# instinct and reason

## Community attitudes to gene technology

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## TABLE OF CONTENTS

1.	EXECUTIVE SUMMARY	4
	Overview	4
	Awareness and understanding of biotechnologies	5
	Perceptions towards science and technology	6
	Attitudes and beliefs	6
	Segmentation	9
2.	BACKGROUND AND OBJECTIVES	10
3.	METHODOLOGY	11
	Stage 1 - Planning	11
	Stage 2 – Survey design	11
	Stage 3 – Survey commencement	12
4.	LITERATURE REVIEW	14
5.	KEY FINDINGS	16
Α	wareness and understanding of biotechnologies	16
	Perceptions on whether GM technologies will improve our way of life or not	18
	Levels of support for GMOs and gene technology	19
	Perceptions towards science and technology	20
Α	ttitudes and beliefs	24
	Confidence in food and the influence of GM on food consumption	24
	Genetic modification in Australia	28
	Modifying genes of plants to produce food	29
	GM in food production	30
	GM crops in your state or territory	32
	Support for growing GM crops in your state/territory	35
	Public opinion on using GM technology to produce food	38
	Attitudes to GM for industrial or therapeutic uses	46
	Attitudes to GM for industrial or therapeutic uses Awareness of organisations responsible for regulation of GM	46 47
	Attitudes to GM for industrial or therapeutic uses Awareness of organisations responsible for regulation of GM Trust in what organisations say about gene technology	46 47 49
	Attitudes to GM for industrial or therapeutic uses Awareness of organisations responsible for regulation of GM Trust in what organisations say about gene technology Attitudes and beliefs towards government involvement	46 47 49 50



	Values-based segmentation	54
	Segment 1 – The Lost (31%)	54
	Segment 2 – Uninformed Doubting Thomases (20%)	56
	Segment 3 – Uninformed Supporters with Provisos (32%)	57
	Segment 4 – The Disciples (17%)	59
	Attitudes towards GM foods by segment	60
	Further segmentation analysis	62
6.	CONCLUSIONS	68
AF	PPENDIX I – SAMPLE PROFILE	70
AF	PPENDIX II – REFERENCES	71



## 1. Executive summary

#### Overview

There has been a drop in both awareness and support for gene technologies in Australia since 2012, with mean levels of support dropping from 6.07 out of ten to 5.33. As in previous studies it appears that people with less knowledge of gene technology are less likely to support it.

However, there were still more people in support of GMOs generally than were opposed, although this changed with the applications. Support was much greater when the applications were for medical uses (such as producing insulin or vaccines), for industrial uses (such as making biofuels or plastic replacement parts from plants) and for other uses (such as modifying microbes to clean up the environment). Using gene technology in food and crops had far less support than the other applications.

Generally speaking, women were more concerned than men about the possible negative impacts of gene technology, and older people were more concerned than younger people.

Most support or rejection of GM foods was conditional, and is likely to move based on knowledge of regulation or scientific evidence of safety, indicating that a higher awareness of the OGTR and other regulators, and their roles, would have some impact on public concerns.

Thirteen per cent of people were aware of the OGTR before participating in the survey – up from 5% awareness in 2012. This was a significant rise, although still relatively low in comparison to the other agencies mentioned in the study. But trust in the OGTR was high, at 7.6 out of ten – the highest of all organisations tested.

Dividing the audience into four segments based on their support for GM foods, almost a half of survey respondents were against the production of GM foods until the science proved it was safe. More than a quarter stated they were open to the production of food this way as long as the regulations were in place to make sure it is safe. Only 15% were completely against the production of GM foods and would never change their minds, and 12% accepted it was safe way to produce food.

Other key findings included:

- Knowledge about what foods were genetically modified in Australia is generally poor.
- As has repeatedly been shown in previous studies, people have different attitudes towards different genetic modifications, and there is more support for modifications that are perceived to be less radical.
- Awareness of whether GM crops were grown in a respondent's state was generally not high, with an average of only 37% being aware of whether GM crops were grown in their state.



- There has been a significant drop in support for growing GM crops in a person's state from more than 50% support in 2007, 2009 and in 2012 to a low in 2015 of 38%.
- Those organisations thought to be regulators of GM were the Department of Agriculture 37%, Food Standards Australia New Zealand (FSANZ) 34%, CSIRO 30%, the Office of the Gene Technology Regulator (OGTR) 25%, Department of Health 24%, National Health and Medical Research Council (NHMRC) 21%, State government 19%, the Therapeutic Goods Administration (TGA) 18%, and the Australian Pesticides and Veterinary Medicines Authority (APVMA) 16%.
- When asked about the rules and regulations relating to GM, and whether they were sufficiently rigorous and complied with, there was majority agreement, but also significant *don't know* responses.
- Most respondents (69%) felt that biotechnology would improve our way of life in the future, while only 46% felt that GMOs would improve our way of life in the future.
- Although only 46% of people had any awareness or knowledge of synthetic biology, there was significant support for it with 59% of respondents stating they felt it would improve our way of life in the future.

#### Awareness and understanding of biotechnologies

Awareness of all gene technologies has fallen since 2012. Awareness of the term 'biotechnology' has dropped from a high point in 2012 of 84% to 74% in 2015, similar to the awareness level of 1999 (73%). Fewer than two out of ten respondents to the survey stated that they knew enough about biotechnology to be able to explain it to a friend.

There were higher levels of awareness of genetic modification or GMOs (81%) and cloning of animals (88%), however both have dropped since 2012. The highest *don't know* rating was for synthetic biology, with 48% stating that they had not heard of it, and only 9% stating they knew enough about it that they could explain it to a friend.

Generally speaking women were more concerned than men about the possible negative impact of gene technology and older people were more concerned than younger people. As in the 2012 survey, it would appear that people without knowledge of gene technology are more likely to be concerned by it and not support it.

Support for gene technology appears to decrease with age. Those in the 51-75 age groups were more likely to indicate a low level of support for gene tech generally but those in the 16-30 age group were more likely to indicate a high level of support for gene tech generally.

Most respondents (69%), however, felt that biotechnology would improve our way of life in the future and this was slightly up from 2012 (64%). There were drops, however, in belief that GMOs and cloning of animals would improve our way of life in the future—GMOs dropped from 50% to



46% and cloning of animals dropped from 39% to 31%. Correspondingly, almost 3 in 10 felt that GMOs would make things worse in the future, and the same amount felt that cloning of animals would make our life worse in the future, both increasing from 2012.

Although only 46% of people had any awareness or knowledge of synthetic biology, there was significant support for it with 59% of respondents stating they felt it would improve our way of life in the future.

While there were more people in support of GMOs generally than were opposed to it, this changed with the applications of the technology. Support was much greater when the applications were for medical uses (such as producing insulin or vaccines), for industrial uses (such as making biofuels or plastic replacement parts from plants) and for other uses (such as modifying microbes to clean up the environment). Using gene technology in food and crops had far less support than the other applications. Going against this trend however were respondents from SA who were more likely to indicate support for gene technology for use in foods and crops than for other uses.

#### Perceptions towards science and technology

Looking at correlations between attitudes towards GMOs and science and technology provides insights into the values that drive attitudes. Eight key statements were tested to gauge public sentiment and inform the segmentation.

Those statements with the largest levels of support were:

- not vaccinating children puts others at risk
- commercial use of genetic modification and its products should only be allowed after regulatory approval
- children must be protected from all risks
- technological change happens too fast for me to keep up with.

By contrast, those statements that received the lowest levels of support were:

- we rely too much on science and not enough on faith
- science and technology creates more problems than it solves.

#### Attitudes and beliefs

Respondents were asked to place themselves in one of four categories relating to attitudes to genetically modified (GM) foods, which showed almost half of the respondents were against the production of GM food until the science proves it is safe. More than a quarter stated they were open



to the production of food this way as long as the regulations are in place to make sure it's safe. Only 15% were completely against GM foods and would never change their mind to support them, and 12% accepted that it was a safe way to produce food.

It is also important to note from these findings that most support or rejection of GM food and crops is conditional, and is likely to move based on regulation or scientific evidence of safety.

Survey results from a number of countries including Australia consistently show that the public acceptability for GM crops varies according to the trait or intended use (Biotechnology Australia, 2005; Gaskell et al., 2006; Hossain et al., 2003), so it is important to understand just what attitudes respondents had to different traits and whether they saw them as valuable or not. Those traits that were perceived to have the highest benefits were *making plants drought resistant* (44%) and *making food healthier* (42%). Those with lesser levels of perceived value were *making the plants pest resistant* (37%), *frost resistant* (30%) *able to grow in salty soils* (33%) and *to make the food cheaper* (31%). The least highly rated benefits were for *making the food taste better* (23%), *making the plants herbicide tolerant* (23%) and *making plants mature more quickly* (20%).

In the 2015 study there was a uniformity of support for GM products, as well as food grown with the use of pesticides or chemicals, between 27% and 36%. And those not supporting them were also similarly ranked between 27% and 37%. There has been a general flattening of differences from previous studies.

The two major points of significance are that attitudes to processed foods and GM foods are similar, and the attitudes to most GM foods lie between that of pesticides and preservatives in foods. This suggests that GM food buying and consuming behaviour could also lie between consumers' behaviour towards preservatives and their behaviour towards pesticides in foods.

#### Genetic modification in Australia

Beliefs about what foods were genetically modified in Australia were little changed from 2012 and showed that knowledge about GM foods is generally poor. For instance more people believed (incorrectly) that most of the processed foods in Australian supermarkets contained GM ingredients (32%) compared to 27% who correctly stated that this was false.

Those who correctly stated that most of the fruits and vegetable grown in Australia were **not** genetically modified was 42% (down from 50% in 2012). 21% of respondents believed this to be true (up from 15% in 2012). 36% correctly stated that most of the cotton grown in Australia is genetically modified (up from 29% in 2012). There was also a high belief that most of the vegetable oils produced in Australia were made from GM crops (31%, up from 23% in 2012). Of note, the *don't know* responses against all four categories was very high, ranging from 37% to 49%.

As has repeatedly been shown in previous studies, people have different attitudes towards different genetic modifications and there is more support for modifications that are perceived to be less radical. The greatest levels of support were for introducing the genes of a plant of the same species



(41% support in the highest Likert grouping<sup>1</sup>), followed by 33% support for switching on or off the genes within a plant and also for introducing the genes of a plant of a different species. Introducing the genes of a bacterium only received high support from 24% of people, and introducing the genes of an animal only received high support from 23%.

Awareness of whether GM crops were grown in a respondent's state was generally not high, with an average of only 37% being aware of whether GM crops were grown in their state. The GM crops most commonly mentioned were canola (55%) and cotton (35%) [which are correct], and wheat (31%) [which is not correct], followed by soya and corn and tomatoes.

This suggests that some information about GM crops could be coming from international media as soya and corn are widely grown as GM crops overseas, but not grown in Australia. This is unsurprising given the international nature of communication. It also suggests that knowledge and awareness of GM issues can be shallow.

There has been a significant drop in support for growing GM crops in a person's state from more than 50% support in 2007, 2009 and in 2012 (albeit with a slight drop that year) to a low in 2015 of 38%.

#### Regulation

There is generally low awareness of organisations that are responsible for the regulation of GM in Australia, with a significant don't know response (37%). Those organisations that were most commonly believed to regulate GM were the Department of Agriculture 37%, FSANZ 34%, CSIRO 30%, the OGTR 25%, Department of Health 24%, NHMRC 21%, State government 19%, TGA 18%, and the APVMA 16%.

When asked about the rules and regulations relating to GM, and whether they were sufficiently rigorous and complied with, there was majority agreement but also significant *don't know* responses.

<sup>&</sup>lt;sup>1</sup> A Likert scale ranging from 0 to 10 was used for many of the questions, to better measure degrees of support or opposition to issues. Responses were then often grouped for ease of analysis.



#### Segmentation

The Department of Industry study of 2012 identified several values statements as useful for defining values-based segments, which were used again in this 2015 study. A cluster analysis of ratings to a series of statements produced four distinct attitudinal groups. Two of the segments (Segments 1 and 2) were less positive toward science and technology, while two segments were more positive. Each segment is profiled in more detail below.

#### Segment 1 – The Lost (31%)

Segment 1 was the least enthusiastic about the benefits of science and technology. They were most likely to feel that biotechnology, genetic modification, cloning of animals and synthetic biology would make things worse in the future and to rate their support for all uses of gene technology as low. They had the highest agreement that *the pace of technological change is too fast to keep up with* and were the most likely to agree that *science and technology creates more problems than it solves*, that *we depend too much on science and not enough on faith*.

