kauri trees to assist with bioremediation; pre-implantation genetic diagnosis; and pest-resistant GM pine and fruit crops. A summary of the key points elicited by these four scenarios are provided in table 2.

Attitudes towards biotechnology in general and to science were diverse, with some women expressing a great deal of suspicion and discomfort, and others feeling optimistic and grateful for the improvements science had made in the medical sphere. The level of knowledge too, varied across the groups, with some women demonstrating considerable confusion regarding the procedures, while others were quite knowledgeable or even experienced (for example with IVF). For the most part, the women were very respectful of the opinions of others, an especially important factor given the sensitivity of the topic of PGD. A number of women also commented that they had found the discussion enlightening and interesting.

The findings from the current stage of the research are consistent on a number of points with the perspectives of the women interviewed for the previous stage of the research (Gamble and Kassardjian, 2004), and with findings on the general public throughout the world (NFO, 2003; Henderson and Weaver, 2003; Dietrich and Schibeci, 2003; KRC Research, 2003; Shaw, 2002).

- The women expressed a range of descriptors associated with biotechnology (from ‘scary’ to ‘progress’).
- The media was the main source of images, and there was an awareness of the need to sensationalise.
- There was a fear of unknown long-term consequences on health and environment.
- Some women viewed the technology as ‘Playing God’, or interfering with nature.
- There was a desire for biotechnology to be highly controlled/contained.
- Thus there was a desire for an objective and transparent regulatory body to ensure regulation and control of the technology.
- Many women experienced some form of consumer alienation (Allison, 1978), including a resentment of financial motivations and considerations, and a lack of trust in big businesses and institutions involved in biotechnology.
- Women expressed concern about the ever-widening boundaries of acceptability (what is ethically acceptable) and potential for misuse of the technology e.g. human cloning.
- They expressed the need to protect the environment.
- They emphasised the value of ‘nature’, and the perception that ‘natural’ is better.
- Safety/health of children/future generations was of considerable importance and was seen to be influenced by quality of food and safety of environment (among other things).
- A number of women expressed a desire to return to traditional food production.
- Labelling was seen as a means of exercising choice over consumption.
- The women felt that those who were less well off financially had less choice/control, because they could not afford alternatives.
- The women felt there was a lack of unbiased information, but conversely expressed a feeling of information overload.
- Some women felt that scientists were out of touch with reality, although more women in the current study were optimistic and appreciative of the role that science played in their lives compared with the 2003 study.

- The feeling of powerlessness apparent in previous research was not so prevalent in this series of focus groups.

The participants in these focus groups required additional information to that provided in the scenarios in order to voice an opinion. The sort of information they wanted included how and why the procedure was done, comparison with existing alternatives, effects on the extended environment, where GM crops would be grown, and any potential long-term effects on health.

Consistent with the previous stage of the research, when an application could be deemed to fulfil a real need, could be contained, caused no loss of life or suffering and enabled choice on the part of the recipient, these participants could accept specific biotechnology applications. Additionally, in order for an application to be sustainable, the women in the current study required the application to look after people socially, culturally and ethically, have no negative health consequences in the short and long term, have little negative impact on environment in the short and long term and involve transparent decision processes with a high level of participation by all parties.

5.1 VALUES OF MOTHERS, AND BIOTECHNOLOGY

Schwartz has shown that people's basic values can typically be organised into 10 distinct motivational types that relate to each other on two bipolar dimensions (Schwartz, 1994). Dimension one contrasts the motivational types of values of universalism and benevolence, which call for the transcendence of selfish personal interests, with those of power and achievement, which justify the pursuit of self-enhancing goals. Dimension two contrasts the motivational types of values of conformity, tradition and security, which emphasise conservation of the status quo, to those of stimulation and self-direction, which emphasize openness to change.

The women we interviewed quite clearly demonstrated the values of universalism (understanding, appreciation, tolerance and protection for the welfare of all people and for nature), benevolence (preservation and enhancement of the welfare of people with whom one is in frequent personal contact), and security (safety, harmony, and stability of society, of relationships and of self), and to a lesser extent those of tradition (respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide), and conformity (restraint of actions, inclinations, and impulses likely to upset or harm others, and violate social expectations or norms). It is thus apparent that using Schwartz's dimensions, the women in our study may be more aligned with the self-transcendent, conservative poles of the two dimensions than the self-enhancing, openness-to-change poles. Previous research has revealed significant differences in values orientation for men and women (Boehnke *et al.*, 1998), with women being particularly positively inclined toward benevolent values. For mothers, this seems makes inherent sense.

The scenario of PGD created a particularly interesting discussion, since it was highly relevant to being a mother. The value of all life came through very strongly. Those who had children with disabilities felt horrified that they might not have had this child had they taken the opportunity to have PGD. On the other hand, supporters of the procedure felt that all women had a right to have their own child (rather than having to adopt) and it was important that where possible, suffering should be eliminated. The difference in opinion may partly be a reflection of how likely the participant thought the procedure would be used for non life-threatening conditions, or conditions that might not significantly decrease quality of life (for instance Down's Syndrome). However, it was unanimously agreed that perfection should never be the goal of the procedure, with the selection of children for their gender or physical

attributes seen as morally abhorrent. Those with any sort of disability were seen to be valuable members of society.