#### Segment 2 – The Uninformed Doubting Thomases (20%)

This segment stood out as being relatively middle of the road. Their support for science and technology and for GMOs tended to hover between the low to middle end of all scales. Segment 2 was more likely to live in non-metropolitan WA, and to say that their highest level of education was year 11.

#### Segment 3 – The Uniformed Supporters with Provisos (32%)

Segment 3 tended to rate their support for science and gene technology around the middle to higher levels of most ranges with higher levels of support for medical use. They were more likely to have heard of biotechnology, cloning of animals and GMOs but know very little about them, and to believe biotechnology would improve our way of life in the future. Segment 3 is more likely to be female, aged 61–70 years.

#### Segment 4 – The Disciples (17%)

This group was the most positive towards science and technology and were the most supportive of GM and other biotechnologies. Notably, Segment 4 that had the highest proportion of respondents who believed they knew enough about biotechnology, genetic modification and cloning of animals to explain it to a friend. They were also most likely to believe that biotechnology, GMOs, cloning of animals and synthetic biology would improve our way of life in the future.



## 2. Background and objectives

The Gene Technology Regulator (the Regulator) administers the *Gene Technology Act 2000* to protect the health and safety of people and the environment from risks posed by gene technology by regulating genetically modified organisms.

Biotechnology is generally used to describe the use of biology in agriculture, managing environmental concerns, and pharmaceutical development. It also refers to the production of GMOs and the manufacture of products from them. Much of the newer activity in biotechnology involves directly modifying the genetic material of living things, referred to as genetic modification, recombinant DNA technology or genetic engineering. Other types of biotechnology include using enzymes and bacteria in applications such as waste management, industrial and food production, and remediation of contaminated land. The largest sub-sector of biotechnology companies in Australia is involved in human therapeutics, including both pharmaceutical development and medical procedures. Other major sub-sectors are agricultural applications, and diagnostics.

Community attitudes are crucial to the development of the Australian biotechnology sector. If Australians are not in favour of a particular technological application, research and development in this area will be constrained and a host of potential benefits in fields ranging from medicine to textiles are likely to be missed, resulting in a lost opportunity for individuals, industry and the nation as a whole. In addition, public attitudes help shape both industry uptake of emerging technologies and the underlying regulatory framework for them.

Over recent years, there have been a number of surveys of community attitudes towards biotechnology that have helped gauge the state of Australian public awareness, identify knowledge gaps and track changes in awareness and attitudes over time. The findings have been used to develop strategies to engage with the community on these issues including increasing public awareness related to developments in emerging technologies. This study continues the tracking of those community attitudes and behaviours.

#### Objectives

Instinct and Reason understands that the research objectives are as follows:

- Explore current awareness, attitudes and understanding towards general science and technology, specific biotechnology issues and specific applications and controllers of the technology
- Explore differences in awareness, perceptions and attitudes according to key demographic variables such as age, gender, location and education, and in terms of mindsets to determine segments in the community.



## 3. Methodology

#### Stage 1 - Planning

An initial meeting was held with OGTR to define outcomes sought and assess best options to deliver the project in the timeframe specified. OGTR shared the existing body of knowledge about past and current community attitudes and areas of concern, including past and current strategies, initiatives, and the effectiveness of these. External factors impacting on perceptions of gene technology, innovations and its regulation and the social, technological, political, economic or legislative issues affecting the category were also discussed.

Survey methodology was agreed upon, replicating the survey methodologies of previous years and eliminating the impact of externalities. In order to ensure that longitudinal comparisons were valid, some terms that had been used in questions in previous surveys had to be retained.

Instinct and Reason reviewed the existing knowledge and data and prepared a literature review.

#### Stage 2 – Survey design

Instinct and Reason drafted survey questions based on new data from the literature review and ensuring these matched previous questions where possible and aligned with the information being sought by OGTR. The survey covered the following areas:



Figure 1 – Survey design



Based on previous research in similar areas, care was taken in the survey design to manage the tendency of respondents to favour a 'risk' response which could easily distort findings and make concerns appear higher than they actually are.

Cognitive testing of the draft survey was undertaken to ensure respondents understood what they were being asked, and the final version was approved by OGTR.

#### Stage 3 – Survey commencement

The 15 minute survey was completed (n=1160) online and with a booster CATI (phone) survey to ensure a nationally representative sample of Australians (with proper representation from Tasmania, NT and the ACT). Quotas were set for states and territories, rural and metropolitan, and gender. Recruitment was taken from a reputable research-only panel. The following sample breakdown was achieved.

State/Territory	Population Size	% of Australian population	Sample Size	Accuracy level**
NSW	7 544.5	32	320	+/- 5.48%
VIC	5 866.3	25	250	+/- 6.20%
QLD	4 740.9	20	200	+/- 6.93%
SA	1 688.7	7	70	+/- 11.71%
WA	2 589.1	11	110	+/- 9.34%
TAS	515.0	2	20	+/- 21.91%
NT	246.3	1	10	+/- 30.99%
ACT	387.1	2	20	+/- 21.91%
Total	23 581.0m	100	1000	+/- 3.10%

#### Table 1 – Sample structure

\*Based on ABS estimate of population end of September quarter 2014

\*\*based on the 95% confidence interval: in 95 out of 100 surveys, we expect the result to be within this range, so we can be 95% confident the 'true' result lies within this range

To enable detailed analysis of TAS, ACT and NT, their sample was boosted to 70 each (an extra 160 interviews) and then their data weighted to reflect their actual proportion of the Australian community. Without this, detailed analysis of these jurisdictions wouldn't be possible.

The 2015 sample had a quota of 50/50 male/female and also quotas that matched the age profile of the previous sample (16-30; 31-50 and 51-75 years). The combination of a representative national sample with quotas and weighting, delivered a sample that could be directly compared to the previous research and accurately identify changes in the views and attitudes of the Australian community.



While the people sampled in this survey were not the same individuals sampled in previous surveys, they were drawn from similar demographic areas, so the responses obtained, while not indicating individual changes of attitudes, do capture the movement of attitudes across the broader population.



## 4. Literature review

GM crops have been commercialised worldwide since 1996 (Vestal and Bries, 1999) and despite the rapid adoption of GM crops around the world, attitudinal surveys undertaken in several countries show the public still hold concerns about this technology (Legge & Durant, 2010; Cormick, 2007; Department of Innovation 2013). However, understanding public support for genetic engineering, anticipating any potential benefits or negative effects of scientific research, and assessing public reaction towards technology under development can ensure a better alignment of technology and acceptability.

Previous studies of public attitudes towards biotechnology show that the level of support for gene technology depends on the intended use of the technology. For example, for agricultural uses, GM crops grown for non-food products are more acceptable than GM crops grown for food production (Gaskell, Stares et al. 2006; Biotechnology Australia 2007). That the public is more accepting of some GM products than others has been also reported by Lusk et al. (2004a), who found that GM products such as oil were more acceptable than GM meat. Another aspect of this preference might be due to the fact that the use of gene technology in animal production is less acceptable to the general public than it is in plant production (Department of Innovation, 2013). The results are also in line with a previous study (Tenbult, Vries et al. 2008) which has indicated that the public acceptance of a GM product is affected by whether that product is processed or non-processed, with non-processed GM products being less accepted than processed GM products.

Over the past two decades many hundreds of studies of public attitudes have been undertaken to understand what drives public attitudes towards GM crops. Research has moved away from the concept that lack of knowledge is the driver of negative attitudes and biased risk perceptions towards science and technology (Bauer, Allum et al. 2007) to confirm that attitudes tend to be most driven by personal risk-benefit perceptions, existing values and trust (Lyndhurst, 2009; Biotechnology Australia, 2005; Gaskell et al., 2006; Hossain et al., 2003).

Recent studies have shown that attitudes towards science vary according to factors such as the science and the public in question, the context in which the science is discussed, the types of scientific and public knowledge considered, and the credibility and trust of the public in regard to scientific institutions (Bauer, Allum et al. 2007). In addition, previous research has acknowledged that different segments of society have different opinions, interests and modes of interacting with science and technology in everyday life (Allum, Sturgis et al. 2008).

Previous studies have also shown that, in general, the utility of science is viewed differently by each gender (Siegrist 2000). Some authors argue that such differences could be explained by gender differences in risk perception or by different levels of trust in institutions (Siegrist 2000; Qin and Brown 2007). According to Siegrist (2000), males and females have different perceptions of the benefits and risks generated by gene technology and display different levels of trust in institutions that deal with GM products. It is also argued that females are more sensitive about food issues than men as they are usually the nurturer of and care provider for the family (Siegrist 2000; Moerbeek



and Casimir 2005) and the effect of knowledge on the acceptance of GM foods differs according to gender (Moerbeek and Casimir 2005; Qin and Brown 2007).

Simon (2009) also found that while for males a greater knowledge of biotechnology decreased their probability of being pessimistic about science, a greater knowledge of biotechnology within females led to a greater probability of them being pessimistic about science.

Surveys in other countries, as well as Australia, have shown that respondents have a low level of knowledge and awareness about the use of gene technology in agriculture (Hallman, Hebden et al. 2003; Biotechnology Australia 2007). For example, the 2007 surveys conducted for Biotechnology Australia (Biotechnology Australia 2007) showed that while most people (87% of respondents) had heard about genetic modification, only 35% of respondents agreed that they knew enough about genetic modification to be able to explain it to a friend (Biotechnology Australia 2007). In this, and subsequent surveys, the public showed interest in being better informed about the technology as well as in participating in public consultation to improve regulation of GM technology.

While attitudes towards science take on very different forms depending on which subsets of science and society are considered (Pardo and Calvo 2002), only a few studies have looked at audience segmentation, with most concentrating on demographic differences such as age and gender differences (Bauer et al., 2007; Rollin, Kennedy and Wills, 2011; Heiman et al, 2011; Qin and Brown, 2007; and Siegrist, 2000). As Moon and Balasubramanian (2004) have pointed out, "the influence of cognitive factors in this area remains relatively unexplored, particularly in terms of how they can facilitate widespread acceptance of, and shape attitudes and risk perceptions about agrobiotechnology".



## 5. Key findings

### Awareness and understanding of biotechnologies

Many surveys on agricultural biotechnology ask questions based on simple *Yes, No* or *Don't Know* options, which don't accurately reflect the breadth of public attitudes. There will, of course, always be minorities, who are either strongly for or strongly against GM foods, but the majority of the population tends to be a little more moderate in their attitudes, and scales that more accurately reflect this breadth of attitudes are more useful to understanding attitudes.



#### Awareness and understanding of biotechnologies

Awareness of the term 'biotechnology' has dropped since reaching a high point in 2012 (84%) to 74% in 2015, which was similar to levels of 1999 (73%). There has been a particularly high increase in those who stated that they had not heard of biotechnology (rising from 15% in 2012 to 21% in 2015). Less than two out of ten respondents to the survey stated that they knew enough about biotechnology to be able to explain it to a friend.

There were higher levels of awareness of genetic modification or GMOs (81%) and cloning of animals (88%), both of which had also decreased from 2012. In 2012, for instance, 43% of respondents stated they could explain GMOs to a friend and that had dropped to 33%. Those who felt they could explain cloning of animals dropped from 47% to 39%.

**Figure 2 – Q4a**. For the following list of technologies could you please say whether...you have **not heard** of it, OR you **have heard of it** but **know very little** or **nothing about it** OR, you **know enough about it** that **you could explain it to a friend**. There are no right or wrong answers so If you can't say or don't know, please select 'don't know' ... *Please choose one on each row*... *Base: Total sample n=1160* 



The highest *don't know* rating was for synthetic biology, with 48% stating that they had not heard of it, and only 9% stating they knew enough about it that they could explain it to a friend.

There were significant differences between men and women and between younger and older people. Men were much more accepting of the various uses of gene technology than were women, and older people were far less accepting than were younger people.

Of note, 25% of males and just 13% of females believed they could explain biotechnology to a friend. Importantly, previous research (Bauer et al., 2007) has shown that women are more likely to declare their lack of knowledge than men when responding to knowledge questions in survey questionnaires.

After providing a response to the initial question about awareness and knowledge, respondents were given the ability to select definitions to help them answer question throughout the rest of the survey.