It was also very important that a woman had a right to choose to be involved or affected by biotechnology regardless of whether the participant thought it was morally right to be involved or not. Some women felt strongly that PGD was not right, but were reluctant to say it should not be used in any circumstances, since they recognised that they could not and should not put themselves in the position of those who might need the procedure. In addition, it was generally agreed on, even by people who did not support the application, that PGD should be made publicly available to everyone with a high risk of passing on serious inheritable conditions rather than only to those who were wealthy enough to afford it.

It is not surprising that the environment was so frequently raised as an area of concern, since three of the four scenarios involved biotechnology in the environment and would obviously have an impact on the ecosystem. However, the comments made by the women indicated they saw their and future generations' quality of life to be intertwined with the health of the environment, making the environment particularly important. This is consistent with research showing that women more than men tend to see environmental quality as likely to have consequences for personal well-being, social welfare, and health of the biosphere (Stern *et al.*, 1993). In that study, the authors suggested that men might be less attentive than women to links between the environment and things they value, even if men and women hold the same values. In a later study (Stern *et al.*, 1995), the same researchers were able to show that women had stronger biospheric-altruistic values than men (such as unity with nature, protecting the environment, respecting the earth, equality, social justice, a world at peace). In addition, Schultz and Zelenzny (1999) showed that the values of self-transcendence (reflecting a broader cognitive representation of self, and measuring the degree to which a person includes other people and other living things in their notion of self) was positively associated with biospheric concerns (such as ecocentrism). While not consistent over all studies, the theory that differences in social development and sex roles mean that women more carefully consider the impact of their actions on others has been supported in other instances (Straughan and Roberts, 1999).

5.2 CONCLUSIONS

Schwartz's value orientation 'self-transcendence' appears useful in explaining the attitudes mothers of young children hold toward biotechnology. This involves a broader cognitive definition of self as including other people (family) and other living things (the ecosystem) compared with the more narrow perception of self, involving no other people or living things as defined by 'self-enhancement'. In addition, because the environment is so closely linked to society, anything that has potentially negative consequences on the ecosystem is perceived to pose a threat to the woman, her family and future generations. Economical considerations may be perceived to be serving those outside of the sphere of things the woman values and may therefore be considered of lesser priority, or indeed strongly rejected (especially if those outside entities are perceived as threatening). The strong fear of unknown long-term consequences on health and the environment is likely to reflect the desire for a mother to ensure she can protect her offspring from harm both now and in the future. The need for strict controls to be put in place by regulatory and research authorities is therefore seen as an important step in allaying their fears. However, true partnership and participation is a critical aspect of this regulation, since it is only by such means that mothers will feel they are in control of the safety of their own children and future generations.

Table 2. Summary of key points elicited by the four scenarios.

	Non-transgenic GM crops	Bio-remediation	Pre-implantation Genetic Diagnosis	Pest-resistant GM crops
Initial response	<ul style="list-style-type: none"> • More info needed • What's the reason? • Dubious of need - \$ motivated • Unknown long-term consequences • Need for containment • Need for honesty • Labelling for choice 	<ul style="list-style-type: none"> • More info needed • Most acceptable • Good idea • Natural way to protect environment • Environment of greatest concern 	<ul style="list-style-type: none"> • High polarity • Personal choice • Right to own opinion • Slippery slope • Valuable tool to prevent suffering • All life valuable • IVF wrong 	<ul style="list-style-type: none"> • Need for more info • Spraying • Prevention best answer • Other alternatives? • Good idea but not in food • Unknown impact on environment
Values	<ul style="list-style-type: none"> • Natural is best • Role of mother important, control over what kids eat • Concern for future generations health • Negative impact of food on behaviour and health • Science is improving life • Can't control everything in environment 	<ul style="list-style-type: none"> • Environment • Children's/ or future generation health • Trust in science • Consumer alienation • Vulnerable and disempowered by lack of understanding 	<ul style="list-style-type: none"> • Right to own opinion • Value of life • Perfection shouldn't be a goal • Improve quality of life • Morally wrong • Potential for mistakes • Ever-loosening boundaries (need for guidelines and controls) 	<ul style="list-style-type: none"> • Value of nature • Safe in health terms?
Who affected	<ul style="list-style-type: none"> • Public benefit (quality, cheaper) • Public miss out (unknown consequences, lack of choice, expensive) • Industry benefit • Large number of groups miss out 	<ul style="list-style-type: none"> • Everyone (improve health and environmental) benefit • 'them' benefit • Environment will miss out • Economy will miss out 	<ul style="list-style-type: none"> • Couples at risk • Some cultures • Few comments regarding who would miss out • Available to whom? 	<ul style="list-style-type: none"> • Industry benefit • Everyone benefit (better quality, less pesticides) • Few miss out
Sustainable	<ul style="list-style-type: none"> • Open, honest discussion • Contained • Proven safe • Good reason/need • Protection of environment • Looking after people 	<ul style="list-style-type: none"> • Minimise environmental impact • Not harm kauri • Safe and effective • NZ ownership/control 	<ul style="list-style-type: none"> • Ethics committee with international guidelines • Only available for high risk, serious disease • Assessment on case-by-case • Never sustainable 	<ul style="list-style-type: none"> • look after people • Proven safe • Good reasons • Protection of environment • Long-term monitoring • Transparent • Not sustainable