Term	Definition provided in survey
Genetic modification or GM	<b>Genetic modification or GM</b> is using laboratory techniques to basically, "cut and paste" a gene from one living thing to another, or modifying or removing a gene within an organism. Something that has been modified by GM can be called a genetically modified organism (GMO).
Biotechnology	<b>Biotechnology</b> is a broader term that covers the application of the science of living things, and is used widely in agriculture, beer and wine production, food processing and medical treatments. Biotechnology sometimes uses genetic modification, but also includes processes that do not involve the use of genes.
Cloning of animals	<b>Cloning of animals</b> another form of assisted reproduction in animal husbandry which allows livestock breeders to create an exact genetic copy of superior breeding animals to produce essentially an identical twin for the purpose of healthier offspring. Cloning does not manipulate the animal's genetic make-up or change an animal's DNA.
Synthetic biology	<b>Synthetic biology</b> is a new form of biotechnology, where the principles of engineering are used to build new biological structures that might not otherwise have existed, such as creating new organisms to use in medicines or to clean up oil spills.
Nanotechnology	<b>Nanotechnology</b> is the manipulation of matter on an atomic, molecular, and supramolecular scale (nanoscale – which is about 1 to 100 nanometers) to take advantage of enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity.

Table 2 – Definitions provided in the survey

**Q4b.** Throughout this survey the terms **'genetic modification'** or **GM** will be used. Terms such as 'biotechnology', 'cloning of animals' and 'synthetic biology' are also used. To assist you the definitions of these terms are below and are provided throughout the survey by hovering over the applicable word or the link at the bottom of each screen.



## Perceptions on whether GM technologies will improve our way of life or not

A clear majority of respondents felt that biotechnology would improve our way of life in the future (69%), which was up from 2012 (64%). There were drops in belief that GMOs and cloning of animals would improve our way of life in the future, however. With GMOs dropping from 50% belief to 46% belief and cloning of animals dropping from 39% believing it would improve our way of life in the future to 31%.

Almost 3 in 10 felt that GMOs would make things worse in the future, and a similar proportion felt that cloning of animals would make our life worse in the future. This is an increase for GMOs, with 24% in 2012 feeling they would make things worse in the future rising to 29% in 2015.

There was large support for synthetic biology, with 59% or respondents stating they felt it would improve our way of life in the future.



#### Perceptions on whether GM technologies will improve our way of life

**Figure 3 – Q4c.** And do you think these technologies will generally improve our way of life in the future, OR have no effect, OR make things worse in the future? If you don't know or can't say please just say so. *Please choose one on each row...* 

Base: Total sample n=1160



#### Levels of support for GMOs and gene technology

Levels of support for GMOs showed nuances across different applications, with mean levels of support for GMOs generally being at 5.33, a drop from 2012 figures when the mean was close to 6.07.

Obtaining data from an 11-fold response across a Likert scale of support, data was grouped into three major response cohorts (excluding the *can't say/ don't know* responses), representing those most in support, those in the middle and those with the least support.



#### Levels of support for GMOs and gene technology

**Figure 4 – Q5.** For the following statements, on a scale of 0-10, please indicate if you are in support or against the following uses of genetic modification, or gene technology, where **10 is completely supportive** and **0 is completely against it**. If you can't say or don't know, please select 'don't know'. How would you rate your level of support for the use of GM or genetic modification...? *Please choose one on each row... Base:* Total sample n=1160

Across the three major subgroupings of data (as shown in the chart), there were fewer people opposed to the use of GMOs generally than were in support of it. This changed however when the application was for GM foods and crops, with a mean rating of 4.84 and similar levels rating the most in support and most opposed. This can be read as a continued strong polarising of attitudes to GMOs and foods though a close analysis of the data actually shows that a minority of people lie at the extreme for and against ends, and the majority cluster towards the middle.

More significant changes were observed when the applications were for medical uses (such as producing insulin or vaccines) with a mean of 7.06, for industrial uses (such as making biofuels or plastic replacement parts from plants) with a mean of 6.71 and for other uses (such as modifying microbes to clean up the environment) with a mean of 6.70.



Respondents from SA were more likely to indicate support level of 9 out of 10 for gene technology for use in foods and crops, but also more likely to indicate a support level of just 1 out of 10 for gene technology for other uses.

Women were much more hesitant in their support for gene technology than were men. They were more likely to indicate support levels of 0 or 5 out of 10 and *don't know/ can't say* for gene technology generally while men were more likely to indicate a support level of 8-10.

Women more often indicated a support level of 0 and 2 out of 10 for the use of gene technology in foods and crops while men were more likely to indicate a support level of 9-10 out of 10. Men were more likely to indicate a support level of 10 out of 10 for gene tech for medical uses.

Women were more likely to indicate a support level of 1 out of 10 and *don't know/can't say* for gene tech for industrial uses and males are more likely to indicate a support level of 10 out of 10. Women were more likely to indicate they *don't know/can't say* their level of support for gene tech for other uses but men were more likely to indicate a support level of 9-10 out of 10.

Support for gene technology appears to decrease with age. Those in the 51-75 age group were more likely to indicate a support level of 0 out of 10 for gene tech generally but those in the 16-30 age group were more likely to indicate a support level of 9-10 out of 10 for gene tech generally.

Looking at the response variability across the full 11-fold Likert scale reveals that the majority of people are predominantly neither strongly for nor against GM foods, but tend to cluster in the middle levels of support or rejection.

#### Perceptions towards science and technology

Looking at correlations between attitudes towards GMOs and science and technology has provided valuable insights into the values that drive attitudes, and eight key statements were tested across a Likert scale both to gauge public sentiments and to inform values-based segmentation.

The eight statements were:

- Commercial use of genetic modification and its products should only be allowed after regulatory approval
- Children must be protected from all risks
- Not vaccinating children puts others at risk
- People shouldn't tamper with nature
- Scientific advances tend to benefit the rich more than they benefit the poor
- We depend too much on science and not enough on faith
- Science and technology creates more problems than it solves
- Technological change happens too fast for me to keep up with



Those statements with the largest levels of support were *not vaccinating children puts others at risk* (75% of respondents ranking in the highest 4 levels of support), *commercial use of genetic modification and its products should only be allowed after regulatory approval* (68% of respondents ranking in the highest 4 levels of support). The next highest ranked support statements were *children must be protected from all risks* (58% of respondents ranking in the highest 4 levels of support) and *technological change happens too fast for me to keep up with* (42% ranked in the highest levels of support).

By contrast, those statements that highest for lack of support (ie – had the lowest levels of support) were *we rely too much on science and not enough on faith* (43% ranked in the lowest levels of support) and *science and technology creates more problems than it solves* (37% ranked in the lowest levels of support).

Other statements received more evenly distributed responses, as outlined in the figure below.



#### Attitudes towards science and technology

**Figure 5 – Q6.** For the following statements, can you say how much you disagree or agree on a scale of 0 to 10, where **10 is strongly agree** and **0 is strongly disagree.** If you can't say or don't know, please select 'don't know'. *Please choose one on each row....* **Base:** Total sample n=1160

As would be expected, there were some changes in responses from the comparable questions asked in the 2012 study, with the most significant changes being the amount of people who disagree that *scientific advances benefited the rich more than the poor* dropped from 35% to 19%. Also, those that disagree that *technological change happens too fast to keep up with* has dropped from 30% to 21%.

Other significant changes included the amount of people who agreed that *children must be protected from all risks*, which rose from 52% for the highest group to 58%, and there was a drop in support for the statement that *not vaccinating children puts others at risk*, dropping from 83% to



75%. Also those who supported the statement that *people shouldn't tamper with nature* rose from 34% to 41%.



#### Attitudes towards science and technology – 2015 compared to 2012



**Figure 6 – Q6.** For the following statements, can you say how much you disagree or agree on a scale of 0 to 10, where **10 is strongly agree** and **0 is strongly disagree.** If you can't say or don't know, please select 'don't know'. *Please choose one on each row....* **Base:** Total sample n=1160

Respondents from SA were more likely to indicate their agreement as 9 out of 10 with *technological change happens too fast for me to keep up with it* and were also more likely to indicate their agreement with *science and technology creates more problems than it solves* as 8 out of 10.

People from WA and QLD were more likely to indicate their agreement with *we depend too much on science and not enough on faith* as 7 out of 10. Also, those in capital cities were more likely to indicate their agreement with *we depend too much on science and not enough on faith* as 9 out of 10.

Those living in non-capital city areas were more likely to indicate their agreement with *not vaccinating children puts others at risk as 10 out of 10.* 

Men were more likely to indicate their agreement with *technological change happens too fast for me to keep up with it* as only 0 out of 10, and women as 7 out of 10. Men were more likely to indicate their agreement with *people shouldn't tamper with nature* as 0 and 2 out of 10 and women were more likely to indicate their agreement as 8 out of 10.

Men were more likely to indicate their agreement with *not vaccinating children puts others at risk* as 8 out of 10 and women were more likely to indicate their agreement as 10 out of 10.

People in the 51-75 age group were more likely to indicate agreement with *children must be protected from all risks* as 10 out of 10.



## Attitudes and beliefs

## Confidence in food and the influence of GM on food consumption

Seeking to obtain more nuances from people's responses to supporting different types of GM foods, there has been a general flattening of differences from previous studies. In the 2015 study there was a uniformity of support for GM products, as well as food grown with the use of pesticides or chemicals, between 27% and 36%. And those not supporting them were also similarly ranked between 27% and 37%. The only food that rated significantly differently was organic food with those who supported it—coming from the top four rankings out of 11—at 62%.

Looking in more detail at the other food types, the spread of support ranked:

Table 3 – Ranking of confidence of GM in foods

Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	36%
Food containing preservatives	33%
Meat and other products from animals that have been fed GM stock feed	31%
Genetically modified fruit and vegetables	31%
Processed foods such as bread and soymilk that has been made from GM crops	31%
Products from GM animals	28%
Food grown with the use of pesticides	27%

And the ranked lack of support for food types was:

Table 4 – Ranking in the lack of confidence of GM in foods

Food containing preservatives	26%
Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	27%
Processed foods such as bread and soymilk that has been made from GM crops	31%
Food grown with the use of pesticides	32%
Meat and other products from animals that have been fed GM stock feed	33%
Genetically modified fruit and vegetables	33%
Products from GM animals	37%

The two major points of significance that can be seen here are that the spread of attitudes to processed foods and GM foods is fairly close, and that the spread of attitudes to most GM foods (excepting support for Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients) lies that between support for the use of pesticides and preservatives in foods.



This is significant as while there is generally no easy way to test attitudes to GM with actually buying behaviours, buying behaviours for foods grown with pesticides or with the use of preservatives are known, and it is likely that GM food buying and consuming behaviour will also lie between that for preservatives and that for pesticides in foods.





Base: Total sample n=1160

Those who live in SA were more likely to indicate their willingness to eat *meat and other products from animals that have fed with genetically modified stock feed* and *products from genetically modified animals* as 9 out of 10. Those who live in QLD were less likely to indicate their willingness as 9 out of 10 as were those from non-capital city areas.

Those from NSW were less likely to indicate their willingness to eat *processed foods such as bread or soy milk that has been made from genetically modified crops* as 10 out of 10.

Women were more likely to indicate their willingness to *eat food containing preservatives* as 0 and 2 out of 10 and men as 9-10 out of 10. Women were more likely to indicate their willingness to eat *food grown with the use of pesticides* as 0 out of 10 and men as 8-10 out of 10.

Women were more likely to indicate their willingness to eat organic food as 10 out of 10.

Women were more likely to indicate their willingness to eat *processed foods such as bread or soy milk that has been made from genetically modified crops* as 0 out of 10 and their willingness to eat *processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients* as 0 out of 10.



Men were more likely to indicate their willingness to eat *processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients* as 9-10 out of 10.

Women were less willing to eat genetically modified fruit and vegetables, with more women scoring this as 0 out of 10 and more men scoring this as 8-10 out of 10. Similarly women scored very low on their willingness to eat meat and other products from animals that have been fed with genetically modified stock feed with a rating of 0 and 2 out of 10, while more men provided a rating of 8-10 out of 10.

Women were more likely to give a 0-1 rating for *eating products from genetically modified animals* and men were more likely to rate it as 8-10 out of 10.



#### Confidence in GM food - by gender

**Figure 8 – Q7.** Now I'd like you to think about food. How unwilling or willing would you be to eat the following...? Please use a scale of 0-10, where 10 means you would be extremely <u>willing</u> and where 0 means you would be extremely <u>unwilling</u>. If you can't say or don't know, please select 'don't know'. *Please choose one on each row...* 

Base: Total sample n=1160

Those in the 51-75 age group are more likely to indicate as 0 out of 10 their willingness to eat *food* grown with the use of pesticides and to eat processed foods such as bread or soy milk, that has been made from genetically modified crops and to eat genetically modified fruit and vegetables and to eat meat and other products from animals that have been fed with genetically modified stock feed.