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7.0 APPENDICES

APPENDIX 1: DISCUSSION GUIDELINE

Introductory questions

- I have written the term “Sustainable development” on the board. I would like you to call out any words, images or associations that come to mind when you see this term?
- What do you think is informing these words, images or associations?
- The government uses the following *Definition of Sustainable Development in New Zealand* (provide participants with handout of this for them to read):

“The Government’s Programme of Action for Sustainable Development for New Zealand explains “sustainable development” in the following way: *[display poster/handout]* Sustainable development is “development which meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Achieving sustainable development involves a different way of thinking and working. It requires:

- looking after people
- taking the long-term view
- taking account of the social, economic, environmental and cultural effects of our decisions
- encouraging participation and partnerships.”
- How does this Government explanation of “sustainable development” align with your understanding?
- I have written the word “biotechnology” on the board. I would like you to call out any words, images or associations that come to mind when you see this word.
- What do you think is informing these words, images or associations?

We want to explore how you might think about biotechnology from a sustainable development perspective. We have a number of examples of possible biotechnology applications that we would like to discuss with you.

Note to researchers:

We are interested in examining what is acceptable and what is not acceptable, and where people draw the line in relation to various biotechnology applications. We have consulted with end-users at CRIs, universities and in private industry in relation to the issues that they would like further information on from the public.

We have selected a sample of possible scenarios that should be put to the focus groups. We are trying to identify whether the possible health, economic, environmental benefits etc. of the scientific applications outweigh the possible risks or ethical concerns perceived, and what values are informing people’s views.

The four scenarios are as follows:

Scenarios

1. Developing non-transgenic genetically modified plants

Controversy has surrounded the development of genetically modified or GM crops, particularly where this is perceived to involve the transfer of genes between different species. Even transferring genes between plants of the same species has required the use of DNA sequences from bacteria to transfer the genes. However, scientists are now developing a technique that allows genes to be transferred between plants of the same species using DNA sequences from the target plant species. Although the resulting plants are genetically modified, no foreign genetic material is involved or transferred. Scientists hope that this will allow the use of GM for highly targeted and precise breeding in a way that is socially acceptable and responsible.

Questions for the scenario:

- If you had to decide whether this research should go ahead, what are the issues for you?
- What values are informing your views on this biotechnology example?
- Are there likely to be impacts for particular groups in society (e.g. Maori, scientists, business, consumers)? Who benefits? Who loses?
- Under what circumstances would this biotechnology be “sustainable” or acceptable for New Zealand?

Possible issues raised by this scenario: these are not questions to ask but some of the types of concerns that may be raised and which we are simply interested to see if they come up at all.

Would no longer using bacterial DNA to transfer genes make GM more acceptable?

Is GM OK if it is not transgenic? Is any GM acceptable?

Are there risks that remain?

Is this form of GM different from (better than) traditional plant breeding using induced mutations?

2. Bioremediation/bioprospecting

A New Zealand university research team working in a national park has identified a native fungus growing on New Zealand kauri trees that has the ability to break down and remove dangerous poisons from soil. The fungus offers a way to improve the safety of work conditions at existing industrial production sites or decontaminate former sites that may have been subsequently built upon. The researchers have formed a joint venture with an overseas biotechnology company to develop and commercially exploit the new fungus technology. The joint venture has filed patent applications in New Zealand and overseas for the use of the native fungus.

Questions for the scenario:

- If you had to decide whether this research should go ahead, what are the issues for you?
- What values are informing your views on this biotechnology example?
- Are there likely to be impacts for particular groups in society (e.g. Maori, scientists, business, consumers)? Who benefits? Who loses?
- Under what circumstances would this biotechnology be “sustainable” or acceptable for New Zealand?

Possible issues raised by this scenario: these are not questions to ask but some of the types of concerns that may be raised and which we are simply interested to see if they come up at all.

Is this a more “natural” way of decontamination?

Who owns the native fungus, and who should benefit from its use?

Should native plants be able to be patented?

Would it make a difference if all the commercial parties involved are New Zealand owned?

Should national parks be available for such biodiscovery?

Is it OK to introduce a fungus to environments outside its native habitat?

3. Preimplantation Genetic Diagnosis (PGD)

PGD is a procedure for testing early human embryos for serious inherited genetic conditions causing disease or disability. PGD involves the creation of embryos via *in vitro* fertilisation (IVF), the genetic testing of one or two cells from these embryos for specific genetic conditions, and the subsequent transfer of unaffected embryos to a woman's uterus. Affected embryos are discarded. This allows prospective parents at risk of transmitting a serious genetic condition to their children an alternative to attempted natural conception. Natural conception would involve a risk to the health of the future child or the possibility of pregnancy termination if the foetus is found to be affected by the condition following prenatal diagnosis.

Questions for the scenario:

- If you had to decide whether this research should go ahead, what are the issues for you?
- What values are informing your views on this biotechnology example?
- Are there likely to be impacts for particular groups in society (e.g. Maori, scientists, business, consumers)? Who benefits? Who loses?
- Under what circumstances would this biotechnology be “sustainable” or acceptable for New Zealand?

Possible issues raised by this scenario: these are not questions to ask but some of the types of concerns that may be raised and which we are simply interested to see if they come up at all.

Is there a benefit in avoiding the birth of individuals who might suffer pain all of their lives?

Are there economic benefits for society in saved medical and care costs?

How is “serious inherited genetic condition” defined (and by whom)? Where do we draw the line?

Should all disease/disability be eliminated from society?

Could PGD be (mis)used for sex selection or eugenics?

Are there ethical concerns based on the moral status of embryos, such as in the discarding of surplus or affected embryos? – when does human life begin?

4. Developing genetically modified pest-resistant trees

Recently, areas of Auckland and Hamilton have been aerially sprayed with insecticides in an attempt to destroy introduced pests such as the painted apple moth that threaten our horticultural industry. These spraying campaigns have caused considerable disruption and alleged health effects for many residents of these sprayed areas. In the future, it might be possible to genetically modify lines of commercial fruit trees and pine trees that would be resistant to such pests. This would protect our horticultural and forestry industries without the need for future aerial spraying campaigns.

Questions for the scenario:

- If you had to decide whether this research should go ahead, what are the issues for you?
- What values are informing your views on this biotechnology example?
- Are there likely to be impacts for particular groups in society (e.g. Maori, scientists, business, consumers)? Who benefits? Who loses?
- Under what circumstances would this biotechnology be “sustainable” or acceptable for New Zealand?

Possible issues raised by this scenario: these are not questions to ask but some of the types of concerns that may be raised and which we are simply interested to see if they come up at all.

Is this an acceptable use of GM technology?

Is there a difference between the use of this technology on fruit trees and on pine trees?

Would you buy and consume fruit or timber from such GM trees?

Is it acceptable to export fruit or timber from GM fruit or pine trees?

Do the economic and public convenience/health benefits outweigh the risks?

Are there long-term implications of GM trees for the environment, food consumption, or other species that feed or live on the trees?

Concluding questions

- What aspects of sustainable development should take precedence in deciding what is an acceptable, sustainable biotechnology (e.g. economic, social, environmental, cultural and ethical values)?
- Are specific biotechnologies sustainable and others not? Why?

APPENDIX 2: QUESTIONNAIRE FOR FOCUS GROUP PARTICIPANTS

The purpose of this very brief survey is to gather some basic demographic information about you.

1. How old were you on your last birthday? _____
2. Are you male or female? (circle one) Male Female
3. What is your highest educational qualification? _____
4. What is your race or ethnicity? _____
5. In which country were you born? _____
6. How long have you lived in New Zealand? _____
7. Do you have any religious affiliations? If so please state: _____
8. What is your occupation? _____
9. Have you followed the public discussion/debate about biotechnology in New Zealand? Please circle as appropriate:

A lot Occasionally Not at all
10. Have you participated in any events about biotechnology (for example, anti-GM marches, public dialogues, seminars on GM and/or biotechnology)? If so what? _____

APPENDIX 3: CODING SCHEDULE WHERE EACH ITEM IS IDENTIFIED BY AN ALPHA-NUMERIC CODE

Code	Item
A	Associations with 'sustainable development'
B	Sources of images of 'sustainable development'
C	Response to Government definition of 'sustainable development'
D	Associations with 'biotechnology'
E	Sources of images of 'biotechnology'
F	GM crops - Initial response
G	GM crops - Values
H	GM crops - Groups affected
I	GM crops - Sustainability
J	Bioremediation - Initial response
K	Bioremediation - Values
L	Bioremediation - Groups affected
M	Bioremediation - Sustainability
N	PGD - Initial response
P	PGD - Values
Q	PGD - Groups affected
R	PGD - Sustainability
S	Pest-resistance - Initial response
T	Pest-resistance - Values
U	Pest-resistance - Groups affected
V	Pest-resistance - Sustainability
W	Values to take precedence
X	Sustainable or unsustainable applications of biotechnology

APPENDIX 4: NUMBER OF INDIVIDUALS MAKING EACH COMMENT. MULTIPLE COMMENTS ON THE SAME ITEM MADE BY THE SAME INDIVIDUAL ARE COUNTED AS ONE COMMENT.

Code Item	Number of individuals making the comment
A	
Associations with 'sustainable'	
positive	
A1 development	7
A2 moving forward/progress	4
A3 renewable/re-useable/recyclable	6
A4 achievable	4
A5 environmentally friendly	8
A6 long-term/leaving the world for our children	3
A7 maintenance	2
A8 positive (general)	2
A9 respect	1
A10 common sense	1
A11 replenishing	3
A12 manageable/controllable	2
A13 excited	1
A14 stable	1
A15 healthy	1
A16 improvement	3
A17 growth	1
A18 diet	1
A19 without loss	1
A20 economical	2
neutral	
A21 organic	1
A22 food crops	2
A23 subsistence	1
A24 changing	1
A25 research	1
A26 continuing	2
A27 global	1
negative	
A28 angry	1
A29 fearful	1
A30 infill housing	1
A31 word 'development' can be scary	3