Those in the 16-30 age group were more likely to indicate their willingness to eat *meat and other products from animals that have been fed with genetically modified stock feed* as 9 out of 10. A general trend was that the younger age groups were more willing to eat different types of GM foods – often at nearly double the level of other age groups (e.g. 57% of 16 - 30-year-olds were in the highest grouping of support for eating processed foods with a small amount of GM ingredients,



compared to only 27% of 31-50-year-olds). There was also more confidence in processed foods by the younger age group than older groups.

Comparing support for the different food types in 2012 and 2015 showed both increases and drops, with most food types recording drops in support.

 Table 5 – Ranking of confidence of GM in foods between 2012 and 2015

	2012	2015
Processed foods such as cakes and biscuits that contain only a small amount of GM ingredients	33%	36%
Food containing preservatives	28%	33%
Meat and other products from animals that have been fed GM stock feed	39%	31%
Genetically modified fruit and vegetables	38%	31%
Processed foods such as bread and soymilk that has been made from GM crops	36%	31%
Products from GM animals	45%	28%
Food grown with the use of pesticides	38%	27%

There were some significant differences from the 2012 data, notably there were changes of over 5% for *products from GM animals* (dropped from 45% to 28%), *GM vegetables* (dropped from 38% to 31%), and *meat and other products from animals that have been fed GM stock feed* (dropped from 39% to 31%).

While the drops in support for GM products were generally uniform, there is no apparent indication of the huge change of support for Products from GM animals that is evident from the data.





#### Confidence in GM fruit and vegetables – by state and territory

**Figure 9 – Q7.** Now I'd like you to think about food. How unwilling or willing would you be to eat genetically modified fruit and vegetables? Please use a scale of 0-10, where **10 means you would be extremely** <u>willing</u> and where **0 means you would be extremely** <u>un</u>willing. If you can't say or don't know, please select 'don't know'. *Please choose one on each row...* 

**Base:** Total sample n=1160

#### Genetic modification in Australia

Beliefs about what foods were genetically modified in Australia were little changed from 2012 and showed that knowledge about GM foods is generally poor. For instance more people believed (incorrectly) that most of the processed foods in Australian supermarkets contained GM ingredients (32%) compared to 27% who correctly stated this was false.

Those who correctly stated that most of the fruits and vegetable grown in Australia are not genetically modified was 42% (down from 50% in 2012). Twenty one per cent of respondents believed this to be true (up from 15% in 2012).

Thirty six per cent also correctly stated that most of the cotton grown in Australia is genetically modified (up from 29% in 2012). There was also a high belief that most of the vegetable oils produced in Australia were made from GM crops (31%, up from 23% in 2012).

Of note, the *don't know* responses against all four categories was very high, ranging from 37% to 49%. The only major difference of more than 5% was the decrease in the *don't know* response for *most of the cotton grown in Australia being genetically modified* (from 55% down to 49%).





#### Attitudes towards genetic modification in Australia

**Figure 10 – Q8.** Please say whether you think each of the following statements is **true** or **false**. If you can't say, or don't know, please select 'don't know'. *Please choose one on each row...* **Base:** Total sample 2015, n=1160; Total sample 2012, n=1000.

#### Modifying genes of plants to produce food

Accepting that many beliefs about what foods are genetically modified are incorrect, as shown in Figure 10, the community was relatively evenly split on how acceptable it was to them. Almost a third indicated that it was acceptable, another third were less sure and were hedging their bets and just over a quarter clearly believed it was not acceptable. Approximately one in ten indicated 'don't know'.



#### How acceptable it is to modify the genes of plants to produce food

**Figure 11 – Q9a.** Please indicate how **acceptable** modifying the genes of *plants* to produce food is to you, where **10 is completely acceptable** and 0 is **completely <u>un</u>acceptable**. *Please choose one only* **Base:** Total sample n=1160



#### GM in food production

As has repeatedly be shown in previous studies, people do have different attitudes towards different genetic modifications, and as the data shows, there is more support for modifications that are perceived to be less radical. The greatest levels of support were for introducing the genes of a plant of the same species (41% support in the highest Likert grouping), followed by 33% support for switching on or off the genes within a plant and also for introducing the genes of a plant of a different species. Introducing the genes of a bacterium only received high support from 24% of people, and introducing the genes of an animal only received high support by 23%, which also ranked the highest for the grouped responses of lower support (37%).

#### Attitudes to GM in food production – 2015 compared to 2012



#### 2015







Base: Total sample n=1160

There were some differences in the aspects tested in 2015 compared to 2012. However, among the aspects that were kept the same significant differences exist between 2015 and 2012 that are somewhat surprising. For example, there has been a significant decline in the proportion of the community indicating that the benefits outweigh the risks for *introducing the genes of a plant of the* 



*same species* from 59% to 41%, while the proportion of the community indicating that the benefits outweigh the risks for *introducing the genes of an animal* has almost doubled from 12% to 23%.

Respondents in WA were more likely to indicate their acceptance with *introducing the genes of a plant of the same species* as 10 out of 10 but more likely to indicate their acceptance with *introducing the genes of a plant of a different species* as just 1 out of 10. Whereas people from NSW were less likely to indicate their acceptance of *'switching on' or 'switching off' the genes within a plant* as 1 out of 10 but were also less likely to indicate their acceptance with *introducing the genes of a bacterium* as 10 out of 10. Those from QLD were also more likely to indicate their acceptance with *introducing the genes of a bacterium* as 1 out of 10 but those from SA were more likely to rate this as 10 out of 10.

Those living in non-capital city areas were more likely to indicate their acceptance as just 1 out of 10 for *introducing the genes of an animal* and *introducing the genes of a bacterium*. People from capital cities were less likely to indicate their acceptance of *introducing the genes of a plant of the same species, introducing the genes of an animal* and *introducing the genes of a bacterium* as 1 out of 10.

Women were more likely to indicate their acceptance with 'switching on' or 'switching off' the genes within a plant, introducing the genes of a plant of a different species and introducing the genes of an animal as 0 out of 10 and don't know/can't say but men were more likely to rate 8-10 out of 10. Women were also more likely to indicate they don't know/can't say their acceptance of introducing the genes of a plant of the same species but men were more likely to rate it as 9-10 out of 10. Men were also more likely than women to indicate their acceptance of introducing the genes of a bacterium as 8-10 out of 10.

Those in the 51-75 age group were more likely to indicate their acceptance as 0 out of 10 of 'switching on' or 'switching off' the genes within a plant, introducing the genes of a plant of the same species, introducing the genes of a plant of a different species, introducing the genes of an animal and introducing the genes of a bacterium, whereas those in the 16-30 age group were more likely to indicate their acceptance as at 7-10 out of 10.

#### Drivers to increasing acceptance in gene modification in food production

Stepwise regression analysis shown in the diagram below suggests that if community education can address the first six attitudinal states it would move significantly more people to from apposition of 1 to 3 out of 10 in terms of acceptance of gene modification in food production to a higher level of acceptance at 4 to 6 out of 10. It also indicates that by addressing the second set of four attitudinal states it will move a significant proportion of the community to having strong acceptance of the use of the technology in food production.





**Figure 13** – Stepwise regression analysis on the drivers for greater acceptance. Rsquare is the proportion of total variation of outcomes explained by the model.

Base: Total sample n=1160

#### GM crops in your state or territory

Awareness of whether GM crops were grown in a respondent's state were generally not high, with an average of only 37% being aware of whether GM crops were grown in their state or territory. This is a slight decline from 44% in 2012.

However, of those who stated correctly that GM crops were grown in their state or territory, there was a consistent increase in the claimed awareness of the specific GM crops grown in the state or territory.





Unprompted awareness of specific GM crops

**Figure 14 – Q10.** As far as you know, are commercial genetically modified crops allowed to be grown in your State or Territory?

Q11. Can you name any genetically modified crops that are grown in your State or Territory?Base: Total sample '15, n=1160; Total sample '12, n=1000

Awareness of GM crops in state

The GM crops most commonly mentioned were canola (55%) and cotton (35%) [which are correct], and wheat (31%) [which is not correct], followed by soya and corn and tomatoes (ranking between 22% and 27%).

This indicates that awareness of GM crops may be coming from international and national media, as soya and corn are widely grown as GM crops overseas, but not grown in Australia. This also demonstrates that knowledge and awareness of GM issues can be shallow, but that has to be understood in terms of the increased responses to which GM crops were grown in a respondent's state or territory. For instance, unprompted awareness of GM cotton rose from 9% to 35%, perhaps an indication of increased media about GM cotton. There were also significant rises in awareness of other GM crops that are not grown commercially in Australia (GM soya rose from 5% to 27%, GM corn rose from 9% to 25% and GM wheat rose from 22% to 31%).

State-based knowledge on whether GM crops were grown in respondents' states showed moderate to low accurate awareness and very high don't know responses averaged at 56%. QLD and NT have no moratoria; NSW and VIC have moratoria but no active prohibitions; WA and ACT have some prohibitions in place; TAS and SA have broad prohibitions in place.





#### Awareness of GM crops grown in their state or territory – state & territory comparisons

**Figure 15 – Q10.** As far as you know, are commercial genetically modified crops allowed to be grown in your State or Territory?

Base: Total sample n=1160

Those states where GM crops are grown with no legal restrictions, had mixed accurate responses. For Queensland 29% accurately stated Yes, GM crops were allowed to be grown in their state, and the Northern Territory had the second highest accurate Yes response at 46%.

Those states with Moratoria, but no active prohibitions (Victoria and NSW), both had 35% accurate Yes responses. These were close on the national average responses. In Victoria the claimed awareness of GM crops was in line with the national average at 35%.

Of those states with some prohibitions in place, but GM crops still able to be grown under certain conditions, Western Australia had the highest correct Yes response at 48%, and the ACT was close to the national average at 38%.

Of the two states that have broad prohibitions in place, Tasmania and South Australia, Tasmania had a moderately high accurate No response at 41%, while South Australia had a very low accurate No response at only 7%.

It is possible that those states with the highest accurate answers to this question, Victoria, Tasmania and Western Australia, have had more media coverage of GM food and crop issues, leading to increased accurate responses.

There was not a significant difference in claimed awareness between the capital cities and elsewhere.

There are also significant differences between the states and territories in terms of the claimed awareness of the type of crop grown locally.





#### Awareness of specific GM crops grown in their state or territory

**Figure 16 – Q11.** Can you name any genetically modified crops that are grown in your State or Territory? **Base:** *Total sample '15, n=1160* 

#### Support for growing GM crops in your state/territory

There have been significant changes in support for growing GM crops in a person's state.



Whether in favour of growing genetically modified crops in their State or Territory

**Figure 17 – Q12.** Are you in favour of growing genetically modified crops in your State or Territory? **Base:** *Total sample '15, n=1160; Total sample '12, n=1000* 



There was a general high approval rating of over 50% support in 2007, 2009 and in 2012 (with a slight drop that year), dropping quite significantly to 38% in 2015.

Over that period there had also been a slow decrease in the numbers who did not support growing GM crops in the state since 2007, reaching 31% against in 2012 that has climbed slightly to 36% in 2015.

The *don't know* response, by comparison was under 10% in 2007 and 2009, climbing rapidly to 16% in 2012, and climbing even higher to 26% in 2015.



#### In favour of growing GM crops in their state or territory – comparisons by state & territory

**Figure 18 – Q12.** Are you in favour of growing genetically modified crops in your State or Territory? **Base:** Total sample '15, n=1160; Total sample '12, n=1000

The levels of support for GM crops in their state or territory was quite similar across the jurisdictions with support being generally around the national average of 38% support, with the two smallest jurisdictions and SA having different responses (NT at 43%, SA at 45% and ACT at 49%). The levels of those who are not in favour of growing GM crops in their state or territory was also quite consistent at just over a third of the population, with the exceptions being SA with a lower 25% and TAS with a high 49%. The levels of support were also quite similar between people living within and outside capital cities.

Having ascertained what percentage of people were supportive or not of growing GM crops in their state or territory, those who were opposed to growing GM crops were asked whether they would be in favour of growing genetically modified crops in their state or territory if the following applied:

- 'The crops provided positive benefits for human health'
- 'The crops provided positive outcomes for the environment'


- 'The crops passed stringent health and environment regulations'
- 'There was evidence that it would enhance Australia's economic competitiveness'.
- 'All of the above conditions were met'.



Whether those opposed would be in favour if they knew the following existed

**Figure 19 – Q13.** Would you be in favour of growing genetically modified crops in your State or Territory if...? **Base:** Total sample '15, n=715; Total sample '12, n=471.

Citing the two highest ranking statements for 2015, *the crops providing positive human health benefits*, and *all of the above conditions being met*, would represent a combined support for GM crops being grown in a respondent's state or territory of 54% (36% plus 17%). However, this represents a decrease in the total combined figure from 2012, which had been 70%.