Code Item	Number of individuals making the comment
B	Sources of images of 'sustainable development'
B1 Media	6
B2 television	2
B3 ads	3
B4 radio	3
B5 newspapers/magazines/books	5
B6 media presents extremes/sensationalises	3
B7 too polarised	2
B8 generally negative	1
B9 propaganda	1
B10 prominent people	1
B11 friends/family	1
B12 tertiary study	2
B13 profession	1
B14 work it out from the words	2
B15 food	1
B16 a jargon word	2
B17 don't know	1
C	Response to Government definition of 'sustainable biotechnology'
C1 fits well/similar	10
C2 takes the important things into account	6
C3 takes a long-term view	5
C4 no new aspects	4
C5 nothing missing	2
C6 consistent with Maori approach	1
C7 it's like a moral code	1
C8 reflects the importance of communication	1
C9 sounds safe	1
C10 we need slow positive progress	1
can't tell what the needs of the future generations are going to be/can't predict	
C11 the future	2
C12 we need to make sure we learn by our mistakes	2
C13 sounds difficult	2
C14 doesn't have enough emphasis on environment	1
C15 doesn't take a global perspective	1
C16 there will always be other factors having an impact	1
C17 changing governments make this definition difficult to maintain	1
C18 very generic points/don't say a lot	1
D	Associations with 'biotechnology'
D1 positive	
D2 improvement/progress	8
D3 less chemicals	2

Code Item	Number of individuals making the comment
D4 fascinating	1
D5 helping	1
D6 improved wellbeing	1
D7 making things easier	1
D8 knowledge	1
D9 productivity	1
negative	
D10 mucking around/tampering with nature	4
D11 anxious/scary	6
D12 unnatural/artificial	3
D13 unsure what they're doing to us	1
D14 secrecy	2
D15 the opposite of organic	3
D16 risky	2
D17 unknown long-term outcomes	3
D18 technical manipulation of living things	2
D19 don't understand	2
D20 research on animals	1
D21 more chemicals	1
D22 removal of humanity	1
D23 war	1
D24 negative	2
neutral	
D25 research/experimenting/inventing/testing	11
D26 science	8
D27 labs	5
D28 sterile	5
D29 white coats	3
D30 professor	1
D31 DNA/cells	3
D32 microbiology	1
D33 living/plants/animals	4
D34 technological know-how/technology	3
D35 intelligence	1
D36 futuristic	3
D37 new development	1
D38 change	1
D39 man-made	2
D40 machines	1
D41 GM/GE	2

Code Item	Number of individuals making the comment
D42 manipulation	2
D43 modified	1
D44 engineered	1
D45 processed food	1
D46 a mystery	1
D47 use of land and growing	1
D48 money	1
D49 patent	1
D50 demand	1
D51 sheep and cloning	1
<hr/>	
E	Source of images of 'biotechnology'
E1 media	10
E2 television	6
E3 newspaper	6
E4 documentaries/Discovery channel	2
E5 magazines (<i>New Scientist</i>)	4
E6 news	2
E7 internet	2
E8 farming programmes	1
E9 movies	1
E10 media are biased	1
E11 friends/family	3
E12 school	2
E14 interest groups	2
E15 political debate	2
E16 food labels	2
E17 by breaking the word down	2
E18 we don't really discuss it	1
E19 there's too much information	1
E20 it's a different kind of science from what we used to know	1
<hr/>	
F	GM crops - Initial response
negative	
F1 difficult to know long-term outcomes	5
F2 crops need to be contained (potential for spread)	4
F3 keep it in the lab	1
F4 ripple effect – affects other links in the ecosystem	1
F5 slippery slope	2
F6 between species, or using animals not OK	4
F7 reasons for doing it typically unnecessary	1
F8 no reasons are acceptable	1

Code	Item	Number of individuals making the comment
F9	need to explore other alternatives	1
F10	greed of big corporations/marketing ploy/consumer demand	4
F11	big companies make it so you have to be seed each year	3
F12	negative health issues	2
F13	concerns with antibiotic resistance/use of bacteria	4
F14	parallels: HIV DDT, Thalidomide, cancer, arsenic (unknown long-term effects)	2
F15	negative effects on kids	2
F16	negative emotion	1
F17	unnatural (wouldn't happen in nature)	2
F18	messing around	1
F19	NZ should be GE free	2
F20	the wording makes it sound suspicious	2
F21	inability to get unbiased information	2
	positive	4
F22	OK if within the same species	5
F23	feel fine about it	3
F24	need to feed the world	3
F25	good idea	2
F26	getting the best	1
	neutral	
F27	need for more information/clarification	16
F28	why do it? What are the benefits?	8
F29	what products, different if they are going to be eaten	2
F30	should be selective	1
F31	information about what is good/bad for health always changing	2
F32	need to take risks to progress	3
F33	need government controls	1
F34	who decides?	2
F35	need for honesty about process/contents	3
F36	need for labelling to enable choice	5
F37	medicine more acceptable than food	5
F38	don't understand it	3
F39	mixed feelings	1
F40	confusion	2
G	GM crops - Values	
G1	take responsibility for own health	5
G3	should grow own food	5
G4	don't have time/space/inclination for growing own food healthy food is expensive/food choices often dictated by cost/unhealthy food	1
G5	cheap	6
G6	ethics/need for an unbiased committee	3
G7	the need to be heard in decision-making	2
G8	honesty	3
G9	accountability	1
G2	education important to inform oneself and children	1
G28	science is intimidating/inaccessible	4
G10	money is a motivating factor in GM	3
G11	GM is a quick-fix solution, may be other alternatives	3

Code Item	Number of individuals making the comment
G12 science has lead to improved health	5
G13 research should be controlled	3
G38 need for environmental safety	1
G14 need for health safety	2
G15 negative impacts on health	2
G16 unknown health effects	1
G17 keep things as they are	2
G18 variation is good	1
G19 GM OK in same species/could occur naturally	3
G20 GM not OK between species	2
G21 improved nutritional quality more acceptable than taste etc	2
G22 food/fruit OK	1
G23 animals/humans not OK	1
G24 ripple effect	1
G25 slippery slope	2
G26 value of original	2
G27 balance of nature/nature can't be improved on	2
G29 playing with nature/unnatural	3
G30 unknown long-term effects on kids/future generations	10
G31 need the ability to control what children eat/need awareness	6
G32 need for labelling to allow choice	1
G33 protection over children	1
G34 food can have an impact on children's behaviour/mental state	1
G35 GM/chemicals cause sickness in children/allergies	5
G36 wouldn't give GM to their children	2
H	GM crops - Groups affected
	who would lose out
H1 producers - selling less because better quality	1
H32 growers - reduced demand	1
H2 environment	2
H3 environmental people	1
H4 restaurants - higher prices	1
H5 farmers who don't want GM crops - no choice	2
H6 public - suffer unknown consequences	6
H7 public - anti big-business	1
H8 public- don't want GM crops	2
H9 public - higher prices for GM food	1
H10 public - higher prices for organics	1
H11 low income - no choice	1
H12 third world countries - guinea pigs	1
H13 children - unknown long-term consequences	1
H14 chemical companies - sell less chemicals	3
H15 plants	1
	who would benefit
H16 growers/farmers/sellers	7
H17 government	4
H18 NZ if we go GE free	1
H19 higher income - could afford them	2

Code	Item	Number of individuals making the comment
H20	body conscious	1
H21	those who want it	1
H22	public - lower prices	3
H23	public - less wastage	1
H24	public - better quality	2
H25	world - more food	1
H26	world - less wastage	1
H27	third world countries - better productivity	1
H28	science and research	1
H29	GM organisations	1
H30	plants	1
	general impact	
H31	farmers - to be organic or not	1
H33	everyone	1
H34	depends on the product	1
H35	depends on the reason for GM	2
H36	whose interests are being served by the development	2
I	GM crops - Sustainability	
I1	if there is open, honest discussion/education about research/partnership	7
I2	needs to be labelled to allow informed choice	1
I3	if it's in a controlled environment or lab	6
I4	needs strict guidelines/rules	1
I5	needs to be proven safe	3
I7	needs a good reason/need	3
I8	takes into account social, economic, cultural and environmental factors	2
I9	looking after people	2
I10	if it helps feed the masses	1
I11	nutritional value needs to be maintained	2
I12	having children's future at heart	2
I13	needs to look after the planet	2
I14	if it uses fewer pesticides	2
I15	genetic diversity needs to be maintained	1
I16	needs to be economically sound	1
I17	money shouldn't be the driving force	1
J	Bioremediation - Initial response	
J1	sounds like a good idea	24
J2	a natural way to protect the environment/'natural' is good	6
J3	as long as testing has shown it's safe and effective in the long-term	5
J4	need more information	9
J5	impact on kauri tree - would it kill the tree, does the tree need the fungus?	15
J6	how does the fungus grow, how is it collected, how do they get enough what happens to the fungus once the poison removed from the soil, is the	16
J7	fungus safe?	5
J8	impact on environment/food chain etc.	8
J9	how long is soil decontaminated for?	2
J10	will there be spread of contaminated fungus?	2
J11	needs to be controlled so they don't strip the fungus off the trees	1

Code Item	Number of individuals making the comment
J13 Concerns with overseas involvement/\$ will take over	5
J14 NZ should be the ones to benefit financially/NZ should have ownership	3
J15 lack of funding to do this in NZ	2
J16 will bring money to NZ	1
J17 keep it in the lab	1
J18 concern about patenting of our native fungus	3
J19 Maori ownership issues	1

J20	protect the children	2
K	Bioremediation - Values	
K1	sounds positive	3
K2	good to clean up land for future generations	3
K3	don't know what's in our soil currently	6
K4	optimistic that development has been researched	4
K5	should keep the technology in NZ	1
K6	could be a good source of income for NZ	1
K7	consumer alienation	1
K8	don't like overseas company involvement	3
K9	potential irresponsibility of overseas company	4
K10	overseas company would only be financially motivated	3
K12	who's liable for problems?	1
K13	lack of trust in authorities	2
K14	lack of understanding is disempowering	5
K15	need for partnership and participation	1
K16	need for honesty/transparency	1
K17	unknown health effects	4
K18	concern for children's health/they play in the dirt	8
K19	unknown long-term effects	3
K20	protection of environment	4
K21	keep it natural	2
K22	protecting kauri	6
K23	taking out the goodness in the soil?	3
K24	make sure the fungus is safe	2
K25	need for long-term research	4
K26	role as a mother has little impact	2
L	Bioremediation - Groups affected	
	benefit	
L1	government	3
L2	big businesses/overseas companies	7
L3	researchers	4
L4	biotechnology companies	2
L19	private business	1
L5	those working/living on sites	7
L6	forestry - need to grow more trees	1
L7	builders/developers	2
L8	farmers - can use the land	1
L9	everyone	4
L10	everyone-improved health	1
L11	everyone-improved environment	1
L12	future generations	1
	lose out	
L13	kauri	4
L14	environment if not controlled	1
L15	public if environment destroyed	2
L16	public won't see the money	2
L17	NZ economy if technology goes overseas	3