These rankings also represent drops in willingness to change one's position from the 2012 data. For the statement *the crops provided positive outcomes for the environment [or climate change – in 2012 only]*, 63% of those in 2012 who did not support growing GM crops in their state or territory indicated that they would change their support compared to 46% in 2015. For the statement, *the crops provided benefits to [human – in 2015 only] health*, 62% of those in 2012 who did not support growing GM crops in their state or territory indicated that they would change their state or territory indicated that they would change their support compared to 51% in 2015. And for the statement *the crops passed stringent health and environment regulations*, 60% in 2012 indicated that they would change their support while only 41% indicated the same in 2015. There was only a slight change in those who indicate that if *there was evidence that it would enhance Australia's economic competitiveness* it would change them to being favour of growing genetically modified crops in their state or territory (from 38% in 2012 to 31% in 2015).



There were no statistically significant differences by state or between those who live within or outside a capital city.

Of note, people were most likely to be responding not to whether such regulations referred to did exist, but whether they had an understanding of, or perception of them existing. In the realms of public attitudes, perceptions become realities.

The implications of this data relating to attitudes to growing GM crops in a respondent's state and what might change their minds, shows that for general attitudes there is not significant support for growing them.

## Public opinion on using GM technology to produce food

Respondents were asked to place themselves in one of four categories relating to attitudes to GM foods, which showed almost half of the respondents were against the production of GM food until the science proves it is safe. Less than a third stated they were open to the production of food this way as long as the regulations are in place to make sure it's safe. Only 15% were completely against GM foods and would never change their mind to support them, and 12% accepted that it was a safe way to produce food (which is in line with past research results).

These findings are also important to note that most support or rejection of GM food and crops is conditional, and is likely to move based on regulation or scientific evidence of safety.

#### Attitudinal category in using GM technology to produce food





Those who are opposed to the use of genetically modified technology and believe nothing is likely to change it are more likely to have a trade or diploma as their highest level of education.



The other segment who are against genetically modified technology but only until the science proves it safe are more likely to be female, live outside of Brisbane in Queensland and have a highest education level of technical school, commercial college or TAFE.

The segment that is open to genetically modified technology, providing the regulations are in place to make sure it is safe (and therefore put their trust and rely on the regulator), do not tend to have any particular demographic markers. Whereas as the other segment that accepts that it is safe are more likely to be male, aged 40 or younger (and especially 30 or younger), live in Adelaide, have children under 10 years living in their household, have a university degree or higher qualification, be employed full time and a landholder who derives most of their income from primary production (which does not mean that everyone with such characteristics is likely to accept that GM foods are safe, only that this is the strongest indicative profile of that segment).

Respondents who indicated they accept that *it's a safe way to produce food* were asked why they were in favour of genetically modified technologies to produce food. The largest proportion at approximately a half of these respondents (50%) was not able to provide any particular reason for their support of GM technology to produce food. Among those who could and were prepared to provide a reason, the most common responses were that 'more crops could be produced', 'it improves the quality of the food produced', 'provides pest and disease resistant crops', 'it's the way of the future' and 'it is healthy' – with some respondents adding the proviso of 'as long as it is healthy'. Some specific examples of the reasons given in their own words were as follows:

- 'At the end of the day, whether it's done in the lab or over many generations by selective breeding, it's all genetically modified by man'
- 'GMC are the way of the future to produce pest resistant crops for human consumption and to increase yields for growing world'
- 'More efficient [and] needs less pesticides and other additives'







**Figure 21 – Q14b.** Why are you in favour of genetically modified (GM) [technologies to produce food? **Base:** *Those who indicated it is a safe way to produce food n=170* 

Respondents who indicated they were open to the production of food using genetically modified technologies as long as the regulations are in place to make sure it's safe were asked what do they want to know from the regulator to be re-assured genetically modified technologies are safe to produce food.

Almost a third (32%) of these respondents most wanted to know from the regulator whether there are any health effects. Nineteen per cent were not able to indicate anything specifically that would reassure them, which was followed by 17% wanting to be reassured of complete and transparent testing and 10% wanting to know of and be reassured by the testing for long term effects. Some of the other areas of knowledge that would provide them reassurance included that it would not harm the environment (6%), details of its safety (4%), how it is produced (4%), if it is nutritional (3%) and open and honest information and reassurance (3%). Two specific examples of comments provided were:

- 'I want to know that there are no short-term or long-term adverse effects and that the genetically modified food is just as nutritionally beneficial as non-genetically modified food.
- 'That food production companies are complying with regulations and are punished if they do not comply.'





#### What they want to know from the regulator to be re-assured it is safe for producing food

**Figure 22 – Q14c** What do you want to know from the regulator to be re-assured genetically modified technologies are safe to produce food? **Base:** Total sample n=533

Respondents who indicated they were against the production of food this way until the science proves it's safe were asked what they want to know about the science to be re-assured genetically modified technologies are safe to produce food.

There was again a significant proportion of respondents (15%) who could not provide an answer – in this instance on what they want to know about the science to be re-assured. However, almost a third (32%) wanted to know the long terms effects to be re-assured genetically modified technologies are safe to produce food and approximately a quarter (24%) wanted to know via the science that the use of genetically modified technologies is not harmful.

Nine per cent indicated that they wanted to know from the science the effect on the environment to be reassured, while transparency of testing (5%), more public information (5), indications that GM food is nutritional (5%) and proof from scientist that it is safe (4%) were the next levels of desired information about the science.

Two examples of specific comments on what they want to know about the science were:

- 'I want long term evidence of no harm coming to people, animals or plant life. Too many examples of things being introduced and then found to be harmful.'
- 'Studies would have to be conducted on such a long term basis that it would be impossible for the human population to conceive their extent. No one has a clue of the long term ramifications of fiddling with nature in this way.'





#### What they want to know about the science to be re-assured it is safe for producing food

Figure 23 – Q14d What do you want to know about the science to be re-assured genetically modified (GM) technologies are safe to produce food?
Base: Total sample n=320

Lastly, those respondents who indicated they were opposed to the use of genetically modified technologies to produce food and nothing is likely to change my mind were asked why they are opposed.

Almost half of the respondents (49%) gave general responses on why they were opposed to the use of genetically modified technologies to produce food that indicated a belief it was just 'not natural' and approximately another quarter (22%) could not express why they are so strongly opposed. Approximately one in five (21%) of the respondents indicated they were opposed to the use of genetically modified technologies to produce food on the basis it is harmful and 13% indicated they were rigidly opposed because of the lack of knowledge of the long term effects of using the technology in food production.

There was again, like in some other segments above, a lack of trust in the motivations for and who benefits from the use of the technology in food production with 9% indicating their rigid opposition based on the belief big business will profit and 2% not trusting the companies involved.

Two examples of the comments from respondents who are rigidly opposed are:

- 'Big corps own the seed and tech to the determent of other producers and if any improvements are made they will benefit the companies and not the consumer.'
- 'Because I think humans should not change nature that has been untouched for millions of years just to make more money.'





#### Reasons for being opposed to GM technologies to produce food

**Figure 24 – Q14e.** Why are you opposed to the use of genetically modified (GM) technologies to **produce food**?

#### **Base:** Total sample n=137

Survey results from a number of countries including Australia consistently show that the public acceptability for GM crops varies according to the trait, (Biotechnology Australia, 2005; Gaskell et al., 2006; Hossain et al., 2003), so it is important to understand just what attitudes respondents had to different traits and whether they saw them as valuable or not.





#### How valuable are the different reasons for using GM technologies to produce food?

**Figure 25 – Q15.** We now want to know what you think about different objectives of genetically modifying plants to produce food. Can you now tell us how **valuable** you feel these objectives are to individuals or society? Please tell us whether you think these objectives are **very valuable**, **somewhat valuable**, **not very valuable** or **not at all valuable**. So what about genetically modifying plants... *Base:* Total sample n=1160

Rating the traits as *very valuable, somewhat valuable, not very valuable* and *not at all valuable* (and *don't know*), those traits that were perceived to have the highest benefits were:

- - making plants drought resistant (44%) and
- - to make food healthier (42%).

Those with lesser levels of perceived value were:

- making the plants pest resistant (37%),
- frost resistant (30%)
- able to grow in salty soils (33%), and
- to make the food cheaper (31%).

The least highly rated traits were for *making the food taste better* (23%), *making the plants herbicide tolerant* (23%) and *making plants mature more quickly* (20%). It should be noted though that even for the trait with the lowest ranking of support, and the highest ranking of being *not at all valuable* (15%) the combined ratings for value (*very valuable* and *somewhat valuable*) were still more than 50%.

Combining very valuable with somewhat valuable ratings gave the following rankings:



To make plants drought resistant	77%
To make foods healthier	75%
To make plants pest resistant	74%
To make crops pest resistant	67%
To make plants that can grow in salty soil	67%
To make the foods cheaper	66%
Too make the foods last longer	61%
To make foods taste better	58%
To make plants herbicide tolerant	54%
To make plants mature more quickly	52%

Table 6 – Whether the objective of genetically modifying plants to produce food is valuable

In 2012 only four of the above objectives were tested and an alternative 11 point scale was used. Therefore direct comparisons cannot be made; however, overall results and rankings for the four objectives appear to be very similar or the same between 2012 and 2015.





30 10-7 out of 10 6-4 out of 10 3-0 out of 10

Figure 26 – Q15. We now want to know what you think about different objectives of genetically modifying plants to produce food. Can you now tell us how valuable you feel these objectives are to individuals or society? Please tell us whether you think these objectives are very valuable, somewhat valuable, not very valuable or not at all valuable. So what about genetically modifying plants...

40

50

60

70

80

90

Base: *Total sample n=1160* 

0

10

20

100%



52

## Attitudes to GM for industrial or therapeutic uses

Respondents were also asked to place themselves in one of four categories relating to attitudes to GM for industrial or therapeutic uses, with examples cited as being to make biofuels or plastic replacements.

# Attitudes to genetic modification for industrial or therapeutic uses

products

#### Attitudes to genetic modification for industrial or therapeutic uses

**Figure 27 – Q16.** Which of the following best describes your views on the use of genetically modified (GM) technology for **industrial or therapeutic uses** (such as to make biofuels or plastic replacements from plants)? *Please choose one only* 

10

20

30

40

50

60 %

0

#### Base Total sample n=1160

The results were fairly similar to the food-based question 14a. However an interesting finding in this question was that a slightly higher proportion of respondents were against this use of the technology until science proves it is safe (46% for food and 52% for GM therapeutics). Also, slightly less stated they were open to the production of therapeutics this way as long as the regulations are in place to make sure it's safe (28% for GM foods and 22% for GM industrial or therapeutics).

Nineteen per cent were completely against GM industrial and therapeutics and would never change their mind to support them (compared to 15% for GM foods), and only 7% accepted that it was a safe way to produce industrial or therapeutic products (compared to 12% for GM foods).

These findings are quite interesting, as there is generally a higher support for genetic modification that results in health outcomes, or is used to produce medicines, yet these results show a counter finding relative to its use for food production. For example earlier in the survey (see Figure 4, Question 5)) the use of genetic modification and gene technology for medical uses such as producing insulin or vaccine had the highest support with 60% of respondents giving a rating of between 7 and 10 out of an 11 point rating scale, whereas its use in food and crops was only given a 7 to 10 rating by 33% of respondents.

This may be due to the combination of medical products with industrial products and possibly the use of the term therapeutic in place of medical. Previous work by Instinct and Reason for the



Therapeutic Goods Administration (TGA) found there can be issues with public interpretation and understanding of the term therapeutic.

In other words the inconsistency of the response to this question compared to the earlier responses around the use of GM for medical uses may be due to way the question was interpreted and may also reflect a sense that GM should not be used to produced industrial or therapeutic products if other means are available, and the responses might have been quite different if there was a perception that this way is a more efficient, safe or sustainable way to produce such goods rather than seeking to find a use for GM.

## Awareness of organisations responsible for regulation of GM

Survey respondents were asked from a list which organisation or organisations they believed was responsible for the regulation of genetic modification in Australia.

Despite having a list to choose from, there was a general high lack of awareness of organisations that are responsible for the regulation of GM in Australia, with a significant don't know response (37%). Those organisations that were most commonly believed to regulate GM were the Department of Agriculture 37%, Food Standards Australia New Zealand (FSANZ) 34%, CSIRO 30%, the Office of the Gene Technology Regulator (OGTR) 25%, Department of Health 24%, the National Health and Medical Research Council (NHMRC) 21%, State government 19%, TGA 18%, and the Australian Pesticides and Veterinary Medicines Authority (APVMA) 16%.