general		
L18	future generations	1
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M	Bioremediation - Sustainability	
M1	should be affordable	1
M2	should be proven to be effective	1
M3	that it increases the safety in work sites	1
M4	the long-term effects are researched	3
M5	that there are no side-effects	2
M6	needs NZ control	4
M7	should be government owned/controlled rather than privately owned	3
M8	should only be grown/used in NZ	3
M9	that overseas company role is limited	3
M10	doesn't harm kauri/protects kauri	4
M11	doesn't harm environment	3
M12	that it remains all-natural	1
M13	that fungus is removed in a controlled way/limited areas	3
M14	that it is in a controlled environment and can be contained	2
M15	that it isn't in soil where food is grown	1
M16	takes into account social environment	2
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N	PGD - Initial response	
N1	personal /right to own opinion	16
N2	hard to judge unless you are in that position	6
N3	lots of opinions	1
N4	you should have a choice	7
N5	Is a good idea	11
N6	IVF OK	1
N7	prevents a child from suffering	7
N8	wellbeing of child most important	4
N9	better at this stage than later in pregnancy	3
N10	depends if it is life threatening	6
N41	could have long-term benefits	1
N40	could wipe out disabilities/have long-term benefits	2
N11	it's unstoppable	1
N12	story about friends/family/personal revelation	12
N13	should have the right to have own child	1
N14	should be limits/strict guidelines	2
N15	should be/there is an ethics committee	4
N16	who decides what is serious?	6
N17	slippery slope/where do you draw the line?	17
N18	different perspectives on what is a good reason/what is classed as 'serious'	5
N19	tampering with nature/playing God/what's meant to be	9
N20	nature might have done it anyway	2
N21	at what stage is life?	3
N22	if condition known, then shouldn't have kids/should adopt	2
N23	throwing away of people	3
N24	lucky to get what you are given	4
N25	those with disabilities being treated as less deserving	2
N26	is selfish	1
N27	IVF is wrong	4

N28	gender/age/physical appearance/boutique babies unacceptable	14
N29	misuse/Nazis/supermodels	6
N30	shouldn't try for perfection/societies perspective on perfection	7
N31	culturally wrong to mess with bodies	1
N32	religiously wrong	1
N33	what if a cure was found?	1
N34	\$ is the motivator	1
N35	only for the wealthy/not available to everyone	6
N37	lost society/family support	4
N38	should put money into treating conditions	3
N39	clarification	3
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P	PGD - Values	
P1	right to have a choice	8
P2	everybody's right to have a child	2
P3	should adopt	1
P4	questionable motives of science	1
P5	fear of science	2
P6	science is offering an improved life	1
P7	sometimes better not to know	2
P8	may still end up with other problems (get hit by a bus)	4
P9	lucky to have any child at all/you get what you are given	2
P10	perfection shouldn't be a goal	4
P11	valuable contribution of those with disabilities	3
P12	nature dictates what should happen with the baby	2
P13	unnatural	1
P14	playing God	4
P15	religious concerns	3
P16	when does life begin?	3
P17	the right to life even though it might be horrible	1
P18	is just wrong	1
P19	ensuring future wellbeing of the child	1
P20	fine if it means a healthy baby	7
P21	need to consider future quality of life	2
P22	unknown long-term consequences	1
P23	potential for mistakes	2
P24	slippery slope	3
P25	need for guidelines and control	3
P26	inequality in society (wealthy versus poor)	2
P27	public money should be spent on this (other priorities)	3
P28	personal comment	3
P29	being a mother plays a huge role in this issue	3
P30	being able to be a good mum to all the family	1
P31	benefits should outweigh the moral considerations (e.g. not hair colour, gender etc.)	2
P32	better than terminating later on	2
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Q	PGD - Groups affected	
	who benefits?	
	people who might normally choose not to have children, or who would have children	
Q1	with a serious inheritable disease	8
Q2	child - will be healthy	1