These are moderate to good findings for the regulators (though it is worth noting that CSIRO—not a regulator—rates quite highly) when their names are prompted. When a similar but unprompted response question (i.e. with no list of organisations) was asked in 2012, the only organisation that rated over 5% was the CSIRO with 12% awareness. However the data shows that many respondents are answering the question based on the names of the regulators, and deducing they are regulators.





#### Organisation/s they believe are responsible for the regulation of genetic modification in Australia

**Figure 28 – Q17.** Which organisation or organisations do you believe are responsible for the regulation of genetic modification in Australia? Please choose all that apply **Base:** Total sample '15, n=1160; Total sample '12, n=1000

When asked if they had been aware of the organisation before the survey, the figures were generally much lower for gene technology regulators. Only 13% were aware of the OGTR before conducting the survey—which compared to 5% awareness in 2012, which was a significant rise, although still relatively low in comparison to the other agencies mentioned.



**Figure 29 – Q18.** Had you heard of the following organisations before completing this survey? Please choose one on each row

Base: Total sample '15, n=1160; Total sample '12, n=1000



Comparing 2012 to 2015 data, most other organisations rated fairly similar, with the exception of the Department of Agriculture rising from 26% to 84%) – though the question asked in 2012 was slightly different, citing 'DAFF Biosecurity (Department of Agriculture, Fisheries and Forestry Biosecurity)' - a much more complex name, and there had also been a Biosecurity Australia option which may have split the responses.

Like the Department of Agriculture, the CSIRO also had a high proportion of respondents indicating they had heard of it beforehand at 85%. This is not able to be compared with 2012 where the CSIRO was not included.

The following table provides a comparison between the proportion of respondents who indicated an organisation was responsible for GM regulation from the list provided and the proportion who indicated they had heard of the organisation previously.

	Responsible for GM regulation	Heard of previously	
OGTR	25%	13%	$\checkmark$
APVMA	16%	19%	$\uparrow$
NHMRC	21%	42%	$\uparrow$
FSANZ	34%	52%	$\uparrow$
TGA	18%	54%	$\uparrow$
Dept Ag	37%	84%	$\uparrow$
CSIRO	30%	85%	$\uparrow$

 Table 7 – Comparison between who they though was responsible for regulation and prior awareness

With the exception of OGTR, all other agencies that could be compared on this basis had a higher proportion of people who had heard of the agency previously to the proportion who thought the agency was responsible for GM regulation. This does suggest that respondents were trying to be discerning in which agencies they indicated were responsible for GM regulation. It also reinforces that awareness of the OGTR and it role is not well known in the public.

## Trust in what organisations say about gene technology

All the regulators and other organisations polled received quite high levels of trust for what they said about gene technology, with the OGTR obtaining the highest results of 72% in the highest support grouping using the three grouped categories of the 11-point Likert scale used throughout the study. It was followed by the NHMRC at 67%, the APVMA and CSIRO at 66%, the TGA at 60%, FSANZ at 56%, and the Department of Agriculture at 54%.

It should be noted that this does not necessarily reflect respondent trust in these organisations, as the question specifically asked how much trust was placed on what the organisations tell a respondent about the risks and benefits of gene technology.





#### Trust in what certain organisations tell them about GM and gene technology

**Figure 30 – Q19.** And how much trust do you place on <u>what these organisations tell you</u> about the risks and benefits of genetic modification or gene technology, on a scale where **10 is trust completely** and **0 is do not trust at all?** If you can't say, or don't know please select 'don't know'. **Base:** Total sample n=1160

This is a very good finding for the OGTR, showing it ranks above the NHMRC and the CSIRO, which are amongst the most trusted organisations in Australia and ones that the public could reasonably expect to be making statements on the health and safety of GM technologies.

It is worth pointing out that only 4% of respondents ranked the OGTR as an organisation that they did not trust to tell them the risks and benefits of gene technology.

The data also shows an increase in trust in what the OGTR tells the public about GM technologies since 2012 (61% highest support to 72%), which was mirrored across all the organisations, with an increased trust rating for every one of them that had been asked in both 2012 and 2015.

### Attitudes and beliefs towards government involvement

When asked about the rules and regulations relating to GM, and whether they were sufficiently rigorous and complied with, there was majority agreement but also significant don't know responses.

That the rules regulating the uses of GM in medical research are sufficiently rigorous was agreed to by 38% of respondents who rated this most highly (and 10% rated a high disagreement), with a very similar response for those who stated that the rules were also complied with (39% most agree and 8% disagree).



Similar questions on the regulation of GM in agriculture and food production received slightly lower agreement and slightly higher disagreement, but still many more agreed than disagreed. 34% agreed most strongly with the statement that the rules that regulate the use of GM in agriculture and food production are sufficiently rigorous, and 12% disagreed, while 35% most agreed that such rules are complied with, and 11% disagreed.



#### Attitudes and belief in government rules and regulation

**Figure 31 – Q20.** The government sets rules that regulate the use of genetic modification and other biotechnologies. Below are four statements and for each one, please state how strongly you agree or disagree on a scale of 0 to 10, where **10 is strongly agree** and **0 is strongly disagree**. *Please choose one on each row* **Base:** Total sample n=1160

It is worth noting that the likelihood that people would agree the rules that regulate the use of genetic modification are sufficiently rigorous and that they are complied with strongly correlate with their attitudes to genetic modification for food production and for industrial and therapeutic uses. They also correlate with the value-based segment with which they belong.

A new question, not previously asked, was whether the fact that something was being regulated led to any increased concern or not about it. There was an interesting response to the question with almost identical answers to the statements that people were less concerned because the government regulator was ensuring higher levels of safety. The results, shown below in Figure 32 indicate a reasonably high rate of responding to how a question is asked, thus if something is framed in terms of risk, it is likely to result in a higher risk response, and if it is asked in terms of safety it will result in a higher safety response. In fact, each response is perfectly valid even if it seems counter intuitive.

For example, knowing that a government regulator is ensuring higher levels of safety are applied to something that is perceived to be risky is reasonable, while at the same time being more concerned that something actually required government regulation (particularly with a lack of knowledge and understanding of the actual risks).





#### Attitudes and beliefs - Need for Government rules and regulation of GM

**Figure 32 – Q21.** For the following, please indicate how much you disagree or agree on a scale of 0 to 10, where **10 is strongly agree** and **0 is strongly disagree**. If you can't say or don't know, please select 'don't know'. If something is regulated by the government, how does the fact that is "regulated" make you feel...? *Please choose one on each row Base: Total sample n=1160* 

The above results also demonstrate the inherent trouble in surveys that don't frame questions from differing points of view as any single question can have built-in biases that skew the responses towards the framing of the question. Responses can also be influenced by previous questions, which if concentrating strongly on risk or benefit, might skew a response one way of the other. This has been amply demonstrated by the many surveys seeking a single percentage number for the amount of people who might eat or support GM foods or crops and how different surveys elicit such radically different responses.

## Support for GM sciences and technologies

The final question in the survey was a repeat of the question about people's support or not for the applications of GMOs and other technologies asked earlier in the survey to study what impact engagement or thinking about these technologies and their regulation had on people's attitudes, or indeed what impact all the questions in the survey had on peoples' responses.

The result was that there was a slight increase in support for the technologies. For instance, 36% of respondents stated they had the highest levels of support for GM foods, and 35% stated they had the highest levels of support for GM crops, while at the start of the survey the ranking had been 33% for GM food and crops both.

The other questions asked in question 22 were not similar enough to earlier questions to gain a valid comparable response, but were useful to show where comparable levels of support lay, and most interestingly the highest level of support was for GM therapeutics or medicines (which rated rather poorly in question 16) with 46% rating it the highest level of support. This was above nanotechnology at 49% and synthetic biology and GM foods at 36% and GM crops at 35% support.



Cloning of animals was the only technology that had less support than support 33% against it and 27% supporting it.



#### Support for science and technology development

**Figure 33 – Q22.** Please indicate your level of support for the following science and technology developments using the 0-10 scale, where **10 is completely supportive** and **0 is completely against it**. If, for any of the technologies, you are not sure or don't know, please select 'don't know'. *Please choose one on each row* **Base:** Total sample n=1160

Interestingly, when asked earlier in the survey if these technologies would improve our way of life in the future, synthetic biology received a much larger support rating than GM food, and at this final question they were at similar levels (59% support for synthetic biology in questions 4c and only 36% in question 22 and 33% support for GM foods in question 5, up to 36%).

Also of note, there had been a significant diminution across the survey respondents of those who were against GM foods and crops, dropping from 33% to 25% (for foods) and 28% (for crops).

The most likely conclusion, based on the data and responses in the survey, is that increasing a person's awareness of regulation and regulators of gene technology through the survey questions may have a minor impact in increasing their support for GM, and more in diminishing their lack of support for it.

It is worth noting that, as with attitudes to government regulation, the likelihood that people would support each of the different GM technologies strongly correlates with their attitudes to genetic modification for food production and for industrial and therapeutic uses. They also correlate with the value-based segment with which they belong.



## Values-based segmentation

A key part of the study was an attempt to better understand the Australian public by values-based segments. Traditionally segmentation studies are based on demographics. Values-based studies have shown though that there are strong correlations between certain values, such as receptiveness toward science and technology being a primary predictor of acceptance of GM foods (Mohr et al, 2007).

The Department of Industry study of 2012 identified several values statements as useful for defining values-based segments, which were used in this study. They include:

- Commercial use of genetic modification and its products should only be allowed after regulatory approval
- Children must be protected from all risks
- Not vaccinating children puts others at risk
- People shouldn't tamper with nature
- Scientific advances tend to benefit the rich more than they benefit the poor
- We depend too much on science and not enough on faith
- Science and technology creates more problems than it solves
- Technological change happens too fast for me to keep up with

The order of which the statements were presented was randomised to diminish any order bias, and respondents were asked the degree to which they agreed or disagreed to each statement across an 11-fold Likert scale.

Applying a cluster analysis to the findings of the value statements, and creating composite scores across values, four distinct segments emerged. The results showed that two of the segments (Segments 1 and 2) were less positive toward science and technology, and two segments (3 and 4) were more positive. The clusters were very strong against some values but weaker against others. Each segment is profiled in more detail below.

## Segment 1 – The Lost (31%)

 Table 8 – Segment 1 gender, age and state/territory profile

Male	Female	30	31-50	51	QLD	NSW	АСТ	VIC	TAS	NT	SA	WA
		years or	years	years								
		younger		or								
				older								
47%	53%	27%	41%	32%	22%	33%	1%	22%	2%	-	11%	9%

This segment is more likely to identify as Aboriginal, Torres Strait Islander or both.



The Lost are more likely to **not** have heard about the cloning of animals, yet claim to know enough about synthetic biology to be able to explain it to a friend.

The Lost are also more likely to feel that biotechnology, genetic modification, cloning of animals and synthetic biology will make things worse in the future.

The Lost are more likely to rate their support of the use of gene technology generally as well as its use in foods and crops, and for medical, industrial and for other uses such as modifying microbes to clean up the environment in the low 0-3 out of 10. While they are more likely to rate their support of the following statements in question six in the higher 7-10 out of 10 category—technological change happens too fast for me to keep up with it, science and technology creates more problems than it solves, we depend too much on science and not enough on faith, scientific advances tend to benefit the rich more than they benefit the poor, people shouldn't tamper with nature, not vaccinating children puts others at risk, children must be protected from all risks, and commercial use of genetic modification and its products should only be allowed after regulatory approval.

They rate their willingness to eat food containing preservatives, grown with the use of pesticides or organic in the 7-10 category but rate their willingness to eat any of the five categories of GM food in the low 0-3 out of 10 category (ie *processed foods such as bread or soy milk that has been made from genetically modified crops, processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients, genetically modified fruit and vegetables, meat and other products from animals that have been fed with genetically modified stock feed as well as products from genetically modified animals).* 

This segment is also more likely to indicate they believe that most of the fresh fruit and vegetables grown in Australia are genetically modified, that most of the cotton grown in Australia is genetically modified, and that most of the vegetable oils produced in Australia are made from genetically modified crops. They also rate their acceptance of modifying the genes of plants to produce food as 0-3 or 0-4 out of 10 (Q9a).

They consider the acceptability of *introducing the genes of a plant of the same species* as 9 out of 10 but find it completely unacceptable (0 out of 10) to *introduce the genes of a plant of a different species*.

They are more likely to say they believe that commercial genetically modified crops are allowed to be grown in their state/territory and to name corn, cotton, soya, tomatoes and wheat as examples. They are also more likely to **not** be in favour of growing GM crops in their state/territory, even if the crops passed stringent health and environmental regulations or there was evidence they would enhance Australia's economic competitiveness.

The segment shows strong split views in some areas. They are more likely to indicate both *I accept that it's safe way to produce food* and *I am opposed to the production of food this way and nothing is likely to change my mind*. They also have split views on GM technology for industrial or therapeutic uses.



They are more likely to:

- believe FSANZ and APVMA are responsible for the regulation of genetic modification in Australia
- have heard of the OGTR and APVMA but not TGA before the survey
- indicate their trust level of FSANZ as 1 out of 10 (Q19) and the Department of Agriculture as 2 out of 10.

They strongly agree (10) that they are less concerned, *because the government regulator is ensuring higher levels of safety* however they are still more likely to indicate their support of GM foods and GM crops as 0 out of 10, and for therapeutics and medicines as 0 or 2 out of 10.

## Segment 2 – Uninformed Doubting Thomases (20%)

Table 9 – Segment 2 gender, age and state/territory profile

Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	ACT	VIC	TAS	NT	SA	WA
55%	45%	31%	45%	24%	23%	30%	1%	22%	1%	2%	15%	11%

The Doubting Thomases are more likely to live in non-metropolitan Western Australia and have a highest education level of Year 11 or equivalent.

They are more likely to have not heard about the cloning of animals. They are also more likely to feel that biotechnology and genetic modification will have no effect on the future.

Their support for the use of gene technology in all areas is more likely to be rated in the middle, between 4-6 out of 10. They also tend to have 'a middle of the road' response to the statements in question six:

- technological change happens to fast for me to keep up with it,
- science and technology creates more problems than it solves,
- we depend too much on science and not enough on faith,
- scientific advances tend to benefit the rich more than they benefit the poor,
- people shouldn't tamper with nature,
- not vaccinating children puts others at risk, and
- commercial use of genetic modification and its products should only be allowed after regulatory approval.

They are more likely to rate their willingness to eat food containing preservatives, food grown with the use of pesticides, and organic food in the middle categories.



They are more likely to rate their willingness to eat processed foods such as bread or soy milk that have been made from genetically modified crops as between 3 and 6 out of 10, their willingness to eat processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients as 4 and 5 out of 10, their willingness to eat genetically modified fruit and vegetables as 4 and 5 out of 10, their willingness to eat meat and other products from animals that have been fed with genetically modified stock feed as 3, 4 and 5 out of 10, and their willingness to eat products from genetically modified animals as 3, 4, 5, and 6 out of 10.

This trend continues with the segment being more likely to give middle ratings to their acceptance of modifying genes of plants to produce food, of switching on or off genes within a plant, of introducing the genes of a plant of the same species, of introducing the genes of a plant of a different species, of introducing the genes of a bacterium.

They were more likely to be unable to name any genetically modified crops in their state or territory.

They were more likely to **not** be in favour of growing genetically modified crops in their state even if the crops provided positive benefits to human health. They were also more likely to place low value on using gene technology to modify food to make it last longer, to make the plants pest resistant, to make plants drought resistant, to make plants that can grow in salty soils, or to make the food cheaper.

They were more likely to have **not** heard of the CSIRO and either hadn't heard or were unsure if they had heard of the Department of Agriculture, to rate their trust level for FSANZ as 7 out of 10, for OGTR as 4-6 out of 10 and for TGA as 0-3 or 4-6 out of 10.

They were more likely to give a moderate rating to their agreement with the statements: the rules that regulate the use of genetic modification in agriculture and food production are sufficiently rigorous, the rules that regulate the use of genetic modification in agriculture and food production are complied with, the rules that regulate the use of genetic modification in medical research are sufficiently rigorous, and the rules that regulate the use of genetic modification in medical research are are complied with.

They rate their support of genetically modified foods as 4-5 out of 10, genetically modified crops as 5-6 out of 10, cloning of animals as 4-6 out of 10, synthetic biology as 5 out of 10 and nanotechnology as 5-6 out of 10.

## Segment 3 – Uninformed Supporters with Provisos (32%)

Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	АСТ	VIC	TAS	NT	SA	WA
43%	57%	17%	37%	45%	18%	31%	1%	32%	2%	1%	3%	11%

 Table 10 – Segment 3 gender, age and state/territory profile



The Uninformed Supporters with Provisos are more likely to be female, aged 61–70 years and **not** to identify as Aboriginal, Torres Strait islander or both.

They have heard of biotechnology, cloning of animals and GMOs but know very little about them. They are more likely to believe biotechnology will improve our way of life in the future, but to have **not** heard of synthetic biology.

They indicate their support for GM technology as 6 out of 10 but this increases to 8 out of 10 for GM technology for medical uses.

They rate their agreement with science and technology creates more problems than it solves at a low 1-3 out of 10, we depend too much on science and not enough on faith at a similarly low 0–4 out of 10, people shouldn't tamper with nature as 5-6 out of 10, children must be protected from all risks at 8–10 out of 10 and not vaccinating children puts others at risk and commercial use of genetic modification and its products should only be allowed after regulatory approval as 10 out of 10.

They were more likely to rate their willingness to eat products from genetically modified animals and processed foods such as bread or soy milk, that has been made from genetically modified crops as 2 out of 10, food containing preservatives as 5 out of 10, and food grown with the use of pesticides as 7 out of 10.

They were more likely to say they did not to know if *most of the cotton grown in Australia is genetically modified* and *most of the vegetable oils produced in Australia are made from genetically modified crops*.

The Uninformed Supporters with Provisos were also more likely to rate their acceptance of introducing the genes of an animal and introducing the genes of a bacterium as 3 out of 10, and of modifying the genes of plants to produce food, of switching on and off the genes within a plant, and introducing the genes of a plant of different species as 5 out of 10.

They were more likely to indicate they would be in favour of GM crops if the crops passed stringent health and environmental regulations, provided positive outcomes for the environment, and/or provided positive benefits for human health.

They were more likely to indicate that their view on GM technology to produce food was *I am open to the production of food this way as long as the regulations are in place to make sure its safe* (Q14a) and to place a high value on genetically modifying plants to make the food healthier, to make the plants drought resistant, to make the food cheaper and to make the plants pest resistant. They were also more likely to hold the view I am open to the production of industrial or therapeutic products this way as long as the regulations are in place to make sure its safe.

This segment was more likely to believe that the Department of Agriculture and CSIRO were responsible for the regulation of GM in Australia. They were also more likely to have **not** heard of the OGTR or APVMA. They were more likely to rate their trust in CSIRO as 10 out of 10.



## Segment 4 – The Disciples (17%)

 Table 11 – Segment 4 gender, age and state/territory profile

Male	Female	30 years or younger	31-50 years	51 years or older	QLD	NSW	АСТ	VIC	TAS	NT	SA	WA
58%	42%	30%	32%	39%	17%	30%	6%	24%	4%	2%	8%	11%

The Disciples are more likely to live in the Australian Capital Territory and **not** to identify as Aboriginal, Torres Strait islander or both.

The Disciples are also more likely to claim to know enough about biotechnology, genetic modification and cloning of animals to explain it to a friend and to believe that biotechnology, GMOs, cloning of animals and synthetic biology will improve our way of life in the future.

They are more likely to indicate support levels of 8 and 10 out of 10 for gene tech generally, 9–10 for gene technology for medical uses and 10 out of 10 for gene tech for use in foods and crops and for industrial uses.

They are more likely to give a low rating to the statements:

- technological change happens too fast for me to keep up with it,
- science and technology creates more problems than it solves,
- we depend too much on science and not enough on faith,
- scientific advances tend to benefit the rich more than they benefit the poor and
- people shouldn't tamper with nature.

They are also more likely to rate the statement *not vaccinating children puts others at risk* as 10 out of 10.

The Disciples are more likely to rate their willingness to eat organic food and processed foods such as bread or soy milk that has been made from genetically modified crops as 7 or 10 out of 10. They were more likely to indicate their willingness to eat food containing preservatives, food grown with the use of pesticides, processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients, genetically modified fruit and vegetables, meat and other products from animals that have been fed with genetically modified stock feed and products from genetically modified animals all as 10 out of 10.

They are more likely to believe that it is false that most of the fresh fruit and vegetables grown in Australia are genetically modified.



## Attitudes towards GM foods by Values segment

When the main survey questions were analysed against the segment breakdown, it showed that for the general question on support for biotechnology in general, segment 1, the Lost, had an average of 4.66 out of 10.

Segment 2, the Doubting Thomases, averaged 4.86.

Segment 3, the Uninformed Supporters with Provisos, averaged 5.40 and segment four averaged 6.93.

Segment 4, the Disciples, were also significantly more likely to value making food healthier, cheaper, last longer and taste better than other segments, while the Lost were the segment least likely to value any of the objectives of genetically modifying food.

Average out of 11 (0-10 scale Not valuable at all/Extremely valuable)	Segment 1	Segment 2	Segment 3	Segment 4	Total
The food was healthier	6.6	6.2	7.5	7.7	7.0
The food cheaper	6.1	5.5	6.6	7.0	6.3
The food last longer	5.5	5.1	6.1	6.8	5.9
The food taste better	5.1	4.2	5.4	5.3	5.0

 Table 12 – Value of objectives genetically modifying food by segment

Against all types of modified foods tested, segment 4 rated the highest levels of support, and of note they rated all genetic modifications of food above support for the use of pesticides and preservatives in food.



Average (2012 results) + 2015 results	Segment 1	Segment 2	Segment 3	Segment 4	Total
Organic food	(7.9) 7.7	(7.4) 6.5	(8.0) 7.7	(8.1) 7.8	(7.8) 7.4
Food containing preservatives	(4.2) 5.3	(4.9) 4.5	(5.2) 5.2	(5.8) 6.1	(5.0) 5.2
Processed foods such as cakes or biscuits that contain only a small amount of genetically modified ingredients	(4.0) 5.0	(4.6) 4.4	(5.2) 5.5	(6.6) 6.7	(4.9) 5.3
Processed foods such as bread or soy milk, that has been made from genetically modified crops	(3.9) 4.8	(4.2) 4.2	(5.0) 4.5	(6.3) 6.5	(4.7) 5.0
Genetically modified fruit and vegetables	(3.5) 4.6	(4.2) 4.0	(4.9) 4.6	(6.3) 6.4	(4.6) 4.8
Meat and other products from animals that have been fed with genetically modified stock feed	(3.4) 4.5	(4.2) 4.2	(4.8) 4.7	(6.4) 6.3	(4.5) 4.8
Food grown with the use of pesticides	(3.5) 4.6	(4.3) 4.1	(4.3) 4.5	(4.8) 5.4	(4.3) 4.7
Products from genetically modified animals	(3.0) 4.4	(3.6) 4.0	(4.2) 4.3	(5.8) 6.0	(4.0) 4.5
Meat and other products from cloned animals	(2.7)	(3.4)	(3.8)	(6.1)	(3.8)

#### Table 13 – Willingness to eat food under certain conditions – 2012 figures are in brackets



## Further segmentation analysis

Analysis of the four segments based around people's attitudes to GM foods (ie not the values-based segments of the Lost, the Disciples etc, but the four categories as shown in Figure 34 below) showed a clear correlation with support for GM in general. For instance, those that accepted that GM was a safe way to produce food (Segment A) scored 75 across the highest Likert grouping, and had a mean score of 8.04, while the segment that were opposed to the production of GM foods with nothing likely to change their minds (Segment D), scored 71 across the lowest Likert grouping, with a mean score of 1.76.



**Figure 34 – Q5.** For the following statements, on a scale of 0-10, please indicate if you are in support or against the following uses of genetic modification, or gene technology, where **10 is completely supportive** and **0 is completely against it**. If you can't say or don't know, please select 'don't know'. How would you rate your level of support for the use of GM or genetic modification...? *Please choose one on each row... Base:* Total sample n=1160

Of perhaps greater interest to the Regulator is the attitudinal Segment B, shown above that stated it was open to the production of food this way as long as the regulations were in place and the segment who was against the production of food this way until the science proved it was safe. Segment B had a mean score of 6.49 with a slight majority scoring in the highest Likert grouping (42%), and the highest and middle grouping together accounting for 81% of responses.

For Segment C, who were waiting for the science to prove it was safe, a similar spread was seen, but across the lowest and middle Likert groupings with a combined score of 83%.

There was a significant shift in attitudes however when the topic was changed from GM in general to use in foods and crops. There were changes in all segments except Segment C, who were wanting scientific evidence of safety. They dropped from a mean of 3.47 to 2.39, scoring 63% in the lowest Likert grouping and only 21% in the middle grouping.