Q3	those who will benefit financially (e.g. specialists, medical profession)	2
Q4	medicine - eradicate disease	1
Q5	dwindling cultures	3
	who loses?	
Q6	the baby - if it survived pregnancy it was meant to	1
Q7	world - might become overpopulated	1
Q8	no-one	2
Q9	government - cost of procedure	1
Q10	babies with the disease that wouldn't be born	2
Q11	couples who would be childless if they had to discard all the embryos - might have been happy with an unhealthy child	3
	general	
Q12	who would be able to afford it	5
Q13	tests should be available to everyone	1
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R	PGD - Sustainability	
R1	needs a trustworthy ethics committee, and strict international guidelines	5
R2	only available to those with a high likelihood of passing on the condition	3
R3	only available for severe conditions	4
R4	only if all other avenues have been pursued	1
R5	needs to be on a case-by-case basis	5
R6	as long as it's an individual's choice	1
R7	should be available regardless of wealth	2
R8	shouldn't be used to get a perfect child	2
R9	shouldn't become the norm	2
R10	never	3
R11	ethically wrong	1
R12	playing God/messing with nature	2
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S	Pest-resistance - Initial response	
S1	issues with spraying	29
S2	prevention/need better border control	10
S3	how would it work?	7
S4	where will they be grown/how many?	2
S5	what's in the GM trees - would they be harmful if eaten or taste bad?	9
S6	sounds great	4
S7	pine trees OK because not eaten, but not fruit trees	5
S8	as long as proven safe	4
S9	GM better than spraying	1
S10	negative about GM trees	2
S11	GM trees are scary	2
S12	wouldn't eat GM fruit/let kids eat GM fruit	3
S13	there's always going to be a pest it doesn't control for	5
S14	expensive/who pays for them	2
S15	only for financial benefit	1
S16	unknown long-term consequences	2
S17	previous mistakes about sprays/chemicals	1
S18	concerns about health (sprays or GM)	4
S19	messing with nature	2
S20	insects may become resistant/mutating to something worse	3

S21	unknown impacts on the balance of nature, like effects on non-target species, birds, food chain	7
S22	impact on native species	1
S23	use other alternatives such as natural pest control	5
S24	encourages a lazy attitude towards the environment	1
Pest-resistance - Values		
T1	issues with spraying	7
T2	prevention/need better border control	3
T3	what's in the GM trees - would they be harmful if eaten or taste bad?	1
T4	pine trees OK because not eaten, but not fruit trees	1
T27	concern with burning of GM wood	1
T5	as long as proven safe	2
T6	GM better than spraying	2
T7	wouldn't eat GM fruit/let kids eat GM fruit	5
T8	concerns about health (sprays or GM)	1
T9	unknown long-term consequences	1
T10	there's always going to be a pest it doesn't control for/insects may become resistant/mutating to something worse	4
T11	unknown impacts on the balance of nature, like effects on non-target species, birds, food chain	7
T12	need to be contained	1
T13	short-term thinking	1
T14	use other alternatives such as natural pest control	2
T15	encourages a lazy attitude towards the environment	1
T16	value of nature/natural	2
T17	preservation of nature/future of planet	6
T18	economic value of being clean/green	2
T19	economic impact on health, education etc.	1
T20	lack of control	3
T21	need more info	2
T22	a choice of two evils	4
T23	Maori concerns	1
T24	being a mother magnifies importance of issues	1
T25	protection of children	1
T26	honesty/transparency	1
U Pest-resistance - Groups impacted on		
benefiting		
U1	general public/everybody	1
U2	horticulture	3
U3	forestry	1
U4	exporters	
U5	general public/everybody - because wouldn't be sprayed	3
U6	general public/everybody - because would get better fruit	1
U7	people who want the fruit and pine trees	1
U8	NZ economy - better quality produce, less pesticides	2
lose out		
U9	public	1
U10	public - degraded environment	1
U11	public if not safe	1

U12	insects	1
U13	native bush if insects move to a new plant	1
U14	NZ economy if we go with GM	1
	general impact	
U15	everyone	3
U16	growers	1
U17	forestry	1
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V	Pest-resistance - Sustainability	
V1	not sustainable/acceptable	7
V2	as long as proven safe	4
V3	if for a good reason	1
V4	safe for children/grandchildren/future generations	5
V5	if it is looking after people	2
V6	if it is safe for the environment	3
V7	if it doesn't affect the soil/water	2
V8	if it doesn't affect the food chain/non-target species etc	3
V9	if it has long-term research/monitoring	2
V10	as long as we are given the full facts/are kept informed	3
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W	Values to take precedence	
W1	environmental, cultural, social and economic all interrelated	7
W2	should be balanced over the four	3
W3	depends on the situation/individual/reason	6
W4	environment influences everything else	2
W5	environmental	8
W6	environmental and social	1
W7	ethical	7
W8	ethical difficult because who decides?	3
W9	cultural - our values and beliefs	3
W10	should be all cultures, not just one	1
W11	all groups should be talked to and listened to	5
W12	looking after people	6
W13	if it's going to help us	2
W14	health	1
W15	realistically its economical and environmental	3
W16	economic should not take precedence	7
W17	should take the long-term view/no negative long-term consequences	3
W18	if it's safe	2
W19	scientists need to communicate	1
W20	children should be educated on this so they can make informed choices	2
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X	Sustainable or unsustainable applications of biotechnology	
X1	none of the four scenarios	3
X2	has to fit government definition of 'sustainable'	2
X3	PGD least sustainable because it doesn't look after future generations	2
X4	PGD is sustainable	3
X5	we need to benefit	1
X6	improves quality of life	1
X7	those with medical benefits	1
X8	plants OK but not humans	2

X9	not food, because affects our health	1
X10	cheaper and better quality of food	2
X11	economic considerations shouldn't come first	3
X12	bioremediation	2
X13	alternative fuels	2
X14	needs to be non-transgenic	1
X15	listening to public	2
X16	anti-GM	1