**Figure 35 – Q5.** For the following statements, on a scale of 0-10, please indicate if you are in support or against the following uses of genetic modification, or gene technology, where **10 is completely supportive** and **0 is completely against it**. If you can't say or don't know, please select 'don't know'. How would you rate your level of support for the use of GM or genetic modification...? *Please choose one on each row... Base:* Total sample n=1160

Of interest, the two middle segments, who were most wanting scientific evidence or information on regulations and the effectiveness, provided large Don't Know responses to questions relating to the rigour of current regulations – at 28% and 41%. It is worth noting that the segment group that was most opposed to the production of GM food and nothing was likely to change their mind also had a very large *Don't Know* response to this statement (37%), unlike the other extreme group, who accepted it was a safe way to produce food, who only had a 6% *Don't Know* response.

Analysing the four attitudinal segments' (A to D) trust of what OGTR told them about the risk and benefits of GM provided interesting insights into correlations between acceptance of GM foods and crops and trust in the regulator. Those who felt it was a safe way to produce food, Segment A, scored 97% across the highest Likert grouping. Segment B, who were open to this way of producing food as long as regulations were in place, rated 68% across the highest Likert grouping, and even Segment C, who were against it until the science proved it was safe, had moderate trust in OGTR, scoring 34% in the highest Likert grouping and 43% in the middle ranking. Only 10% of Segment C scored in the lowest Likert grouping.

Segment D however, the segment group most against opposed to GM food production with nothing likely to change their minds, had the highest mistrust of OGTR, with 25% scoring in the lowest Likert rating (but with 8% still in the highest grouping and 60% in the middle grouping. This indicates that OGTR still has moderate levels of trust from within this group.

On a comparative scale with other regulators, OGTR rated the highest source of mean trust – which was also replicated in Segment A, who accepted that GM was a safe way to produce food. However across Segment D, that was most opposed to gene technology to produce food, and unlikely to change their mind, the lowest mean trust was for OGTR, as shown in the table below. Taken with the low actual awareness of OGTR this indicates that the name Office of Gene Technology Regulator



both gives trust to those who support gene technology, and leads to a lack of trust amongst those who do not accept GM foods and crops.

Organisation	FSANZ	OGTR	Dept Ag	NHMRC	TGA	APVMA	CSIRO
Mean Trust	6.76	7.61	6.65	7.38	6.82	7.30	7.40
Trust amongst most supporting	8.63	8.80	8.08	8.48	8.25	8.37	8.47
Trust amongst Most opposed	4.46	3.98	4.64	4.41	4.21	4.72	5.40

Table 14 – How much trust they place on what these organisations tell them about genetic modification



**Figure 36 – Q19.** And how much trust do you place on <u>what these organisations tell you</u> about the risks and benefits of genetic modification or gene technology, on a scale where **10 is trust completely** and **0 is do not trust at all?** If you can't say, or don't know please select 'don't know'. **Base:** Total sample n=1160

When the segments 1 - 4 were run against the statements on whether the need for regulation made somebody more or less concerned (as shown in Figure 32), the results showed that while the totals for each question were quite similar, the segments answered them with more difference. For instance, Segment 1, the Lost, were much more likely to be more concerned due to something needed to be regulated, while Segment 4, The Disciples, were less likely to be more concerned, and had the lowest Don't know responses.

Interesting, when asked to agree or disagree if they were less concerned, because the government regulator is ensuring higher levels of safety, there was quite a uniformity of responses across all the segments, except for segment 2, the Doubting Thomases, who had the lowest level of most agreement (7-10). The Doubting Thomases also had the highest mid-level responses to whether they would be more concerned (47%, compared to the average of 32% for the 4 – 6 response range).





## Concern over regulation, by segments

Figure 37. – Q. Q21. For the following, please indicate whether you disagree or agree, on a scale of 0 to 10, where **10** is **completely** agree and **0** is **do not agree**, I **am less** concerned, because the government regulator is ensuring higher levels of safety? Q. 21.1. I am more concerned about why it needs to be **regulated.** If you can't say, or don't know please select 'don't know'.

Base: Total sample n=1160

Combining the two key segment groupings provided insights into the correlations between the two segment groupings, but it was not absolute. For instance, the Lost values segment was close to evenly divided across the four attitudinal segments. Interestingly they had the highest response to the statement that they accepted it was a safe way to produce food (26% - even higher than the Disciples at 16%). Indeed the uniformity of responses from the Lost segment indicates that they are a very heterogeneous group by attitude, more so than another values group.



#### Attitudes of different segments

The Lost	%	Uninformed Doubting Thomas's	%
I accept that it's a safe way to produce food	26	I accept that it's a safe way to produce food	10
I am open to the production of food this way as long as the regulations are in place to make sure it's safe		I am open to the production of food this way as long as the regulations are in place to make sure it's safe	47
l am against the production of food this way until the science proves it's safe		I am against the production of food this way until the science proves it's safe	29
I am opposed to the production of food this way and nothing is likely to change my mind	21	I am opposed to the production of food this way and nothing is likely to change my mind	15
Uninformed Supporters with Provisos	%	The Disciples	%
I accept that it's a safe way to produce food	7	I accept that it's a safe way to produce food	16
I am open to the production of food this way as long as the regulations are in place to make sure it's safe	58	I am open to the production of food this way as long as the regulations are in place to make sure it's safe	60
I am against the production of food this way until the science proves it's safe	29	I am against the production of food this way until the science proves it's safe	19
	6	am opposed to the production of food this way and	5
I am opposed to the production of food this way and nothing is likely to change my mind	D	nothing is likely to change my mind	

**Figure 38** – Which of the following best describes your views on the use of genetically modified (GM) technology to produce food. **Base:** Total sample n=1160

The other three segments all had one attitude statement that most defined their segment, however only two of the three (Segments 3 and 4) rated above 50% Somewhat surprisingly it was the same key statement for the values segments (the Doubting Thomases, the Uninformed Supporters with Provisos and the Disciples) : I am open to the production of food this way as long as the regulations are in place to make sure it's safe.

This indicates that increased awareness of OGTR and the Gene Technology Regulations could have a significant impact across all values groups.

The four values segments did not show as large a variation across naming the regulator as might be expected, with the Uninformed Doubting Thomases having the lowest awareness, but the other three segments falling within three points of each other in relation to the believing that OGTR was responsible for the regulation of gene technology (26% - 29%). Awareness of OGTR was more variable across the values segments – but was surprisingly highest amongst the Lost (24%).

Uninformed Doubting Thomases had an awareness of OGTR of 12%, the Uninformed Supporters with Provisos were 8%, and the Disciples had an awareness of only 10%. This indicates that there is not one of the values segments with a pre-existing high awareness of OGTR that might be useful for influencing other segments, but it does show that low level awareness is quite uniform.





#### Organisation/s they believe are responsible - by segment

**Figure 39 – Q17.** Which organisation or organisations do you believe are responsible for the regulation of genetic modification in Australia? Please choose all that apply **Base:** Total sample '15, n=1160; Total sample '12, n=1000



#### Awareness of organisations – by segment

**Figure 40 – Q18.** Had you heard of the following organisations before completing this survey? Please choose one on each row

Base: Total sample '15, n=1160; Total sample '12, n=1000



# 6. Conclusions

While there has been a general drop in awareness and support for gene technologies, and in particular for GM foods and crops, since the last study in 2012, and previous studies, it is useful to try and correlate these changes with wider public attitudinal changes. For instance, over the past 15 years it has been possible to track rising and dropping support for GM foods and crops with general paradigm changes.

Current general trends in Australia are slightly more pessimistic about the future and at the same time the results seem to be indicating a decline in media coverage, and thereby public profile of genetic modification and gene technology, which correlates with the consistent growth in 2015 of 'don't know' and 'not sure' responses.

It is also important to note that most support or rejection of GM food and crops is conditional, and is likely to move based on regulation or scientific evidence of safety. Only 15% of the population are so against GM foods that they would never change their stance.

The data also indicates that that knowledge and awareness of GM issues can be shallow, with moderate awareness of what GM crops are being produced around the world, for instance, but not a strong ability to identify which ones are grown in Australia. This indicates that GM is a low-level of general background noise issue for many people, indicating that they pick up the general thread of topics, without knowing particulars. This is in line with the broader community trend relating to information overload and a narrowing of attention to only those things that are deemed personally relevant, or have sufficient profile in the media that they follow.

Data indicates that increasing a person's awareness of regulation and regulators of gene technology may have a minor impact in increasing their support for GM, and more in diminishing how much they are against GM.

By looking at the issue of public acceptance or rejection of GM foods and crops from multiple and more complex perspectives, we get a much more nuanced and complex understanding of public attitudes, and see that there is no Holy Grail of a single percentage figure for or against support of GM crops or foods.

The data also shows the importance of understanding different segments that exist within the community. While there are a breadth of attitudes to gene technology across the community, there are clusters of like-minded people, that can be defined by attitudes or by values. One of the strengths of understanding the public by values segments is knowing that values provide insights into the types of framing that different groups are receptive to, when seeking to engage with them.

For instance, the research indicates that segment 1, the Lost, should be more receptive to messages along the lines of: 'biotechnology allows nature to adapt to our changing global climate'. Segment 2, the Doubting Thomases, would be more receptive to messages of balancing the benefits of any biotechnology applications with strict regulation and safeguards and long-term testing. And Segment



3, Uninformed Supporters with Provisos, would be more receptive to messages relating to protecting children from risks and also balancing the benefits of any biotechnology applications with strict regulation and safeguards and long-term testing.

While Segment 4, the Disciples, need no particular framing of messages to ensure increased engagement or acceptance. However it should be noted that they do tend to over-represent the public in many communication activities where participants self-select to take part, and do not necessarily reflect the values and attitudes of the other segments.

A stronger understanding of segment differences can help determine how often communications are 'preaching to the converted' rather than reaching those other segments who would perhaps better benefit from information and engagement, as it is important to continuously engage all segments of society – but in different ways.

These findings also reinforce the importance for any one undertaking engagement, information, education or communication activities on gene technology – to first understanding their audience and their values, to ensure that their messages are delivered as effectively as possible. This may be particularly relevant for the OGTR given its role in the regulation of GM crops and the level of concern the public attach to them.



# Appendix I – Sample profile

The following provides a more detailed picture of the sample profile obtained. Please note that the figures are unweighted.

Gender		n=	%
Total Sample		1160	100
	Ma	le 569	49
	Fema	le 591	51
Age		n=	%
Total Sample		1160	100
	16 - 17 year	<sup>rs</sup> 11	1
n=244, %=21	18 – 20 year	rs 39	3
	21 – 30 year	<sup>rs</sup> 194	17
	31 – 40 year	<sup>rs</sup> 210	18
n=468, %=40	- 41 – 50 year	<sup>rs</sup> 258	22
	51 – 60 year	<sup>rs</sup> 202	17
n=448, %=39	61 – 70 yeai	<sup>rs</sup> 199	17
	71 – 75 year	<sup>rs</sup> 47	4
Non-English language spoken a	at home	n=	%
Total Sample		1160	100
	Ye	es 136	12

State of residence	n=	%
Total Sample	1160	100
Sydney	224	19
Other New South Wales	96	8
Melbourne	175	15
Other Victoria	75	6
Brisbane	140	12
Other Queensland	60	5
Adelaide	49	4
Other South Australia	21	2
Perth	77	7
Other Western Australia	33	3
Hobart	49	4
Other Tasmania	21	2
Canberra/ACT	70	6
Darwin	49	4
Other Northern Territory	21	2

 $N{=}822\ ({71\%})$  indicated they would participate in further research in the future

Aboriginal or Torres Strait Islander origin	n=	%
Total Sample	1160	100
Yes	61	5
No	1099	95
	-	
Children under age of 10 living in household	n=	%
Total Sample	1160	100
Yes	272	23

No 1024

No 888

88

77

Unemployed

Other

Highest level of education	n=	%
Total Sample	1160	100
No formal schooling	5	0
Primary school	8	1
Some high school	37	3
Year 10/4th Form or equivalent	87	8
Year 11/5th Form or equivalent	41	4
Year 12/6th Form or equivalent	162	14
Technical school, commercial college or TAFE	276	24
University degree or diploma (undergraduate or postgraduate)	529	46
Other	15	1

Land ownership and farming	n=	%
Total Sample	1160	100
A landholder who derives <b>most</b> of my income from primary production (farming)	81	7
A landholder who derives <b>some</b> of my income from primary production (farming)	13	1
A landholder who undertakes hobby farming	45	4
None of the above	1021	88
Employment	n=	%
Total Sample	1160	100
Employed full time	449	39
Employed part time	209	18
Retired or Pensioner	223	19
Home duties	96	8
School or secondary student	17	1
TAFE or university student	59	5

5

3

58

39



# Appendix II – References

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